VEHICLE electronics

The monthly magazine for automotive electronics engineers

Volvo and Daimler plan software-defined lorry

Volvo and Daimler Truck have formed a joint venture to develop a software-defined heavy-duty commercial vehicle.

They also plan to develop a dedicated truck operating system, providing the basis for future software-defined commercial vehicles.

The intention is to make the joint venture a developer of standard hardware and software. This technical basis will then enable Volvo, Daimler and potentially other partners to provide differentiating digital vehicle features.

Volvo and Daimler will have equal shares in the venture, which will operate as an independent entity, with Volvo and Daimler Truck continuing to be competitors in all other areas of business.

"We are combining our forces to accelerate the benefits that a software-defined truck platform will bring," said Martin Lundstedt, Volvo Group CEO. "Given the rapid transformation of our industry, it makes sense to collaborate to accelerate development, increase volumes and share cost."

He said making a lorry a programmable device with standard hardware and operating system for fast product updates would give both companies the chance to create value though differentiating digital services.

Martin Daum, CEO of Daimler Truck, added: "It will allow us to build differentiating digital vehicle features with significantly greater speed and efficiency for our truck and bus customers around the globe."

The joint venture is to be headquartered in Gothenburg, Sweden, incorporating existing assets and resources of both companies. It will provide a common developer platform as a service, on top of which its customers can build differentiating software.

Both companies will provide their own end-user applications on top of the platform to offer differentiating digital vehicle features.



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Tata Elxsi turns to Arm to boost SDV journey

Arm is helping Tata Elxsi accelerate the software-defined vehicle (SDV) work for vehicle OEMs and tier-one suppliers.

Automotive architectures are evolving from a distributed and domain-based paradigm to SDV, which includes the use of high-performance computing (HPC). This evolution requires a shift in software development, validation and deployment philosophies.

Tata Elxsi brings its portfolio of SDV options through Avenir, a Soafee-based software suite that enables the development, integration, building, testing and deployment of applications entirely on the cloud for OEMs and suppliers.

Through this technology collaboration, Tata Elxsi will make this software suite available on the latest Arm Automotive Enhanced (AE) technology that will power the high-performance requirements of vehicles.

Avenir includes a cloud-native development and validation environment that enables seamless collaboration to develop and validate SDV functionalities, a connected framework that enables easier adoption and management of digital twins, and pre-integrated subscription management software so end users can subscribe to automotive features on demand.

"The automotive industry is being transformed by a massive increase in software and AI that demands more computing within the efficiency and safety constraints of the vehicle," said Arm VP Suraj Gajendra. "By bringing together its SDV options with Arm's latest AE technology, Tata Elxsi is leveraging Arm's efficient performance and safety leadership to accelerate software development cycles."

Students make connection at Lane



Lane Motorsport hosted a visit by Loughborough University's LUMotorsport Formula Student racing-car development team at its manufacturing facility in Sussex, UK. Lane is sponsoring LUMotorsport for the third year running, providing technical support on connector selection and implementation, and offering supported pricing and fibre-optic interconnects using franchised suppliers such as Eaton Souriau and Hellermann Tyton.

LUMotorsport has 50 members working on funding, design, build, testing, racing and promotion of a single-seat racing car to compete in the Formula Student UK (FSUK) racing series. Four out of five students involved in the project go on to work in motorsport in areas such as aerodynamics and battery design.

The 2024 FSUK racing series starts at Silverstone on 17th July.

During their visit, the students had a company tour, met the Lane support team, and were shown the Souriau VAD and Weald Electronics assembly facilities, where they had hands-on exercises with Souriau 8STA, Elio Fibre and motorsport accessories.

Nick Wheeler, director of Lane Motorsport, said: "Sharing our expertise with the universities competing in FSUK provides the race teams with support while providing us with insights as to the future of motorsport."

LG entertains Kia SUV passengers

LG Electronics is bringing its ACP automotive entertainment platform powered by WebOs to a Kia all-electric SUV.

The integration into the recently unveiled Kia EV3 marks the first time this has been applied to an electric vehicle.

The platform debuted in South Korea last year with the introduction of the Hyundai Genesis GV80 and GV80 Coupe.

This platform is part of LG's AlphaWare software for software-defined vehicles (SDVs). It offers content that has made LG smart TVs with WebOs popular with consumers.

It provides passengers access to apps from premium content providers, including Netflix, YouTube, Baby Shark World for Kids, Stingray Karaoke, Play Works and LG Channels.

The entertainment system is continuously updated and enhanced.

The company's LG Channels free streaming service is tailored for in-vehicle use, with more than 80 channels, real-time news updates and over 400 VoD content options, including movies, dramas and animated series for children.

"Featuring numerous user-centric innovations including LG's ACP powered by WebOs, the EV3 enables our customers to enjoy a compelling in-vehicle experience, complete with many premium streaming services," said Ryu Chang-sung, senior vice president at Kia.

Eun Seok-hyun from LG added: "Our in-vehicle content platform elevates the mobility experience, providing easy access to a diverse array of high-quality content. We will continue to collaborate with leading global content providers to further enrich LG's ACP, meeting the demands of both automakers and end users."



LG brings streaming content to Kia SUVs



R&S partners VI-Grade and Dürr for adas testing

Rohde & Schwarz is working with simulation company VI-Grade and engineering firm Dürr to improve driver-in-the-loop adas and automated driving testing.

The core of this partnership with VI-Grade involves interfacing R&S's automotive radar tester with driving simulators to provide a seamless testing environment, combining simulation models and driving simulators for driver-in-the-loop.

This should enable testing of real radar sensors within a virtual setting.

The AREG800A automotive radar echo generator and the QAT100 antenna array provide vehicle makers and their suppliers with the ability to simulate adas scenarios such as those defined by Euro NCap in a precise and repeatable way.

Dürr and R&S have developed a method for over-the-air (OTA) vehicle-in-the-loop testing. This validates conformity and effectiveness during end-of-line testing or periodical inspection.

The joint project incorporates Dürr's patented X-Road Curve multi-function roll test stand, R&S's Radest radar target simulator and the Carla open-source simulation platform.

The combination creates a virtual environment for the camera and radar sensors installed in the test vehicle, allowing for the OTA simulation of different inspection scenarios without touching the vehicle.

These scenarios include critical situations such as unintended lane departures and other vehicles braking suddenly or switching lanes directly in front of the test vehicle. The test vehicle must react promptly to changes in the VIL simulation and, if necessary, trigger the automated lane-keeping or emergency braking systems, for example, to pass inspection.

LeddarTech and Immervision accelerate adas training

LeddarTech and Immervision are collaborating to streamline the perception model training process with a view to making it faster, more cost-effective and less data-intensive.

LeddarTech is an automotive software company that provides patented disruptive AI-based low-level sensor fusion and perception software technology, LeddarVision, for adas, autonomous driving and parking applications.

Immervision develops vision systems combining optics, image processing and sensor fusion.

This effort combines LeddarTech's expertise in AI-based low-level sensor fusion and perception software and Immervision's vision systems, to improve adas and AD perception training.

The goal of perception technology in adas is to provide accurate and timely information to the vehicle's control system, so it can make informed decisions and assist the driver in driving tasks, such as collision avoidance, lane keeping and adaptive cruise control.

However, the development and validation process requires costly data collection and labelling.

LeddarTech and Immervision's collaboration aims to improve and optimise this process by allowing large-scale data re-usability. The breakthrough achieved by their research teams allows the re-use of data across various adas and AD platforms, with zero simulation-to-reality gap.

This means existing data assets can be leveraged for new platforms, shrinking the development time and cost for the perception models, thus enabling a faster and more cost-effective development cycle for the complete system.

This optimisation is expected to result in a more cost-effective and safer future for adas and AD.

The companies intend to demonstrate this technology this summer.

"Our partnership with LeddarTech is a leap forward in refining the training of perception software," said Immervision CEO Michel Van Maercke.



Continental and Qualcomm put cross-domain HPC in car

Continental collaborated with Qualcomm to implement a cross-domain high-performance computer (HPC) in a car.

For the first time, hosting cockpit and additional vehicle functions for driving safety and automated parking including holistic motion control in a real-life vehicle application was made possible.

Serving as a showcase for what the development of software-defined vehicles (SDVs) can look like for automotive engineers, the technology uses Continental's CAEdge cloud-based automotive edge framework.



Continental SDV technology show car

The implementation was leveraged by the Snapdragon Ride Flex system-on-chip (SoC) with pre-integrated Snapdragon Ride Vision perception stack from Qualcomm.

"With the SDV technology car, we are able to demonstrate Continental's ecosystem: from road to cloud, from virtual to real," said Gilles Mabire, CTO at Continental Automotive. "As the first development partners for vehicle manufacturers in the world, we are proud of how we have moved beyond concepts and can showcase the capabilities and challenges of the convergence of automotive domains in a tangible software-defined vehicle."

The technology includes automated parking functions with holistic motion control, ultrasonic sensors, integrated brake system, and surround-view cameras, all within a cross domain HPC.

"The goal is not only to show how well functions work, but to validate how well multiple technologies can be integrated and work alongside each other in HPC-based vehicle architectures within a software-defined vehicle," said Jean-François Tarabbia from Continental Automotive. "This is a crucial step to convince the market that the goal to combine several control units in one HPC is not just feasible but can also render the cost benefits we want to achieve."

The Snapdragon Ride Flex SoC supports multi-modal critical workloads on a single chip.

"The Flex SoC provides a more integrated and adaptable approach to designing and developing vehicle architectures," said Enrico Salvatori, SVP at Qualcomm.

The show car's software architecture has been developed using Continental's cloud-based development platform for the software-defined vehicle. It connects the vehicle to the cloud and features a virtual workbench to simplify and accelerate development, supply and maintenance of software-intensive system functions.

This offers automotive software engineers the opportunity to test software on a virtual HPC before deploying onto the physical hardware and to fix software-related issues by debugging software directly in the cloud.

In the SDV technology show car, Continental can prove speed, development productivity and customer-oriented thinking for an advantage when shortening time-to-market by deploying software functions from a virtual HPC into a production vehicle.

Otobrite vision-AI monitors drivers

Otobrite has made a compact all-weather vision-AI driver monitoring system (DMS).

With a high-sensitivity automotive-grade global shutter image sensor, the system can provide clear images day and night.

With a proprietary secondary optical system, the combination enhances the accuracy and reliability of the vision-AI algorithm in all weather conditions.

The DMS has already been delivered to heavy commercial vehicle manufacturers.

It uses self-developed AI 3D facial landmark technology to identify more than 100 driver IDs.



LA digital twin

Simulation software firm RFPro has developed a digital model of roads in Los Angeles to test autonomous vehicles (AVs) and automated driving technologies.

The virtual environment lets engineers conduct testing of AVs in simulation before progressing to public roads.

The digital twin features a 36km loop, making it the largest public road model developed by RFPro. It is navigable in both directions and offers test engineers a real-world-based environment.

Capturing the intricate layout of Los Angeles' roads, the model includes configurations such as highways, split-dual carriageways and single carriageway sections.

"LA is one of the leading cities globally for developing and trialling autonomous vehicle technologies," said RFPro technical director Matt Daley. "Our model provides OEMs with the ability to thoroughly train and test perception systems in a safe and repeatable environment."

The digital model has been created using survey-grade lidar scan data to create a vehicle dynamics grade road surface, which is accurate to within 1mm in height across the entire route.



Version 2.2 enables more collaboration

Update to eSync spec improves OTA exchange

The eSync Alliance has updated its specification for over-the-air (OTA) data exchange.

Version 2.2 emphasises interoperability, enabling collaboration among automakers and suppliers, and accelerating the development of software defined vehicles (SDVs).

Based on the three-level server-client-agent architecture of eSync, the specification ensures devices with agents from numerous sources can quickly be integrated into the common OTA data pipeline. This is crucial to accelerating the development of SDVs, which rely on connectivity and upgradability of software in every electronic device in the car.

The alliance's compliance working group has launched an agent validation tool, providing users with a capability to test their eSync implementations. The web-based interface allows for full verification of the OTA processes of an eSync agent. Its launch can give automakers confidence that a tier-one supplier's eSync agent is compliant and interoperable with other suppliers' devices.

The bi-directional OTA pipeline standard for automotive lets car makers seamlessly deliver remote vehicle updates that can reach every area of the vehicle. Manufacturers can also receive diagnostic data back from a vehicle through the same data pipeline.

"With version 2.2 of our specification, we're standardising the standard," said Mike Gardner, executive director of the eSync Alliance. "Version 2.2 is about practical improvements that make eSync technology consistent for OEMs and tier-ones, and is the step change that will facilitate significant growth in the years to come."

For tier-one suppliers, a fully interoperable, standard approach to OTA helps businesses supply an OTA-ready product to automakers, with confidence they can be quickly and easily integrated into the platform architecture.

A benefit for automakers is that, by sourcing interoperable OTA devices, much of the infrastructure is already in place.

AGL adds cloud-native functions and Risc-V support

Automotive Grade Linux (AGL) has announced the latest code release of its UCB 17.0, or Quirky Quillback, platform.

The unified code base (UCB) platform is open source software for infotainment, telematics and instrument clusters.

The platform now includes support for Amazon Web Services (AWS) Graviton processors for cloud workloads running on Amazon EC2. This lets AGL run in a cloud-based environment.

Combined with the work being done by the AGL SDV Expert Group to decouple the hardware from the software using virtualisation and VirtIO, engineers can develop and test AGL software from anywhere in the world without access to the physical hardware.

Running AGL in the cloud supports a software-first development approach, reducing the need for expensive hardware and enabling a high level of software reuse and scalability. It also improves the continuous integration and continuous development and deployment process by allowing for frequent software iteration and testing across global teams.

The release also includes a vehicle-to-cloud demo application that can be used to access Kuksa.val and Can signals remotely. Two ECUs feed data including speed, tachometer, fuel gauge and hvac to the AGL reference hardware gateway demo and then to AWS cloud, demonstrating how AGL could be used for fleet management and remote diagnostics.

With the release, AGL supports Risc-V with the SiFive Unmatched hardware board. By leveraging the open Risc-V architecture, hardware developers can create custom processors for individual automotive functions that all use the same architecture, enabling scalability, simplified software deployment and faster time to market.

Quirky Quillback also includes Toyota's automotive embedded version of Flutter, an open source app and UI development toolkit designed for automotive applications.



Wayve raises $1bn to progress embodied intelligence in vehicles

Microsoft, Nvidia and SoftBank have invested $1bn in autonomous driving AI start-up Wayve.

The series C round will be used to accelerate research into what it calls embodied artificial intelligence (AI).

Embodied AI can transform how machines interact with, comprehend and learn from human behaviour in real-world environments. It is paving the way for greater usability and safety in autonomous driving.

Founded in 2017, Wayve was the first to develop and test an end-to-end deep learning autonomous driving system on public roads. Today, the company is building foundation models for autonomy, similar to a GPT for driving, that can empower any vehicle to see, think and drive through any environment.

This has paved the way for an industry-wide shift towards AI, coined AV2.0.



Wayve paves way towards autonomous driving

This holds potential to enhance the usability and safety of autonomous driving systems, empowering them with the intelligence to navigate situations that do not follow strict patterns or rules, such as unexpected actions by drivers, pedestrians or environmental elements.

The firm's research on multimodal and generative models, known as Lingo and Gaia, is looking at how AI in vehicles can offer features such as intuition, language-responsive interfaces, personalised driving styles and co-piloting to enhance the automated driving experience.

"At Wayve, our vision is to develop autonomous technology that not only becomes a reality in millions of vehicles but also earns people's trust by seamlessly integrating into their everyday lives to unlock extraordinary value," said Alex Kendall, CEO of Wayve.

Wayve's hardware-agnostic, mapless products allow OEMs to upgrade software in cars to higher levels of driving automation from eyes-on assisted driving to eyes-off fully automated driving as Wayve's AI models progress. The company will also focus on scaling its foundation models, advancing embodied AI research, and building an AV2.0 platform with reliable simulation, measurement and active learning tools for automotive applications.

"Wayve is pioneering new AI applications for the next-generation AV2.0 approach, built on Nvidia Drive Orin and Thor, which uses the new Nvidia Blackwell architecture designed for transformer, LLM and generative AI workloads," said Rishi Dhall, vice president at Nvidia.

Dominik Wee, vice president at Microsoft, added: "By utilising Microsoft's supercomputing capabilities and cloud computing technology, copilot-enabled developer platform, enterprise data management applications, and leading AI model commercialisation expertise, Wayve can deliver and scale innovative embodied AI that enables safer and more accessible autonomous driving experiences."

Murata development meets ISO 26262 Asil D

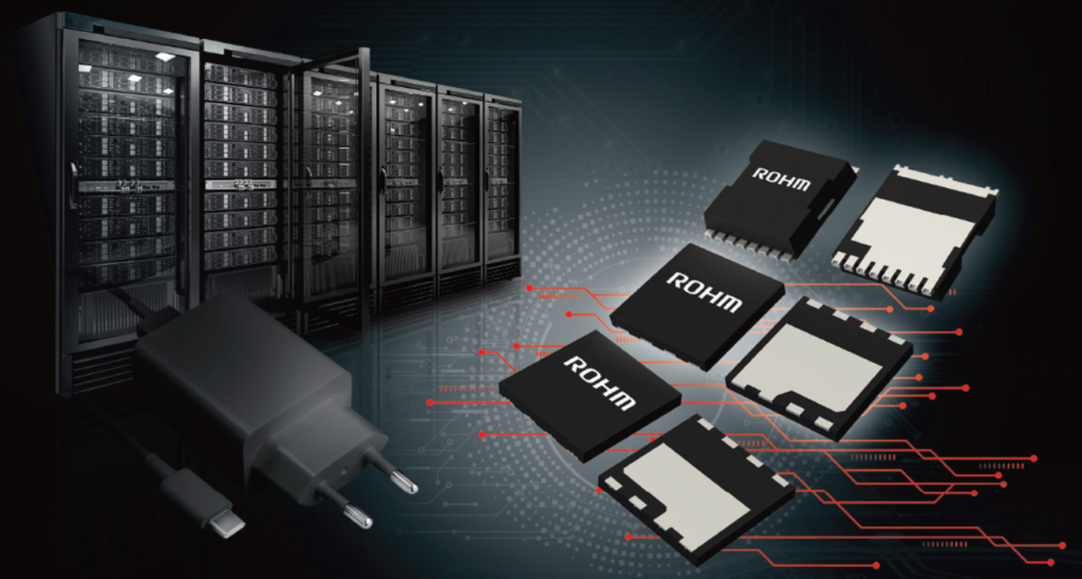
Murata has obtained ISO 26262 Asil D functional safety certification for its development process from SGS-TÜV.

This validates the development process for hardware, software and integrated systems for the likes of communication modules and sensors.

The certification ceremony took place last month.

ISO 26262 provides a framework for the development and validation of electronic systems, ensuring their reliable and safe performance over their entire lifecycle, helping reduce the risk of malfunctions that could lead to hazardous situations.

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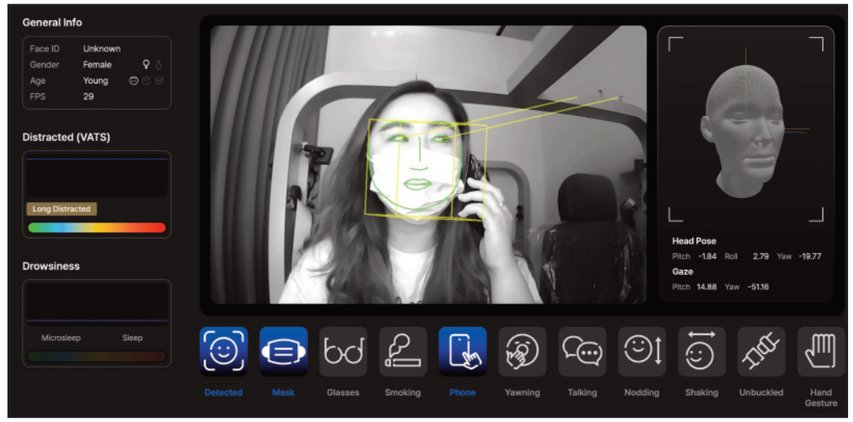
Access Europe and Neusoft have signed an MoU to supply automotive OEMs with in-vehicle intelligent mobility apps.

This lets OEMs provide in-vehicle mobility services powered by the integration of the Access Twine4Car app store with the Neusoft global navigation product family.

The app store is a flexible white-labelled in-vehicle-infotainment market that spans the gap between the automotive and the content and services providers.

Guan Xin, general manager of Neusoft, said this let it provide global automakers with online navigation and entertainment content.

The one-stop includes hybrid navigation, electric vehicle navigation, music, video, social networking and games. This integration means automakers do not need to spend time and energy to source, evaluate and communicate with third-party service providers.



Deep In Sight facial recognition system

Start-up unveils in-cabin monitoring at Detroit show

South Korean start-up Deep In Sight unveiled its Camosys in-cabin monitoring system and face recognition unit (FRU) at last month's InCabin show in Detroit.

At the core of Camosys lies its ability to optimise AI models for in-cabin monitoring. Tailored to integrate seamlessly into the vehicle environment, it can detect and respond to various safety hazards, including drowsiness, distraction, fatigue, phone usage, seatbelt compliance and unexpected driving events.

It complies with safety regulations such as Euro NCap and NTHSA.

Personalised and customised features include facial recognition and gesture control.

The FRU technology is already integrated into electric vehicles by a global OEM. This lets drivers and passengers authenticate themselves without the need for car keys, solely through facial recognition.

With its ability to distinguish fake facial images and fast AI models, FRU lets drivers and passengers unlock their vehicles in three seconds.

"Camosys sets a new benchmark for safety, security, convenience and driver experience," said Lucas Oh, CEO of Deep In Sight. "We are eager to become a key partner in the global in-cabin monitoring market and are fully prepared to collaborate with leading OEMs and tier-one companies."

Tier IV integrates Driveblocks Mapless platform

Open-source autonomous driving (AD) technology firm Tier IV has announced an initiative in response to driver shortages in Japan's cargo industry The company is developing a reference design encompassing the core functionalities of Autoware open-source software.

It plans to conduct proof of concept (PoC) tests on Japan's highways this year to facilitate the deployment of autonomous driving.

For the PoC tests, Tier IV is integrating the Mapless autonomy platform from German start-up Driveblocks into its AD software. This lets AD platforms navigate using perception, rather than high-definition (HD) maps, a method proven effective in Europe.

The integration of Driveblocks' technology creates a redundant safety layer and a secondary path for where HD maps become unavailable or outdated.

Eseye provides IoT for Zero Motorcycles

California-based Zero Motorcycles has selected Eseye's multi-IMSI AnyNet+ eSIMs to provide IoT connectivity to support two-way communication for its SR/F bike.

The SR/F's functionality is powered by the Helios system which is manufactured by T42 and combines GPS and cellular GSM technology to monitor and protect the bikes while allowing Zero Motorcycles to offer information and security features to its customers.

This includes real-time data on location, speed, power consumption and battery status, as well as safety alerts.

The Helios system has built-in IoT connectivity provided by Eseye's white-labelled AnyNet+ eSIMs. Sensors within the Helios device collect telemetry data from the vehicle for consolidation and processing.

The eSIMs route the data to T42's IoT management platform, via Eseye's API connections, where they can then be made available in real time to the rider, T42 and Zero Motorcycles, depending on relevance.

"Stable, reliable cellular connectivity is critical to delivering the great user experience Zero Motorcycle's customers expect," said Maxim Perry, account manager at T42. "To achieve this, the bikes must be connected wherever they are and with maximum uptime."

Having signed agreements with every major mobile network operator across the globe, Eseye gives Zero Motorcycles access to more than 700 networks in over 190 countries, resulting in greater than 99.5% connectivity uptime. The SIM embedded in each bike's tracking device can be loaded with multiple network user profiles, allowing T42 to localise it to the owner's market, and prioritise network choice by quality in line with Zero's strategy.

If there's a drop in performance or an outage, the eSIM automatically switches the device to an alternative network.

This is particularly beneficial as Zero produces bikes that are sold in 32 countries.



INFOTAINMENT

SOUND AND VISION

Steve Rogerson looks round last month's Harman Explore exhibition in Munich



Boris Muller: “Demo cars introduce people to all our products.”

Once upon a time, having a radio in a car was considered a luxury. In 1965, Ford was the first to introduce an eight-track tape player; drivers could choose their own music. The less bulky cassette player became popular followed by better quality CDs.

All these, revolutionary at the time, now seem so incredibly dated. Streaming music, sound quality that was once confined to professional studios, displays that just amaze, and more. The car today can even provide a quick health check.

All these, and what is coming next, not years away but months away, were on show at Harman Explore, a roadshow event organised by the Samsung subsidiary to show its latest in-car products, some of which had their first outing at CES in Las Vegas in January, others are just being unveiled now.

The German event at Harman’s offices just outside Munich took place in May and included real demo vehicles where visitors could have a hands-on experience of the technology; the Dolby Atmos sound demo playing Elton John’s Rocket Man was out of this world.

“We have these demo cars to introduce people to all our products,” said Boris Muller, Harman business development director.

He was sitting in a BMW X5 hybrid that was fitted with Harman’s Ready Vision QVue display technology introduced at CES.

QVue puts information most important to the driver on the lower portion of the windshield, allowing for easy readability without obstructing the view of the road, while offering a large field of view for all vehicle occupants.

This HDR-capable reflective display powered by Samsung Neo QLED offers high-resolution with vivid colours and brilliant optics.

The display is reflected onto a black strip along the bottom of the windscreen from displays built into the area just below that that take up very little space.

“These are built into the dashboard and reflect onto the windscreen,” said senior director Peter Kipfelsberger. “The key advantage is it can fit into a tight space. And when it is turned off, you wouldn’t even know a display was there.”

The three displays to provide a pillar-to-pillar strip each take up 0.5 litres, so a total of 1.5 litres.

On the flip side, the reflected display only has 20% of the brightness of the original; 80% is lost.

“This means you have to provide a very high brightness display,” said Kipfelsberger. “You need more than double the brightness of a standard display. We use powerful backlit LEDs, and we use blue not white LEDs. That is the key story of Neo QLED.”



Yuriy Mitrofanov: “We don’t need a car for 90% of the tests.”

Legislation in different countries limits the depth of the black strip so it does not impact on the driver’s view of the road.

Kipfelsberger said the technology would be production ready by the end of this year and Harman has been discussing it with potential customers since January.

“We expect the first cars with our technology will be on the market in early 2026,” he said.

This fits in with the pillar-to-pillar display trend being led by Mercedes, he said, as opposed to the trend being pushed by BMW and others to have a central display backed up by augmented reality (AR) projected onto the windscreen.



Peter Kipfelsberger: “It can fit into a tight space.”

The Ready Vision AR software incorporates artificial intelligence, combining visuals such as traffic, 3D navigation and hazard alerts to increase the driver’s situational awareness.

“This is projected directly onto the windscreen,” said Yuriy Mitrofanov, delivery manager at Harman. “There is a static zone that supports drivers with speed limits, navigation, lane-departure warning, and an augmented zone with arrows on the windscreen showing where to go.”

The software is available for any brand and they can choose which features they need. Simulation tools are also available for testing the software without using an actual car.

“We don’t need a car for 90% of the tests,” said Mitrofanov.

Audi and Porsche are early customers.

Music

Music when you drive has come a long way since those eight-track tape players and often tinny sound quality. Now the goal is to produce the high quality that people can get in their homes or studios. This is more than just a matter of sticking in the best speakers and amplifiers, it has to be tuned to the car model. Different vehicles have different acoustic profiles and it is important the sound system is designed to match that.

“For every car, OEM and model, we do the tuning,” said Stefan Dorr, acoustic systems engineering manager. “This is like a finished instrument. If you build a piano, all the parts have to work together and this is what we are doing with the car. We do it across all the brands. It is the sound DNA, each car is unique.”

This needs to start early to have the biggest impact. Harman builds

relationships with the customers and often has prototype vehicles to work with so the sound system can be designed in from the start.

"We look at it from the start, on the number and position of the speakers, and the software," said Dorr. "It doesn't matter how good the speakers are, you need the mechanical installation to be pure. You don't want rattling."

Harman's labs and studios have high security as they are often working with cars that the OEMs are not yet ready for the public to see.

"Our job is to make sure the end customer gets the best sound in their cars," said Christopher Herold, director of acoustic system engineering. "We have a lot of musicians here as well as acoustic and electric engineers. Our main target is to take the sound you have at home and bring that to the car."

He said for OEMs, this was a big extra in the same way as offering leather seats. And it is not just for music.

"In a car, you want to deliver more information to the driver, and sound can play a big role in that," said Herold.

Health

Major advances have been made in recent years in monitoring drivers and passengers. The cars can check the driver is paying attention, that passengers are correctly strapped in and children have not been left in the car. This is now being taken to a new level to monitor the health of the drivers and even linking with existing smart watches and phones to build up a picture of state of mind, even checking they have had enough sleep.

"We are now coming up with options for mitigating for drowsiness," said Marcus Futterlieb, senior principal engineer. "If you detect a gradient that someone is going into drowsiness, you can do some nudges such as blowing cold air or changing the playlist. These are implemented by each OEM. They want to have their own options. We provide the regulated warnings and we come up with concepts that the OEMs can adjust to what they want."



Marcus Futterlieb: "The watch goes places that the car doesn't."



Stefan Dorr: "You don't want rattling."

Harman has designed cameras that focus on the driver and cabin; they can detect breathing, they can measure the pulse rate, all to build up a picture of driver health.

"These are ready but we don't have a customer for some of them yet," said Futterlieb. "NCap is always pushing the market. A key one is detecting if the driver is out of position, such as with their feet on the dashboard. We are going to release a limb detection option in September or October."

Harman is also taking advantage of having Samsung as its parent company by integrating its sensors with the Galaxy Watch, and there are plans to extend that to the Apple ecosystem.

"The watch goes places that the car doesn't, so now we can know if the driver has had a good night's sleep," said Futterlieb.

The company is using an open system that links with an app on the phone.

However, the Ignite app store is for the time being only working with Android. At CES this year, it announced an integration with OEM wallets and support for multiple payment service providers. This also allows car makers to monetise and maintain control of commercial relationships with customers.

The product is powered by Samsung Checkout, which executes millions of transactions a day and has been tested and built to enable secure transactions at a global scale. It is the same payment system integrated into Samsung's TVs to make online purchases and the Galaxy Store, Samsung's official app store.

"We offer a white-label app store, so our customers can customise it," said Saverio Labella, principal systems architect. "They can change how it works. We will do the customisation for them or we can provide an SDK so they can do it themselves."

Harman is also providing video apps that can be used in the car. This will be extended to premium video content by the end of this year and to productivity applications such as Microsoft Teams by the end of next year.

Within the Ignite store, OEMs have access to a curated list of more than 70 safe and secure apps to enrich the in-cabin experience; the aim is to extend this to more than 300. Newly available apps include Novo, a driver safety app from connected car software provider Telenav. Novo monitors driving habits and encourages safe driving via safety alerts, challenges and rewards. This was tailor-made for the Ignite store.

"It takes us just a couple of hours to put it in and start testing on the target vehicle," said Jens Rogotzki, director of product management at Telenav. "We can calculate the safety score from the car's sensors, such as rapid acceleration, hard braking and speeding. This shows how safe you are driving. We also offer challenges and rewards, so if say



Sound engineering lab at Harman's Munich facility



Jens Rogotzki (left) and Saverio Labella

the driver doesn't break the speed limit for a week, they will get a gift card."

Connection

Bringing all these technologies together is the Ready Connect 5G telematics control unit (TCU), leveraging Snapdragon Digital Chassis connected car products from Qualcomm. Based on the Snapdragon Auto 5G Modem-RF Gen 2, the TCU can deliver in-cabin experiences for consumers while reducing time to market and engineering efforts for OEMs.

"Without my little box, we would not see all these nice products," said Achim Mattern, innovation product manager. "This is a ready-to-go telematics control unit for 4G and 5G, and even to 6G and beyond. We start with 4G and just change it to a pin-compatible module for, say, 5G."

The modules Harman is using at the moment are from Chinese company Quectel but the current China-USA trade war could see that company's products restricted, so Harman is looking for alternatives should that prove necessary.

The TCU uses Harman's smart conformal antenna, which means an external antenna is not needed. Antennas are built into the unit to cover cellular and GNSS as well as, optionally, Bluetooth, Bluetooth LE and wifi.

"By the end of this year, it will be in a vehicle," said Mattern. "We have OEMs working on this already. This is a product that all cars can have in a couple of years."

Conclusion

Samsung's acquisition of Harman back in 2017 is looking a better buy every year. Not only has Samsung's display and connectivity technology enhanced the Harman offering, it also gives Samsung access to automotive technology at a time when vehicle electronics are playing a big part for consumer electronic brands.

"Samsung never had a deep automotive business," said Philip Siebourg, senior director of automotive design at Harman. "That is why we have been successful as an automotive team within Samsung. And because people also use Apple, we have to be open. We have to transform it into an automotive experience that everyone can use regardless of the brand they are close to. We really need to work for the complete market."



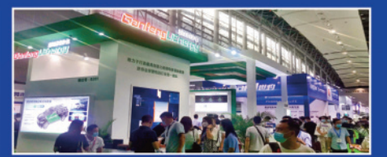
Achim Mattern

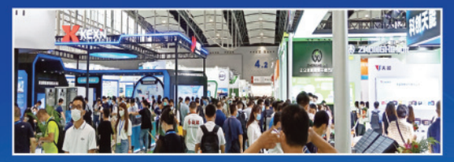


Philip Siebourg

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AI

VERIFY AND VALIDATE

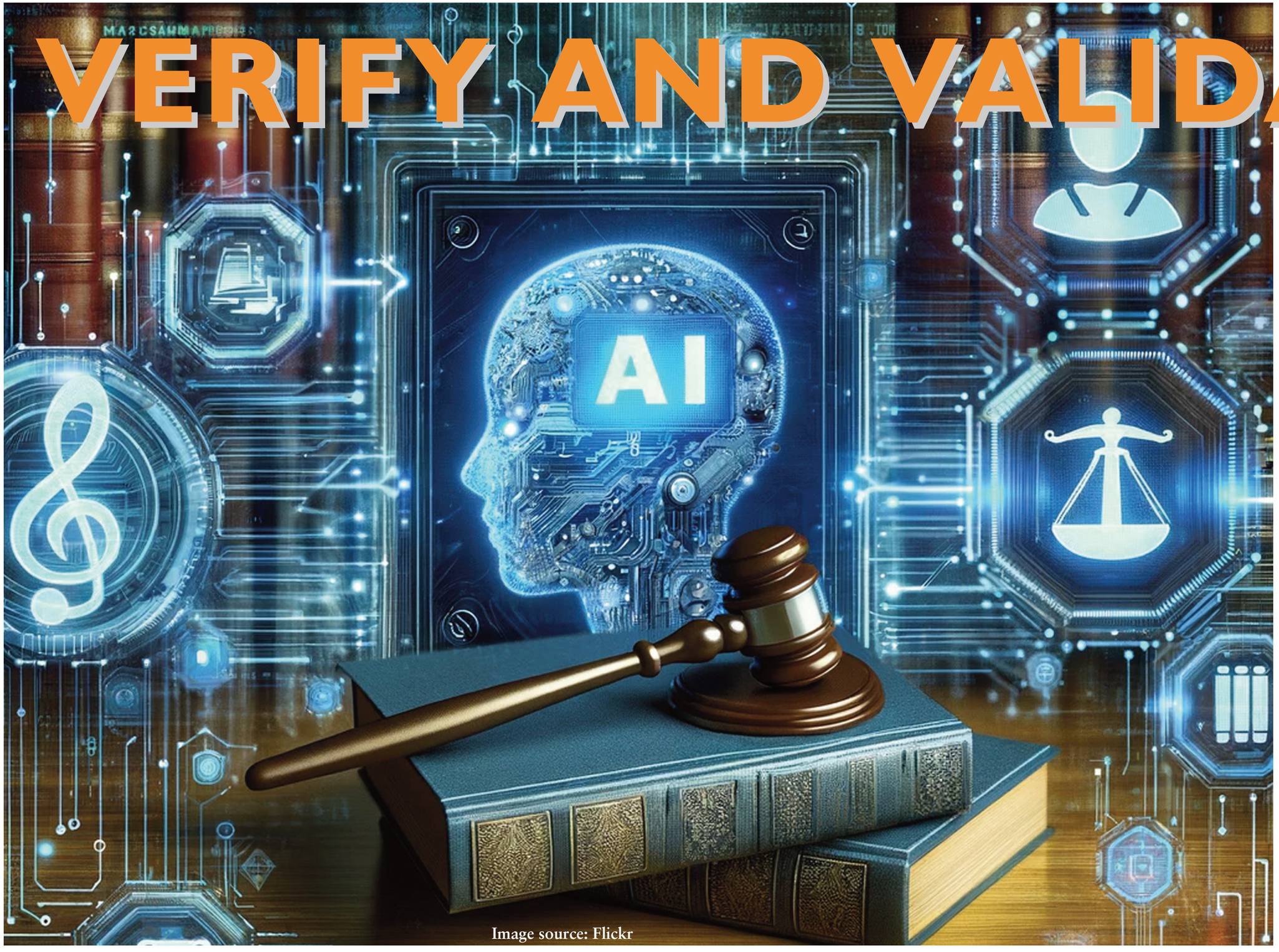


Image source: Flickr

Lucas Garcia asks how engineers can verify and validate AI in safety critical systems in a complex regulatory environment

Governments worldwide are pressing on with plans to regulate the use of AI. In January, the UK introduced the AI Safety Institute, the first government-backed organisation to focus on advancing AI safety for the public interest. Last month, the European Union unveiled the AI Act, which mandated AI companies to report and test models to ensure AI systems meet specified requirements.

While in the USA, the White House has issued an executive order that highlighted the importance of robust verification and validation (V&V) processes for AI-enabled systems.

With policymakers therefore making concerted efforts to move towards establishing AI regulation and distinct frameworks for its deployment across industries, engineers designing AI-enabled systems are under increasing pressure to meet new and evolving specifications and V&V

processes will significantly impact safety-critical systems.

Aspects

First, it is worth defining each aspect of V&V and their importance. Verification determines whether an AI model is designed and developed per the specified requirements, whereas validation involves checking whether the product has met needs and expectations.

V&V techniques allow engineers to ensure the AI model's outputs meet requirements, allowing for swift bug detection and removing the probability of data bias.

One advantage of using AI in safety-critical systems is AI models can approximate physical systems and validate the design. Engineers simulate entire AI-enabled systems and use the data to test systems in different scenarios. Performing V&V in safety-critical scenarios ensures an AI-enabled safety-critical system can maintain its performance level under various circumstances.

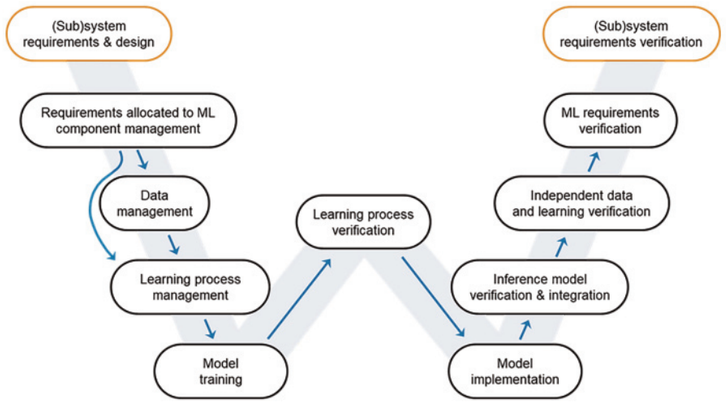
Most industries that develop AI-enhanced products require engineers to comply with standards before going to market. These certification processes ensure specific elements are built into these products. Engineers perform V&V to test the functionality of these elements, which makes it easier to obtain certifications.

Safety critical

When performing V&V, the engineer's goal is to ensure the AI component meets the specified requirements and is reliable under all operating conditions. This is to ensure it is safe and ready for deployment.

V&V processes for AI vary slightly across industries, but there are four overarching steps:

- Analysing the decision-making process to solve the black-box problem
- Testing the model against representative datasets
- Conducting AI system simulations
- Ensuring the model operates within acceptable bounds



The W-shaped development process is a non-linear V&V workflow designed to ensure accuracy and reliability

The importance of these steps is outlined later, as they continue to be refined and improved as engineers collect new data, gain insights and integrate operational feedback.

Analysis

When engineers use an AI model to add automation to a system, one issue that arises is the black-box problem. Understanding how AI-based systems make decisions is crucial to providing transparency, enabling engineers and scientists to build trust in model predictions and comprehend decision-making.

This first technique that can be used is feature importance analysis. This helps engineers identify which input variables impact a model's predictions most significantly. Although the analysis works differently for different models, such as tree-based and linear models, the general procedure assigns a feature importance score to each input variable.

A higher importance score signifies the feature has a greater impact on the model's decision. In the case of a safety-critical system in the automotive industry, variables may include environmental factors, such as precipitation or the presence and behaviour of other vehicles.

Secondly, explainability techniques offer insights into the model's behaviour. This is especially relevant when the black-box nature of the model prevents other approaches. In the context of images, these techniques identify the regions of an image that contribute the most to the final prediction. This lets engineers understand the model's primary focus when making a prediction.

Datasets

Engineers often evaluate performance in real-world scenarios where the safety-critical system is expected to operate. They gather a wide range of real-world representative datasets suitable for test cases, designed to evaluate various aspects of the model. The model is then applied to the datasets, with the results recorded and compared with the expected output.

Bounds

For AI models to operate safely and reliably, it is vital to establish limits and monitor the model's behaviour to ensure it stays within those boundaries.

One of the most common boundary issues occurs when a model has been trained on a limited dataset and encounters out-of-distribution data at runtime. Similarly, the model may not be robust enough and can potentially lead to unpredictable behaviour.

Engineers employ data bias mitigation and robustification techniques to ensure AI models operate safely, and within acceptable bounds.

First, data augmentation ensures fairness and equal treatment of different classes and demographics. In the case of a self-driving car, this may involve using pictures of pedestrians to help the model detect a pedestrian, regardless of their positioning.

Data balancing is often paired with data augmentation, and includes similar samples from each data class. Using the pedestrian example, this means ensuring the dataset contains a proportionate number of images for each variation of pedestrian scenarios. This technique reduces bias and improves the model's generalisation ability across real-world situations.

Robustness, meanwhile, is a concern when deploying neural networks in safety-critical situations. Neural networks are susceptible to misclassification due to small, imperceptible changes that can cause a neural network to produce incorrect or dangerous results.

Integrating formal methods into the development and validation process is a common solution to the problem. They involve using rigorous mathematical models to establish and prove the correctness properties of neural networks that ensure higher robustness and reliability in safety-critical applications.



In the automotive industry, standards are being developed to address safety-related properties and risk factors for self-driving vehicles; Source: Flickr

Conclusion

AI adoption is growing exponentially, but it will become more challenging as policymakers pay increasing attention to its deployment. As engineers continue to apply AI into systems, it is crucial they continue to explore a range of approaches to testing that can address both the regulatory requirements and the increasingly complex challenges of the technology. This will ensure V&V processes continue to be responsibly and transparently applied in safety-critical systems.



Lucas Garcia is product manager at Mathworks

POWER TECHNOLOGIES

BALANCE OF POWER



Starry Tsai discusses choosing an off-battery power management integrated circuit for powering automotive electronics

Vehicle Electronics

Providing power rails for automobile instrument clusters and radio head units presents many conflicting design challenges. These include finding a highly efficient switching regulator with low quiescent current (I_Q) that can generate a low output voltage directly from the vehicle battery, while still maintaining low electromagnetic interference (EMI).

Even as the fuel efficiency of modern automobiles increases, they are burdened with ever-increasing electrical demands. These include the numerous in-cabin convenience, telematics connectivity and infotainment features that provide information to the driver via the vehicle instrument cluster and/or heads-up display (see Fig. 1) and are controlled using touchscreens and switches located on the centre console, commonly referred to as the radio head unit.

This article reviews the challenge of providing multiple supply rails to these systems using the vehicle battery as voltage input. There are challenges in meeting the required regulator output voltage range while maintaining low I_Q and low EMI. An automotive power management IC (PMIC) can remove the compromises associated with alternatives in meeting these challenges.



Fig. 1: Automobile instrument cluster and centre console

Requirements

To limit heat dissipation, automotive applications require highly efficient DC-DC converters that meet stringent manufacturer quiescent current requirements. These converters must operate with a low input battery voltage to support cold-crank and start-stop events.

A common approach to managing cold crank is to use multiple PMICs and other components to step down the battery voltage with two stages of buck regulators. This requires complex circuit design and layout, which increases the size.

This approach is also more susceptible to EMI interference, making it difficult to meet EMI standards such as Cispr Class 5.

Another concern arises where loads are suddenly disconnected from the car battery, known as a load-dump event, causing the rail voltage to spike suddenly, which can create potentially destructive transient voltages as high as 40V.

Uncompromising

Instead of using a two-stage step-down, a more straightforward approach is to use an integrated PMIC such as the one shown in Fig. 2, which has several advantages over other automotive PMICs.

This highly integrated triple-output PMIC includes two synchronous buck converters (3.5 and 2A) with an asynchronous boost controller that can be used to provide an adjustable 10V typical voltage to the buck converters and keep them in regulation during cold-crank operation even if the battery voltage falls as low as the 2V battery input.

The buck converters have a wide 3.5 to 36V input operating voltage range with operating current requirements of only 10μA (V_{OUT} = 5V) and 8μA (V_{OUT} = 3.3V), making it suitable for voltage regulation when an automobile is switched off for extended periods.

EMI mitigation

To address critical EMI concerns, this PMIC has a user-selectable spread-spectrum function that provides significant reduction in peak EMI levels. This spreads spurious energy across a wider frequency band while lowering its magnitude.

Regulator switching frequency is fixed at either 400kHz or 2.1MHz. High switching frequency provides multiple benefits such as requiring smaller external components and reducing output voltage ripple while also guaranteeing no AM band interference.

This PMIC can be programmed to operate in any one of three modes for optimised performance as required, that is, forced fixed-frequency operation, skip mode with ultralow quiescent current, and phase-locked synchronisation to an external clock.

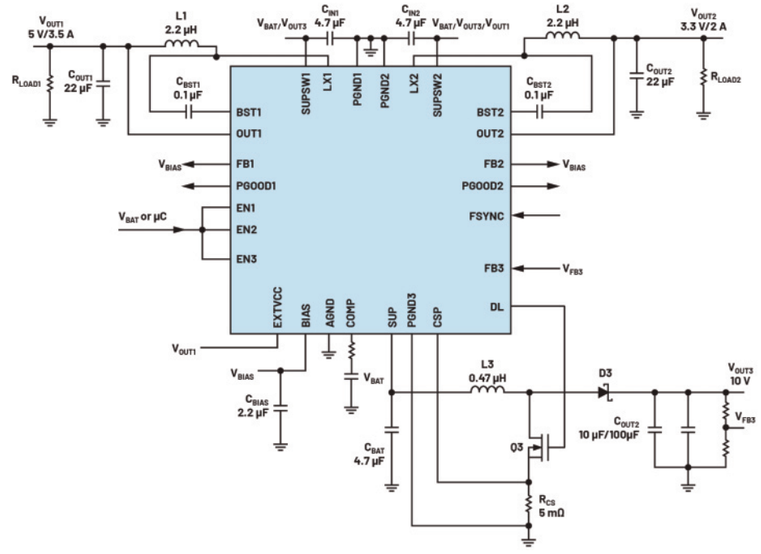


Fig. 2: 36V boost controller with dual 3.5A/2A synchronous buck converters for automotive applications

Voltage conversion

While some automotive PMICs include buck regulators that provide low output voltages from a relatively wide input range, they do so by running at a low switching frequency. The reason for this is because the minimum voltage conversion ratio (V_{OUT}/V_{IN}) is limited by the regulator's minimum controllable on-time, typically 60 to 120ns.

For proper fixed-frequency pulse-width modulation (PWM) operation and optimal efficiency, buck regulators must operate in continuous conduction mode (CCM) during normal operating conditions. In CCM, the minimum output to input voltage ratio is determined by the following formula:

$$\frac{V_{OUT}}{V_{IN}} > t_{ON(MIN)} \times f_{SW}$$

For a typical buck regulator with a minimum on-time of 120ns and a 12V input, maintaining CCM at 2.1MHz means the output voltage can go no lower than 3V; realistically, allowing for design margin, this could be up to 5V in some circumstances.

Achieving lower output voltages requires pulse skipping decreasing the effective duty cycle, but this has the effect of increasing unwanted EMI. To maintain a constant switching rate, the switching frequency must be reduced, but this also negatively impacts EMI performance.

This PMIC has an advantage over other automotive regulators in this regard. With a typical minimum on-time of only 20ns, its integrated buck regulators can theoretically achieve an output voltage as low as 0.5V for 12V battery input with 2.1MHz switching frequency. This figure is below the minimum specified regulated output voltage (1V), meaning it can be used to supply low voltage rails without the need to reduce switching frequency. This lets it maintain EMI performance at low output voltage levels.

Conclusion

This article reviewed the requirements for providing power to the infotainment, telematics and head unit systems within the instrument cluster and centre console of an automobile. Some methods trade off output voltage range for EMI performance, but a highly efficient, low on-time, automotive PMIC can overcome this compromise. This makes it suitable for use in all types of vehicles, including those using stop-start technology.

Starry Tsai is executive business manager of automotive power at Analog Devices



SMART COCKPITS

BOARD MEETING

A reference design from Rohm and SemiDrive helps create smart cockpits

In recent years, the proliferation of smart cockpits and adas in vehicles has increased the demand for automotive electronics and components. The performance of PMICs and serdes ICs, which are at the heart of electronic systems in vehicles, has a direct impact on the stability and efficiency of the entire system.

Rohm and Nanjing SemiDrive Technology, China's largest SoC manufacturer for smart cockpits, have jointly developed a smart cockpit reference design. The design is primarily based on SemiDrive's X9M and X9E automotive SoCs, and includes PMICs, serdes ICs, LED driver IC, and other components.

A reference board based on this design is also available, consisting of three boards: the core, serdes and display boards.

Rohm PMICs and serdes ICs achieve a high level of integration in power supply blocks while supporting increased stability during high-speed data transmission.

Rohm and SemiDrive have been exchanging technologies since 2019, particularly in the development of applications for vehicle cockpits. In 2022, the two companies entered into a partnership for the development of technologies in the automotive sector.

This resulted in Rohm components such as PMICs and serdes ICs being integrated into the reference board for SemiDrive's X9H in-vehicle SoC. The reference board has since been adopted by a number of automakers to provide functionality for cockpits and other vehicle applications.

This time, Rohm and SemiDrive have collaborated on the development of the REF66004 reference design featuring the vehicle-mounted SoCs X9M and X9E. As such, the REF66004 is expected to expand application line-up, including in popular mass-market models.

In addition to the serdes IC used in the X9H reference board, Rohm also provides the BD96801Q12-C SoC PMIC and BD9SA01F80-C buck converter IC for driving the SoC, as well as the BD39031MUF-C general-purpose PMIC for adas that supplies power to the serdes IC.

This supports operation of up to three display projections and four adas surround-view cameras.

"As vehicles become increasingly smart, so too does the demand for car electronics and components," said Zhang Qiang, chairman of Nanjing SemiDrive Technology. "SemiDrive is focused on providing core components such as automotive SoCs and controllers for next-generation automotive EE [electrical and electronic] architectures. Partnering with Rohm, which offers a rich portfolio of semiconductors for adas and cockpits, will greatly contribute to achieving next-generation cockpits. In particular, Rohm serdes ICs and PMICs, which leverage original analogue technology, are key components in our reference design. We look forward to continuing our collaboration with Rohm to provide innovations in a wide range of automotive fields."

Going forward, Rohm says it will continue to develop products for car infotainment systems that contribute to improving automotive safety and comfort.

"We are pleased to have developed this reference design in collaboration with SemiDrive, a company with extensive experience in automotive SoCs," said Tetsuo Tateishi, member of Rohm's board. "As adas evolves and cockpits become more multifunctional, the role of automotive analogue semiconductors such as serdes ICs and PMICs is becoming increasingly important. At the same time, the new PMIC provided by Rohm for SoCs represents a novel concept in power ICs that can flexibly adapt to next-generation automotive power system configurations. Going forward, we will continue to deepen our partnership with SemiDrive to increase our understanding of next-generation cockpits and accelerate the development of a wide range of products, contributing to further evolution in the automotive sector."

The REF66004 reference design combines SemiDrive's X9M and X9E SoCs for smart cockpits with Rohm PMICs for SoCs and adas, serdes ICs for display and camera, LVDS splitter IC, and LED driver IC for vehicle displays.

The design offers a cockpit option capable of driving up to three screen projections and four cameras. In addition, Rohm's latest PMICs for SoCs enable arbitrary output voltage setting and sequence control via internal one-time programmable memory, allowing flexible, high efficiency power supplies to be achieved that are tailored to circuit requirements.

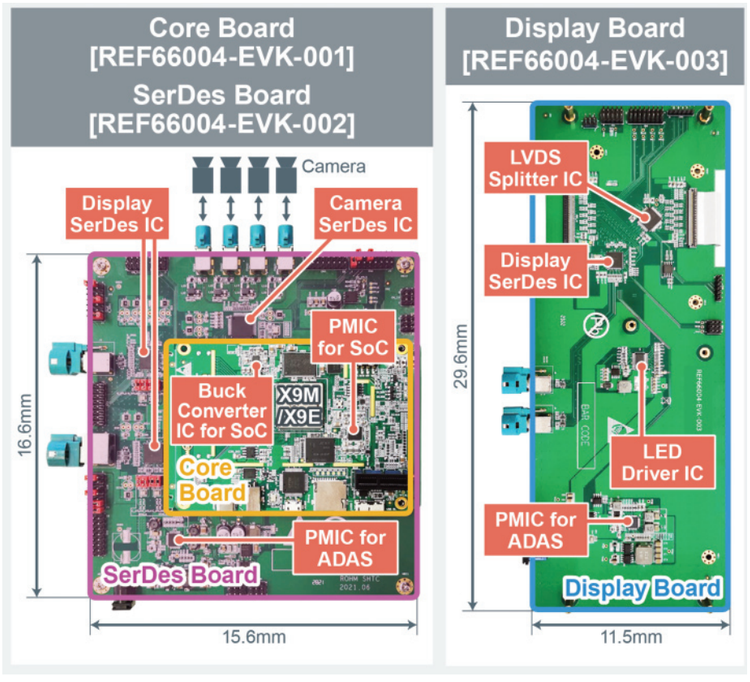
A reference board based on this design is also available individually on request, capable of running multiple operating systems on a single SoC, taking advantage of SemiDrive's hardware virtualisation capabilities. At the same time, a hardware security management module enables the transmission of commands from the operating system to the SoC and GPU. By swapping different SemiDrive SoCs with compatible pinouts, application specifications can be changed quickly and without circuit changes.

Ranging from entry-level to flagship models, SemiDrive's X9 in-vehicle SoCs, which support various applications, including instrument clusters, car infotainment, cockpit domain control and intelligent monitoring systems, have already completed shipments exceeding one million units. In addition, a sufficient production system has been established through extensive mass production experience.

SemiDrive is the first automotive SoC manufacturer to comply with major automotive-related standards, including AEC-Q100, ISO 26262 Asil B to D and China Commercial Pin Certification. For the future of smart mobility, SemiDrive offers a line of products suitable for EE architectures, such as smart cockpits, smart control systems and autonomous driving.

SemiDrive's automotive SoCs have already achieved large-scale production, with over 260 customers, nearly 200 projects, and shipments exceeding three million units. In addition to engaging with over 90% of automakers in China, it also does business with global automotive manufacturers.

Rohm develops and manufactures products from SiC diodes and mosfets, analogue ICs such as gate drivers and power management ICs to power transistors and diodes to passive components. These products are made in plants in Japan, Germany, Korea, Malaysia, Thailand, Philippines and China.



Reference board design overview

MAPPING

WAY TO GO

Kate Legnola shows how to transform transport operations with mapping intelligence

Vehicle Electronics

Route optimisation has become ever more important in recent years. The rise in ecommerce has created routing pressures, especially in the last kilometre, while rising fuel costs, the push towards net zero and load theft have placed the spotlight on using preferred refuelling locations and the need for safe, comfortable parking, especially overnight.

Layering these demands over the traditional goals of controlling costs and meeting tight deadlines has highlighted the limitations of generic mapping and routing options. From large HGVs stuck in tiny rural lanes to the damage – and cost – incurred when an HGV hits a low bridge or the risk of compliance breach associated with taking a hazardous load through a tunnel without permission, many transportation companies have learnt the painful lessons of relying on a phone's satnav.

Consumer mapping technologies may be ubiquitous but they lack the depth of insight required to manage the complexity associated with the commercial movement of goods. However, dedicated commercial route mapping technology has been developed to address the very specific demands of transportation fleets, from height and weight restrictions and hazardous materials transport designations to improving driver well-being and safety.



Transport companies can optimise routes

Goals

Reliance on online maps has become standard for most drivers but effective commercial route optimisation requires far more depth and breadth of insight than the basic, ubiquitous directions that cannot differentiate between a driver in a heavy goods vehicle or a two-seater sports car.

Commercial mapping intelligence has evolved beyond simple visualisation on a map to offering a wide range of insights on business and driver behaviour that can significantly enhance fleet management. Complex routing algorithms are used to determine the most efficient routes for delivery or service vehicles by considering factors such as traffic patterns, road permissions, congestion and clean air zones, low bridges, narrow lanes, and fuel consumption.

Data, including not only construction of new infrastructure but also any changes in existing restrictions, are continually updated following routine bridge and tunnel inspections undertaken by highways authorities to give planners confidence in the safety and legality of the designated route.

Sustainable

Transportation companies can leverage this depth of information to plan based on different priorities, comparing routes based on sustainability, cost and time objectives. The ability to offer clients different routing models provides a competitive advantage by enabling a transport business to demonstrate how it is supporting a client's sustainability reputation, for example.

It is also assisting fleets in future-proofing their operations so they can better serve and meet their sustainability goals. Among them are a better ability to adhere to environmental rules and guidelines, a better understanding of vehicle carbon footprint, and a reduction in operating costs with the efficient allocation of vehicles based on electric vehicles, thus achieving long-term, sustainable cost reduction.

Efficiency

Complex algorithms are used to determine the most efficient routes for delivery or service vehicles by considering factors such as traffic patterns, road permissions, congestion and clean air zones, and low bridges. Route intelligence software can also track dwell time, a perennial problem for all transportation companies.

Using precise polygonal geofencing to improve the accuracy of arrival and departure notifications, the overall journey time, including both travel and stop time, is more precise. It is also enabling companies to understand better the overall efficiency and performance of the fleet, information that can help reduce empty kilometres, cutting costs and reducing emissions while adding revenue.

Safety

Indeed, by investing in smart mapping technology, elements such as planning processes will automatically consider drivers' hours of service (HoS) and can include specific locations for resting and parking to avoid the risk of drivers being compelled to park on the roadside, which is both uncomfortable and unsafe.

Further, using intelligent route mapping, transportation companies can improve loyalty programmes and discounts around specific brands of fuel to optimise routes, understand freight spend and plan routes more efficiently. The routes can be designed around the use of rest stops preferred by drivers wherever possible to ensure they have access to good quality food and showers.

Driver safety can be further enhanced with vehicle specific information throughout the journey especially regarding the trickier problems that can arise during the last kilometre. Commercial mapping intelligence options pinpoint the actual final locations, such as the delivery entrance to the shopping centre rather than the consumer entrance used by the generic mapping software.



Intelligent route mapping can improve day-to-day planning

In addition, transportation companies can opt to customise the mapping, overlaying a preferred approach path for specific locations to ensure every driver, however new to the business, has the optimal, safe route to each location, whether that is a store, warehouse or distribution centre.

Conclusion

For transportation companies wrestling daily with the need to mitigate disruption, reduce costs and meet escalating customer demands, intelligent mapping and routing are becoming a strategic imperative. Companies can no longer afford to rely on traditional manual route planning processes or allow drivers to rely on their own generic mapping systems. The risks of delays, damage and missed opportunities are simply too high.

Intelligent route mapping provides businesses with a chance to improve day-to-day planning and ensure routes are optimised for each vehicle, taking into account the essential features of weight, size and hazardous materials. It gives the chance to focus on both driver performance and well-being, enabling companies to prioritise access to safe overnight parking and rest stops.

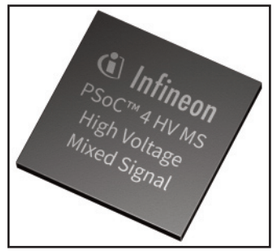
Finally, it also delivers vital insight into the intricate interplay of suppliers, processes and partners that allows transportation companies to optimise operations, intelligently consider innovations in areas such as EVs, and confidently navigate today's complex marketplace.



Kate Legnola is senior product manager for map data at Trimble

Microcontrollers for if you want to touch

The PSoC 4 HVMS family of automotive microcontrollers from Infineon integrates 12V regulator and Lin and CXPI-transceiver with analogue features such as Capsense and inductive sensing.



Target applications include touch-enabled automotive HMIs with touch buttons, sliders and touchpads for controlling HVAC, interior lighting, power windows and sunroofs, or in door handles.

In steering wheels, the PSoC 4 HVMS is used for touch sensing as well as safety-critical hands-off detection.

The Capsense module also supports proximity detection for occupant detection or foot kick control.

It can also be used in generic sensing applications such as liquid level and Wheatstone bridge sensing, or in simple actuators such as a PTC heater or interior and exterior lighting.

The family is AEC-Q100 qualified and offered in QFN packages with wettable flanks. The ICs are scalable and pin compatibility across devices.

ISO 26262 Asil-B compliance ensures safe operation at temperatures up to +125°C.

The family is based on Arm Cortex-M0+ processors with up to 128kbyte of embedded flash and 16kbyte of sram. The microcontrollers can be powered directly from a 12V battery and include Lin and CXPI phy.

There is support for parasitic capacitance up to 3000pF and overlays up to 18mm.

Additional analogue integration includes a 12bit SAR ADC, up to two op amps and low power comparators.

Software support includes AutoPDL, automotive middleware library for Capsense, and SafeTlib for automotive PDL.

The software package meets ASpice, Misra 2012 AMD1 and Cert C coding standards.

The software package is ISO 26262 compliant and developed as a safety element out of context (SEooC) for applications with safety targets up to Asil B.

The ModusToolbox software development platform will be available soon.

Relay removes need to reduce voltage

A lightweight, 60A, 400V DC switching relay from FCL Components is for power and automotive applications.

With no specific polarity requirement for the connection of load terminals, and a power consumption of about 1.2W at rated coil voltage, the FTR-E1-HC eliminates the need to reduce the voltage applied to the coil to the holding voltage, avoiding the space requirements of a holding voltage coil drive circuit.

The single-pole PCB relay, part of the FTR-E1 family, is one of the smallest in the HV DC 60A class.

With a dielectric strength of 5kV AC for one minute between coil and contacts, and 2.5kV AC for one minute between contacts, it provides twice the insulation properties of similar relays.

Non-polarised contacts let it switch between charging and discharging the load, making this relay suitable for applications such as electric vehicles, fast charging stations, photovoltaic power generation systems, hybrid construction machinery and battery systems.

The relay is plastic-sealed, and the plastic material complies with UL flammability standard 94V-0, which stipulates a burning time of up to10s and afterglow time up to 30s for each specimen.

Arc extinguishing technology uses a permanent magnet to extend the arc's path within the same air-gap. This keeps it compact, as well as making it safe, robust and affordable.

Available immediately, it is lead-free and RoHS compliant.





Image sensor

A 5Mpixel cmos image sensor from Omnivision uses TheiaCel technology and provides LED flicker mitigation (LFM) without sacrificing image quality.

The OX05D10 is for all automotive use cases where high dynamic range (HDR), low-light performance and LFM are critical.

The increasing adoption of adas and autonomous driving requires improved LFM, HDR and high-resolution image sensors.

This is addressed with its 2.1μm single-pixel TheiaCel technology that leverages lateral overflow integration capacitor (LOFIC) capabilities with other proprietary HDR technologies such as dual conversion gain (DCG) to capture high-contrast scenes for better content and image quality.

Dynamic range is about 140dB using VS exposure for dynamic range extension. LFM and motion free dynamic range is more than 110dB.

PureCel Plus-S technology is known for its low-light sensitivity and signal-to-noise ratio performance.

Eight infra-red emitters boost radiant intensity

Eight AEC-Q102 qualified 850 and 940nm high-power infra-red (IR) emitters from Vishay come in 3.4 by 3.4mm surface-mount packages.

Built on the firm's Astral surface emitter chip technology, the devices are for high drive currents up to 1.5A DC and 5A pulsed in automotive applications.

Featuring a double-stack chip, the IR emitters provide typical radiant intensity up to 6000mW/sr at a 5A pulse current and 2000mW/sr at a 1.5A DC current, which is said to be 10% higher than the closest competing device.

These values increase illumination for better contrast while reducing the number of components required. For further space savings, the emitter's surface-mount packages with lenses is said to occupy a 20% smaller footprint than competing devices.

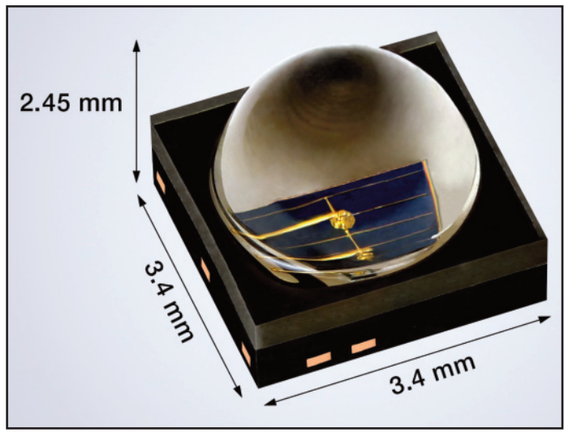
The IR emitters are for adas, driver and cabin monitoring systems, and eye tracking, as well as CCTV. For these applications, the 940nm devices suppress the red glow effect, while the 850nm emitters provide a better match with cameras.

To accommodate varying fields of view across different applications, the devices are available with four angles of half intensity: ±28°, ±40°, ±60° and ±75°.

Operating temperature is -40 to +125°C and thermal resistance from 5 to 9K/W, which provides optimised thermal management and enables their high drive currents.

RoHS-compliant, halogen-free and Vishay Green, they support lead-free reflow soldering.

ESD immunity is up to 5kV in accordance with Ansi, Esda and Jedec JS-001, floor life is 168 hours, and moisture-sensitivity level is three in accordance with J-020E.



Sealant for cmos image sensors

Delo has developed a sealant adhesive for cmos image sensors in driver monitoring systems.

Glass filters can be bonded directly to the chip using the Dualbond EG6290. It can be dispensed in narrow, high bondlines, compensate for temperature-dependent pressure changes, and meet routine automotive standards.

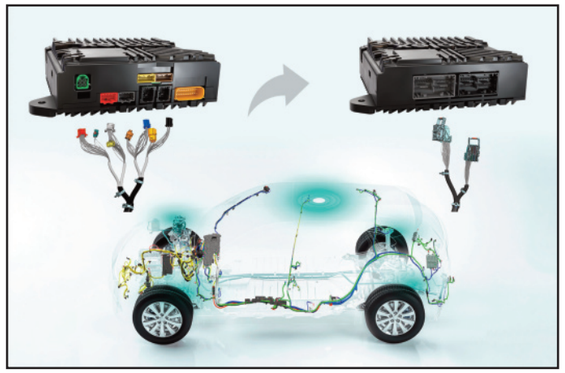
The adhesive was designed for the glass-on-die assembly method. The glass filter is fixed directly onto the chip, as is typical with iBGA image sensor packaging.

It has a Young's modulus of 2350MPa.

Glass transition temperature is over +130°C.

It can compensate for temperature-dependent pressure changes and meets AEC-Q100 grade two.

Data, signal and power combined



Data-signal hybrid connectors from Molex unify power, signal and high-speed data connectivity in one system.

The MX-Dash family of wire-to-wire and wire-to-board connectors can support the transition to zonal architecture and address emerging applications requiring reliable data transmission.

These include autonomous driving modules, camera systems, GPS and infotainment devices, lidar, high-resolution displays, and sensor-device connectivity.

The connectors come in sealed and unsealed versions.

Configurations support different power and signal terminal sizes, such as 0.50, 0.64, 1.20, 1.50, 2.80 or 4.80mm, as well as high-speed Fakra Mini (HFM) modules for high-speed data transmission.

The wire-to-wire connectors feature male blade stabilisation and independent secondary locks for robust and reliable terminal mating.

They help automotive engineers accommodate a growing mix of devices and sensors with different network requirements by offering modular sections or cartridges in the wire-to-board option that support various interfaces without changing form factors or footprints.

Engineers can reduce the number of inline, wire-to-board connectors for an instrument panel and body control harness from eight to two while removing up to six metres of copper wiring, depending on the vehicle model.

The 31+1-way connector combines 31 power and ground circuits, as well as a high-speed data connection, to decrease packaging requirements by up to 30%.

With more functionality built into every connector, time savings can be realised through streamlined harness installations. Fewer component requirements can also reduce costs.

They have been designed for automated harness assembly to decrease cycle times and elevate overall manufacturing efficiency and quality.

They have been validated in accordance with global standards groups, including USCar, Peugeot and IEC, to ensure performance under harsh automotive environmental conditions.

The wire-to-wire connector models are available, along with select wire-to-board models and custom configurations. Expansion of the family is underway.

Step-down DC-DC converters save space

Automotive-qualified step-down synchronous DC-DC converters from ST Microelectronics can save space in applications such as body electronics, audio systems and inverter gate drivers.

The A6983 converters comprise six non-isolated step-down converters in low-consumption and low-noise configurations



and the A6983I isolated buck converter.

Compensation circuitry is on-chip. These integrated monolithic non-isolated converters can supply up to 3A load current and achieve 88% typical efficiency at full load.

The low-consumption A6983C is for light-load operation, with high efficiency and low output ripple, to reduce drain on the vehicle battery in applications that remain active when parked.

The low-noise A6983N operates with constant switching frequency and reduces output ripple across the load range for applications such as audio power supplies. Both offer a choice of 3.3V, 5.0V and adjustable output voltage from 0.85V to V_{IN}.

The A6983I is a 10W iso-buck converter with primary-side regulation that eliminates the need for an optocoupler. For use as an isolated gate driver for IGBTs or SiC mosfets in traction inverters and on-board chargers, it allows accurate adjustment of the primary output voltage.

All-in-one tool tests EV charging stations

An all-in-one tool from Fluke is for safety and performance testing of EV AC charging stations with types two or one connectors.

The FEV350 EV charging station analyser lets technicians involved in the functional testing and troubleshooting of levels two and one AC charging stations carry out multiple tests without the need for different tools.

All EV supply equipment functional tests can be done on one device.

Traditionally, operators would have to use multiple tools connected together. For example, those using a multi-function tester would need to attach it to an adapter to display and record the measurements taken. This analyser has a built-in colour LCD that simplifies the process of analysing charging performance.

Designed to be portable and easy to operate with its intuitive user interface and Bluetooth communications, it provides predefined test plans and checklists that guide users through all the recommended and mandatory processes before providing easily readable pass-fail indications.

Type two is for commercial and outdoor use and type one is mainly for residential connectors.

It can carry out 30mA RCD and 6mA RDC-DD trip tests to detect leak current faults safely, efficiently and consistently. Protective earth (PE) pretests can also be carried out to ensure no dangerous voltage is present.

An auto control pilot simulates the state of various vehicle types and provides instant on-screen feedback of nominal results, with one button operation for automatic waveform analysis.

Users can create and save projects, add charging stations to a project and configure individual stations for pass-fail results.

Meeting IEC/EN61851-1 and IEC/HD 60364-7-72 standards, it satisfies the criteria of relevant measurement, regulatory and safety tests.

Compatible with Fluke's 1664FC multi-function installation tester via wireless connection for full charging station certification, the analyser can also provide earth bond, insulation and loop-line impedance measurements.

The 1664FC makes it possible to share data online via Fluke Connect and Fluke Cloud.

The FEV350 integrates seamlessly with the company's TruTest software for data management and reporting. This lets users quickly import measurement results from the EV charging analyser to the computer, organise and analyse the data, compare individual asset data against previous measurements imported, and provide a comprehensive and visual client report.



SSD stores data in connected vehicles

For data storage requirements in connected and autonomous vehicles, the AS500 NVMe BGA solid-state drive (SSD) from Exascend combines endurance with virtualisation capabilities.

The soldered SSD is built to safeguard data integrity in harsh environments. It operates from -40 to +105°C while withstanding extreme shock and vibration.

A proprietary adaptive thermal control algorithm enables sustained peak performance by regulating temperature within specified thresholds. It is undergoing AEC-Q100 grade-two qualification.

The dram-less device leverages host memory buffer technology to optimise IO performance without SSD onboard dram, mitigating the storage capacity limitations of embedded systems.

Active power consumption is under 3.5W.

With built-in SR-IoV support for up to four virtual machines via direct PCIe, it increases performance across multiple in-vehicle applications.

Available up to 1Tbyte capacities, it is for automotive use cases such as in-vehicle infotainment, navigation, digital cockpit, black box and adas.

High-side switch in two versions

A single-chip 80mΩ high-side switch from HMI is for automotive applications needing a power switch for low wattage lamps, high-side relays and valves, and general resistive, inductive and capacitive loads.

The HL8518 is a single-channel switch with 80mΩ typical $R_{ds(on)}$ power fet. It combines diagnostic capabilities, protection mechanisms and a current detection function. Through intelligent control of the load, it also enhances safety.

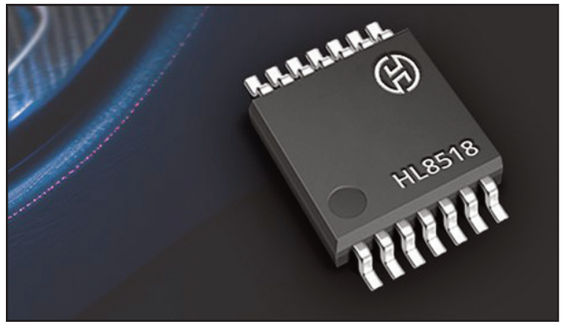
There are two versions. Version A outputs the digital diagnosis from the FLTn pin employing an open drain structure. During a fault condition, this pin is pulled down to ground. An external pull-up resistor connecting to a 3.3 or 5V power rail is required to match the MCU IO voltage level.

For version B, the device outputs a current from the ISNS pin which is 1/K ratio of the load current. The ISNS pin can also report a fault by pulling up the voltage of V_{ISNS_H}. When the diag pin is pulled low, the FLTn/ISNS pin is set to a high impedance state.

The switch uses an internal power fet with adjustable current limits through an external resistor, and an internal charge pump facilitates efficient gate control.

It regulates output current; connecting the ILIM pin to ground establishes a default current limit. Increased power consumption may trigger thermal shutdown, disconnecting the power path and reducing device temperature. On cooling, the power fet is reactivated, restoring the power path.

It meets AEC-Q100-012 and has Class-A certification by enduring one million short circuits to ground.





Crossbar simplifies USB-C connectivity

A 10Gbit/s automotive-compliant crossbar switch from Diodes can simplify in-vehicle USB-C connectivity.

Designed for routing USB 3.2 and DisplayPort 2.1 signals through a USB type-C connector, the PI3USB31532Q switch ensures signal integrity and saves power compared with a conventional crossbar multiplexer and re-driver.

This crossbar switch is for use in rear-seat entertainment systems and smart cockpits with their large, high-definition displays.

It supports three configuration modes with USB type-C compliance, providing options for designers.

It can connect a single lane of USB 3.2 Gen 2 to the USB type-C connector; connect one lane of USB 3.2 Gen 2 and two channels of DP 2.1 UHBR10; or connect four channels of DP 2.1 UHBR10.

When configured for DisplayPort, it also connects the complementary aux channels to the SBU1 and SBU2 type-C sideband pins.

The configuration is controlled by I²C or on-chip logic using four external pins.

Packaged in the 40-pin W-QFN3060-40, it occupies 3 by 6mm.

Signal integrity is assured with its -3dB bandwidth of 8.3GHz, and low insertion loss, return loss and crosstalk of -1.7, -15 and -38dB, respectively, at 10Gbit/s.

The switch is qualified to AEC-Q100 grade two, allowing use in temperatures from -40 to +105°C.

It is made in IATF 16949 certified facilities and is PPAP capable.

AI SoCs handle in-vehicle fleet telematics

Ambarella announced during AutoSens in Detroit two AI systems-on-chip (SoCs) for in-vehicle fleet telematics.

Suitable for AI dash cams integrating front-facing adas and driver monitoring, the CV75AX provides up to twice the AI performance over its previous SoC, enabling transformer neural networks for improved accuracy and reduced false positives without having to train for every object.

It also provides the AI horsepower for more complex driver-scoring models.

For vehicle gateways, the CV72AX supports up to ten cameras and offers up to six times the AI performance over its predecessor, enabling vision transformers and multi-modal vision language models, which provide instant event alerts, as well as multi-channel video pre-categorisation and natural-language searches for more efficient video analysis, all without the need for training.

Both fleet telematics SoCs feature the firm's CVFlow 3.0 AI engine, twice the CPU performance, LPDDR5 support with twice the dram bandwidth, and a higher-speed USB 3.2 interface for 5G modems, compared with the prior generation.

They also integrate the firm's image signal processor and H.264/5 video encoder, providing image quality for human viewing and computer vision, as well as multi-channel recording for evidence collection.

Made with Samsung's 5nm Finfet process technology, they operate over a temperature range of -40 to +105°C ambient.

They also bring AI-based high dynamic range (HDR) image processing technology to in-vehicle fleet telematics. Known as Vivid HDR, this proprietary technology uses AI to augment and improve the image quality in scenes with widely contrasting light and dark areas.

The CV75AX's on-chip MCU core has a low-power sleep mode where the SoC consumes less than 5mW. This eliminates the need for an external MCU to monitor the parked vehicle's sensors without battery depletion.

Both use the same SDK and are supported by the Cooper developer platform that provides hardware and software for creating edge AI systems.



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