VEHICLE electronics

The monthly magazine for automotive electronics engineers

Google and Qualcomm work on software-defined vehicles

Qualcomm and Google are collaborating to produce a standard reference framework for generative AI-enabled digital cockpits and software-defined vehicles (SDVs).

The firms will leverage Snapdragon Digital Chassis and Google's in-vehicle technologies.

The multi-year technology collaboration is aimed at advancing digital transformation in automotive using the Snapdragon Digital Chassis, Android Automotive OS and Google Cloud to produce a reference platform for developing cockpit technology using gen AI.

Underpinning this will be Google AI, to create gen AI-enabled in-car experiences such as intuitive voice assistants, immersive map experiences, and real-time updates to anticipate driver needs, powered by Snapdragon heterogeneous edge AI SoCs and Qualcomm AI Hub, which simplifies deploying AI models for vision, audio and speech applications to the cockpit.

A key element of the collaboration is an upgradeable, automotive-grade framework to provide digital cockpit experiences that can be enhanced in real time.

Pre-integrated Android Automotive OS software and services will enable customisable and responsive voice user interfaces and real-time driver updates using Google gen AI leveraging edge optimisations through Snapdragon SoCs.

A unified framework for SDV development with vehicle-to-cloud infrastructure will be based on foundational technologies from both firms.

The framework enables Google Cloud hosted automotive software development to be optimised for Snapdragon platforms, increasing developer productivity while reducing time to market for Android OS platform and services.



Qualcomm partners Google on gen AI for cars

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QNX strengthens OS with integrity checking

Blackberry has strengthened its QNX OS for Safety with the addition of a Posix-compliant, ISO 26262 certified, integrity checking filesystem to provide OEMs and other embedded software suppliers an additional layer of validation when building safety-critical systems.

Certified to ISO 26262 Asil B, the Filesystem for Safety (FfS) verifies the integrity of all filesystem contents at runtime, helping embedded software developers detect if any corruption has taken place and to take necessary actions to maintain the safety of the system.

If, for instance, a file that ran a safety-critical function such as collision avoidance or object detection got corrupted before running or was loaded with incorrect configuration data, the issue might not be noticed until it was needed in a crucial moment, potentially leading to a dangerous or even fatal situation. FfS guards against this, validating all data and performance parameters on which safety-critical systems are built and run.

"For automakers, having a pre-certified software stack and OS significantly accelerates time-to-market, reduces development costs and ensures that safety remains paramount throughout the entire lifecycle, from development to production," said Grant Courville, vice president at Blackberry QNX.

Select OEMs and tier-one suppliers are using QNX FfS 1.0 in their development. It is available as part of QNX OS for Safety 2.2.3.

• LDRA has announced that its tool suite supports the Blackberry QNX SDP 8.0 software development platform. The integration of these tools offers safety and security for embedded applications, including automotive, industrial controls, robotic systems, manufacturing, materials handling and surgical robots.

WeRide robotaxi packs them in



Autonomous driving company WeRide has unveiled its latest robotaxi, the GXR, said to be the world's most spacious production robotaxi model.

WeRide is a Chinese commercial-stage company developing autonomous driving technologies from level two to four.

Leveraging WeRide's experience of more than 1800 days in public robotaxi operations, GXR integrates self-developed level-four autonomous driving hardware and software, open-concept spacious designs, the Sensor Suite 5.6, and the HPC 2.0 high-performance computing platform, handling peak traffic hours, mixed traffic conditions and high-speed driving at night.

The redundancy system includes architecture, steer-by-wire chassis, computing units and braking, preventing single-point failures.

Sensor Suite 5.6 features an aerodynamic and compact design with over 20 sensors, including lidar, cameras and an RTK high-precision inertial navigation set, with 360° blind-spot-free perception and 200m front detection.



Audi integrates NXP UWB to enable hands-free access

Audi is integrating NXP's Trimension NCJ29Dx family into its Premium Platform Electric (PPE) vehicles, delivering hands-free, secure car access and a suite of safety and convenience features.

The NCJ29Dx family is part of the firm's UWB portfolio, the technology foundation for Audi's UWB platform, delivering the precise and secure real-time localisation required to enable hands-free secure car access via smart mobile devices and other UWB-based features.

Cars featuring the UWB devices, including the Audi Q6 E-Tron, will hit the road this year.

Smart, secure car access leverages the fine-ranging capabilities of NXP's UWB portfolio to identify precisely the location of the driver in relation to the car, allowing the doors to be unlocked only when the driver is close. Drivers can unlock and start their car hands-free using a digital key on a UWB-enabled mobile phone or wearable, which can remain in the driver's pocket or bag.

"Audi has long been on the leading edge of automotive technology, and this new UWB-enabled platform is no exception," said Ulf Warschat, head of development body electronics at Audi. "The precise and secure real-time localisation delivered by NXP's Trimension UWB portfolio ensures that our drivers will benefit from the advanced features and capabilities, allowing them to enjoy the driving experience in a whole new way."

The NCJ29Dx family is part of NXP's portfolio of secure car access systems, which includes the NCF3340 NFC controller and the KW37 Bluetooth 5.0 long-range MCU. These devices are being used by Audi as part of its platform.

The devices enable UWB-based fine-ranging capabilities and comply with IEEE 802.15.4, Car Connectivity Consortium (CCC) and FiRa standards.

"NXP's proven Trimension UWB platform enables OEMs to deliver new features for drivers, allowing secure and easy hands-free access to their cars, as well as supporting a variety of additional use cases like automated EV charging and more," said Markus Staeblein, senior vice president at NXP. "Building on our expertise and standardisation efforts in bodies such as the CCC and the FiRa Consortium, UWB will continue to drive new enhancements to the consumer automotive experience and is quickly becoming an essential component in the automotive ecosystem."

They deliver high localisation resolution and power optimisation for battery-powered devices such as key fobs, while also reducing costs. They protect against car theft through relay attacks and include on-chip support for cryptographic operations.

Leapmotor picks Hesai for long-range lidar

Chinese car maker Leapmotor has chosen Hesai as the exclusive provider of automotive long-range lidar for a platform due to enter mass production next year.

Hesai will provide lidar for multiple models of Leapmotor's platform.

The Leapmotor C-series intelligent driving edition is equipped with Hesai's AT128 high-definition long-range lidar, enabling navigation assist pilot and cruise, and other smart driving functions.

Infineon to present 300mm GaN wafer at Electronica

Infineon will present its first 300mm GaN wafers to the public at the Electronica trade show in Munich in November.

The firm says it has succeeded in developing the world's first 300mm power gallium nitride (GaN) wafer technology in an existing and scalable high-volume manufacturing environment.

The breakthrough will help drive the market for GaN-based power semiconductors. Chip production on 300mm wafers is more advanced and efficient compared with 200mm wafers, since the bigger wafer diameter fits 2.3 times as many chips per wafer.

GaN-based power semiconductors find fast adoption in automotive, industrial, consumer, computing and communication applications, including power supplies for AI systems, solar inverters, chargers and adapters, and motor-control systems.

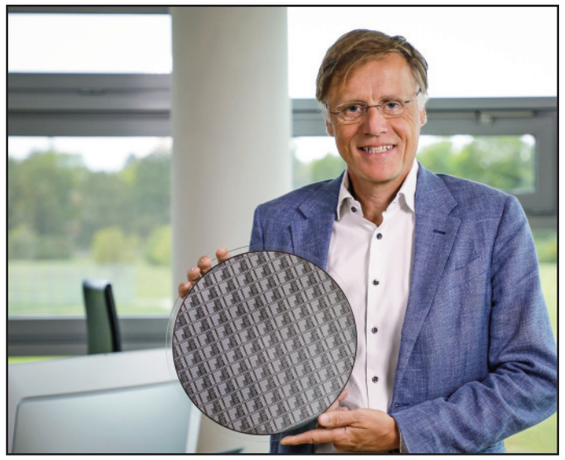
GaN manufacturing processes lead to improved device performance resulting in benefits in end applications as they enable efficiency, performance, smaller size, lighter weight and lower overall cost.

"This remarkable success is the result of our innovative strength and the dedicated work of our global team to demonstrate our position as the innovation leader in GaN and power systems," said Jochen Hanebeck, CEO of Infineon. "The technological breakthrough will be an industry game-changer and enable us to unlock the full potential of gallium nitride. Nearly one year after the acquisition of GaN Systems, we are demonstrating again that we are determined to be a leader in the fast-growing GaN market."

Infineon has succeeded in manufacturing 300mm GaN wafers on an integrated pilot line in existing 300mm silicon production in its power fab in Villach, Austria. The company is leveraging competence in the existing production of 300mm silicon and 200mm GaN.

Infineon says it will further scale GaN capacity aligned with market needs.

A significant advantage of 300mm GaN technology is that it can use existing 300mm silicon manufacturing equipment, since gallium nitride and silicon are very similar in manufacturing processes.



Jochen Hanebeck holds one of the 300mm GaN power wafers

BMW software upgrades pass ten million mark

The number of BMW remote software upgrades passed the ten million mark at the end of September.

These upgrades are transmitted over the air to the vehicles and then launched by the user.

"Today, BMW is able to deliver over-the-air updates to more than nine million vehicles worldwide," said Christoph Grote, senior vice president at BMW. "And we can update the entire vehicle software in this way. This capability clearly demonstrates our expertise in the field of software-defined vehicles."

He said the fact that ten million upgrades had been carried out underlined the popularity of this form of innovation.

BMW sent out its first over-the-air upgrade five years ago. This functionality has been extended to all brands, model series and drive types.

The arrival of Operating System 9 means Mini models can also be updated remotely, as can the Rolls-Royce Spectre.

The technology has enabled numerous functions and improvements to be rolled out. In addition to comfort and safety features, the updates have benefited infotainment, driving, drive system and driver assistance.

More upgrades are planned including model-specific features such as a silent mode and a curve ahead view in the head-up display for seeing around bends virtually.

Collaboration needed for route to 48V, says Molex report



The move to 48V electrical systems is poised to fuel major improvements in vehicle performance, efficiency, functionality and comfort, according to a report by Molex.

Scott Whicker, senior vice president at Molex, said 48V technology held great promise, but the path forward required industry-wide collaboration to overcome technical obstacles and establish industry standards.

"We are working with partners across the automotive ecosystem to accelerate 48V adoption," he said. "Together, we can optimise system integration, reduce development costs, and speed time to market for power system components and connectivity, ensuring reliable and efficient power delivery."

By quadrupling system voltage, 48V technology advances automotive features and functionality, including electric turbocharging, regenerative braking, infotainment and battery preconditioning for auxiliary charging.

The increased voltage boosts the efficiency of electrically powered components for more responsive climate control and steering, and precise engine temperature management.

The delivery of higher current and voltage also increases power efficiencies in the critical sensors, actuators and control units needed for adas while paving the way for fully autonomous driving.

Versatile 48V systems are adaptable to traditional ICE vehicles and fully electric models.

The higher voltage levels though can lead to increased EMI, making it more difficult to shield against interference than lower voltage systems.

Equally important are wiring and harness designs, as higher current and voltage requirements introduce problems related to weight, space and cost.

"The emergence of 48V architecture is a turning point for meeting critical environmental regulations and consumer demand," said Terry Woychowski, president of Caresoft Global. "Forward-looking EV manufacturers are poised to increase 48V innovation and lower barriers to success by working closely with crucial stakeholders across the entire EV ecosystem."

The journey to full-scale 48V adoption requires agile methods and industry collaboration to clear a litany of roadblocks, including upfront investments in 48V components, integration of 48V into existing vehicle platforms, and seamless compatibility with current electrical systems and safety features.

The need to fine-tune 48V battery performance is essential to elevating energy density, power output and lifespan while decreasing costs.

Modular platforms consisting of interchangeable components, including electric motors, inverters, DC-DC converters and batteries, offer much-needed building blocks for more efficient and cost-effective vehicle designs.

These systems also need heightened connector performance and reliability, as well as materials with better electrical and thermal properties.

Digital twin improves tyre development

Kumho Tire has developed a tyre digital twin for development engineers. This brings big data analytics, artificial intelligence, digital transformation and computer aided engineering (CAE) to the tyre development process.

By applying the system, the tyre development process has evolved from the physical tyre development in the real world to virtual development in the digital space.

The digital twin will be used by engineers for generating tyre designs, conducting performance prediction, performing design optimisation and simulating vehicle performance.

This should result in a shortened tyre development time, improved tyre performance and reduced development costs.

Imec gets initial support for chiplet programme

Arm, ASE, BMW, Bosch, Cadence, Siemens, SiliconAuto, Synopsys, Tenstorrent and Valeo are the first to join Imec's automotive chiplet programme.

At an October gathering in Ann Arbor, Michigan, Imec announced the first members as it aims to bring together stakeholders from across the automotive ecosystem in a pre-competitive research effort.

The programme's goal is to evaluate which chiplet architectures and packaging technologies are best suited to support car manufacturers' high-performance computing and strict safety requirements, while striving to extend the benefits of chiplet technology, such as increased flexibility, improved performance and cost savings, to the entire automotive industry.

Car makers have been integrating chip technology into their vehicles since the late 1970s. Lately, however, traditional chip architectures have struggled to meet the requirements of more demanding automotive technologies, such as adas and immersive in-vehicle infotainment (IVI) services.

Enter chiplets – modular chips designed to perform specialised functions efficiently that can be seamlessly combined to create more sophisticated compute systems.

"The adoption of chiplet technology would signal a disruptive shift in central vehicle computer design, offering distinct advantages over traditional monolithic approaches," said Bart Placklé, vice-president at Imec. "Chiplets facilitate rapid customisation and upgrades, while reducing development time and costs."

However, he said moving to a chiplet architecture was prohibitively expensive for OEMs if done in isolation.

"Commercial viability thus hinges on industry alignment around a set of chiplet standards, enabling car manufacturers to procure chiplets from the market and integrate them with proprietary chiplets to build unique offerings," he said.

Companies developing supercomputing, data centre and smartphone technology have long explored the benefits of chiplet technology to meet their rapidly increasing computing needs. But the automotive industry has been more reluctant to embrace the chiplet paradigm due to the unique problems they face.

First, automotive products must meet strict robustness and reliability requirements, ensuring continuous operation and passenger safety over a car's typical lifespan of ten to fifteen years. Cost is another crucial factor to consider. And, performance and energy efficiency are critical to preserving a car's battery life. These are some of the issues Imec's chiplet programme hopes to address.



Bart Placklé

VW deploys gen AI in mobile app

Volkswagen is deploying generative AI within the MyVW mobile app through a partnership with Google Cloud.

VW is leveraging Google's AI and machine-learning capabilities to power the MyVW virtual assistant and provide vehicle owners with access to critical vehicle information and services.

It is available for all My24 Atlas and Atlas Cross Sport vehicle owners, with drivers able to access information specific to their vehicles.

The virtual assistant combines Volkswagen's connected car data with Gemini models on Google Cloud's Vertex AI platform to deliver low-latency, accurate information to users.

Atlas and Atlas Cross Sport owners through the app can use the assistant to explore their owners' manuals and ask questions such as how to change a flat tyre or what a cockpit indicator light means.

Codasip core eases customisation

Risc-V specialist Codasip has announced an embedded core that meets automotive safety and security needs enabling ISO/SAE 21434 and ISO 26262 compliance up to Asil D.

The L730 core incorporates optional safety mechanisms and security features, providing engineers with flexibility while meeting their needs for verified and supported core IP.

It is available in pre-verified, baseline configurations that can be configured and customised through risk-free custom instruction extensions.

This is made possible by an added level of customisation in Codasip Studio Fusion. Called bounded customisation, it means the core can be extended with new instructions without risk because the functionality of the baseline core is guaranteed in all cases via defined bounds and formal methods.

Studio Fusion generates a verification framework that simplifies the verification of the custom instructions.

The core supports the Risc-V Scalar Crypto extension and will offer the Cheri memory safety technology for security.

Custom compute is enabled by Studio Fusion, a set of tools for optimising processors for specific software applications. The benefits of the Studio Fusion toolset are reflected in the L730 core, which can be used as a pre-verified starting point to achieve the right level of customisation.

Depending on their needs and the results of software application profiling performed in Studio Fusion, users can either configure the core from a defined set of pre-verified options, create custom instructions within set bounds, or design freely.

• Codasip has donated its newly developed SDK for Cheri to the community-interest organisation Cheri Alliance to makes the SDK freely available for download on GitHub.

Everspin supplies Lucid memory



Lucid Motors is using Everspin Technologies' Persyst magnetoresistive random access memory (mram) in its recently released Gravity SUV.

The MR25H256A 256kbit serial mram was selected because it meets AEC Q100 grade one for -40 to +125°C operation. The mram is used in the Gravity to handle data logging and parameter storage to assist in the efficient operation of the all-electric powertrain.

Sanjeev Aggarwal, CEO of Everspin Technologies, said: "As the automotive industry evolves, the ability to ensure data integrity and system resilience is critical, and our memory continues to play an essential role in meeting those challenges."

The Persyst family is said to have virtually infinite write endurance. Users can thus adopt mram and be confident the product performance will not degrade over the life of the system.

Combined with fast write speed and low read latency, it can handle stringent memory workloads and protect vital user data, even in the event of power loss or interruption.



From the left: Alexander Gach, CEO of Peak-System; Ines Dohmann, managing director of the Peak group. Staffan Dahlström, CEO of HMS Networks; and Uwe Wilhelm, general manager of Peak-System

HMS acquires Peak-System

Industrial information and communication technology firm HMS Networks has acquired Peak-System Technik, a German provider of industrial communications and a specialist in automotive communication technologies such as Can and Lin.

The acquisition should strengthen HMS's position within communications for engineering tools, and testing and control within automotive, medical and transportation.

HMS sees several synergies between HMS's Ixxat business unit and Peak-System as there is a lot of common expertise within automotive communication technologies such as Can, Can-FD, Lin, Flexray and Automotive Ethernet, but aimed at different applications and target groups. Hence there is opportunities for cross-selling, both when it comes to product development and using the sales channels of both companies.

The acquisition will increase HMS's presence within automotive communications, especially in the German market.

"Peak-System's extensive product portfolio and expertise expand our existing product offering in communications for advanced engineering tools, testing and control in applications within automotive, medical and transportation," said Staffan Dahlström, CEO of HMS Networks. "We also see excellent cross-selling opportunities, both geographically and technically. Our Ixxat brand and Peak-System already offer unique sets of software and hardware tools and, together, they will provide our customers with more options to solve their communications challenges."

Peak-System offers hardware and software for industrial and automotive communications. The company was founded in 1999 and is located in Darmstadt, Germany.

There is also a French subsidiary with an office in Maxéville, close to Nancy.

Peak-System employs about 50 people. About half its sales are in Europe, with 25% in Asia and 25% in the USA.

Autobrains architecture changes way AI works

Autobrains believes it is changing the way AI works in automotive with its Skills architecture using its proprietary Liquid AI technology.

Existing autonomous driving methods face difficulties in handling edge cases, which demand more adaptive AI technologies. Compound architectures, such as those employed by Mobileye, divide tasks into separate modules, resulting in an information bottleneck.

Monolithic end-to-end systems such as Tesla's FSD full self-driving suite face issues with explainability, transparency and efficiency in adapting to new scenarios.

The Skills architecture addresses these issues by decomposing autonomous driving into a collection of smaller, context-specific AI models – referred to as "skills" – each trained and deployed independently.

These skills are activated dynamically based on the driving situation, optimising performance and reducing computational power demands.

Each skill is optimised to handle specific driving scenarios, leading to better performance in edge cases. The Skills architecture can expand from tens of skills for adas applications to hundreds of thousands for full autonomy. Skills are activated only when relevant, reducing power consumption.

Unlike models that require exponentially more resources as they scale, the Skills architecture allows for more efficient, logarithmic resource expansion.

By focusing on specific edge cases, it provides precise, targeted responses, enhancing overall system safety.



Hyundai and Zeiss plan holographic windshield

Hyundai Mobis is partnering with optical company Zeiss to develop a holographic windshield display, called Holographic Hud. It uses the vehicle's windshield as a transparent display to check various driving information or simultaneously enjoy infotainment features such as music, videos and games.

Imagine navigation and driving information unfolding like a panorama across the wide, transparent windshield where the driver's gaze rests.

Passengers next to the driver can watch movies or other videos on the vehicle's glass. While viewing the latest video, a video call comes in, and a friend's face appears in the corner of the glass screen.

This technology is about to become reality thanks to the convergence of automotive electronic systems and precise optical technology.

Hyundai has signed an agreement with Zeiss for the joint development of Holographic HUD at its technical research centre in South Korea. They plan to start mass production as early as 2027.

The core of the technology is to display various driving, convenience and infotainment content clearly in a wide space extending from the driver's seat to the passenger seat. This has evolved from existing head-up displays, which only showed relatively simple information such as driving speed, navigation routes and speed limit warnings.

This technology can enhance driving safety as the driver can view all information at once without significantly moving their line of sight from the road ahead. And it can completely transform the interior front design of vehicles by eliminating various display devices mounted on the dashboard while providing an unobstructed, open feeling without interfering with the driver's and passengers' field of vision.

Zeiss provides micro-optical and holographic-optical technology for various applications in the automotive, home and consumer sectors. Multi-functional smart glass technology enables large-scale holographic projection systems, integrated cameras in transparent media and holographic lighting applications.

Hyundai will oversee development and supply the projector, a key component technology. In the Holographic HUD system, it projects content such as videos and images onto a transparent screen using lenses and reflectors. This requires miniaturisation, noise reduction, heat reduction and thermal management optimised for passenger vehicles.

A transparent and thin film applying holographic technology is needed to render content on the transparent windshield from the light emitted by the projector. This film creates various patterns using photochemical properties when light enters, realising videos and images.

The thickness of the film is less than 100μm.

The two firms have built a prototype and conducted a demonstration for global car makers.

R&S and IMST develop antenna digital twin

Rohde & Schwarz and wireless communications engineering firm IMST have developed an antenna digital twin to help vehicle manufacturers and their suppliers optimise automotive connectivity.

It lets the optimal location of the antenna be found before the physical vehicle is available, thereby avoiding expensive and time-consuming development cycles.

The technology combines measurements of the antenna characteristics with a simulation of the electromagnetic wave propagation to optimise the antennas' design and their position, ensuring, for example, there is optimal wifi coverage inside the vehicle.

Performing antenna simulations is complex and time consuming, and simulation results have to be proven by physical measurements. Accurate measurements inside the vehicle are not possible due to the closed vehicle environment.

A combination of measurements and simulation is needed to achieve the best antenna position and connectivity performance inside the vehicle.

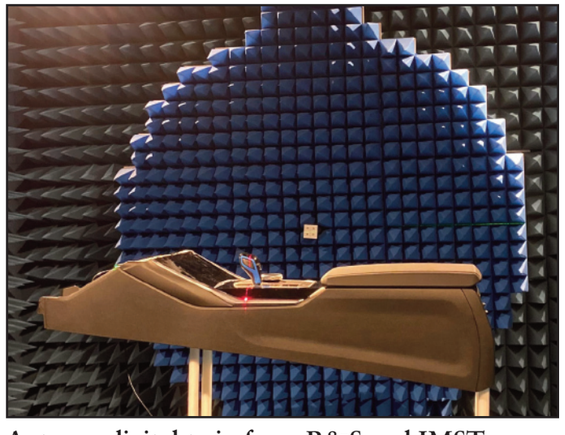
The R&S and IMST process is divided into three steps. The first involves the characterisation of physical antennas using R&S test equipment, including an anechoic chamber, a ZNA vector network analyser and AMS32 software.

The second step focuses on creating a digital twin by involving the easy to use near-field to far-field transformation algorithm (FIAFTA). This is followed by a 3D EM simulation of a virtual scenario using EM-Twin software from IMST.

The antenna digital twin brings about a reduction in cost and time for antenna suppliers and vehicle manufacturers through the front-loading of antenna validation by combining measurements and simulations. It ensures the accurate and consistent characterisation of physical antennas through the use of anechoic chambers and vector network analysers with the AMS32 automation software.

Moreover, it reduces development time as EM-Twin simulation results are available within hours, not days. The performance of the antenna can be enhanced as production tolerances and reflections from the vehicles' bodies are considered.

The technology is said to provide a high level of modelling accuracy.



Antenna digital twin from R&S and IMST

ZF opens HV test laboratory

ZF has opened a high-voltage test and validation laboratory at its R&D hub near Solihull, UK.

The main aim is to accelerate the adoption of 800V architectures with improved efficiency, charging and vehicle performance.

Developed and installed with a project cost partially funded by the APC, the laboratory will offer ZF and its customers specialist hazardous voltage testing capacity.

To enable more mobility projects to take advantage of switching to 800V, ZF will also offer validation testing to third parties.

"OEMs want the compelling benefits of 800V but finding facilities capable of validating these higher-rated systems has not been easy," said Adrian Mitcham from ZF. "We plan to offer 800V validation services to external organisations so that more of the benefits can be realised in the wider mobility sector."

Currently, most EVs are based on 400V architectures and need approximately 20 minutes of charging to add 200km of range. An 800V EV would need half that time.

The systems unlock further efficiencies such as lower gauge and therefore lighter wiring. When combined with SiC mosfets, up to ten per cent efficiency gains are possible.

Measuring 46m^2, the unit can accommodate anything from the smallest modules to a full e-drive truck axle.

Additional floorspace is available if required.

Nuro extends autonomy licensing options

Nuro has expanded its business model to include licensing its Nuro Driver AI-driven autonomy platform to OEMs and mobility providers.

For the first time, the Nuro Driver will enable up to level-four passenger vehicles, as well as goods delivery.

The Nuro Driver is an autonomous driving system powered by the Nvidia Drive Thor with Arm Neoverse technology. It combines automotive-grade hardware with AI-powered self-driving software, to enable up to L4 autonomy for personally-owned vehicles and mobility platforms.

As part of the licensing model, the firm is announcing an AI platform, consisting of scalable and performant developer tools to support AI development and validation for the Nuro Driver.

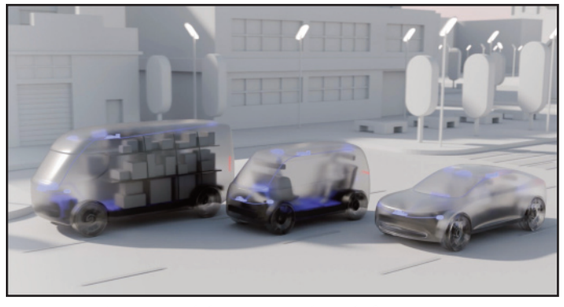
"It's not a question of if, but when L4 autonomy will become widespread," said Jiajun Zhu, CEO at Nuro. "We believe Nuro is positioned to be a major contributor to this autonomous future where people and goods mobility are free-flowing, representing a significant increase in the quality of life for everyone."

The AI-first approach to autonomy allows for rapid scaling and safe operation on public roads. The Nuro Driver leverages AI across its autonomy stack, allowing it to navigate urban and highway environments. Safety remains paramount, with redundant systems and a parallel autonomy stack helping ensure reliable performance.

The licensing model offers OEMs and mobility companies access to a commercially independent, road-proven platform, accelerating their autonomous vehicle development and deployment timelines.

"Advancements in AI throughout the vehicle mean OEMs need an entirely new level of safety-enabled compute performance to deliver the benefits of autonomous technology to drivers," said Dipti Vachani, senior vice president at Arm.

Rishi Dhall, vice president at Nvidia, added: "The Nuro Driver can integrate sensor processing and other safety-critical capabilities, along with AI-driven autonomy, into a single, centralised computing system, This enables the reliability and performance needed for safe deployment of autonomous vehicles at scale."



Nuro Driver enables up to level-four passenger vehicles and goods delivery

Tier IV partners Hitachi to advance autonomous driving

Tier IV, the force behind Autoware open-source software for autonomous driving, has launched a joint initiative with Hitachi Astemo to advance autonomous driving systems and software-defined vehicles (SDVs).

This collaboration builds on both companies' engagement with the Autoware Foundation (AWF) and Scalable Open Architecture for Embedded Edge (Soafee) initiative. With their sights set on 2030, the companies are intensifying their efforts to deliver innovations for mass production vehicle models.

Amid major shifts in the industry, a class of suppliers dubbed tier 0.5 is emerging, offering value-added options that go beyond conventional tier-one models. Positioned as a tier-0.5 supplier, Hitachi Astemo provides systems that consider the entire vehicle's architecture. In line with this, the company is developing a reference system – IoV PF internet of vehicles platform – for system development tailored to the needs of automakers.

Hitachi Astemo is also pioneering a cloud-native software architecture that facilitates development and standardises specifications on the cloud. These should enhance development efficiency, elevate product quality, reduce costs and enable faster time to market.

The architecture will integrate Autoware as the core autonomous driving software.

Tier IV has been collaborating with members of AWF and Soafee to define industry standards and expand the reach of the Open AD referential development kit for autonomous driving systems built on Autoware.



Yasa joins Formula Student in race to recruit engineers

Mercedes-Benz subsidiary Yasa is partnering with Formula Student 2025 to inspire future automotive engineers.

Launched in 1998, Formula Student is Europe's most established educational engineering competition, having inspired thousands of students to take up a career in engineering. With more than 100 university teams taking part every year, the competition provides real-world experience combining practical engineering skills with broader business competencies, such as logistical planning, budgeting and project management.

"Formula Student holds a special place in my heart," said Simon Odling, Yasa's chief of new technology. "It's a competition that has shaped the careers of so many engineers, myself included, in the automotive and motorsport industries. At Yasa, we're thrilled to be involved with next year's event, and we can't wait to meet the talented young engineers who could be the future of Yasa, joining our exceptional engineering placement programmes in 2025."

Yasa has launched a campaign to recruit students to take part in its engineering placement programmes at its sites in the UK.

Founded in 2009, Yasa designs and manufactures electric motors and power electronics for the premium automotive sector, with high profile customers including Ferrari and McLaren. Its axial-flux electric powertrain technology is said to bring the highest power and torque densities in its class for the smallest size and weight dimensions.

The firm is looking for up to ten university students to take part in its placement programmes. Starting in July 2025, the three- and 12-month placements offer students real-world, hands-on experience in Yasa's design, development and manufacturing environment.

The placements are available across the company's engineering functions including development, design, testing, manufacturing and innovation. Students will be given the opportunity to work on current and future electric motor and e-propulsion projects as well as work on current tech and engineering challenges.

"Being a University of Oxford start-up success story, we have tried to consistently support many placement students across our engineering functions, and several of them have subsequently returned to work for us as graduates," said Chris Jeffcock, Yasa recruitment manager. "As a lean, agile company, we can offer students an unrivalled level of hands-on experience working on some of the most innovative projects in today's automotive industry."

Danae Topi, former placement student at Yasa, added: "With the support of my manager, I had the opportunity to collaborate with the innovation team on a year-long project involving electromagnetic design, simulations and motor control software development. Throughout my placement, I have developed my practical engineering skills through component testing alongside learning more about materials, manufacturing, failure analysis and microscopy among others"

SAFETY & SECURITY

FUTURE THREATS



Paul Wooderson asks if automotive cyber security is the new normal

As of July 2024, the United Nations Economic Commission (UNECE) for Europe's WP.29 regulations on cyber security, encapsulated in UN Regulation No 155 (R155), have become mandatory for all vehicles produced in several signatory countries, including the EU and Japan.

The full implementation of these regulations has been a long time coming, and their official arrival marks a significant milestone as car makers work to protect their vehicles. Fortunately, the necessity for automotive cyber security is widely recognised across the industry, with the publication and widespread adoption of the international standard ISO/SAE 21434.

In recent times, the conversation has shifted from justifying the need for cyber security to determining how to implement the requirements effectively at scale. The industry must avoid reducing cyber-security measures to a simple checklist-based compliance activity, and instead ensure that cyber-security risks are properly managed in the face of an evolving threat. But this brings its own challenges, particularly in a sector already suffering from a shortage of skilled cyber-security professionals.

Beyond compliance

Many vehicle manufacturers have now successfully navigated at least one cycle of cyber-security approvals under the new regulations, establishing baseline processes to meet compliance requirements.

While initial compliance efforts have laid some solid foundations, the topic of cyber security remains a relatively new field of automotive engineering, with some understanding and capability still needing to be built.

The automotive industry faces a pressing challenge; adherence to regulatory standards while simultaneously increasing maturity and advancing robust cyber-security measures.

Scaling up cyber-security activities requires a multifaceted approach. Technological advancements must be paired with procedural and cultural shifts within organisations to prioritise cyber security, not just as a compliance issue but as a core element of vehicle development and operations. But this is particularly difficult due to the growing volume of vulnerabilities reported each year.

Many new products and methods to address aspects of vehicle cyber-security risk are appearing on the market, for example intrusion detection, hardware security features, and tools for verification and validation. A key difficulty moving forward is finding effective methods to evaluate and validate the myriad of new cyber-security options available on an objective basis.

The industry is now developing more detailed guidance for stakeholders, including several standardisation activities within ISO and SAE, such as ISO/SAE PAS 8475 and ISO/SAE TR 8477, which focus on cyber-security assurance and verification and validation.

Another critical issue is maintaining a vehicle's cyber-security capability after it's been released. Once a vehicle is in production, manufacturers are still obligated to protect it against new risks, but the required R&D resources are often reallocated

towards the development of new models, potentially leaving a critical gap in ongoing cyber-security management.

Cost of safety

There's no question that maintaining cyber security over the lifespan of a vehicle is expensive. Manufacturers must build systems to monitor vehicles, and detect and respond to attacks, all of which require significant investment.

In traditional vehicle sales models, such additional engineering costs may be typically absorbed into the price of the vehicle itself. But it still isn't clear how these costs can be re-distributed within alternative ownership models such as smart mobility and shared vehicles. It also raises the question of who is responsible for cyber security on existing vehicles and how to maintain an acceptable level of protection while managing the long-term costs.

It has been proven that even the most advanced cyber-security measures used in other industries, such as IT, are fraught with risks and problems when it comes to providing robust, long-term protection. The recent global IT outage, linked to the roll-out of a software update from cyber-security firm CrowdStrike, highlights how difficult it is to implement effective security without introducing vulnerabilities.

No price can override the need to ensure people's safety with cyber-security regulations. Unlike a hacked computer or smartphone, a compromised vehicle poses a direct threat to human life. The worst-case scenario of a cyber attack on a vehicle could result in injury or death, making cyber security a critical aspect of vehicle safety.

To mitigate these risks, the industry must invest in procedural and technical options, and develop rigorous testing methods to validate them thoroughly. The true challenge lies in determining the appropriate level of rigour for development and testing, and deciding when enough has been done to be confident in a vehicle's security.

As well as the emerging standards in this area, engineering, test and assurance methods are being developed to enhance risk management, identify vulnerabilities more effectively and ensure vehicle systems are robust and resilient against potential threats.

Limitations

As the automotive industry embraces artificial intelligence (AI) and other technologies, it must also address associated cyber-security risks. AI-based technology, which is being increasingly used in automotive applications, such as automated driving, driver assistance and battery management, introduces vulnerabilities. The industry must anticipate how attackers might exploit these systems and develop countermeasures accordingly.

Automated driving systems in vehicles rely on increasingly complex systems to make safety-relevant driving decisions, and any compromise in this capability could have serious consequences. The industry must consider how cyber attacks might exploit weaknesses in these systems to influence these decision-making processes and whether they could be compromised to cause accidents.



Ensuring the safety of vehicles with robust cyber-security frameworks

Remote operation, where an operator controls a vehicle from a distance, can also be susceptible to security vulnerabilities. Securing the communication link between the operator and the vehicle is crucial, especially if this connection is made over the internet or other long-range communication methods. As the industry moves towards greater connectivity and automation, understanding and mitigating these newly emerging risks are key.

The advent of quantum computing presents another looming hurdle. Quantum computers, once fully realised, could be used to break many of the cryptographic algorithms currently used in vehicle systems. The typical lifetime of a vehicle is much longer than for many other technology products, so there is a significant chance of practical quantum computers becoming feasible while today's vehicles are still on the roads. It is therefore imperative to explore post-quantum cryptography techniques and how these can be implemented in automotive systems to make sure vehicles remain secure across their

SAFETY & SECURITY



Securing connected and autonomous vehicles

lifespans.

Given the extended lifecycle of today's vehicles – commonly amounting to decades – this is a critical issue that must be addressed now to safeguard future safety. Both the ISO/SAE 21434 international standard and the UNECE R155 regulation play key roles in guiding manufacturers to manage cyber-security risks and implement certified cyber-security management systems throughout the vehicle lifecycle.

Learning

The automotive industry can learn valuable lessons from other sectors as it builds its cyber-security infrastructure. The aerospace industry, for instance, has a wealth of experience in cyber security. While some of its methods may be too costly for automotive applications, there is valuable knowledge that can be taken, adapted and implemented.

But not all options from other industries are directly applicable and transferable.

The automotive sector presents unique constraints, such as the need for methods that can be scaled across millions of vehicles, implemented across different entities within the supply chain, and fit within the cost and resource limitations inherent to the industry.

The scarcity of competent cyber-security professionals is a cross-sector challenge, and the automotive industry must invest to develop the right skills. This involves working closely with educational institutions to ensure cyber security is integrated into engineering-based learning. This will help prepare the workforce of tomorrow and secure the skills needed to tackle future problems.

New normal

Cyber security cannot be viewed as a one-time compliance activity, but as an ongoing commitment that starts at the beginning of vehicle development and continues throughout its lifespan. It's not just a technical challenge, but requires organisation-wide support and a fundamental commitment to public safety, calling for continued vigilance and innovation.

The future of cyber security in the automotive industry is complex and requires a combination of technical innovation, cross-sector collaboration and cultural change within organisations to get it right. The goal has to be to make sure technology can protect, detect and respond to threats efficiently and effectively.

While there are misconceptions about the ease or difficulty of achieving effective cyber security, it's clear the industry must strive for continuous improvement. With an ever-evolving threat landscape, there is no such thing as perfect security, but doing nothing is not an option.

The road ahead is difficult but it provides the route for an exciting and creative journey, offering opportunities for engineers to make a significant impact on the safety and security of future vehicles.

Looking to the future, the automotive industry must remain vigilant and committed to adapting constantly to new threats and technologies. By creating a culture to address cyber security properly and investing in the right skills and resources to enable that, the industry can ensure vehicles remain safe and secure in an increasingly connected world.



Paul Wooderson is chief engineer for cyber security at Horiba Mira

VEHICLE electronics

The monthly magazine for automotive electronics engineers

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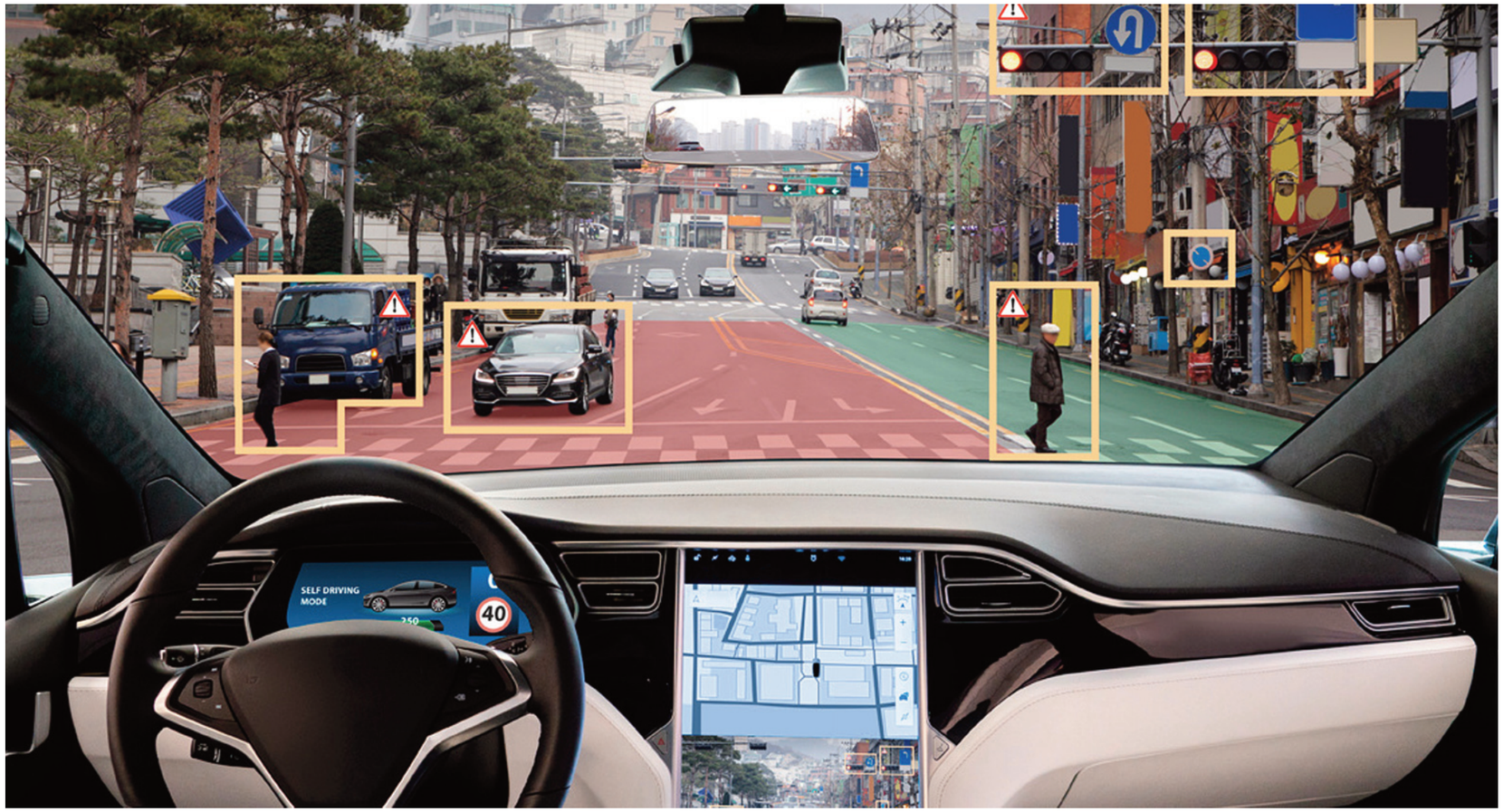
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NOISE SUPPRESSION



KEEPING DOWN THE NOISE

Shingo Uda explains how creating connected and autonomous vehicles starts with noise suppression for the smallest components

The fundamental elements that define the nature of an automotive vehicle have remained relatively unchanged since its inception until recently. In essence, a car was a means of personal transportation powered by an internal combustion engine and perfect for transporting one or more individuals. It was standalone, controlled by the driver with limited mechanical and electronic assists present.

However, there has been a significant shift in recent years as vehicles transition from standalone fossil fuel burning options to electric vehicles that are integrated into a larger network. This aims to create truly intuitive mobility that can be encompassed by the acronym case, for Connected, Autonomous, Shared and Electric. But as we enter the next generation of case-era cars, technical difficulties arise that must be overcome if the automotive industry is to realise this ambitious goal.

One challenge at the core of this evolution is the near exponential growth in vehicle communications. Case-era vehicles need to have robust in-vehicle networks (IVN) capable of connecting control modules and the critical sensors that underpin adas, as well as communication beyond the vehicles chassis in the form of vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and vehicle-to-everything (V2X).

This core requirement for greater communication has a profound impact on vehicle electronics, increasing the volume of wiring and the noise considerations, an issue that is also amplified by the presence of high-voltage AC motors. Therefore, the automotive industry requires elegant methods that are capable of both streamlining system complexity and are immune to noise.

Architecture

Traditionally, vehicles have relied on domain-based architecture, whereby domain control units (DCUs) were responsible for overseeing discrete aspects of the vehicle's functionality, such as infotainment, engine, chassis and adas. However, with the increase in component count and the advancement of vehicle intelligence, this architecture has become unmanageable.

The need for components from different parts of the vehicle to connect back to centralised DCUs has become too intricate and heavy. Additionally, the speed of the IVN has become an issue, especially with adas and dynamic lighting, as their requirements surpass the relatively low data rate of 1Mbit/s provided by the existing vehicle Can.

Zonal

With the aim of enhancing connectivity and control, new vehicles are adopting a design shift towards zonal control. This approach is based on the position of the equipment within the vehicle, rather than its functionality.

Zonal architecture offers several advantages, including better scalability and the provision of a software-driven framework. By bringing control units closer to sensors and devices, it simplifies cabling and reduces complexity in the connections between gateways and hosts.

In zonal systems, communication across the vehicle is underpinned by higher-speed Ethernet and Can-FD networks. This ensures sensors and controllers can communicate seamlessly, regardless of their position or wiring harness connection point on the vehicle. As a result, it significantly reduces the complexity of cables compared with domain-based control.

Furthermore, this architecture allows for localised control at the vehicle's edge with distributed SoCs capable of controlling basic vehicle functions, reducing the data that are communicated across the IVNs.

To realise case-era cars, fast and robust Ethernet backed zonal architectures are needed, along with other intelligent options capable of reducing capable complexity and working in noisy EV environments.

High speed

The noise that can impact high-speed IVNs consists of two types: normal-mode noise and common-mode noise.

Ferrite beads, capacitors and resistors are used to remove normal-mode noise, while common-mode choke coils (CMCCs) are used to remove common-mode noise.

Common-mode noise is generated when a phase shift occurs in a differential signal in a cable, connector or other part. Differential signals are frequently used within IVNs and so high-quality CMCCs are required.

To meet this requirement, there are products that meet the

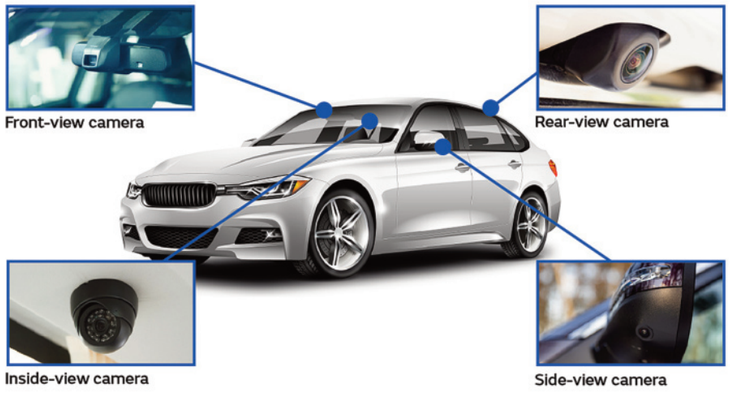


Fig. 1: Some locations where on-board cameras can be mounted

standards for Can and Can-FD, vehicle-mounted Ethernet, and other vehicle-mounted networks, providing noise suppression in a compact form factor.

Historically, CMCCs in Cans were large-size toroidal types where copper wires are wrapped around a ring magnet or a 4532 (4.5 by 3.2mm) size automatic-winding type.

There are now smaller 3225 (3.2 by 2.5mm) size automatic-winding CMCC.

For CMCCs in Can and Ethernet networks, reduced loss is required, and the characteristic known as mode conversion takes on even greater importance. The mode conversion characteristic is an indicator of the level of conversion from normal mode to common mode, and a smaller value signifies a decreased probability of common-mode noise occurrence.

A CMCC is made up of two coils combined together, but to enhance the mode conversion characteristic, the symmetry of this pair of coils needs to be enhanced.

The coil design and winding method of automotive CMCCs has been improved to enhance symmetry, resulting in improved performance.

Combination

Cars equipped with multiple automotive cameras have become a standard offering in the market in recent years, see Fig. 1. Numerous automotive cameras are installed in self-driving vehicles to recognise and interpret the external environment.

To output the captured data, it is necessary to connect these cameras to both a power supply line and a signal line. But this twin connection requirement across countless on-board cameras can lead to a significant number of cables, increasing vehicle build complexity and weight.

Many automotive manufacturers, including OEMs and tier-one suppliers, are actively adopting power over coaxial (PoC) technology to reduce the number of cables required for automotive cameras. This technology integrates both signal lines and power supply lines, as illustrated in Fig. 2.

To introduce PoC, it is necessary to include a circuit known as a bias-T circuit on both the transmitting and receiving sides, as well as on the power supply, see Fig. 3.

The purpose of a bias-T circuit is to separate the high-frequency signal from the DC power supply on the low-frequency side. The circuit consists of an inductor that filters out high-frequency video signals and a capacitor that filters

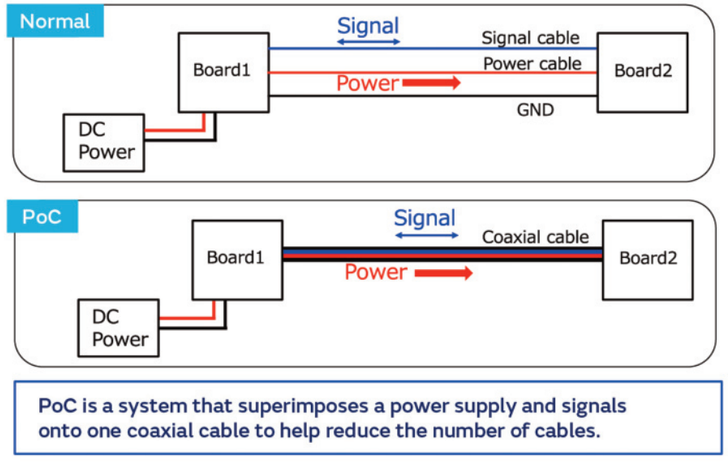


Fig. 2: Bias-T circuit separates power supply line from signal line

out the DC power supply.

When creating a bias-T circuit, it is essential to select an appropriate inductor to serve as a PoC filter.

This inductor should have precise characteristics that allow for the effective separation of signals and the power supply. Failure to achieve adequate separation may result in the unwanted flow of high-frequency signals into the power supply circuit, causing disruptions and malfunctions in connected devices.

When selecting an inductor, it is important to choose one that acts as a high-impedance filter across a broad frequency range, from several MHz to several GHz. However, it can be difficult to find a single inductor that covers such a wide band.

Typically, the desired characteristics can be achieved by combining multiple inductors and ferrite beads.

Choosing the best combination from a diverse range of inductor products is a time-consuming and demanding task. The first step involves selecting components that are suitable for the frequencies of the signals, the power amperage, the ambient temperature and other relevant conditions.

But it is not possible to decide simply by summing up the characteristics of each individual component at that specific time. This is due to the presence of parasitic capacitance on the circuit board, as well as the impact of parasitic inductance and the characteristics of the coaxial cable that links to the circuit board. These factors greatly influence the behaviour within the high-frequency range.

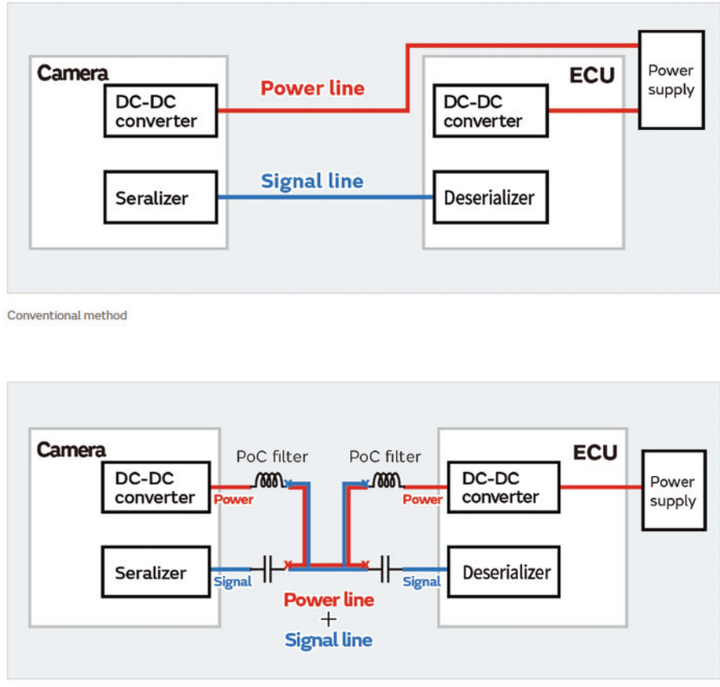


Fig. 3: Comparison between conventional setup and PoC method complete with bias-T filter circuits

Selection

When choosing components to use, it is important to consider the specifications of the automotive camera system and the characteristics of the circuit board on which it will be mounted. It is also necessary to test different combinations of components through simulation to find the best option.

Conclusion

As vehicle-mounted networks continue to advance and become more widely used, the demand for these components is expected to rise significantly.

The evolution of cars based on case requires the integration of various peripheral technologies to implement advanced features. These include artificial intelligence (AI) as the self-driving car's brain, as well as the inverter and battery, which serve as the heart of electric vehicles.

However, to be one of the pioneers in equipping cars with advanced vehicle-mounted networks and entering the market early, it is crucial first to prepare noise suppression components and similar products.



Shingo Uda is manager for field application engineering at Murata

INDUCTORS

TOP NOTCH

Jon Wallace, Issac Siavashani and Alexandr Ikriannikov
show how to enhance speed and efficiency for high transient automotive applications



Vehicle Electronics

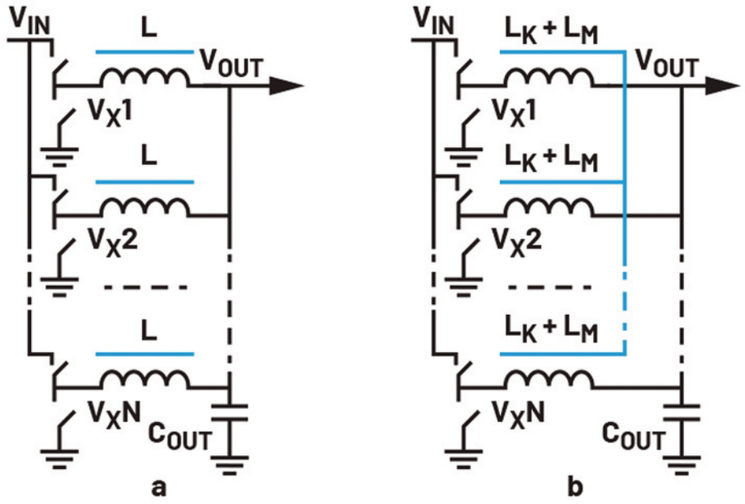


Fig. 1: Multiphase buck converter with (a) discrete inductors and (b) coupled inductors

As adas and other high-current applications are proliferating in automotive, the computing power of the related GPUs and asics continues to rise significantly. This puts additional pressure on the performance of voltage regulators for such demanding loads, where the currents increase and transients become larger and faster.

Efficiency expectations continue to grow at the same time, while the load voltages decrease below 1V for better thermal management and to enable advanced semiconductor processes with faster clocks. As low load voltage proportionally slows down the unloading transient and therefore causes a large increase in the bypassing capacitance, the voltage tolerance and transient specs are also tightening.

This calls for smaller and faster inductances in the multiphase voltage regulator to support such aggressive transients. The question is where coupled inductors can support the fastest current slew rates, while simultaneously reducing the current ripple and supporting high efficiency in a small size.

Introduction

High-current, low-voltage applications frequently employ a multiphase buck converter topology for the voltage step down.

This multiphase buck can use traditional discrete inductors (DLs), as shown in Fig. 1a, or coupled inductors (CLs), as depicted in Fig. 1b. In the case of CL, the windings are magnetically coupled, providing the advantage of current ripple cancellation.

Automotive adas applications face a challenge in maintaining tight regulation for GPU or asic rails within the 0.4 to 1V range, especially under fast transient conditions.

$$\frac{dIL_{UP}}{dt} = \frac{V_{IN} - V_O}{L} \quad (1)$$

$$\frac{dIL_{DOWN}}{dt} = \frac{-V_O}{L} \quad (2)$$

A loading transient generally causes all phases to turn the switching nodes V_X high to V_{IN}, so the inductor current in each phase ramps up with a slew rate (equation 1), where V_{IN} is input voltage, Vo is output voltage, and L is inductance value. An unloading transient typically causes all phases to turn low to ground and the inductor current ramps down (equation 2).

Given the low output voltage value V_{OUT} < 1V and assuming the input voltage is typically 5V or even higher, it is easy to see from the comparison of equations 1 and 2 that the unloading transient creates the main problem as there is only a small voltage to ramp the current down.

The simple answer involves increasing the number of ceramic output capacitors in C_{OUT}. However, the size and cost of this approach can swiftly become impractical.

In the automotive industry, voltage regulators are often configured to switch at a relatively higher frequency (F_S), typically exceeding 2MHz. This is in contrast to regulators in cloud or industrial applications. The higher switching frequency is necessary in automotive settings due to specific EMI requirements. While this choice helps decrease inductance values in the regulator, further enhancements are still required.

$$dIL_{DL} = \frac{V_{IN} - V_O}{L} \times \frac{D}{F_S} \quad (3)$$

The current ripple in each phase of the conventional buck with DL can be found as equation 3, where the duty cycle is $D = V_{OUT}/V_{IN}$, V_{OUT} is the output voltage, V_{IN} is the input voltage, L is inductance value, and FS is the switching frequency.

$$dIL_{CL} = \frac{V_{IN} - V_{OUT}}{L_K} \times \frac{D}{F_S} \times \frac{1}{FOM_{CL}(D, N_{PH}, \rho, k)} \quad (4)$$

$$FOM_{CL} = \frac{\left(1 + \frac{\rho}{\rho+1} \times \frac{1}{N_{PH}-1}\right)}{1 - \left[\frac{(N_{PH}-2\times j-2) + \frac{j\times(j+1)}{N_{PH}\times D}}{+\frac{N_{PH}\times D\times(N_{PH}-2\times j-1)+j\times(j+1)}{N_{PH}\times(1-D)}}\right] \times \frac{\rho}{\rho+1} \times \frac{1}{N_{PH}-1}} \quad (5)$$

$$\rho = \frac{L_M}{L_K} \quad (6)$$

$$j = floor(D \times N_{PH}) \quad (7)$$

Replacing the DL with CL that has a leakage inductance L_K and the mutual inductance L_M, the current ripple in CL can be shown as equation 4. The term defined as figure of merit (FOM) is expressed as equation 5, where N_{PH} is the number of coupled phases, ρ is a coupling coefficient (equation 6), and j is a running index, which just defines an applicable interval of the duty cycle (equation 7). The parameters of the CL are the leakage inductance L_K and the mutual inductance L_M.

The meaning of FOM in equations 4 and 5 for the particular CL design can be interpreted as an additional multiplier in current ripple cancellation as compared with the conventional buck with discrete inductor L. The definition of FOM and its meaning were also generalised and extended to compare any systems with arbitrary current ripple and transient performances.

$$FOM = \frac{SR_{TR}}{SR_{TR_DL}} \Big/ \frac{\Delta IL}{\Delta IL_{DL}} \quad (8)$$

$$FOM = \frac{SR_{TR}}{\Delta IL} \times D \times T_S \quad (9)$$

The proposal is to use a ratio of the normalised transient spew rate (desired high) to the normalised current ripple (desired low), see equation 8. The transient slew rate and the current ripple are normalised by related numbers for some benchmark converters with discrete inductors, so any system with DL will still lead to FOM = 1. The SR_{TR} and ΔIL are transient current slew rate and current ripple in a steady state of the chosen design or technology, while SR_{TR_DL} and ΔIL_{DL} are the same parameters but for the benchmark DL design.

Equation 8 can be simplified into equation 9, using the fact that the current slew rate for the discrete inductor is the same in transient and steady state. This way, any actual reference to DL design is completely removed, while the benchmarking ideology is still there.

Notice that using the generalised FOM definition, equation 9, for the CL will result in equation 5, so the new definition is backwards compatible, but can also be used for technologies where both current ripple and transient slew rate are arbitrarily different from the DL equations, for example, TLVR.

Considerations

The application specifications are V_{IN} = 5V, V_{OUT} = 0.8V, FS =

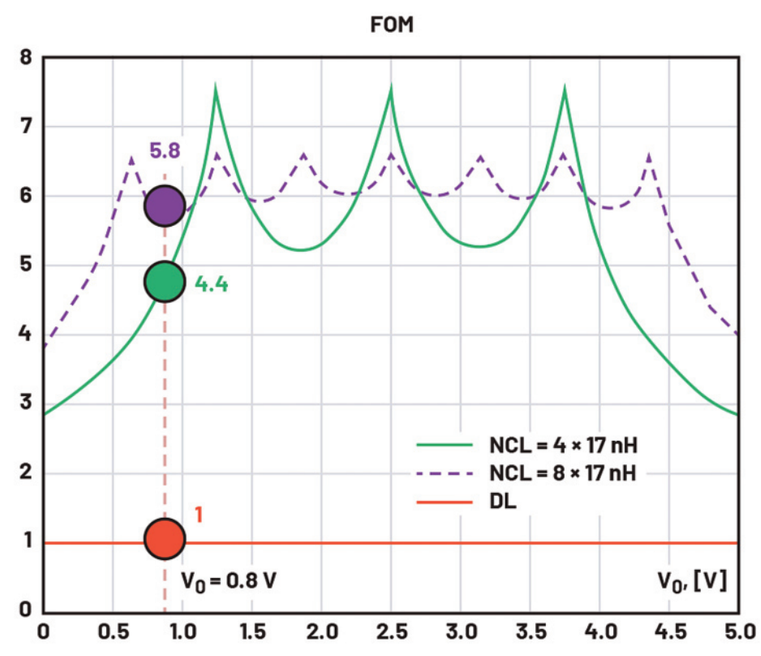


Fig. 2: FOM for the developed NCL = four times 17nH and theoretical NCL = eight times 17nH as a function of V_{OUT} compared with the FOM of any DL at V_{IN} = 5 V

2.1MHz and N_{PH} = 8. As a starting point, DL = 32nH is chosen to support the fast transient, while each inductor occupies 4.2 by 4.2 by 4.2mm. Ideally, these would be substituted with an eight-phase coupled inductor (CL).

However, the low height requirement of h = 4mm presents a challenge, as it would make such a lengthy component unmanufacturable due to being excessively thin and long, while also increasing sensitivity to board flex.

Therefore, the four-phase building block was chosen for CL. This also enables better flexibility with placement and layout.

As the faster transient is targeted and knowing the CL will have smaller ripple than the starting DL value, the recently introduced notch CL (NCL) structure was proposed to reduce the leakage value L_K. It was designed with L_K~17nH and OCL = L_M + L_K = 100nH, N_{PH} = 4, phase pitch 6.9mm/phase, and a height h = 4.0mm maximum.

A good way to compare different designs is a FOM plot. Any DL design will have FOM = 1, as the trade-off between the current slew rates in steady state and transient is 1:1.

The NCL structure of the coupled inductor increases L_M/L_K ratio in a given size, so it generally results in the highest FOM. The FOM comparison is shown in Fig. 3, where the developed NCL is ~4.4 times better than DL around the targeted output voltage.

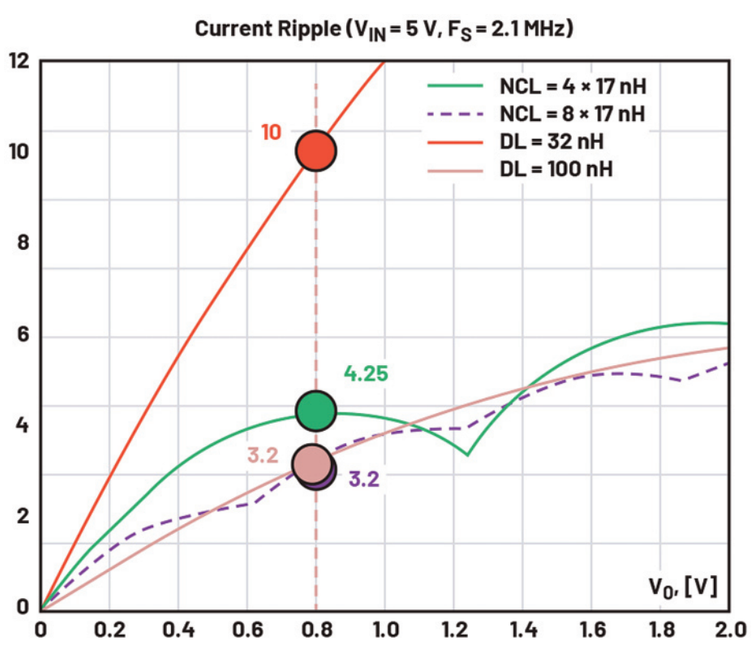


Fig. 3: Current ripple for the developed NCL= 4 times 17nH and theoretical NCL = eight times 17nH compared with DL = 32nH and DL = 100nH as a function of the output voltage V_{OUT}

The corresponding current ripple comparison is shown in Fig. 3.

While the DL value can be chosen in a wide range for a different compromise between current ripple and transient slew rate, the advantage of developed NCL is always 4.4 times. This correlates to 2.35 times smaller current ripple than the ripple of DL = 32nH while NCL is 1.88 times faster. Then 2.35 times 1.88~4.4, matching the predicted FOM = 4.4.

The current ripple can also be lowered a lot by using DL = 100nH, which makes it 1.33 times smaller current ripple than that in NCL, but NCL is then 5.88 times faster, resulting in the same 5.88/1.33~4.4 times advantage of NCL over any DL, FOM = 4.4 for NCL.

Looking at a theoretical FOM for the same NCL in Fig. 2 but considering if N_{PH} = 8 is manufacturable: the performance advantage of NCL over DL would increase from 4.4 to 5.8 times, and make even more relative difference at a lower V_{OUT}.

Looking ahead, it might be worth considering a different design for the NCL. One possibility is arranging the phases in two rows to maintain a low aspect ratio (length/height) of the ferrite core, making it conducive to manufacturing. In this scenario, the NCL could potentially be positioned at the bottom of the PCB, directly above the ceramic bypass for the GPU, with power stages surrounding the NCL on the perimeter.

The approach, akin to a vertical power delivery (VPD) arrangement, could potentially enhance the trade-off between transient and ripple, effectively transient efficiency.

However, it's crucial to note that implementing such a change would be a significant departure from the existing design and layout. Whether this proposed approach is considered in the future will depend on user preferences.

Experimental results

Substituting the DL = 32H inductors resulted in enhanced efficiency, as shown in Fig. 4. This improvement is mainly attributed to the significant reduction in current ripple (Fig. 3), leading to lower RMS currents in windings, power stages and traces.

Additionally, it contributes to lower AC losses, as depicted in Fig. 4.

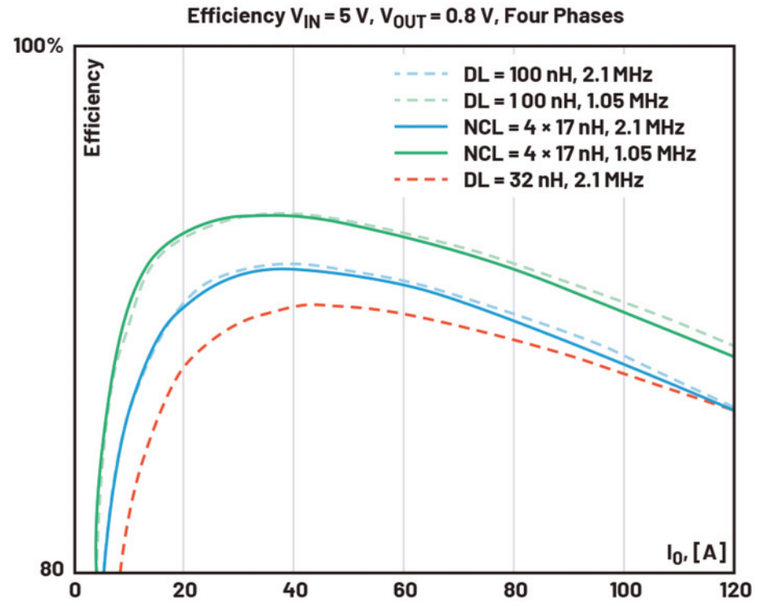


Fig. 4: Efficiency comparison of the DL = 32nH (h = 4.4mm), DL = 100nH (h = 6.4mm), and NCL = 4 times 17nH (h = 4.0mm): 5 to 0.8V, four phases

At the same time, the 17nH/phase NCL offers ~1.9 times faster current slew rate in transient and generally improves the phase margin in the feedback loop. Stepping down on ripple with DL = 100nH recovers the efficiency, Fig. 4, but such DL is significantly taller than the allowed h = 4mm height, while also being ~5.9 times slower than developed NCL. The latter would cause extreme implications for the amount of needed output capacitors.

The results confirm the fundamental performance advantage of NCL as expected from the FOM estimates, against the different trade-off options of the discrete inductor approach.

Conclusion

In summary, a new coupled inductor with the NCL structure was developed to optimise performance for an application with very low output voltage and aggressive load transient specifications.

This CL was also done to fit the specified low profile for the automotive design.

The NCL structure was chosen to reduce leakage, achieving a formal benefit of over four times in transient and ripple performance compared with the conventional discrete inductor option.

To match the efficiency of the developed NCL, a DL with 1.6 times the height (DL = 100nH) would be needed. However, this alternative would fall 5.9 times behind in transient speed, significantly impacting the size and cost of the output capacitance.

Jon Wallace is senior director,





Issac Siavashani is principal engineer and



Alexandr Ikriannikov is a fellow, all at Analog Devices

COLLABORATION

EZTow autonomous baggage tractor at Toulouse-Blagnac Airport in France

EasyMile is developing safety-critical technology for autonomous driving

EASY TRANSFER

Vehicle Electronics November 2024, 30

COLLABORATION

Driverless technology specialist EasyMile wants to develop safety critical systems targeting future vehicles, a wider range of uses and higher levels of integrity.

Autonomous driving is already a reality and not just a vision for the future for EasyMile, which prioritises deploying the technology at scale. It was the first company in the world to launch commercial vehicles with comprehensive homologations made by independent assessors back in 2018. Since then, there have been numerous deployments around the world.

EasyMile vehicles have already driven more than a million kilometres at level four autonomous driving – completely removing any human attendant from on board – in over 400 locations worldwide, with a zero-collision record. In the same way, EasyMile has tailored this technology to address the market of freight transport and goods moving, for airports, harbours and industrial logistic hubs and offers products developed in cooperation with automotive suppliers.

The EZTow for example is the most-deployed autonomous tow tractor globally. It operates in production flows on a number of major automotive manufacturing plants and logistics centres in Europe and the USA. It is also in use at airports for baggage towing.

Its EZTug is a driverless terminal tractors used to transport containers autonomously within ports, improving throughput and reducing congestion and delays.

Right now, the company is turning a corner prioritising what is delivering the highest return on investment to its clients today, namely its driverless technology for industrial applications. In addition, it is continuing to develop its technology for passenger shuttles alongside these and sees more mass adoption of this platform in the next three to five years.

All these developments are based on EasyMile's experience and globally deployed products, which have proved extremely successful to date.

The company already serves well-known users in numerous applications. These include material transport in large industrial manufacturing plants of BMW and Daimler Trucks, for example, as well as in ports such as Vlissingen in the Netherlands and airports including Changi in Singapore, DFW in the USA, Toulouse in France and Narita in Japan. In passenger transport, it is mainly campus and smart city projects, including the largest connected fleets in Europe.

Safety critical

A collaboration between EasyMile and Microsys is tightly coupled with the development of EasyMile's safety critical embedded systems. This is particular important because the deployment and operation of autonomous vehicles is intrinsically exposed to risks from the environment, pedestrians and road users. A high level of integrity is thus a prerequisite to address the markets of industrial logistics and public transportation.

At the same time, the development of embedded systems – being safety related or not – for autonomous vehicles is by nature also a kind of prospective activity, typically something safety does not cope with easily as sensors, algorithms and computing technologies are evolving faster than ever.



EasyMile's fleet of shuttles at the Terhills tourist site in Belgium is remotely supervised

Developing a safety-critical system demands to freeze, at least partially, some parts of a system, especially the overall safety concept and the functional scope of the safety function. Then, the development and certification are a matter of years, meaning the final system that will benefit from the safety-critical function does not exist yet. It is therefore essential to anticipate correctly the evolution of the autonomous vehicles' needs to cope with tomorrow's features, with today's technology.

These features are especially linked with the extension of the operational design domain (ODD), especially to address more complex use cases with an

increased speed, up to 50km/h. Operational scenarios include more and more interactions with other users, being other vehicles, pedestrians or even planes.

Inception

The hardware carrying the safety-critical functions is at the heart of the overall system's safety. For a young company such as EasyMile, investing in the right hardware is important. The decision to invest into the development of a customised ECU came because it allowed EasyMile to control the development of safety-critical software with a step-by-step approach, by incrementally increasing the level of integrity of the whole software stack.

It seized the computing power of the ECU with a high level of performance, for a safety-relevant ECUe. This meant the company could address various interfaces and protocols, which made it able to use the ECU in a large variety of vehicles with a uniform level of integrity.

EasyMile works with a supplier network for numerous components and software. It chose Microsys as the supplier of the system-on-module (SoM) with the option of scaling performance in the future by replacing the module.

Microsys has been providing support for EasyMiles' certification requirements, and has integrated this SoM into an ECU to EasyMile's specifications. Microsys also ensures the series production of the ECU.

For the development of the next ECU, Microsys will follow the same path, whereby EasyMile will benefit from the advantages of Microsys' scalable SoM family, which uses NXP's S32 vehicle network processor technology.



EZTug autonomous yard tractor at a logistics terminal in Vlissingen in the Netherlands



Kelheim in Germany has Europe's largest connected operating area for autonomous shuttles

However, it is the overall package of all previous joint developments that will now contribute to EasyMile realising the next ECUs faster and more efficiently. EasyMile can therefore leave a large part of the necessary development for the ECU to Microsys.

Keys

The collaboration between EasyMile and Microsys has always been efficient, and this success is largely due to the strong partnership built between the companies. Microsys has been proactively supporting and mentoring EasyMile during the development of the ECU, while EasyMile has invested to make a core business of the development of safety-critical ECUs using Microsys' support.

This has allowed both companies to achieve a high level of understanding of the activities of one another, to adapt their respective processes to reduce the overhead to achieve the required quality, and to manage the product in a collaborative manner. Finally, Microsys' support also lets EasyMile conduct safety audits with independent assessors or customers, with the expected positive results.

EasyMile's investment in safety critical ECUs allowed it to have a deep mastery of the embedded software stack, and maintain a product based on a simple, minimal architecture. The approach has been executed step by step, with incremental investments to reach each milestone. As a result, the safety-critical system has been sent quickly into the field and benefited from continuous improvement.

Future

It will be interesting to see what EasyMile will use in the future. The anticipated needs of future safety-critical functions will make the use of more powerful microprocessors, typically with eight to sixteen cores, more memory and faster interfaces. There is definitely room for improvement in terms of performance and energy efficiency that needs to be explored.

Microsys' portfolio can support this evolution, based on NXP S32 processors with eight Arm Cortex-A53 cores in combination with four Cortex-M7 lockstep cores on one SoC already possible today. Future developments of SoCs are also promising. NXP has announced even more performance for its S32 real-time processors and integration in future 5nm products to provide a roadmap with software compatibility. NXP already has a working 5nm real-time processor test chip as a first step in this direction. Corresponding systems-on-module will then surely follow over time as well.



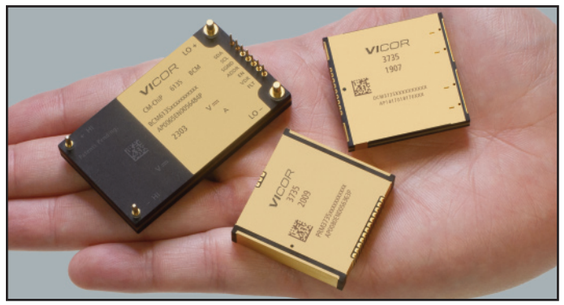
EasyMile's autonomous driving software is used on a range of vehicle platforms

Power modules ease shift to 48V

Three automotive-grade power modules for 48V EVs are said to deliver industry-leading power density, and support automotive OEMs and tier-one production.

The Vicor BCM6135, DCM3735 and PRM3735 use AEC-Q100 certified ICs and have completed the PPAP process with automotive users.

The BCM6135 is a 98% efficient 2.5kW BCM bus converter that converts 800V from the traction battery to 48V to provide a safety extra-low voltage (SELV) power supply for the vehicle. Internally, it provides the isolation between high and low voltage, creating a large reduction in the space required for the DC-DC conversion.



The power density of 158kW/L allows EV designers to reduce the size of the primary DC-DC converter and reduce vehicle weight.

The bidirectional rapid current transient response rate of 8MA/s lets it replace a 48V battery by serving as a virtual 48V battery in the xEV vehicle and delivering additional cost and weight savings.

The DCM3735 2.0kW DCM DC-DC converter transforms an unregulated 48V input into a regulated 12V output. It has a wide input range compatible with various automotive applications because the output can be trimmed within 8 to 16V.

Power density is 300kW/L making it a choice for architectures bridging a 48V distribution to 12V subsystems in zonal ECU applications.

The PRM3735 is a 2.5kW PRM regulator for 48V power that is 99.2% efficient. Its small footprint and 260kW/L power density frees up packaging space and reduces the overall DC-DC power supply. It can support regulated 48V loads that are implemented in new vehicle architectures.

The three modules can be arranged in over 300 configurations, offering flexibility and scalability to support innovation for vehicle subsystems.

Further, as the market shifts from 12 to 48V zonal architecture, these are efficient in converting to and from 48V.

All three modules can be arrayed easily to increase power supply levels, and they have automatic power sharing for optimum performance in an array.

Board aids LED development

A development board from Rutronik was designed for LED applications in the automotive industry and Industry 4.0.

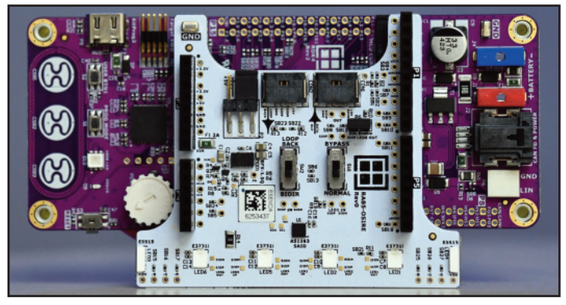
The RAB5 uses LEDs from AMS Osram's Osire series. These are designed for dynamic ambient lighting and offer individually addressable chips for flexibility in colour and driver selection.

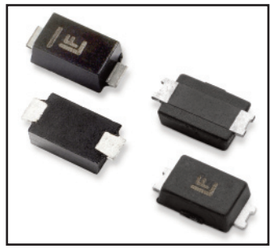
A user-friendly gui from AMS Osram also allows for easy programming of each LED. The intelligent LEDs can be individually programmed, offering customisation and control options.

Thanks to integrated algorithms and a built-in temperature sensor, the quality of the LEDs is maintained without temperature influence. Up to 1000 LEDs can be connected to a single bus, ensuring scalability.

Using the Arduino interface, the board can also be combined with other base boards and adapter boards from Rutronik. The modular concept allows for various approaches for development projects that are technically sophisticated.

For example, the combination of the board with the RDK4 base board is promising for motor control. The PSoC 4100S Max automotive microcontroller from Infineon, integrated on the RDK4, with an Arm Cortex-M0+ core, enables seamless integration and control capabilities.





TVS diode

A surface-mount asymmetrical TVS diode from Littelfuse can protect silicon carbide (SiC) mosfet gates from overvoltage events.

The SMFA series can enhances circuit reliability while simplifying design.

Unlike traditional options that require multiple Zener or TVS diodes, the SMFA protects against ringing and overshoot phenomena in gate drive circuits using one component, saving PCB space and reducing the complexity of circuit designs.

It is tailored to the specific negative and positive gate voltage ratings of SiC mosfets, ensuring precise and reliable protection.

The device is compatible with all available Littelfuse and other leading SiC mosfets.

Applications include high-efficiency electric vehicle infrastructure power systems, where it provides gate protection in EV charging stations and related power systems, ensuring longevity and performance.

Touch controller meets seamless HMI demands

For OLED and micro-LED displays up to 61cm, a touch controller from Infineon is said to deliver performance and frame rates that meet demands for a seamless HMI experience for infotainment applications.

Users want large touchscreens and are venturing into OLED and micro-OLED as their choice of display.

OLED is seen as the future of smart mobility applications, enabling flexible design and freeform shapes.

The automotive PSoC Multitouch GEN8XL (IAAT818X) touch controller ensures a seamless user experience on various touch-based interfaces, such as touchscreens, touchpads and sliders, while meeting automotive standards for electromagnetic compatibility (EMC IEC 61967), including chip-level emission, conducted emission as in IEC 62132 and radiated emission as in ISO 11452.

AEC-Q100 qualified and Auto-Spice level-three and Asil-B compliant, it is offered in a 128-pin or 100-pin TQFP.

The touch controller operates reliably despite water droplets, condensation or sweat and lets users perform touch operations with gloves up to 4mm.

The design allows for scalability to accommodate larger screen sizes, with the possibility of supporting screens up to 140cm via the implementation of multi-chip architectures. It also supports add-on features such as rotary dial and built-in haptics.

A support package includes application firmware, design guidance for sensors and flexible printed circuits, and touch host emulator tuning to facilitate seamless integration and production.

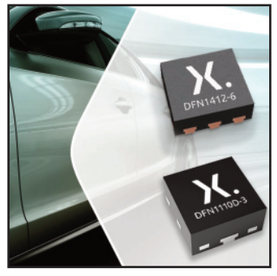
It is expected to go into production in Q4 2025; samples are available now.



Mosfets come in miniature DFN packages

Single and dual small-signal mosfets from Nexperia come in miniature DFN packages.

The automotive qualified devices are available in DFN1110D-3 and DFN1412-6 leadless packages that have almost 50% lower thermal resistance from junction to ambient from a small footprint.



The DFN1110D-3 1.1 by 1mm package has seen increasing adoption and is quickly becoming the de-facto standard for small-signal mosfets and bipolar transistors in automotive applications.

The packages are an alternative to established high-volume leaded enclosures such as SOT23, SOT323, SOT363 or SOT666.

The DFN1110-D-3 also has side-wettable flanks to support automated optical inspection of the solder joints.

There are more than 100 products available in the DFN1110D-3 and 43 in the DFN1412-6.

Photorelay withstands 900V output

An automotive-compliant photorelay from Toshiba is designed for 400V battery-related control systems.

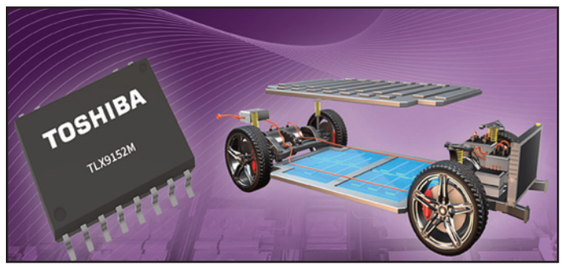
The TLX9152M has a minimum output withstand voltage of 900V to support applications such as battery and fuel-cell control, as well as battery management systems in electric vehicles, where it can be used in circuits to monitor voltages, monitor for mechanical relays sticking and to detect ground faults.

It consists of an infra-red emitting diode optically coupled to a photo-mosfet. Reaction time is 1ms maximum.

The trigger current is 3mA maximum, which lowers system energy consumption. Off-state current is 100nA maximum at ambient temperature, meaning it draws minimal power while inactive.

The IR LED has a 20mA maximum forward current, while its photodetection element has a 50mA on-state current.

For a 400V automotive battery system, the test voltage for the withstand voltage test in the set is 1.8kV, and the same output withstand voltage as the test voltage can be achieved by using two of the products.



It is housed in a SO16L-T package, widely used for high-voltage photorelays. Toshiba's existing product, the TLX9160T, housed in the same package, offers an output withstand voltage of 1.5kV in 800V battery systems when the test voltage is set at 2.6kV. Therefore, this combination allows a 400V and 800V battery system to share the board.

Size is 10.3 by 10.0 by 2.45mm. When used in 1kV systems, this normally-open device exhibits 5mm creepage and clearance distances on its output side, ensuring effective isolation.

It can operate from -40 to +125˚C, and is qualified to AEC-Q101.

Tools optimised for microcontrollers

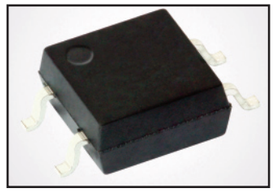
Tasking has enhanced its tools support to optimise and accelerate software development for NXP's automotive microcontrollers and processors.

It has introduced v7.1r1 of the compiler toolchain VX-toolset for Arm for embedded software development.

The version is supported and qualified to be used with NXP's real-time drivers for the S32K388 zonal aggregator microcontroller. Additionally, Tasking's iC7 hardware debuggers now supports virtual and hardware development of NXP's recently announced S32N vehicle super-integration processors.

The VX-toolset platform and NXP real-time drivers let developers optimise software for the Arm architecture, which is used in many safety-oriented automotive systems such as airbags, body electronics and automotive sensor clusters.

With the Tasking iC7 hardware debuggers and WinIdea IDE, developers get a fully integrated option for embedded software development for Autosar and non-Autosar applications.



Solid-state relay

Said to be the industry's first 1 Form A solid-state relay to offer AEC-Q102 qualification and a 100V load voltage, the VORA1010M4 from Vishay comes in the SOP-4 package and delivers turn-on and turn-off times of 0.1ms typical.

Operating temperature is up to +125˚C.

The fast turn-off time of the optically isolated device is a result of its integrated turn-off circuit, while its combination of an infra-red emitter and photovoltaic diode array delivers fast turn-on time.

This switching performance makes the relay suitable for safety-critical applications, while its SOP-4 package saves space the DIP-4 package.

Offering an isolation voltage of 3750V RMS, the automotive-grade device can provide clean, bounce-free switching for glass dimming, lighting control, inverters, motor controls and battery management systems in electric and hybrid electric vehicles.

Available in tape-and-reel packing, the device is RoHS-compliant and halogen-free.

Ethernet switches target software-defined vehicles

To provide OEMs with comprehensive Ethernet, Microchip has announced the LAN969x multi-gigabit Ethernet switches and VelocityDrive software, which is a turnkey Ethernet switch software offering and configuration tool based on standardised Yang models.

Driven by the need for higher bandwidth, advanced features, enhanced security and standardisation, automotive OEMs are transitioning to Ethernet. Automotive Ethernet provides the infrastructure to support software-defined networking by centralising control, enabling flexible configurations and real-time data transfer.

The combination of the devices and software, the industry's first integration of Coreconf Yang, offers a standard network configuration. The Coreconf Yang standard aims to empower designers by separating software development from the hardware network layer. This reduces complexity and costs and accelerates the time to market.

The Ethernet switches are powered by a 1GHz single-core Arm Cortex-A53 CPU and feature multi-gigabit capabilities with scalable bandwidths from 46 to 102Gbit/s.

Time-sensitive networking (TSN) is designed to meet precise timing and reliability requirements of applications such as adas.

The switch family supports Asil-B functional safety and AEC-Q100, offering reliability and safety for automotive applications.

The devices are optimised for systems with a small embedded-memory footprint and feature secure and fast boot capabilities using integrated ECC sram for code execution, which eliminates the need for external DDR memory.

As in-vehicle networking continues to increase, software such as Velocity Drive is needed to configure and manage networking systems.

The switch family joins the firm's Automotive Ethernet offerings, which include 10 to 1000Mbit/s phy transceivers, controllers, switches and endpoints.

The LAN969x devices are supported by the LAN9692 VelocityDrive evaluation board and configuration tool.

The LAN9691, LAN9692 and LAN9693 are available in production quantities. The VelocityDrive software is available to download.



Image sensor enables clarity in all lighting conditions

A 3Mpixel-resolution cmos image sensor from Omnivision is the first 3.0μm pixel automotive viewing sensor with TheiaCel technology.

Announced at AutoSens, the OX03H10 can enhance driving safety by enabling imaging clarity in all lighting conditions for surround-view and rear-view cameras.



The sensor performs well in low light and shows LED flicker mitigation (LFM) by using a single exposure to generate the entire 140dB dynamic range.

This is achieved using TheiaCel technology, which harnesses the capabilities of lateral overflow integration capacitor (LOFIC) technology, together with proprietary single-exposure DCG and split pixel high dynamic range (HDR) technology, to enable superior image quality regardless of lighting conditions.

At 1920 x 1536 resolution, it features 60frame/s and has low power consumption.

The 3.0μm pixel is based on PureCel Plus-S stacking technology.

It comes in an a-CSP package size and is pin-to-pin compatible with the firm's OX03F10 automotive image sensor for seamless upgrades.

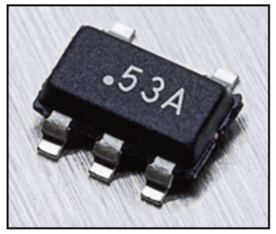
Two signal tracks reduce sensor jitter

A Hall-effect dual-latch sensor from Melexis has two independent signal tracks to reduce jitter as well as consistent 90° phase shift regardless of magnet pole pitch.

This enables accurate speed and direction ECU calculation as well as easy transfer across multiple platforms. The integrated MLX92253 suits DC motors and encoders used in embedded applications, including automotive, alternative mobility, consumer and industrial.

In mobility applications, directional feedback combined with linear speed, rotational speed or angular position sensing is critical for the fundamental operation and safety of countless systems.

This feedback is used in passenger vehicles to monitor and limit the operation of motorised systems such as window lifters, seat motors and powered tailgates. In e-bikes, it is used to detect cadence and activate electric pedal assistance.



The sensor has two Hall plates, one Z axis and one X axis, with two independent signal tracks. It also has a common magnetic centre, which ensures a consistent 90° phase shift (quadrature) between the two speed outputs, independent of the magnet pole pitch.

Furthermore, it features a low and narrow magnetic threshold, allowing for smaller, more affordable magnets or a larger air gap to ease assembly concerns. This functionality provides engineers with flexibility in their magnetic design and allows for the design to be more easily repurposed across various products.

In operation, it offers fast and accurate feedback with low delay, low jitter and increased reliability.

Chopping frequency is 500kHz, operating voltage 2.7 to 5.5V, working temperature -40 to +150°C and output state feedback during start-up.

The start-up feedback function can be used to convert the two outputs into inputs during start-up. This allows a microcontroller to retrieve the previous state before power-down, ensuring no movement is missed.

The device is available in a TSOT23 package, with engineering samples in a VA package.

Long-range lidar sensor detects up to 200m

Promising better sensing performance and certified automotive-grade reliability, the OT128 360° long-range lidar sensor from Hesai can achieve a detection range up to 200m at 10% reflectivity, meeting the requirements of level-four autonomous driving.

With an angular resolution of 0.1° by 0.125° and data points exceeding 3.45 million points per second, it captures environmental details with levels of clarity that exceed automotive industry requirements.

With 66% fewer parts than the previous product, it has a less complex architecture. This means the unit can be mass-produced on an automated manufacturing line, reducing the production time per unit by over 95% compared with the previous mechanical lidar.

It can clearly detect objects near and far. And its surface detection works even for objects that cameras struggle to identify, such as black cars.

As such, it can drive innovation in the commercial automotive sector for self-driving trucks, autonomous shuttles, last-kilometre delivery vehicles and industrial automation.



It meets ISO 26262 Asil-B functional safety standards and complies with ISO 21434 cyber-security requirements.

The device has passed more than 50 automotive-grade reliability tests. Design life exceeds 30,000 hours. It is said to demonstrate stability in complex mechanical shock and vibration environments, such as high-speed driving on rough terrain and prolonged exposure to intense vibrations.

The OT128 has been developed on the same platform as the AT128, re-using 95% of the mature and transceiver modules in the 360° lidar.

Ethernet switches enable secure vehicle networks

NXP has introduced a family of Ethernet switches and network controllers.

The S32J family shares a common switch core, NETC, with the firm's latest S32 microcontrollers and processors, allowing them to operate together as one expanded virtual switch.

The common networking switch core simplifies integration and software re-use with other products within the recently announced CoreRide platform and offers OEMs more efficient and re-configurable networking choices.

It provides 80Gbit/s bandwidth with ports ranging from 10Mbit to 10Gbit, and dual Arm Cortex-R52 cores to address diverse requirements of new vehicle architectures.

The devices meet time-sensitive networking (TSN) automotive standards and provide Asil-D safety, hardware security engine (HSE) and Macsec ports for mixed-critical data traffic.

The combination of the family with the CoreRide platform provides production-grade networking with pre-integrated software and tooling.

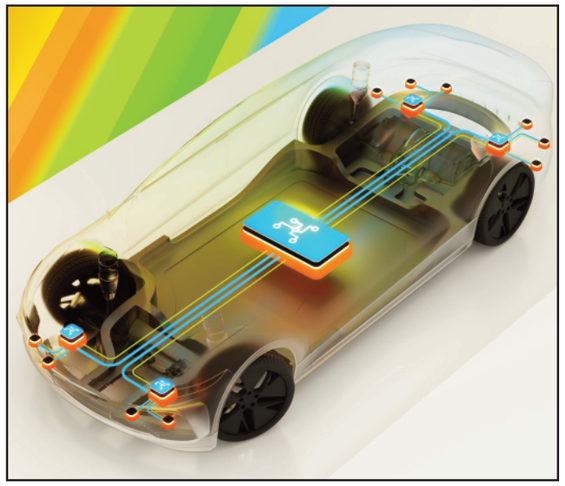
A complete software enablement kit is included for HSE and Macsec security. They have TSN stacks and remote configuration and monitoring capabilities.

A virtual development kit for the family will be available by the end of 2024.

The family will be available to OEMs and tier-one suppliers in 2025.

The CoreRide platform helps automakers overcome software and hardware integration barriers, while scaling development efforts for new architectures in software-defined vehicles.

The platform integrates S32 compute, networking and system power management with middleware, OSes and other software from providers including Accenture ESR Labs, ArcherMind, Blackberry QNX, Elektrobit, Etas, Green Hills Software, Sonatus, Synopsys, TTTech Auto, Vector Informatik and Wind River, as well as tier-one suppliers such as Valeo and integration service providers such as Foxconn.



Editor and Publisher:
Steve Rogerson
editor@vehicle-electronics.biz

Advertising Manager:
Diane Trotman
diane@vehicle-electronics.biz

Web Site Manager:
Martin Wilson
admin@vehicle-electronics.biz

Published by: Vehicle Electronics Magazine, 72 Westwood Road, Nottingham NG2 4FS, UK

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Twitter: @velectronicsmag

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