VEHICLE electronics

The monthly magazine for automotive electronics engineers

Continental to spin off automotive electronics

Continental plans to spin off its automotive electronics business as an independent company.

The firm's executive board aims to make a decision before the end of the year. If approved by shareholders in April, the spin-off would take place by the end of 2025; preparations for the spin-off are already underway.

The aim is to have two independent companies.

The profitable tyres and ContiTech group sectors would remain under the umbrella of Continental.

The spin-off business includes software-defined and autonomous vehicles as well as brake and comfort systems.

"Our strategy aims to increase our value creation," said Continental CEO Nikolai Setzer. "This involves systematically analysing how we can best position our group sectors for success. Markets and customers, especially in the automotive industry, have evolved extremely dynamically. Sharply fluctuating regional developments, as well as the software-driven technology transformation, will require greater flexibility and entrepreneurial freedom. Against this, we are aiming to divide Continental into two independent companies."



Nikolai Setzer

The automotive group sector – which had its activities consolidated in a single legal entity in 2022 – would become a fully independent company as a result of the spin-off.

Automotive electronics generated sales of around €20.3bn in the past fiscal year and employs around 100,000 people. The group sector has a high level of technological and system expertise as well as vertical integration.

It has carved out a strong market position for brake and comfort systems, sensors and displays, and has made strides in developing software, architecture platforms and assistance systems for the software-defined and autonomous vehicle markets.

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Wind River accelerates Tata SDV development

Tata Elxsi will leverage Wind River Studio Developer to accelerate its dev-sec-ops process.

This collaboration aims to streamline and optimise Tata Elxsi's development workflows, enhancing its capabilities in building software-defined vehicles (SDVs).

Studio Developer is an edge-to-cloud dev-sec-ops platform that accelerates the development, deployment and operation of systems in mission-critical industries. It can help software teams adopt cloud-native development capabilities that enable software-defined features to evolve and improve over the lifecycle.

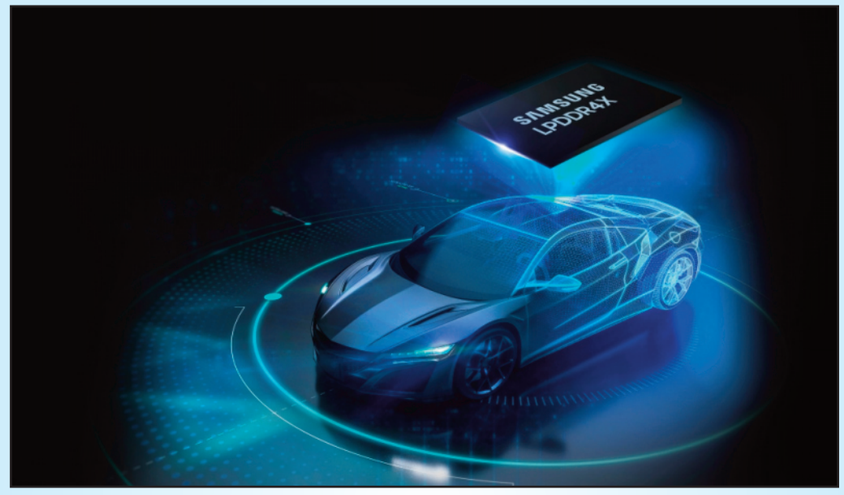
It delivers improvements in software workflow productivity and efficiency by leveraging scalable cloud resources, standardising automation pipelines, allowing cloud-based collaboration on a shared platform, and enhancing traceability throughout the software development process.

The automotive industry's shift towards cloud-connected, software-defined vehicles requires robust dev-sec-ops strategies to manage the software lifecycle. Modern cloud-native tools and techniques allow software teams to innovate quickly; however, they must also be adapted to address the challenges of intelligent systems and embedded software.

Wind River's cloud-native dev-sec-ops tools can reduce disruption and enhance existing investments by enabling teams to improve their workflows and processes incrementally over time, leveraging existing software and IT development infrastructure.

"Studio Developer will allow us to deliver significant improvements in our software workflow productivity and in efficiency in our SDV journey," said Nambi Ganesh, general manager at Tata Elxsi.

Qualcomm thanks Samsung for memory



Samsung's automotive LPDDR4X memory has been qualified for use with the Qualcomm Snapdragon Digital Chassis.

The memory is set to be applied in premium in-vehicle infotainment (IVI) and adas.

The qualification signifies Samsung's long-term support for those with various products and technologies for automotive applications.

This also helps ensure robust supply chain stability and support for ecosystem partners who are using the Snapdragon Digital Chassis.

"With a broad automotive lineup of AEC-Q1001-qualified dram and NAND products, Qualcomm is an ideal partner to work with for long-term customers," said Hyunduk Cho, vice president at Samsung Electronics. "Through Samsung's leadership in design, manufacturing and packaging for memory, our work with Qualcomm can help support rapid development cycles while ensuring reliability, verification and exceptional product control, which are essential for the automotive industry."

Samsung is also developing its next automotive LPDDR5, and samples are expected to be available before the end of this year.

The company says the LPDDR5 will be able to support the highest speed available in the automotive memory market at up to 9.6Gbit/s, even in extreme temperatures.

Intel discrete GPU unlocks AI cockpit experiences

Intel unveiled its first discrete graphics processing unit (dGPU), the Arc Graphics for Automotive, at August's AI Cockpit Innovation Experience event in Shenzhen, China.

The product could be commercially deployed in vehicles as soon as 2025, accelerating automobile technology and unlocking an era of AI-driven cockpit experiences and enhanced personalisation for manufacturers and drivers.

Intel's entry into automotive discrete GPUs addresses growing demand for compute power in increasingly sophisticated vehicle cockpits. By adding the Arc Graphics for Automotive to its portfolio of AI-enhanced software-defined vehicle (SDV) SoCs, Intel offers automakers an open, flexible and scalable platform that brings high-fidelity experiences.

Automakers can design a single vehicle platform that scales across trim levels. Entry and mid-level models can leverage the Intel SDV SoC, while higher-end vehicles can benefit from the added power of the dGPU.

This approach streamlines development as software is compatible across the integrated GPU and the discrete GPU.



Jack Weast with the Arc Graphics unit

Intel's AI Cockpit Experience event showcased a future where in-vehicle AI creates intuitive and personalised interactions among the driver, passengers and vehicle that can personalise the ride and optimise the drive.

"Intel's strategy is to bring the power of AI into devices of every size and shape, and we're thrilled to bring that expertise and our vast open AI ecosystem to the automotive industry," said Jack Weast, vice president of Intel Automotive. "China's rapid electric vehicle development cycles and advanced technological adoption make it an ideal testing ground for our technologies."

Automakers can choose the SDV SoC and later add a discrete GPU for managing larger compute workloads and expanding the AI features thanks to a unified instruction set that simplifies development.

Thundersoft's demo showed its cockpit user interface (UI) that transforms vehicles into immersive mobile hubs supporting seven high-definition screens rendering 3D graphics and six in-vehicle cameras and interactive features.

The UI can also run high-demand AAA gaming titles simultaneously while running AI PC rich applications for smart mobile working.

With AI algorithms learning driver preferences, automakers can offer a personalised experience, adapting cockpit settings without voice commands. Zhipu's AI car assistant demonstrated the power of local large language models (LLMs) running on Intel's compute platform. The demo highlighted the ability to execute complex vehicle control commands through natural language processing, answer vehicle-related questions accurately, and engage in leisurely chat with users.

Automakers can turn the vehicle into a mobile office and entertainment hub with immersive 4K displays, multiscreen setups and 3D interfaces.

Intel's AI PC accelerator programme brings together over 100 independent software vendors who have created 500-plus features and AI apps.

The increased compute power offered by the dGPU opens possibilities for automakers to differentiate their brands today. Intel says it aims to be the go-to partner for automakers. The company's XPU strategy, AI accelerator software ecosystem and optimisation capabilities can provide a foundation for innovation in the automotive space.

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Battery Cell Simulator — Simulate batteries in a stacked architecture
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Temperature Simulator — Simulate Battery Temperature Sensors
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Microchip references aid EV charger design

Electric vehicle charger reference designs from Microchip are designed to meet unique regional requirements.

The three flexible and scalable designs are for single-phase AC residential, three-phase AC commercial with OCPP open charge point protocol and SoC, and three-phase AC commercial with OCPP and display.

Most active components for the reference designs are available from Microchip, including the microcontroller, analogue front-end, memory, connectivity and power conversion. This streamlines the integration process, enabling manufacturers to speed time to market for chargers.

"Microchip's e-mobility team is focused on developing reference designs that our customers can directly use and benefit from," said Joe Thomsen, corporate vice president at Microchip.

The designs help manufacturers scale depending on the target market to meet the needs of residential and commercial charging applications. They provide complete hardware design files and source code with software stacks that are tested and compliant to communication protocols, including OCPP.

OCPP offers manufacturers a standard protocol to communicate between the charge point or charging station and a central system.

This protocol is designed to enable interoperability of the charging applications regardless of the network or vendor.

The residential design has an on-board energy metering device with automatic calibration to simplify the production process. The design has integrated safety protection features including protective earth neutral fault detection and RCD detection.



Reference designs target residential and commercial EV chargers

The commercial with OCPP and wifi SoC design is for high-end residential and commercial charging stations.

It features OCPP 1.6 stack integration for communication with charging networks and wifi SoC for remote management.

The commercial with display design caters to commercial and public charging stations with a focus on robust operation including a completed architecture review according to UL 2231.

It supports up to 22kW with bidirectional charging capabilities and a modular architecture. The design also has a gui with a TFT screen and touch input designed to withstand harsh environments.

Automotive chips set for 9.6% CAGR

The automotive chip market will reach $121.3bn globally by 2031 with a 9.6% CAGR from 2023 to 2032, according to Allied Market Research

Semiconductor chips specifically designed for use in vehicles generated $49.8bn in 2021.

More semiconductors are being used in electric and hybrid vehicles, the demand for which is growing globally. The electrical vehicle market is expected to grow 35% by 2040.

The decreasing cost of components such as lithium-ion batteries, sensors and microcontrollers are major factors.

They are essential for safety features such as airbags, anti-lock brakes and stability control. In addition, the increase in demand for adas and the rise in demand for autonomous driving is accelerating growth.

The microcontrollers segment held the highest market share in 2021, accounting for more than a quarter, and is expected to maintain its leadership throughout the forecast period.

The sensor segment is projected to manifest the highest CAGR of 11.3% from 2022 to 2031.

Based on application, the safety segment holds the highest market share, accounting for more than a quarter of the global market revenue. The same segment will also display the fastest CAGR of 10.5% during the forecast period.

North America holds the highest market share, accounting for nearly a third of revenue.

The Asia-Pacific region is projected to have the highest CAGR of 11.4% from 2022 to 2031.



Infineon Kulim 3 fab in Malaysia

Infineon opens first phase of 200mm SiC fab in Malaysia

Infineon Technologies has officially opened the first phase of a factory in Malaysia that it hopes will become the world's largest and most competitive 200mm silicon carbide (SiC) power semiconductor fab.

The first phase of the fab, with an investment of €2bn, will focus on the production of SiC power semiconductors and will include gallium nitride (GaN) epitaxy.

SiC semiconductors switch electricity more efficiently and enable smaller designs. They increase efficiency in electric vehicles, fast charging stations and trains as well as renewable energy systems and AI data centres.

Around 900 jobs will be created in the first phase. The second phase, with an investment of up to €5bn, could create the world's largest and most efficient 200mm SiC power fab. Overall, up to 4000 jobs will be created with the project.

"New generations of power semiconductors based on innovative technology such as SiC are an absolute prerequisite to achieving decarbonisation and climate protection," said Jochen Hanebeck, CEO of Infineon. "Our technology increases the energy efficiency of ubiquitous applications such as electric cars, solar and wind power systems, and AI data centres. We are therefore investing in the largest and most efficient high-tech SiC production facility in Malaysia, backed by strong customer commitments."

Infineon has secured design wins with a total value of approximately €5bn and has received approximately €1bn in prepayments from existing and new customers for the ongoing expansion of the Kulim 3 fab. Notably, these design wins include six OEMs in the automotive sector as well as customers in the renewable energy and industrial segments.

Kulim 3 will be closely connected to the Infineon site in Villach, Austria, Infineon's global competence centre for power semiconductors. Infineon increased capacity for SiC and GaN power semiconductors in Villach in 2023.

Acting as one virtual fab for wide-bandgap technologies, both manufacturing sites now share technologies and processes that allow for fast ramping and smooth and efficient operation.

The expansion will benefit from the economies of scale already achieved for 200mm manufacturing in Kulim. It will complement Infineon's position in silicon, based on 300mm manufacturing in Villach and Dresden.

Infineon's operations in Malaysia started as early as 1973 in Melaka. In 2006, the company opened Asia's first front-end fab in Kulim. Currently, Infineon employs more than 16.000 people in Malaysia.

The Kulim 3 fab will be powered by 100% green electricity and will employ the energy efficiency measures to support Infineon's goal of carbon neutrality. To avoid emissions, it will use an abatement system and green refrigerants that combine efficiency with low global warming potential.

Other measures to ensure sustainable operations include recycling indirect materials and water efficiency and recycling processes. Infineon is working for recognition with the Green Building Index certification.

Ambarella integrates Plus AD stack on SoC

Plus' PlusVision transformer-based AD perception software stack is now available on Ambarella's CV3-AD AI domain controller family of SoCs.

This should help tier-one suppliers and car makers accelerate the launch of vehicles with L2+ and L3 autonomy.

PlusVision is transformer-based, deep neural network AI perception software combining Plus' L4 perception capabilities with an extensive dataset. Plus' AD stack has accumulated millions of real-world driving kilometres in the USA, Europe and Australia.

This data collection has made PlusVision smarter, enabling information-rich output that helps OEMs develop and fine-tune detailed autonomous driving policies. Implementing uniform perception software is key to enabling these data-driven custom policies across different vehicle models and trim levels.

David Liu, CEO at Plus, said: "This combination will provide tier-ones and OEMs with flexible, high-performance and power-efficient perception, enabling them to create a future-proof platform that can be adapted for their evolving autonomy needs."

The PlusVision stack, running on a mid-range CV3-AD655 SoC, can deliver peak performance of 11 cameras being simultaneously processed at 30 frames per second. This provides more than 200m of front-camera detection range.

"Our collaboration with Plus offers tier-ones and OEMs additional cutting-edge transformer-based AI perception software, to help accelerate their next-generation vehicle development," said Fermi Wang, Ambarella CEO.

Child soft target tests adas



AB Dynamics' sister company Dynamic Research has launched a child version of its pedestrian adas target. The Soft Pedestrian 360 aims to meet the growing demand for child pedestrian testing and focuses on realism and reducing test downtime.

"The number of Euro NCap test scenarios that require a child pedestrian target is expanding and will continue to grow," said Jordan Silberling, general manager of Dynamic Research. "Following the success of the adult version of our Soft Pedestrian 360, we have seen an increase in demand for a child target that caters to these test scenarios and uses the same proven architecture and technology used in the adult version."

To reduce damage to the test vehicle, the child target uses the same modular architecture as the adult to reduce the mass of any individual component that could contact the test vehicle and cause damage.

Additionally, the servos operating the articulating legs are completely encased in foam and sit within each component. This design ensures there are no exposed hard points that could make contact with the test vehicle. This means the vehicle under test is protected when the limbs are disconnected upon impact.

"Downtime during testing sessions due to test vehicle damage or target damage is a significant factor in the overall expense of testing," said Silberling. "Our goal is to help avoid unnecessary delays, ensuring efficient testing."

Jidu upgrades software based on Baidu Apollo

Jidu Auto unveiled its V2.0 software at an AI driving conference in Chengdu, China. The software will debut on the Jidu 07 model.

Powered by Baidu Apollo's level-four autonomous driving capabilities and safety framework, the software encompasses a dozen key modules for up to 947 added features including end-to-end large-scale model smart driving, a large-scale model smart cockpit and intelligent vehicle connectivity.

"This marks a significant achievement as level-four autonomous driving technology is integrated into consumer cars for the first time," said Joe Xia, CEO of Jidu Auto. "Thanks to the deep integration between Baidu's ADFM and Jidu Auto, this is the world's first large-scale autonomous driving model supporting fully unmanned driving applications."



Joe Xia, CEO of Jidu Auto

He said Baidu's more than ten years of continuous R&D in AI and autonomous driving, coupled with investments exceeding RMB150bn, had been instrumental in maintaining Jidu Auto's leadership position.

Considering safety, user experience and other factors, Jidu has opted for a two-stage end-to-end approach.

Leveraging the Apollo ADFM level-four autonomous driving model, it is said to strike a balance between safety and generalisability, offering more safety to human drivers and encompassing the entire range of high-speed and complex urban scenarios.

Apollo's level-four autonomous driving has surpassed 100 million kilometres and has established a high-performance training cluster with over 5.5EFlops of computing power.

The pure vision technology is said to be better than mainstream lidar in perception capabilities. It achieves centimetre-level 3D precision, offering a perception range of up to 250m. It can even identify a mineral water bottle at a distance of 200m and maintain a recognition accuracy of moving obstacle speeds within 0.1m/s.

Features and upgrades include pilot assistance, valet parking, lane keeping and active safety.

Jidu also unveiled a native AI large-scale model cockpit, incorporating an end-cloud AI agent system. Perception, comprehension and execution are model-driven, enabling rapid local responses and leveraging the cloud's understanding and decision-making capabilities.

Wialon hits four million connected vehicles

Gurtam's Wialon fleet management and IoT platform has reached a record number of four million connected vehicles in 160 countries.

This makes Wialon one of the largest fleet management, GPS tracking and IoT software platforms worldwide, by number of connected vehicles.

The platform helps connect, track and monitor vehicles and assets ranging from HGVs and LCVs to public buses, agricultural vehicles, construction vehicles, energy generators, fuel tanks and waste trucks.

Wialon is deployed across varied industries, ranging from logistics and transportation, to agriculture, construction, energy and waste management.

"Year on year we are seeing increased adoption of telematics, and a higher emphasis on safety and data analytics, supporting efficiency and sustainability in fleet operations," said Aliaksandr Kuushynau, head of Wialon.

GotYou Telematics, the company that deployed the four millionth vehicle connection, has been a Wialon partner since 2017. Headquartered in South Africa, it provides security services for fleet management.

Karma and Intel collaborate on SDV architecture

Californian luxury car maker Karma Automotive is collaborating with Intel to co-develop a software-defined vehicle architecture (SDVA) for its upcoming vehicles including the Karma Kaveya super coupe, anticipated to arrive in 2026.

Through shared expertise, the companies plan to demonstrate and validate critical concepts for the advancement of open standards for SDVA that can be shared openly and commercially to support the transformation of the broader automotive industry.

"Karma Automotive, together with Intel Automotive, will realise SDVA's full potential to create innovative, intelligent and beautiful Karma automobiles which, in addition to delivering unparalleled driving dynamics, will be highly efficient and offer an exceptional ownership experience," said Marques McCammon, president of Karma Automotive. "For tier-ones and OEMs not quite ready to take the leap from the old way of doing things to the new, Karma Automotive will play as an ally, helping them make that transition with business-to-business SDVAs in the same way we do today with Karma Connect, our proprietary vehicle data management and over-the-air services platform, which presently provides services to the world's second largest OEM."

The Karma Kaveya super coupe is anticipated to be the world's first vehicle developed from the ground-up with true SDVA. All future Karma automobiles to follow the Kaveya will take this path, using SDVA co-developed with Intel.



Karma Kaveya super coupe due to arrive in 2026

"Together, through this collaboration with Karma Automotive, we're in a position to prepare the industry for the leap forward to SDVA without leaving anyone behind," said Jack Weast, Intel Automotive vice president.

McCammon and Weast first aligned on the vision for the future of the automobile during their work as colleagues over a decade ago at Wind River, formerly a division of Intel.

ESol adds Cortex-R82AE support using virtual prototypes

Automotive real-time embedded software developer eSol supports Arm's latest real-time safety-enabled processor, the Cortex-R82AE.

This was made possible by using virtual prototypes of Arm's Automotive Enhanced IP under Arm Virtual Hardware (AVH) developed by Corellium, also an Arm ecosystem partner. AVH is a cloud offering that hosts virtual platforms of the Arm IP that offers ISA parity accelerating software development activities ahead of silicon availability.

This enables the rapid deployment of a real-time OS on a virtual prototype running natively on an Amazon Web Services (AWS) instance, reducing the development time compared with traditional virtual prototypes.

The Cortex-R82AE implements Arm's 64bit ISA and can be used in applications that enable real-time control and safety islands, ensuring functional safety.

It has a memory management unit (MMU) that supports the deployment of rich operating systems. The ability to deploy eMCos Posix on the Cortex-R82AE, as well as on the Cortex-A family of processors, positions this as a scalable operating system that supports everything from microcontrollers to high-end SoCs.

By leveraging the ISA parity provided by Arm virtual platforms, eMCos Posix can be smoothly deployed on the virtual Cortex-R82AE without special adjustments for the virtual platform executing natively in the cloud, reducing development costs by nearly half.

Functionalities can be tested accurately without waiting for the physical hardware.

This technology lets engineers immediately start designing, developing and validating software for automotive, realising a shift-left approach by conducting functional verification and integration activities early in the development lifecycle.

ZF software improves commercial vehicle intelligence

ZF is harnessing software to develop smarter, more connected and efficient commercial vehicles.

By integrating its intelligent software with its chassis technologies, vehicle performance and safety can be improved, ensuring safer and smoother journeys.

ZF is leveraging its software domain expertise from other vehicle segments within the group to produce intelligent systems quickly and cost effectively that can lower overall cost.

Harnessing the energy created when a vehicle decelerates to recharge onboard batteries can effectively extend the range of an electric vehicle or reduce the size of the batteries needed.

ZF's braking and e-drive synergy programme harmonises the electric driveline and braking functions to optimise recuperation under full stability control, beyond current standards, boosting efficiency, safety and comfort while reducing cost.

The system works by combining ZF's AxTrax 2 and CeTrax 2 dual e-drives with its mBSP XBS braking system so the e-drive can act as an actuator for braking and vice versa, in controlling acceleration and braking.

In doing so, the system increases energy recuperation to recharge the onboard batteries during driving, effectively extending the vehicle's range.

The system also provides one-pedal-drive functionality, increasing driving comfort especially in low-speed manoeuvring, such as for yard vehicle applications or urban driving.

Launch capabilities are improved by optimising the traction control function, reducing tyre wear and enhancing vehicle performance and stability on slippery ground.

ZF's software helps replace hardware in the form of brake resistors for battery electric vehicles. The software can intelligently limit the maximum energy content of the battery in certain charging situations, ensuring any extra energy created by regenerative braking can then be stored in the vehicle's batteries.

This uses location data to determine if it is being charged in an area where it is likely to descend a steep gradient, which could create significant additional battery charge in the early part of its journey. If so, it ensures the battery saves capacity during charging for energy harvesting.

The algorithm intelligently ensures that 100% charge will be reached on its descent.

In other areas, the system allows the battery to be fully charged when plugged in.

Thanks to this, bulky, heavy and expensive brake resistors are no longer needed, while energy efficiency is increased, and all energy is available for propulsion.

This saves approximately 150kg weight and increases available space within the chassis.

The system demonstrates how an intelligent server-cloud based function can save cost and weight while improving efficiency and sustainability.

Inova MoU to supply ISELED to Lextar

Inova has signed a memorandum of understanding (MoU) to provide its ISELED and ILaS technology to Ennostar subsidiary Lextar, a Taiwanese LED optoelectronics provider.

ISELED technology is used by multiple car manufacturers around the world. ILaS lets them network ISELED LEDs and connect all interior light systems via cable, enabling complete, only hardware based interior lighting systems in the car. These are centrally controlled and can be integrated into existing and future EE architectures.

Lextar intends to build smart LED products to enhance the ISELED portfolio, giving users more choices for automotive uses such as interior and exterior functional and decorative lighting.

"This partnership aims to bring various products to the market that meet and exceed OEMs' expectations," said Patrick Fan, chairman of Lextar.



ZF test vehicle equipped with the braking and e-drive synergy programme

LG unlocks and starts cars with smartphone

LG Innotek's digital key can be used to open, lock and start the car using a smartphone connected to the vehicle with wireless communications.

Users will no longer need to carry a separate car key, eliminating the worry of misplacing it and reducing the risk of theft.

With the recent growth of the vehicle sharing industry, including car sharing and car rental, the demand for digital keys is on the rise.

LG Innotek has continuously enhanced the performance of its products since it first launched a digital key module for vehicles in 2021. The latest version is said to enhance the safety and convenience of passengers.

This product comprises a digital key module with an antenna, circuitry and software.

It is equipped with short-range communications, including Bluetooth Low Energy (BLE) and UWB. UWB is a wireless communication technology that uses a wide bandwidth frequency that is less prone to interference than BLE. This technology plays a role in accurately measuring the location of the smartphone connected to the digital key.

This is complemented by the company's proprietary algorithm, which accurately detects the smartphone's location to within 10cm. This is expected to reduce the failure rate of existing digital keys.

Operating on short-range wireless communication reduces the risk of remote hacking. Plus, it is equipped with the company's independently-developed wireless communication hacking prevention technology to ensure the digital key function can be activated only by the smartphone authorised by the user.

It adheres to CCC standards, and can be used regardless of country, terrain or vehicle type; it is compatible with a wide range of smartphones and works with iOS and Android operating systems.

A radar that was developed in-house provides additional functions that enhance safety and convenience. An example is the child presence detection function for when a child is left in the vehicle. The radar instantly detects the child's movement or breathing and sends a real-time alert to the user's smartphone.

More than 60 components and modules for BLE and UWB wireless communication, including RF and power supply devices and in-house developed software, are packed into a device smaller than a business card.

LG Innotek has set 2027 as its target year for full-scale mass production of the digital key and is promoting it to global customers of fully-built units.



LG Innotek employees demonstrate digital key

Delphi adds over 100 parts

Delphi has added 109 parts in the third quarter of this year, covering nearly 900,000 vehicles in operation across the USA and Canada.

The number includes 31 parts in its vehicle electronics line, mainly made up of ABS wheel speed sensors, ignition knock (detonation) sensors and vehicle speed sensors.

"Delphi remains committed to delivering the parts that fit the needs of the market environment," said Russ Stebbins, Delphi vice president. "Our team is already hard at work for our next parts launch later this year. We'll have plenty of new parts to showcase in the coming months."

Delphi's fuel management line adds one new fuel pump module assembly, covering more than 500,000 vehicles.

Sparta, Delphi's specialty fuel line for earlier model and high-mileage vehicles, introduced five more part numbers.

These parts include two electric fuel pumps and three fuel pump module assemblies for various applications.

The steering and suspension line introduced 72 part numbers, mostly consisting of alignment parts, tie rod ends, and control arm and ball joint assemblies. They consist of 14 unique part types.



Vector and HighTec bring functional safety applications to the road

Vector and HighTec mix Rust with Autosar Classic

Vector and HighTec EDV-Systeme have integrated Rust applications with C-based Autosar Classic software and thus removed hurdles for the use of Rust in the automotive sector.

With Vector's Microsar Classic Safe basic software combined with HighTec's automotive grade LLVM open-source-based Rust and C/C++ compiler tools for Infineon Aurix TC3x and TC4x microcontrollers, embedded developers can use the Rust memory safe programming language with its advantages for functional safety applications even in demanding automotive ECUs.

Both Vector's basic software and HighTec's compilers are safety-certified to ISO 26262 up to Asil D.

The modern programming language Rust is characterised by features for memory integrity and conflict-free concurrency at high performance, which reduces safety risks, shortens development cycles and lowers costs.

Microsar Classic Safe is an ISO 26262 Asil-D qualified Autosar Classic implementation and integrates application software written in Rust.

HighTec is the first provider of an ISO 26262 Asil-D qualified Rust compiler for the Aurix TC3x and TC4x series.

Like the C/C++ compiler from HighTec, this uses LLVM open-source technology and supports the advantages of Rust. This toolchain allows developers to integrate newly developed Rust code seamlessly with existing C/C++ code.

The two partners proved that Autosar software components written in Rust can be embedded in an existing Autosar Classic environment.

"With this, developers create safe, efficient and flexible ECU software by combining the best of Rust and established C-based Autosar development," said Falco Bapp, senior manager at Vector. "This is a significant step for the future of automotive software development."

Mario Cupelli, CTO at HighTec, added: "This drives the automotive customer with a competitive advantage to build fast safe and secure software. Together with Vector, we shape the future of automotive software."

Trustonic and Sasken improve security options

Engineering firm Sasken Technologies has formed a partnership with cybersecurity firm Trustonic to improve security options for automotive OEMs.

With 34 years' experience in embedded software, Sasken provides concept-to-market R&D services for semiconductor, automotive, smart devices and transportation sectors.

Trustonic embeds cyber-security technology into smart devices and connected vehicles.

Having obtained EAL5+ certification for its Kinibi trusted execution environment technology in 2022, Trustonic's secure platform is now deployed to two billion smart devices and 20 million vehicles globally, with no safety violations.

"With our deep expertise in the automotive industry, this collaboration enables us to deliver cutting-edge security for automotive OEMs and tier-one suppliers, ensuring our clients can innovate with confidence," said Rajiv Mody, Sasken CEO. "By combining Trustonic's proven security expertise with Sasken's engineering prowess, we are confident of setting new standards for safety and innovation in the industry."

SAFETY & SECURITY

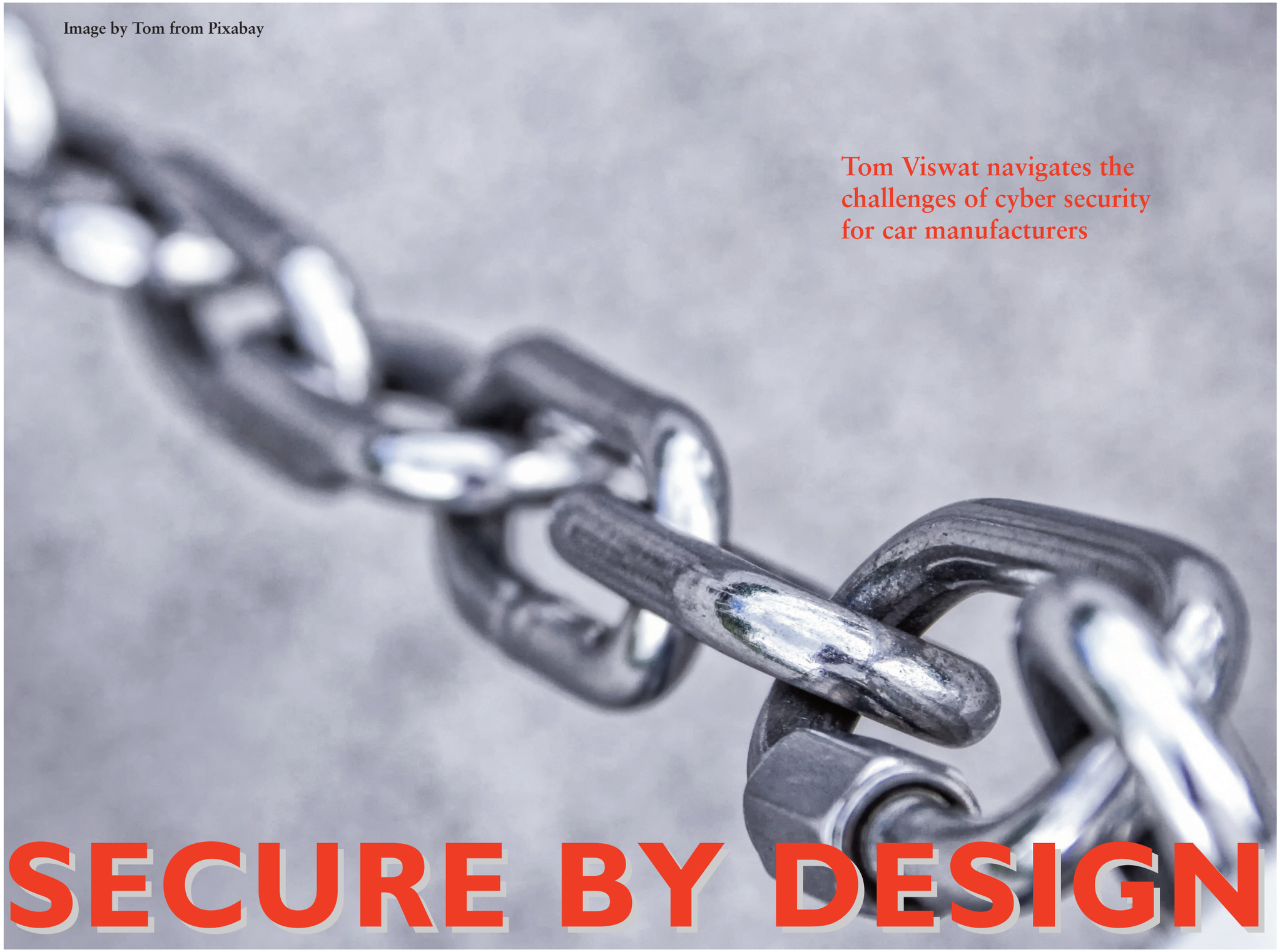


Image by Tom from Pixabay

SECURE BY DESIGN

Tom Viswat navigates the challenges of cyber security for car manufacturers

Modern vehicles are an integral part of the digital world. This article lifts the bonnet on software-defined vehicles and increased cyber-security risk, and asks what it all means for car manufacturers.

Software is at the heart of the modern automotive industry. Vehicles rely on software for everything from engine management to infotainment, ensuring the driving experience is smooth, safe and efficient. However, this dependence on software also makes modern vehicles susceptible to cyber attacks.

Everyone expects connectivity in their homes, at work and even in their pockets, so why not in their vehicles? The modern vehicle is now more than simply a means of transport; it is an integral part of the digital world.

SDVs

Software-defined vehicles (SDVs) are the latest evolution in automotive history. The term encompasses any vehicle where software is crucial for operability, turning it into a platform for the collection and organisation of data. These data are then used for several purposes such as driver assistance systems, autonomous driving, sensors, voice control systems, internet connection, inter-vehicle connection and over-the-air (OTA) remote updates to vehicle systems.

SDVs constantly interact with the environment around them, learning and supporting service-based models while onboard electronics become high-performance computers that

enable a level of autonomous functionality in the vehicle.

A key strength of this approach is that hardware and software are separated, making it easier to update and upgrade the systems that control vehicles.

Risks

Wherever connected technologies are employed, cyber attacks are a concern. This is particularly pertinent when the impact of a system failure could be catastrophic.

For example, if the software in an SDV fails to function properly because it is not adequately protected, there could be a range of outcomes. At one end of the risk scale, the engine could misfire, or an onboard navigation system could stop working. At the other end, however, the driver could lose control, making the vehicle a danger to everyone on the road.

The only way to guard against cyber attacks is to stop hackers from accessing the system. However, SDVs are not closed-loop systems and there are many entry points to exploit – wifi, Bluetooth, OTA and so on.

Responses

Growing awareness of the vulnerabilities of hardware to cyber attacks has resulted in a sharper focus on the security of chips. Several legislative initiatives are being introduced to emphasise security through methodologies that focus on the complete product life cycle. For example, the EU's Cyber Resilience Act (CRA) and the US Cybersecurity & Infrastructure Security Agency's (CISA) hardware bill of materials (HBoM) framework.

These bills seek to force change, making adequate cyber-security provision a central part of every product. For example, under the CRA, companies found to be in non-compliance risk a fine of €15m or 2.5% of global turnover.

The automotive sector advocates a security-by-design approach, as exemplified by standards such as ISO/SAE 21434: Road Vehicles – Cybersecurity Engineering.

The traditional method of testing finished hardware and software is simply not sufficient to respond to modern threats. Instead, designers and manufacturers need to facilitate and strengthen a mindset where security is considered at all stages of the lifecycle by working with



Cars must conform to the highest standards for cyber security

verification teams and cyber-security experts throughout development.

One risk in terms of cyber security is a system-wide breakdown where the complete computer architecture of the vehicle fails. The SDV approach can be an advantage in stopping this possibility because hardware and software are separated. Since each system is isolated, for example, the engine management system does not directly interact with the infotainment system, and so if one is attacked, the problem cannot automatically spread to the rest of the vehicle.

Security

While there is always an element of risk versus cost when considering cyber security, effective mitigation requires both hardware and software to be, at a minimum, compliant with recognised standards.

Hardware components (microcontrollers, sensors, communications modules and so on) should be evaluated against industry-specific standards and guidelines to ensure the necessary security features and resistance to tampering while still enabling operability in all conditions. Software components (operating systems, middleware and applications) benefit from evaluation and certification that covers code reviews, vulnerability assessments and testing against security benchmarks. This will identify potential vulnerabilities and/or demonstrate compliance with industry standards.

The finished SDV should also undergo integrated system certification to ensure the overall



Autonomous car sensor system concept

security and integrity of the full platform. Evaluating the interaction and interoperability of the different components within the SDV provides an overall assessment of the platform's resistance to cyber attacks.

However, each evaluation is a moment-in-time assessment of the SDV's cyber security and it cannot consider unknown future threats. Therefore, certification should be continuous, ensuring compliance throughout the life cycle of the SDV.

Manufacturers and developers must establish mechanisms for continuous monitoring, vulnerability management and compliance auditing to identify and address emerging cyber-security risks and maintain certification requirements.

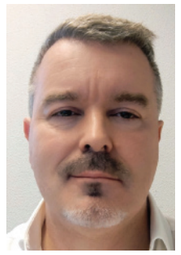
Compliance with standards such as ISO/SAE 21434 and ISO 26262 for functional safety is essential for demonstrating the safety and security of the SDV. It is also partly a regulatory requirement in some territories.

Incorporating hardware and software component certification into the development and deployment of SDVs essentially enhances cyber-security resilience; mitigating vulnerabilities and ensuring regulatory compliance while building trust among consumers.

The total global market for SDVs is expected to see exceptional growth in the next few years, rising from $35.8bn in 2022 to $249.8bn in 2032, a CAGR of 22.1%. To maintain market access and ensure the safety of road-users, manufacturers and developers of SDVs must ensure their products conform to the highest standards for cyber security or there is a very real risk of noncompliance and consumer dissatisfaction.

Conclusion

Automotive cyber-security testing and certification cover everything from complete vehicles to hardware, software and integrated systems. There are organisations that support manufacturers and developers at every stage of the SDV life cycle, from pre-evaluation, including IATF 16949 pre-audits and technical system development life cycle (SDLC) advice, to post-evaluation, with testing and certification that ensure continued compliance.



Tom Viswat is business development director at SGS

SAFETY & SECURITY

KEEPING COOL

Joel Sylvester discusses the role of temperature monitoring in increasing EV safety and performance

Image by Hermann Kollinger from Pixabay

Vehicle Electronics September 2024, 18

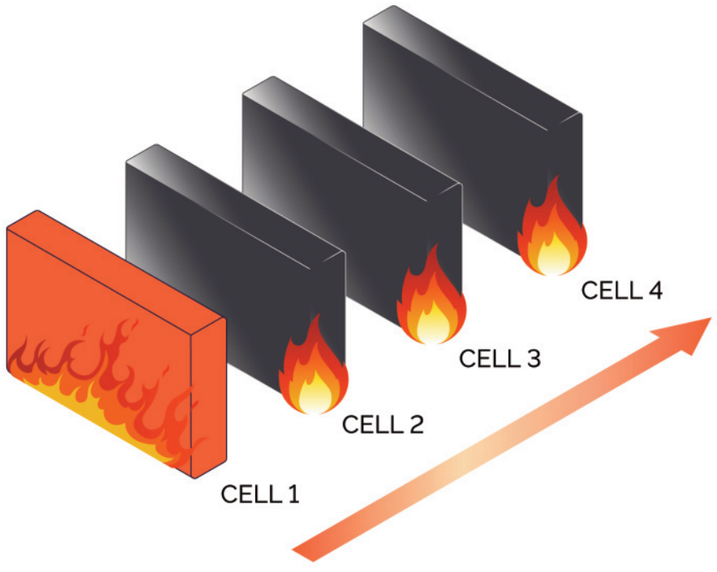


Fig. 1: If one cell experiences thermal runaway, adjacent cells can also be affected

Within any electric vehicle (EV) the voltage, current and temperature of the battery pack must be monitored continuously. This monitoring maintains consistent performance and ensures the cells remain within their designated safe operating area.

Given the critical importance of safety, accurate and frequent monitoring of the battery pack is vital. Furthermore, as well as monitoring the internal cells, an EV's battery management system (BMS) needs to manage connections to charging networks, all while accounting for the impact of internal cells and external environmental temperature.

Therefore, maintaining precise battery cell monitoring is critical for the vehicle's smooth operation. This is particularly important when charging, as the continuous high current raises the battery pack's temperature, causing variations in cell heat due to manufacturing differences.

It is common for an electric vehicle battery pack to be composed of several modules, and each module typically contains approximately 12 to 16 cells. However, the usual practice is to have only one or two temperature sensors in each module, which may restrict performance and safety.

As a result, by integrating extra temperature sensors, it is possible to enhance the monitoring process, ultimately strengthening safety measures and potentially optimising vehicle and fast-charging performance.

Packaging

Economic and packaging constraints have a significant impact on the number of temperature sensors that can fit in a battery pack. Incorporating a network of sensors, wiring and connectors into a pack adds extra weight and material expenses, and increases the chance of short circuits.

Temperature sensors are usually required to be placed by designers as a compromise, either on the side of a 12-16 cell module or at the end of the pack in cell-to-pack designs.

However, it is important to keep in mind that these sensors are commonly placed quite far from the monitoring boards.

Consider a situation where several prismatic cells are placed in a linear configuration within a module, assuming the usual setup of one temperature sensor for every eight cells.

If a cell experiences damage, its temperature might begin to increase, potentially surpassing the maximum temperature recommended by the manufacturer. However, in this example, the cell that is damaged does not have a temperature sensor, and the closest sensor is positioned several cells away.

Due to the design, there is a possibility of a delay in the BMS detecting a breach in the thermal limit. Therefore, it is crucial to identify any abnormal behaviour before a thermal runaway event takes place, see Fig. 1.

Temperature

Accurate temperature measurement is also vital during charging since the charging rate of a cell is frequently constrained by thermal factors. As the current levels rise, the cell temperature increases, necessitating the dissipation of heat into its surroundings. When there is uncertainty about the temperature of each cell, it is important for a fast-charging controller to be cautious, as only an approximation of cell temperatures can be determined for areas without direct temperature sensors.

Similarly, cold temperatures also pose a significant risk during rapid charging due to increased chances of lithium plating and dendrite growth. This leads to unwanted loss of active lithium and weakens the cell upon returning to higher temperatures.

For the best performance, it is advised to maintain the temperature of an EV battery pack between 15 and 35°C.

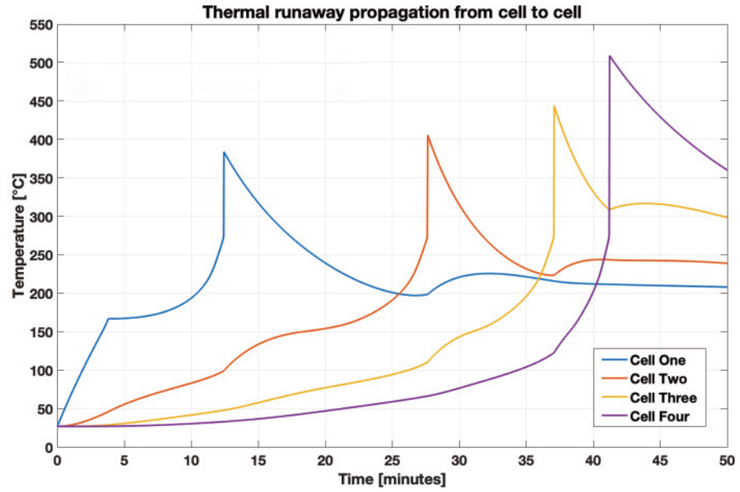


Fig. 3: Graph illustrating the spread of heat transfer and thermal runaway events among four neighbouring cells

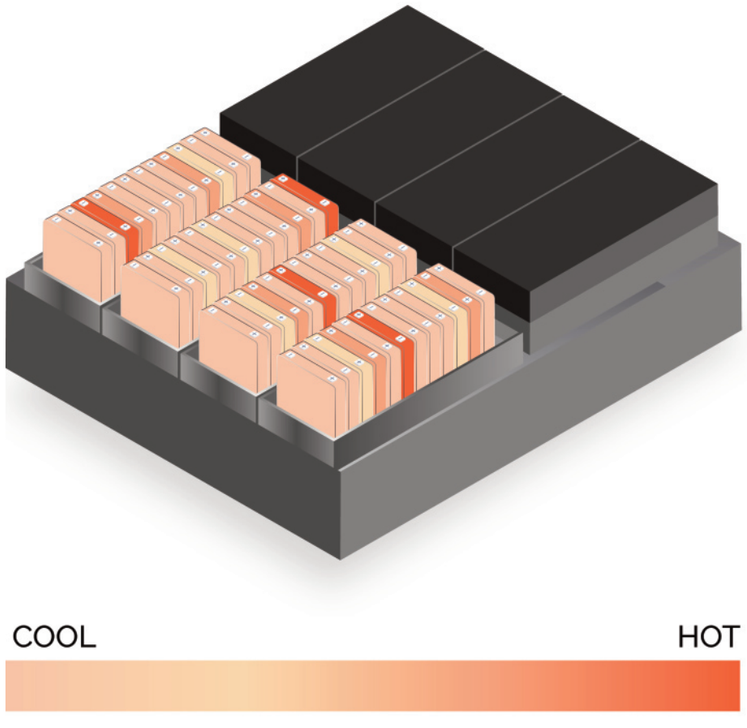


Fig. 2: Visual representation showing temperature variations in a typical EV battery pack

EV range can be reduced by as much as 39% in freezing temperatures. Maintaining the recommended temperature range is crucial for achieving efficiency, reliability and safety. Significant deviations from this range can result in noticeable decreases in performance and cell deterioration.

While a battery pack is charging, the cells produce heat, but variations in manufacturing can lead to differences in temperature. This can lead to one cell becoming much hotter than the others, see Fig. 2.

Without a temperature sensor on that cell, any abnormal temperature rise may go undetected, but if there is a sensor in every cell, the abnormal behaviour of that one cell can be quickly identified.

Runaway

Although certain packaging setups may enhance the distribution of temperature sensors, most cells will still lack sensors and will depend on temperature transmission between adjacent

SAFETY & SECURITY

cells for detection.

This delay in transmission can reduce the efficiency of battery thermal regulation systems and cause a delay in detecting thermal runaway events. These events occur when the temperature of a damaged cell in an electric vehicle exceeds a certain threshold, leading to a chain reaction.

In a thermal runaway event, the rising temperature causes the separator between the electrodes to melt. As a result, the cell has the potential to emit flammable gasses and ignite, creating a real danger of fire spreading to nearby cells.

A simulated experiment of this situation is shown in Fig. 3.

In the experiment, cell one was exposed to a heat source for a duration of approximately four minutes, which resulted in a rapid rise of its temperature to approximately 170˚C. Even without the heat source, the thermal runaway had already been initiated. This can be seen in the subsequent exponential rise in temperature during the next ten minutes.

The model then demonstrated a rapid increase in temperature, reaching nearly 380˚C, and the remaining energy in the cell was suddenly released as the cell burnt out. Simultaneously, cell two experienced a rise in temperature caused by the heat conduction from cell one.

Roughly ten minutes after cell one is activated, cell two also experiences thermal runaway and burns out around the 27-minute mark. Consequently, the thermal engagement of cell three and cell four led to temperatures reaching nearly 400˚C and surpassing 500˚C, ultimately resulting in the complete burnout of cells three and four, respectively.

Prevention

To help engineers avoid such scenarios, a cell monitor chip can eliminate the necessity of deploying numerous temperature sensors across battery modules.

A monitor can be placed on every cell and monitor both cell voltage and temperature.

This allows for thermal monitoring of each individual cell without incurring additional expenses or complicating the design with external thermocouples.

Furthermore, such a monitor can support up to two optional external thermistors, making it suitable for larger cells or other areas of high importance.

Instead of measuring the temperature of multiple cells with a single measurement, the chip-on-cell technology can capture up to three real-time temperature measurements for each cell.

Scenario

In the previously mentioned scenario, if cell one had been equipped with a temperature sensor, the vehicle's control systems would have been able to detect the issue as soon as it crossed a predefined threshold, for example 80˚C, which happened in just over a minute.

For comparison, if only the second cell had a temperature sensor, the BMS would not detect a similar failure until 7.5 minutes later. If the temperature sensor was two cells away on cell three, the delay would increase to over 15 minutes, and at three cells away, the delay extends to 25 minutes.



Overheating cells can affect neighbouring cells

The provided example portrays a simplified version of a standard battery pack, whereas a well-designed pack would integrate gas and pressure sensors to identify such a catastrophic failure when the initial cell starts venting gasses.

Nonetheless, this technique is considerably slower, taking about ten minutes longer than the alternative of employing a temperature sensor on every cell.

Nearly all EVs have effectively tackled this issue by using special materials to contain and prevent the spread of heat. However, it is important to note that there might still be a delay of several minutes before detecting the problem. Placing a temperature sensor on every cell is a simple yet effective solution to the critical safety problem caused by the delay.

Conclusion

Keeping battery cells operating within the recommended range is a difficult task for vehicle manufacturers. However, by accurately monitoring the temperature of each cell, they can guarantee that all cells operate safely, reducing the chances of overheating and potential damage.

By adopting this approach, not only will safety be enhanced, but the battery pack's lifespan and performance will also be increased.

In addition, the ability to record temperature measurements on every cell provides valuable information for diagnostics and preventive maintenance, enabling early detection of any abnormalities or potential issues.

By using this technology, battery designers can proactively monitor and address overheating risks.

This results in a more reliable and resilient energy storage system, improving performance and safety for electric vehicles and other battery applications.



Joel Sylvester is chief technology officer at Dukosi



Saad Dar shows how software is engineering the vehicles of tomorrow

The automotive industry is going through a radical transformation. Previously driven by enthusiast petrol heads debating about speed, acceleration and engine sound, the industry is now taken over by tech nerds who are more interested in the technological capabilities of the vehicle and its driver assist and safety features.

Today's motorists expect the same services from their vehicle as they do from other smart devices, such as the ability to modify and add features as they seem fit for their purpose during the lifecycle of the product, such as Audi's function-on-demand feature or Tesla's acceleration boost feature.

Hence to achieve user configurable capabilities, along with the ability to add new features and functionality throughout the product's lifecycle, vehicles can no longer be defined by their hardware; they must be led by their software.

Software-defined vehicles (SDVs) are steering the automotive industry through a radical transformation. This new generation of vehicles will provide a huge leap forward for vehicle safety, technology and adaptability.

Although the idea of SDVs has been around for a couple of years, the industry is yet to come up with something that benefits all stakeholders.

Some of the key issues faced by the industry include the high computing demands of SDVs. Terabytes of data and millions of lines of code are processed by modern vehicles, and this is only expected to increase as vehicles become more intelligent.

With increased data generation, complex code and the addition of upcoming AI, OEMs are moving to centralised computing platforms with SoCs to meet all computing needs of the vehicle.

Another issue is the standardisation of functional hardware. Traditionally delivered to OEMs by suppliers as a black box, these are each built to their own unique interfaces. As the industry transitions to SDVs, functional hardware such as sensors and actuators must have a standard interface that is replaceable and upgradable.

More of this is being seen in the industry now with OEMs sharing platforms, skateboards and electrical architecture.

With the ability to update software over the air, this adds pressure to the software development process. It is instrumental to have a strong testing and validation approach during pre- and post-production. Specialised dev-ops workbenches are now implemented to use vehicle data from the cloud to run digital twins of subsystems and vehicles to detect any issues before vehicle or software release.



Adas detecting nearby vehicles, pedestrians and obstacles though sensors and cameras



Connected car digital dashboard display

These are just some of the technological challenges, but the automotive industry is also going through an organisational and operational transformation to prepare for the technological changes. This adds another layer of complexity.



Saad Dar is head of connected cars at Contechs

POWER TECHNOLOGIES



Automotive OEMs are preparing to cross to a 48V zonal world, says Nicola Rosano

Tesla's Cybertruck is challenging other OEMs to migrate to 48V

SETTING THE PACE

Vehicle Electronics

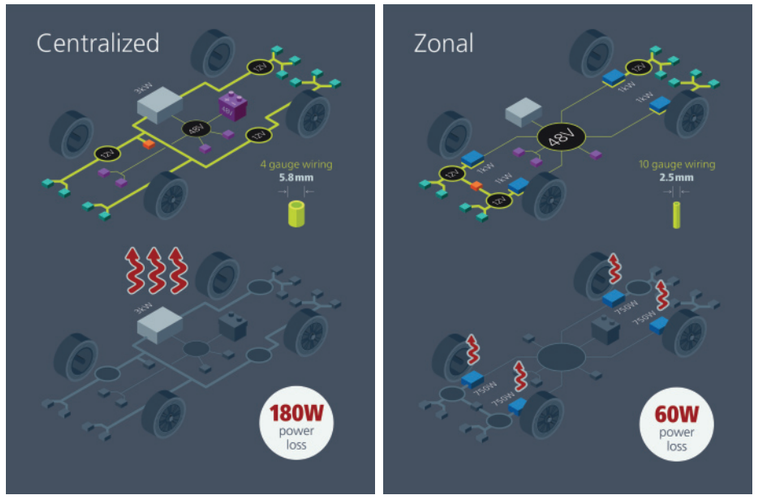


Fig. 1: There are two distinct PDNs used in automobiles today – the 12V centralised architecture (left) and fast-growing 48V zonal architecture (right): the former depends on the thick 12V wire harness, while the latter draws upon the thin 48V wire harness, which is far lighter, reduces heat loss and reduces current by a factor of four

The automotive industry is undergoing a transformative shift towards electric and hybrid vehicles, driven by the need for cleaner and more sustainable transportation.

Automotive OEMs are continuously increasing the number of electrical loads in their vehicles. Features such as heated seats and steering wheels, high-end entertainment systems and active suspension are increasing the electrical demand that the car's power system must supply. This is true not only for luxury brands but for all models.

For decades, the 12V alternator-driven power source has been sufficient for the customary electrical demands in an automobile. Today the traditional 12V automotive electrical architecture, designed originally for internal combustion engine (ICE) vehicles, is proving insufficient for the growing demands of modern electric and hybrid vehicles.

The need for increased power efficiency, improved energy recovery, and the integration of adas and electrified components are drivers for developing power systems that can efficiently provide higher amounts of energy to accommodate the shift to electric and hybrid platforms.

Migration

Automotive OEMs are steadily marching towards the day they transition to a 48V power delivery network (PDN). Using a 48V PDN effectively reduces the dissipation of energy due to resistance, enabling the transmission of higher currents and facilitating better overall power delivery.

A 48V architecture, which uses thinner cabling, results in a power distribution system that is lighter, more cost-effective and simpler to incorporate into the vehicle.

Adopting 48V offers the following benefits:

- Meeting vehicle increased power demands: Electric and hybrid (BEV and PHEV) vehicles demand higher power levels for propulsion and auxiliary systems, exceeding the capabilities of conventional 12V systems.
- Energy recovery: Regenerative braking and other energy recovery technologies are more effective in a 48V system, providing enhanced energy efficiency and increased range for BEVs and PHEVs.
- Reduced CO_2 emissions: The transition to 48V systems contributes to overall fuel efficiency and reduced carbon emissions, aligning with global environmental goals.
- Improved efficiency: A higher-voltage system enables smaller current levels, reducing resistive losses and enhancing overall power distribution efficiency.

Exploring

The 48V zonal architecture is a shift for the industry that capitalises on Ohm's Law: DC-DC conversion occurs closer to the points-of-load rather than inside a centralised silver box.

In this approach, HV-to-48V conversion enables safe 48V to be bussed throughout the vehicle. The 48-to-12V conversion occurs at the point-of-load. By carrying current at 48V instead of 12V, wires can be thinner, lighter and significantly cheaper, see Fig. 1.

This smaller, more flexible wire is also easier to route within the vehicle. Additionally, this approach evenly distributes the heat losses associated with DC-DC converters throughout the vehicle, enabling the potential use of chassis-mounted heat conduction and convective air cooling.

Implementation

The implementation of the 48V zonal architecture can be achieved by several methods. For instance, in mild hybrid systems, a 48V battery can be employed with the existing 12V battery. In the case of BEVs using 800V or 400V batteries, it is possible to use power modules to transform this voltage to 48V and create a simulated or a virtual 48V battery.

Tesla, along with other prominent companies, is embracing this technology with plans to transition its entire fleet to 48V. The first to make the transition is the Cybertruck. Using a 48V zonal architecture and contemporary DC-DC converters the Tesla enhanced power conversion efficiency helps reduce bulky cabling and reduces weight.

A 48V zonal architecture will route 48V throughout the vehicle and convert to 12V at the endpoint zones.

Savings

The 48V zonal architecture better supports the increasing power demand in BEVs, while also cutting vehicle weight in three primary ways.

First, by reducing the wire harness weight by 85%. The upgrade to 48V zonal architecture means traditional 12V, four-gauge wires at 273g/m, will be replaced with 48V, ten-gauge wires at 27g/m. This decreases the wire weight by approximately 85%.

Secondly, by eliminating an auxiliary battery. The power modules in a zonal architecture bring a very fast transient response, which enables the creation of a virtual battery. The power modules replicate the characteristics of 12 and 48V low-voltage batteries, introducing the opportunity to eliminate the physical 12V battery, saving 13kg or more.

And, thirdly, by saving 33% by shrinking the silver box. Substituting the zonal system for the centralised system moves the 48-to-12V power conversion out

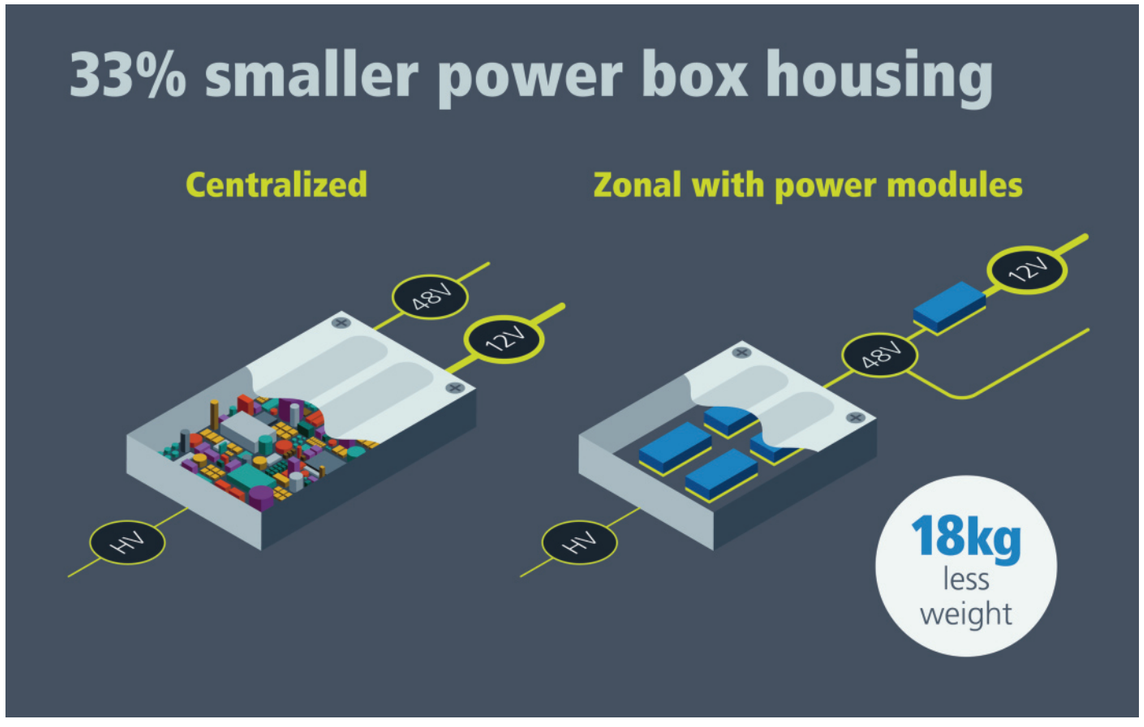


Fig. 2: The centralised housing can be reduced when using power modules and a zonal architecture because heat can be dissipated more efficiently at the endpoints where 48V is converted to 12V loads

Weight reduction realized with zonal architecture

		Weight reduction
Wiring harness	Using 10 gauge wire (48V)	2.5 kg
Auxiliary battery	Eliminated	13.0 kg
Cooling system	45 lbs, reduced by 7%	1.5 kg
Power box housing	6 lbs, reduced by 33%	1 kg
		18 kg

Table 1: A 48V zonal architecture used with high-density power modules will save about 18kg in compact electric SUVs

of the silver box to the points-of-load. The power system box revised to use high-density power modules to provide a 48V output can be up to 33% smaller. Therefore, the housing weight can be reduced by up to one third (33%), see Fig. 2.

In the traditional 12V centralised system, discrete components create a high ambient temperature inside their silver box housing. The power system box using high-density power modules creates less heat, and the point-of-load modules can be efficiently air-cooled on the chassis. These improvements enable the liquid-cooling system to slim down by roughly 7%.

Essential to optimising the 48V zonal PDN are the 48-to-12V DC-DC converters. High-density power modules are compact, lightweight and highly efficient. They can help OEMs harness the benefits of 48V, reducing packaging space and weight.

Fixed-ratio and regulated converters that support both 48 and 12V loads, operating in either buck or boost mode, can be deployed within a single housing or distributed throughout the vehicle to create a more compact and lighter 48V power delivery network.

These modules, when used with a decentralised zonal architecture, can optimise the vehicle power delivery network.

Power modules can reduce vehicle weight by up to 18kg, see Table 1. Hypothetically, if this weight were replaced with 18kg of battery cells, the EV driving range could increase by nearly 6500km per year, with no net weight gain.

This is significant because the average American drives 23,000km per year, according to the Federal Highway Administration in 2023. Therefore, a 48V zonal architecture can increase annual mileage by 28% while reducing yearly recharging time by up to 30%, see Table 2.

30% less recharging time annually

	Average EV	Most efficent EV
Range per charge	571 km	805 km
Range per charge with zonal weight loss	602 km	848 km
Increase in range with zonal weight loss	31 km	43 km
Increase in range, x3 recharges/week	93 km	129 km
Increase in range, x52 weeks/year	**4836 km**	**6708 km**
Recharging time saved	**21%**	**30%**

Table 2: Enhanced range offers drivers more distance per charge, reducing the charges needed per year

Conclusion

Consumer comfort and style desires are part of what drives higher power demands. The push to build BEVs requires more power efficiency to meet compounding power demands throughout the vehicle. The only option today to keep pace with escalating electrical demands is 48V. While there is a cost to converting, a 48V zonal architecture built with power modules delivers far more long-term saving, providing more return on investment.

The most efficient zonal architectures use small, lightweight converters at the point-of-load. Highly efficient power-dense modules are the best choice for 48-to-12V conversion.

In the race to 48V, the Tesla Cybertruck is the rabbit pacing the OEMs. Tesla has successfully crossed over from 12V to 48V. Other will follow and making improvements along the way.

Designing with easy-to-deploy power modules is the alternative to deploying traditional discrete designs used in legacy, centralised power systems. Small, compact, high-density power modules are the obvious choice and natural complement to a 48V zonal architecture, which is the future power delivery network for the automotive industry.



Nicola Rosano is senior strategic application and system engineer at Vicor



OEMs are increasing the number of electrical loads in their vehicles

CLEANING

Elizabeth Norwood explains how to enhance vehicle electronics reliability through precision PCBA cleaning

MAKE IT CLEAN

CLEANING

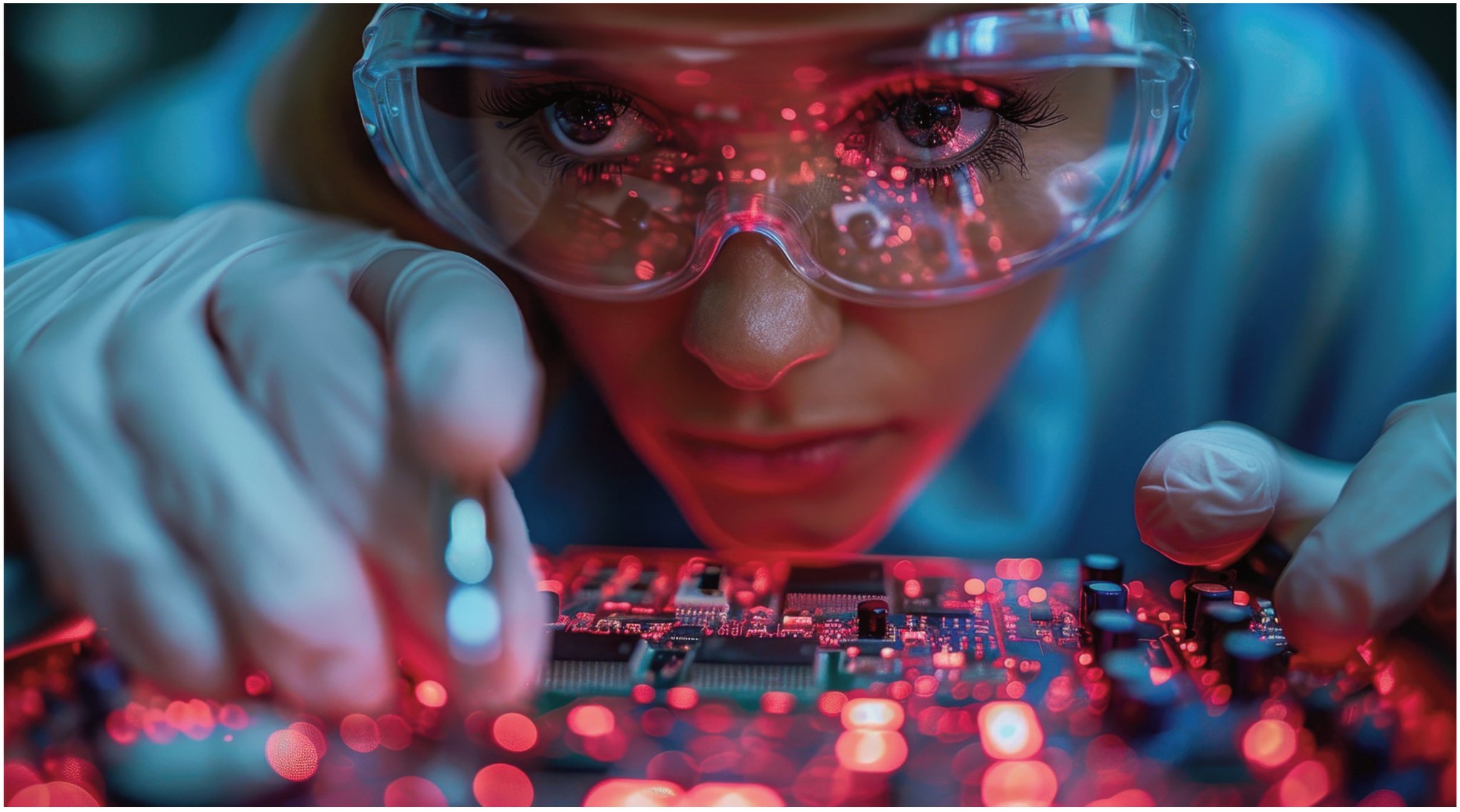
Printed circuit board assemblies (PCBAs) have become the indispensable backbone of modern vehicle electronics, powering everything from adas to sophisticated infotainment centres and critical electric vehicle (EV) components.

As vehicles evolve into rolling computers, the complexity and importance of these electronic systems have grown exponentially. Adas technology, for example, relies on a network of sensors and cameras, all interconnected through PCBAs, to process real-time data and enhance driver safety.

Similarly, today's infotainment systems manage various functions including multimedia content, navigation and connectivity features, all made possible by PCBA infrastructure.

The development of EVs has further increased the demand for advanced PCBAs, which are essential for power distribution, battery management and motor control. As automotive electronic systems grow in sophistication and play an increasingly vital role in vehicle operation, the need for effective PCBA cleaning methods has become more critical.

Ensuring these complex electronic components' best performance and longevity is now a key factor in overall vehicle reliability and safety.



Modern PCB assemblies, with their densely packed components, make it difficult to reach and clean all areas effectively

Crucial

Cleaning PCBAs is essential for keeping optimal functionality and longevity in automotive electronic systems. This process removes contaminants such as flux residues, dust and manufacturing debris, which can cause electrical failures and short circuits, potentially compromising vehicle safety and performance.

Clean PCBAs offer several key benefits in automotive applications. Precision cleaning enhances reliability by eliminating hazards that could affect critical systems such as adas and EV power management. This is particularly crucial as vehicles increasingly rely on complex electronic systems for their core functions.

Furthermore, clean PCBAs show improved electrical performance. Removing substances that interfere with conductivity ensures smooth signal transmission and precise electrical flow. This is especially important in high-frequency applications common in modern vehicle electronics, where even minor disruptions can lead to system malfunctions.

Precision cleaning also plays a vital role in increasing the longevity of PCBAs by promoting conformal coating adhesion, which is essential for protecting vulnerable automotive PCBAs from moisture, dirt and vibration.

By preserving circuit board integrity, effective cleaning enables PCBAs to withstand the harsh environmental conditions and prolonged use typical in the automotive industry. This durability is crucial for supporting consistent performance throughout a vehicle's lifespan.

As automotive technology continues to advance, the importance of clean PCBAs in overall system functionality is critical. By prioritising PCBA cleanliness, automotive manufacturers can ensure the reliability, performance and

longevity of their electronic systems, ultimately contributing to safer and more efficient vehicles on the road.

Challenges

Cleaning automotive PCBAs presents several challenges, primarily driven by PCBA complexity, advanced materials and miniaturisation trends.

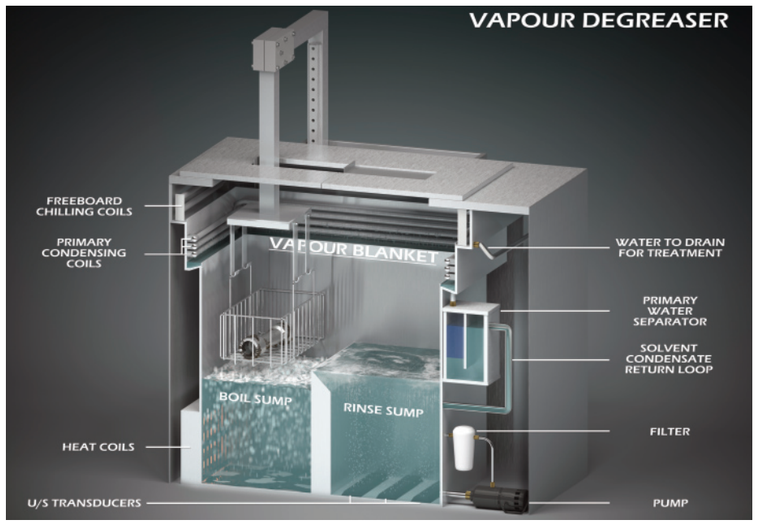
Modern PCB assemblies, with their densely packed components, make it difficult to reach and clean all areas effectively. Intricate designs and tight spaces between components create obstacles to traditional cleaning methods, often leaving hard-to-reach areas vulnerable to residual contamination.

Advanced materials used in automotive PCBAs require specialised cleaning approaches. High-frequency laminates and flexible and ceramic substrates used to improve durability and functionality demand cleaning that is effective yet gentle enough to avoid damaging these delicate components. This balance between thorough cleaning and part preservation adds another layer of complexity to the process.

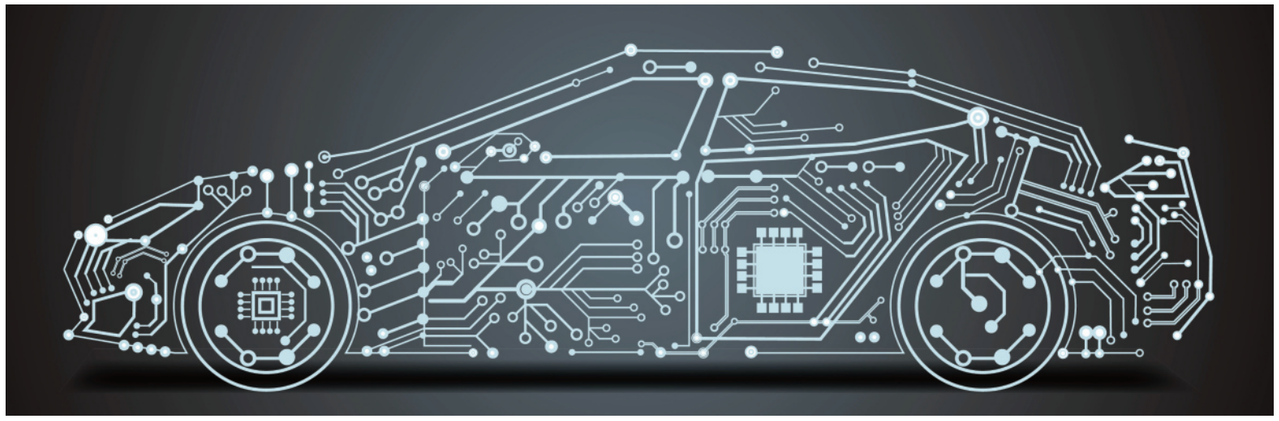
Adding to the cleaning challenge is miniaturisation. The trend towards smaller, more compact PCBAs is increasing, fuelled by the demand for space-efficient options in today's vehicles. As components shrink and the spaces between them become narrower, accessing all areas of the PCBA to get them thoroughly clean becomes increasingly difficult.

Traditional cleaning methods may not effectively remove contaminants from these tight spaces without leaving flux residue and other contaminants behind.

Given these difficulties, some conventional cleaning techniques are no longer effective, potentially leading to inadequate contaminant removal or material degradation. Manufacturers are turning to advanced cleaning technologies and specialised fluids to address these complex requirements.



Modern cleaning fluids used in vapour degreasers are specifically engineered to meet the challenges posed by emerging materials and miniaturisation trends in automotive PCBAs



PCBAs have become the indispensable backbone of modern vehicle electronics

Degreasing

Vapour degreasing is a highly effective method for cleaning PCBAs. This process involves a closed-loop system with a boil sump and a rinse sump. The cleaning fluid is heated in the boil sump, and the PCBAs are immersed in the vapourised fluid for cleaning.

Once cleaned, they are transferred to the rinse sump for a final rinse in uncontaminated fluid. The PCBs are then dried and cooled in the vapour blanket.

This method offers several advantages over traditional cleaning techniques:

- Thorough cleaning: The low viscosity and surface tension of modern cleaning fluids used in vapour degreasing allow them to penetrate even the smallest spaces on densely packed PCBAs.
- Quick drying: These fluids evaporate quickly, ensuring that PCBAs emerge from the process dry and free from residue.
- Consistent results: The closed-loop system ensures consistent cleaning quality, reducing the risk of human error.
- Multi-material compatibility: Modern cleaning fluids are formulated to be compatible with various PCBA materials ensuring effective cleaning across diverse automotive applications.
- Environmental friendliness: Modern vapour degreasing fluids are formulated to be sustainable, and more environmentally friendly, with low global warming potential.

Fluids

Modern cleaning fluids used in vapour degreasers are specifically engineered to meet the challenges posed by emerging materials and miniaturisation trends in automotive PCBAs. These fluids excel in cleaning complex multi-material boards and are particularly effective with the high-density designs common in today's automotive electronics.

Their advanced formulations quickly clean and dry the entire PCBA, without compromising the integrity of delicate components. This combination of properties makes these fluids highly adaptable to both current PCBA designs and future developments in automotive electronics.

The choice of the correct cleaning fluid is important for the vapour degreasing process in electronics manufacturing. While flux residues are a common concern, they are many other potential contaminants.

Modern cleaning fluids are formulated to be effective against a wide range of contaminants found on PCBAs, including organic compounds such as rosin solder pastes, inorganic residues from flux activators, fingerprint oils, dust and marking inks.

When selecting a cleaning fluid, it is important to consider factors such as compatibility with PCBA materials, drying speed and residue-free outcomes. Opting for fast-drying can enhance board cleaning efficiency and reduce post-cleaning processes.

Some cleaning fluids address specific difficulties, such as electrostatic polar cleaning fluids that can break the static bond between particulates and PCBA surfaces, improving the removal of stubborn contaminants.

As automotive electronics continue to evolve, these cleaning fluids provide manufacturers with the flexibility to clean a wide range of PCB assemblies without compromising on quality or performance. This versatility is crucial in an industry where reliability and safety are paramount, ensuring automotive PCBAs meet the standards required for modern vehicles.

Reliability

The global automotive PCBA market is set to grow from $9.15bn in 2023 to $15.10bn by 2032, highlighting the crucial role of PCBA cleanliness in supporting automotive innovation. As vehicle electronics become increasingly complex, cleaning methods such as vapour degreasing play a vital role in supporting the integrity of these essential components.

By using advanced cleaning techniques and fluids, manufacturers can enhance vehicle safety, improve electronic system efficiency and meet the demands of an expanding market. As the automotive electronics industry continues to evolve, effective PCB cleaning will remain a key factor in advancing vehicle technology, supporting the ongoing development of increasingly sophisticated and reliable automotive electronics.

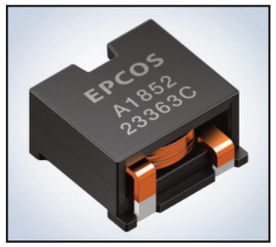


Elizabeth Norwood is senior chemist at MicroCare

Alloy powder choke handles up to 48A

TDK has extended its ERU27M series of SMD high current flat wire inductors consisting of an isolated alloy powder core and flat wire helical winding.

As power densities and currents in automotive and industrial applications continue to increase, this series meets these requirements by using an alloy powder core material that exhibits a softer saturation characteristic than the core material used previously.



Designed for rated currents from 36 to 48A, these surface-mountable components cover inductances from 2.3 to 8.5µH. DC resistances are as low as 0.68 to 1.66mΩ.

Thanks to the flat wire winding, the components have dimensions of 27.1 by 25.55mm, and height from 14.1 to 16.4mm. Operating temperature is from -40 to +150°C.

With this magnetically shielded and robust construction with a third pin that is not electrically connected, these four AEC-Q200-qualified energy storage chokes can be used in DC-DC converters, VRM modules and POL converters especially in the automotive sector, but also in solar converters.

Certain production parameters can be changed, and fully customised designs are possible.

Static analysis tools increase security

The latest versions of Perforce Software's static analysis tools provide enhanced security and CI and CD process flexibility for safety-critical development projects.

The static analysis engines ensure software quality, safety and security, and offer continuous compliance throughout the development process by alerting developers to defects, vulnerabilities and standards rule violations as the code is being written.

Shifting to the left of the linear development timeline makes fixing errors more manageable, improves product quality, increases efficiency, ensures compliance to standards, and reduces time to market.

Using static analysis tools can empower development teams to adopt a shift-left methodology faster, more accurately and at scale.

This release includes the ability to produce delta analysis results for change sets as part of a feature branch commit, merge request or pull request, and then report these results through Perforce Validate, the continuous security and code compliance platform that provides a centralised store of static analysis data for codebases across the organisation, making peer reviews and deviation approvals simpler and more efficient.

Support also extends to analysis jobs running in cloud-based CI pipelines, containerised build tasks and integration into different CI and CD platforms via the built-in web API, allowing development teams to find and fix defects earlier in the development lifecycle.

Users also get enhanced and simplified security with the Validate authentication improvements, including support for integration of identity providers with Validate using SAML and OIDC, allowing IT teams to manage users and groups more efficiently, and making it more convenient for users.



Bluetooth MCU

Infineon has added eight products to its Airoc CYW20829 Bluetooth LE 5.4 MCU family, featuring SoCs and modules for industrial, consumer and automotive use.

The integration helps designers reduce costs and device footprint in various applications.

There is support for secure boot and execution environments and cryptography acceleration to safeguard sensitive data.

The automotive part, the CYW89829 MCU, is for car access and wireless battery management system (wBMS) applications, due to its RF performance, range and Bluetooth 5.4 features including PAwR (periodic advertising with responses).

The dual Arm Cortex core design of the family features separate application and Bluetooth LE subsystems that deliver support for Bluetooth 5.4, low-power, 10dBm output power without a PA, integrated flash, Can-FD, crypto accelerators, and security including root of trust (RoT). It is PSA level-one ready.

Multiplexer simplifies smart cockpits

An automotive-compliant 10Gbit/s 6:4 active crossbar multiplexer from Diodes has a linear redriver.

The PI3DPX1225Q switches USB 3.2 and DisplayPort 2.1 signals through a USB type-C connector, and delivers low-latency connectivity with high signal integrity for smart cockpits and rear-seat entertainment systems.

It supports three operating modes: the device can connect one lane of USB 3.2 gen-two to the USB type-C connector; one lane of USB 3.2 gen-two and two channels of DP 2.1 UHBR10; or four channels of DP 2.1 UHBR10.

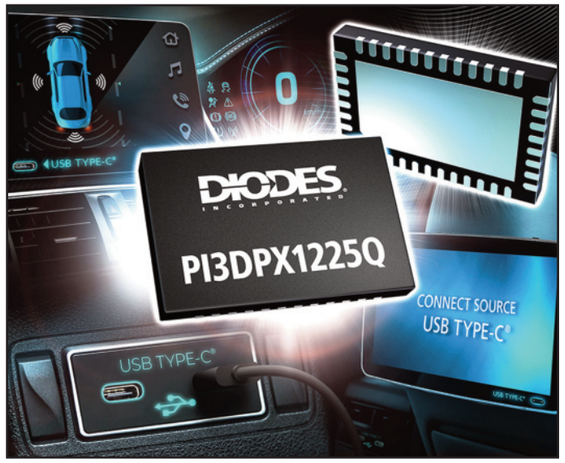
The device also integrates an aux listener and, in compliance with the USB type-C standard, swaps the aux channels when a flipped cable is detected.

For each of the USB 3.2 gen-two and DP 2.1 UHBR10 operating modes, the differential signals can be adjusted with continuous time linear equalisation (CTLE).

Output compression swing (-1dB) and flat-gain values are controlled by the I²C setting.

By reducing intersymbol interference (ISI) jitter, the 10Gbit/s signal performance is optimised over various physical mediums. Linear equalisation does not block the decision feedback equaliser receiver's adaptive channel controls; this supports DP 2.1 transparent link training (LT) without dependency on the DP-aux channels listener.

The device is packaged in a 40-pin W-QFN6040-40 with a 4 by 6mm footprint.

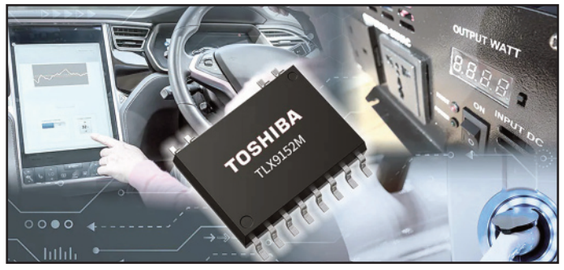


Photorelay withstands up to 900V

An automotive photorelay from Toshiba has a minimum output withstand voltage of 900V and is suitable for application in high-voltage automotive batteries.

The TLX9152M photorelay comes in an SO16L-T package.

Improved charge times and a longer cruising range are essential for wider adoption of electric vehicles, and both require more efficient operation of battery systems. Battery management systems (BMSs) realise efficient operation by monitoring the battery charge status, plus the insulation between the battery and the vehicle body that is essential for the safe use of high-voltage batteries.



In a BMS that must handle high voltages, electrically insulated photorelays are used.

Photorelays commonly used in battery systems must have a withstand voltage of approximately twice the system voltage. Given this, an output withstand voltage of over 800V is necessary for a 400V system.

This product is suitable for 400V systems as it has an output withstand and supply voltage of 900V.

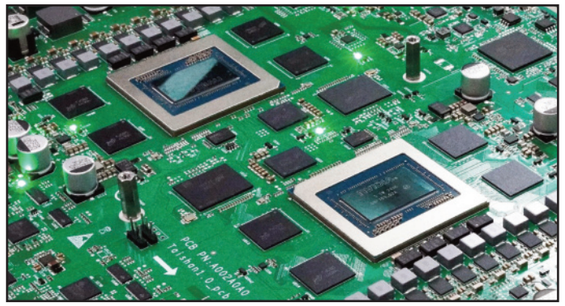
Use of the SO16L-T package facilitates common circuit board pattern design.

BMS applications include battery voltage monitoring, mechanical relay sticking detection and ground fault detection. It can also replace mechanical relays.

It is a normally open 1-Form-A device. Avalanche current rating is 0.6mA and minimum isolation voltage 5kV RMS.

It is AEC-Q101 qualified and complies with IEC 60664-1.

Domain controller targets level-four autonomous cars



An automotive-grade L4 autonomous driving domain controller from Lenovo has rolled off the production line at LCFC Hefei, the group's biggest manufacturing base.

This achievement marks Lenovo as one of the first automotive tier-one suppliers to bring up the Nvidia Drive Thor platform.

The AI computing power of the AD1 is 2100Tops at FP8 and INT8, and its CPU computing power, evaluated based on Specrate 2017, reaches 174.

Its functional safety level is up to Asil D of ISO 26262, and the cyber security complies with ISO 21434, complemented by a range of sensor interfaces.

The domain controller was purpose built for commercial scenarios of SAE level-four autonomous driving, emphasising high computing power, safety, reliability, cost-effectiveness and low maintenance. It paves the way for start of production of driverless commercial vehicles such as robotaxis, trucks, buses and road sweepers.

The controller uses Nvidia Drive Thor, incorporating FP4 and FP8 operations into AI inference. This improves efficiency and maintains precision comparable to FP16, resulting in a fivefold increase in the inference speed of transformer models.

In the future, Lenovo says it will offer its domain controllers tailored for the L3 and L2++ adas market, with various configurations to provide for safer and more convenient adas features.

The firm's UltraBoost AI middleware is also compatible with the domain controllers, improving computational efficiency, operator enhancement and task scheduling.

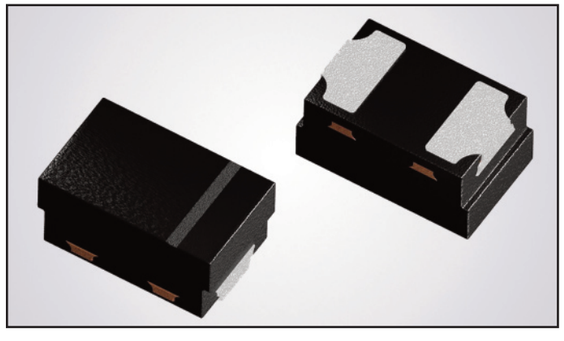
Diodes protect Ethernet networks

An automotive-grade bidirectional single-line ESD protection diode from Vishay comes in the compact DFN1006-2B package with wettable flanks.

Optimised for Automotive Ethernet networks in compliance with Open Alliance 100baseT1 and 1000baseT1 specifications, the VETH-100A1DD1 offers low clamping voltage, dynamic resistance and capacitance for the protection of high speed data lines against transient voltage signals.

Offering a smaller footprint and lower profile than other standard packages, the device has a clamping voltage of 31V typical at 1A, a result of its snap-back technology with a trigger voltage of more than 100V.

Combined with dynamic resistance of 0.4W typical, the diode delivers improved ESD absorption performance and protection, while its maximum capacitance of 2pF enables higher signal integrity.



The device provides transient protection for data lines as per ISO10605 and IEC-61000-4-2 at ±15kV contact discharge for 1000 pulses.

For automotive applications, the protection diode is available in an AEC-Q101 version and offers a working voltage of ±24V.

The diode has a moisture sensitivity level of one in accordance with J-STD-020 and a UL 94 V-0 flammability rating. RoHS-compliant, halogen-free, and Vishay Green, the device supports automated optical inspection for automotive systems.

Samples and production quantities are available now, with lead times of 20 weeks.

Current sensors improve design flexibility

Current sensors from Molex can improve design flexibility and simplify system integration in industrial and automotive applications.

The Percept devices incorporate Infineon coreless current sensors with a differential Hall-effect design for more precise current measurement and better noise suppression.

Proprietary electronics packaging technology reduces sensor size and weight.

The sensor-in-busbar configuration provides a complete package for plug-and-play deployments, saving development time, resources and costs.

The compact, coreless design and electronics packaging results in a product that is 86% lighter and up to half the size of competing current sensors. This enables higher-density packaging within devices, which contributes to reductions in overall weight while facilitating design flexibility.

They provide increased sensing opportunities in space-constrained applications as well as those sensitive to EMI. They also provide accuracy within 2% across a wide temperature range and entire product lifespan, along with low sensitivity and offset errors.

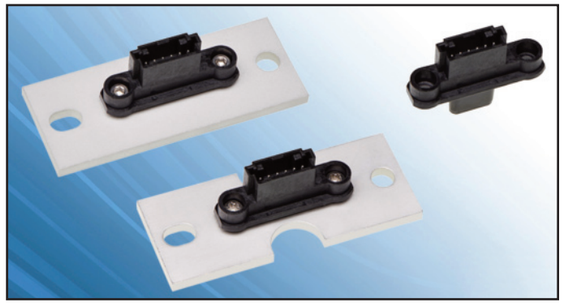
Additionally, Infineon's Xensiv TLE4973 and TLE4972 sensors suppress noise from stray magnetic fields, which are commonly found in industrial motor-drive and automotive applications. Measurement range is 0 to 2kA.

The electronics packaging enables seamless integration of high-current conductors, connectors, PCBs, busbars, heatsinks and other mechanical components in one device. This is suitable for assemblies that must withstand high temperatures, high currents and harsh environments.

This packaging technology uses 99% less water than typical PCB manufacturing and does not require any chemicals or generate copper sludge, enabling a more environmentally friendly manufacturing method.

The sensors are available in industrial- and automotive-grade options, encompassing full-differential and single-ended output modes and bi-directional sensing.

Available current ranges include ±450 to ±1600A, with operating temperatures from -40 to +125°C to AEC-Q100 grade one.



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