VEHICLE electronics

The monthly magazine for automotive electronics engineers

Qualcomm acquires Autotalks

Qualcomm has acquired fabless semiconductor company Autotalks.

Autotalks provides automotive qualified dual-mode global V2X products compatible with multiple V2X standards that are designed to reduce collisions and improve mobility.

The combination of Autotalks' expertise and products with Qualcomm's 20 years of automotive experience and commitment to V2X should accelerate the development and adoption of V2X to improve traffic efficiency and help with driver and road user safety.

Designed to enable vehicles to communicate with one another and to their surrounding environment, vehicle-to-everything (V2X) communications are playing an increasingly important role as they become critical sensors for automotive safety systems.

Through the acquisition, the production-ready, dual mode, Autotalks standalone safety products will be incorporated into Qualcomm's Snapdragon Digital Chassis portfolio, a set of cloud-connected automotive platforms.

"We have been investing in V2X research, development and deployment since 2017 and believe that, as the automotive market matures, a standalone V2X safety architecture will be needed for enhanced road user safety, as well as smart transportation systems," said Nakul Duggal, senior vice president at Qualcomm.

Hagai Zyss, CEO of Autotalks, added: "It has been our mission to revolutionise safety for the transportation and automotive industry through V2X. We are confident that by combining our knowledge and expertise, we will not only deliver strong V2X products that will enhance transportation efficiency and safety for road users but will accelerate widespread adoption of V2X. We look forward to serving the auto industry together with Qualcomm and to bring the best technologies to market."

The transaction is subject to customary closing conditions.



Qualcomm expands in V2X with Autotalks buy

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IN THIS ISSUE

2: Blackberry access for QNX SDP 8.0

3: OnSemi and Infineon SiC news

5: Misra C: 2023 hits the streets

6: MediaTek and Nvidia SDVs

8: Bosch acquires TSI Semiconductors

11: ADI invests €630m in Limerick

13: DSpace World Conference report

21: Analysing EV powertrains

25: Advantages of wireless BMS

29: Safety in power distribution

35: Harman's plans for Ready range

43: Product news

48: Contact details

Blackberry gives early access to QNX SDP 8.0

Blackberry has announced the early access release of the QNX SDP 8.0 software development platform for automakers and IoT developers.

Powered by the latest QNX operating system (OS), SDP 8.0 is designed to realise the performance potential of the increasing number of multi-core processors that automakers and IoT systems developers are selecting for their products.

It is the result of R&D work using QNX's IP and experience in high-performance edge computing.

Providing a safe and secure, Posix-compliant, real-time microkernel-based OS, the architecture has shown a one-to-one performance scaling factor as the number of cores increase.

It targets automakers whose shift towards software-defined vehicles has brought an exponential amount of software architecture complexity.

SDP 8.0 lays the foundation for the next Blackberry QNX product portfolio, including QNX OS for Safety, Hypervisor and Hypervisor for Safety.

"The automotive industry is redefining software in the vehicle," said John Wall, senior vice president at Blackberry. "Automotive architectures are transitioning to zonal, central compute and ultimately software-defined vehicles. The top-to-bottom scalability inherent to SDP 8.0, the QNX OS for Safety and the QNX Hypervisor makes this a natural choice for automakers looking for a total car OS."

Blackberry is working with Nvidia to integrate the QNX OS microkernel on the Nvidia Drive Thor, which delivers 2000-Tflops and consolidates automated driving with an AI cockpit on a centralised platform.

Look, no hands!



Five autonomous buses are operating a scheduled passenger service seven days a week in Scotland on a 22.5km route.

The route involves complex traffic manoeuvres such as roundabouts, traffic lights and weaving motorway lane changes. The vehicles will travel in mixed traffic up to 80kmph.

The CavForth project operates at SAE level four, requiring the buses to retain a safety driver. Twenty autonomous bus professionals have been recruited from Stagecoach East Scotland's existing driving team.

A second autonomous bus professional will act as bus captain, moving freely around the vehicle to engage with passengers. This demonstrates what a future autonomous service could feel like when a single bus captain can leave the cab while the computer does the driving.

In the initial weeks of the public service, over 90% of the route will be covered in autonomous mode, with the remaining short sections under manual control as part of a controlled ramp-up of autonomous driving.

Fusion Processing's autonomous drive system uses data from sensors including cameras, lidar and radar together with artificial intelligence processing. Receiving information directly from traffic light systems lets the bus plan its speed to run smoothly from one green light to the next.

Zeekr adopts OnSemi SiC to boost smart EVs



Zeekr is using OnSemi EliteSiC power devices

In a long-term supply deal, OnSemi will provide its EliteSiC silicon carbide (SiC) devices to increase powertrain efficiency in Zeekr's smart electric vehicles (EVs), resulting in improved performance, faster charging speeds and extended driving range.

To support its expanding portfolio of high-performance EVs, Zeekr will adopt the EliteSiC M3E 1.2kV mosfet.

"With cutting-edge technologies such as advanced SiC, Zeekr will be able to offer electric vehicles with improved performance and even lower carbon emissions," said Andy An, CEO of Zeekr. "As a brand committed to sustainability, Zeekr will continue to explore different ways to accelerate the transition towards new energy vehicles."

The agreement should help both companies build a stronger supply chain relationship to support Zeekr's growth over the next decade.

"A reliable supply chain is critical to business success and, after significant investments in our SiC end-to-end supply chain, OnSemi can offer this strategic value to customers," said Hassane El-Khoury, OnSemi CEO. "This agreement will help our continued ramp of SiC operations, enabling us to offer industry-leading power devices that help our customers deploy the most efficient and highest performing EVs on the market."

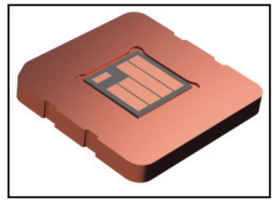
Zeekr is a premium electric mobility brand. Using Geely's SEA sustainable experience architecture, Zeekr develops in-house battery technologies, battery management systems, electric motor technologies and electric vehicle supply chain support.

Infineon and Schweizer increase SiC efficiency

Infineon and Schweizer Electronic are collaborating on increasing the efficiency of chips based on silicon carbide (SiC).

They are embedding Infineon's 1.2kV CoolSiC chips directly onto PCBs to increase the range of electric vehicles and reduce costs.

The two companies have already demonstrated the potential of this approach: They were able to embed a 48V mosfet in the PCB. This resulted in a 35 per cent increase in performance.


Infineon and Schweizer are embedding SiC chips onto PCBs

Schweizer contributed to this with its P²Pack, which enables power semiconductors to be embedded in PCBs.

"Our joint goal is to take automotive power electronics to the next level," said Robert Hermann from Infineon. "The low-inductive environment of a PCB allows clean and fast switching. Combined with the leading performance of 1200V CoolSiC devices, chip embedding enables highly integrated and efficient inverters that reduce overall system costs."

Thomas Gottwald, vice president at Schweizer Electronic, added: "With Infineon's 100 per cent electrically tested standard cells, we can achieve high overall yields in the P²Pack manufacturing process. The fast-switching characteristics of the CoolSiC chips are optimally supported by the low-inductance interconnection that can be achieved with the P²Pack. This leads to increased efficiency and improved reliability of power conversion units such as traction inverters, DC-DC converters or on-board chargers."

- Stabl Energy is using mosfets from Infineon to make stationary energy storage systems from retired electric passenger car batteries. The first pilot systems have already been put into operation in Germany and Switzerland.

Automotive electronics market to see 8.2% CAGR

Global demand for automotive electronics is predicted to grow from $261.8bn in 2023 to $580.5bn by the end of 2033, at a CAGR of 8.2%, according to market watcher Fact MR.

The use of electronics in vehicles has been increasing rapidly in recent years owing to the adoption of electrification and the growing integration of electronic systems.

Increasing focus on safety and implementation of strict vehicle safety mandates by governments around the world are also slated to benefit shipments of automotive electronics.

Increasing digitisation, growing EV sales, rising investments in research and development of novel auto electrical parts, substitution of mechanical components with electrical components, and growing per capita spending capacity could also promulgate sales of vehicle electronics across the forecast period.

Around 10.5 million new BEVs (battery electric vehicles) and PHEVs (plug-in hybrid electric vehicles) were delivered in 2022, which was up 55% from 2021.

Increasing investments in research and development of new autonomous vehicles and supportive government initiatives to promote the same are projected to boost demand for automotive electronic components.

Surging popularity and adoption of levels two and three autonomous vehicles are expected to set the stage for levels four and five autonomous cars, which could boost sales of automotive electrical connectors, capacitors, resistors and other electronic parts till 2033.

The growing availability of driverless taxis and expanding autonomous vehicle fleets are also projected to supplement market growth.

Top-tier automotive electronics companies are focusing on technologies to create innovative electronics. Companies are also expected to adopt strategies such as mergers, partnerships, collaborations and acquisitions to hasten development and product launches.



Misra C: 2023 hits the streets

After a short delay, Misra C: 2023 has been released.

The coding standards were expected to be officially launched at Embedded World in March, but instead were delayed for "a few weeks".

The update incorporates Amendments 2, 3 and 4 and Technical Corrigendum 2 and incorporates support for C11 and C18 language features.

Misra C: 2023 is also known as Misra C Third Edition, Second Revision.

At Embedded World in Nuremberg, the Misra C Working Group announced Amendment 4 to the 2012 version. This amendment specifies rules and directives for multithreading and atomic types as well as clarifications on existing guidance so as to align better with how developers use the C language today.

Misra C: 2023 consolidates previous versions of the guidelines into a single, comprehensive edition to facilitate compliance.



Parasoft Misra C: 2023 compliance dashboard

"By consolidating the recent enhancements into a single source, Misra C: 2023 provides the new benchmark guidance for developers of safety or security-related, or indeed any high-integrity, software," said Misra chair Andrew Banks, a technical specialist at LDRA.

Embedded software company Parasoft has launched C/C++Test 2023, providing support for Misra C: 2023. Other firms are expected to announce support soon.

"Parasoft is devoted to ensuring that our customers are supported with the latest technology in software test automation," said Igor Kirilenko, chief product officer at Parasoft. "This release of C/C++Test completely supports the latest Misra C: 2023 standard and contains other software test automation that reduces effort and costs and ensures delivery of safe, secure and high-quality applications."

The latest version of the LDRA software tool suite integrates the Misra C: 2023 guidelines for static code analysis and reporting capabilities.

Introduced in 1998, Misra C is the standard for developing software in the C programming language where safety, security and code quality are essential.

NXP uses TSMC 16nm finfet for S32 processors

NXP is collaborating with TSMC to deliver automotive embedded mram (magnetic ram) using 16nm finfet technology.

As automakers transition to software-defined vehicles, they need to support multiple generations of software upgrades on one hardware platform. Bringing together NXP's S32 automotive processors with non-volatile memory in 16nm finfet technology provides a hardware platform for this transition.

Mram can update 20Mbyte of code in around three seconds compared with flash that take about a minute, thus reducing the downtime for software updates and helping car makers eliminate bottlenecks that arise from long module programming times.

Mram provides reliable technology for automotive by offering up to a million update cycles, a level of endurance ten times greater than flash and other emerging memory technologies.

Car makers want to roll out comfort, safety and convenience features via over-the-air updates, extending the life of the vehicle and enhancing its functionality, appeal and profitability. As software-based features become more widespread in vehicles, the frequency of updates will increase, and mram's speed and robustness could become even more important.

TSMC's 16nm finfet embedded mram technology exceeds automotive requirements with its one-million cycle endurance, support for solder reflow, and 20-year data retention at +150°C.

"The innovators at NXP have always been quick to recognise the potential of TSMC's new process technologies, especially for demanding automotive applications," said Kevin Zhang, SVP at TSMC.

MediaTek and Nvidia partner on software-defined vehicles

MediaTek and Nvidia are working together to deliver in-vehicle AI cabin options for software-defined vehicles.

The collaboration combines the strength of each company's portfolios for connected cars.

"Nvidia is a world-renowned pioneer and industry leader in AI and computing," said Rick Tsai, CEO of MediaTek. "With this partnership, our collaborative vision is to provide a global one-stop shop for the automotive industry, designing the next generation of intelligent, always-connected vehicles."

Through this collaboration, MediaTek will develop automotive SoCs integrating an Nvidia GPU chiplet with AI and graphics IP.

"AI and accelerated computing are fuelling the transformation of the entire auto industry," said Jensen Huang, CEO of Nvidia. "The combination of MediaTek's industry-leading SoC and Nvidia's GPU and AI software technologies will enable new user experiences, enhanced safety and new connected services for all vehicle segments, from luxury to mainstream."

MediaTek's smart cabin products will run Nvidia Drive OS, Drive IX, Cuda and Tensor RT software technologies, delivering AI cabin and cockpit functions with graphics, AI, safety and security features.

By tapping Nvidia's core expertise in AI, cloud, graphics technology and software, and pairing with Nvidia adas, MediaTek can bolster the capabilities of its Dimensity Auto platform, which leverages the company's expertise in mobile computing, high-speed connectivity, entertainment and Android ecosystem to deliver a smarter in-vehicle experience.

Perrone speeds autonomous manoeuvre verification

Perrone Robotics has integrated GPT general pre-trained transformer AI technology into Max, its general-purpose robotics operating system that forms the basis of the company's vehicle agnostic Tony autonomous vehicle kit.

This fusion increases the number of vehicle manoeuvres and expands the operational design domains for autonomy.

The integration gives Tony-based autonomous vehicles the ability to evaluate a massive number of possible manoeuvres so they can make more informed decisions in complex and dynamic environments.

By harnessing GPT AI's natural-language processing and deep-learning capabilities, Max gains enhanced perception, reasoning and planning capabilities, resulting in improved safety, efficiency and adaptability.

This enables the exponential generation of autonomous manoeuvres, enhancing the vehicle's ability to navigate intricate scenarios with precision and versatility.

Given the patented configurable and modular Max software platform, a practical means for verification and validation of newly created manoeuvres was also discovered. This approach combined with Perrone's existing patented approach to safety verification of AVs, provides a new way for verifying, both offline and online, the safe operation of fully autonomous vehicle systems.

"The fusion of GPT AI technology with Max represents a significant leap forward for autonomous vehicles," said Paul Perrone, CEO of Perrone Robotics. "We are thrilled to witness the exponential expansion in possible operational scenarios and design domains, unlocking endless possibilities for autonomous mobility. This integration not only improves the manoeuvre generation capacity but also strengthens the overall autonomy of our vehicles, bringing us closer to a future of safe and efficient fully automated transportation."


Integration increases AV manoeuvres

Hesai thin lidar maintains visibility

Hesai Technology has released an automotive-grade, thin long-range lidar that is 25mm tall.

Automakers require lidar placement to consider function and aesthetics. The ET25 in-cabin lidar is designed to be placed behind the windshield, which enables a sleeker design without affecting aerodynamics or acceleration.

Dust and rain can block the lidar's field of view (FoV), but the in-cabin design allows for quick cleaning via windshield wipers. This ensures visibility is maintained.

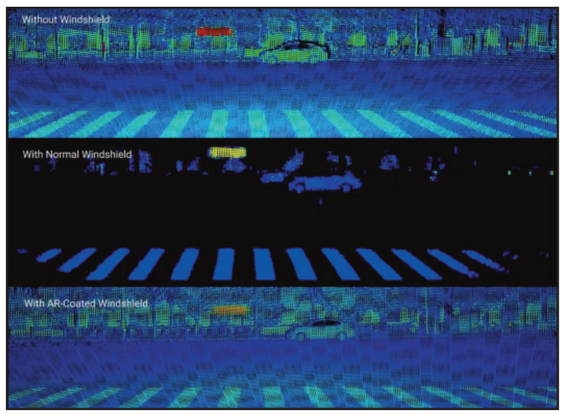
With 120° by 25° FoV, its detection range can reach 250m without the windshield, and 225m behind the windshield. Its point frequency exceeds three million points per second.

With a minimum resolution of 0.05 by 0.05°, it brings high resolution and long-range 3D perception.

The upgraded laser receivers increase sensitivity. As a result, the ranging capability of the 905nm lidar has also increased to over 250m for objects with 10% reflectivity, helping cars assess risks promptly and make safer decisions in complex road conditions.

All sensors integrated in-cabin require some space between the sensor and windshield. The space is called the optical keep out zone (KOZ). The thicker the sensor, the more KOZ it needs. For example, the ET25 with a thickness of 25mm has less than half the KOZ compared with long-range lidars that are 45mm thick.

Since the sensor bracket is placed above the driver, a smaller KOZ takes less in-cabin space and reduces the impact on the driver's vision.



E25 real point cloud

The in-cabin air does not circulate well while driving, especially in high temperatures. After exposure to sunlight, the rear-view mirror tends to become very hot, creating a problem for the in-cabin lidar. If the power of the lidar is too high, it cannot be placed in the cabin due to overheating problems.

The ET25's consumes 12W so, even in hot summer, it can work continuously while maintaining high-performance operation.

The noise level of the ET25 is less than 25dB, which is lower than that in a quiet library.

Normally, when near-infra-red laser light emitted by the lidar encounters traditional car glass, it causes signal attenuation, which lowers the maximum range and resolution. Therefore, integrating the lidar with other devices behind a normal windshield, such as cameras and rain sensors, can be difficult.

Hesai uses Fuyao's near-infra-red anti-reflection glass in the lidar's KOZ to ensure the performance of the lidar behind the windshield, and leave the point cloud effect uncompromised.

LiveWire chooses Airbiquity OTA

LiveWire has selected Airbiquity to enable remote software updates for its global electric motorcycle portfolio.

Airbiquity's OTAmatic will allow LiveWire to deliver reliably and securely over-the-air (OTA) software updates to its vehicles while conserving limited vehicle hardware resources and reducing inconveniences or downtime.

LiveWire, an electric motorcycle brand developed by Harley-Davidson, will use OTA to update its operating software remotely.

"As a long-standing provider of automotive connected vehicle services, we recognise the importance of enabling OTA updates for the two-wheeler market," said Kamyar Moinzadeh, Airbiquity CEO. "LiveWire is a pioneer in the electric motorcycle industry with an outstanding product portfolio. Working with LiveWire to integrate OTAmatic into their vehicles has been a terrific experience and we're proud to contribute to their current and future success."



TSI Semiconductors plant in Roseville, California

Bosch buys TSI to grow SiC production

Bosch is expanding its silicon carbide (SiC) production with the acquisition of California-based chipmaker TSI Semiconductors.

With a workforce of 250, the company is a foundry for asics. It mainly develops and produces large volumes of chips on 200mm silicon wafers for applications in mobility, telecommunications, energy and life sciences.

Over the next years, Bosch intends to invest more than $1.5bn in the Roseville, California, site and convert the TSI manufacturing facilities to the latest SiC processes.

Starting in 2026, the first chips will be produced on 200mm wafers based on SiC.

Bosch's goal is to extend significantly its global portfolio of SiC chips by the end of 2030.

The global boom and ramp-up of electromobility are resulting in huge demand for SiC. The full scope of the planned investment will be heavily dependent on federal funding opportunities available via the Chips & Science Act as well as economic development opportunities within California.

"With the acquisition of TSI Semiconductors, we are establishing manufacturing capacity for SiC chips in an important sales market while also increasing our semiconductor manufacturing, globally," said Stefan Hartung, Bosch chairman. "The existing clean-room facilities and expert personnel in Roseville will allow us to manufacture SiC chips for electromobility on an even larger scale."

The Roseville site has existed since 1984.

"We are pleased to join a globally operating technology company with extensive semiconductor expertise," said Oded Tal, CEO of TSI Semiconductors. "We are confident that our Roseville location will be a significant addition to Bosch's SiC chipmaking operations."

Starting in 2026, following a retooling phase, first SiC chips will be produced on 200mm wafers in a facility offering roughly 10,000m^2 of clean-room space.

Since 2021, Bosch has been using its proprietary, complex processes to mass-produce SiC chips at its Reutlingen location near Stuttgart. In the future, Reutlingen will also produce them on 200mm wafers.

By the end of 2025, the company will have extended its clean-room space in Reutlingen from roughly 35,000 to more than 44,000m^2.

By 2025, Bosch expects to have an average of 25 of its chips integrated in every new vehicle.

Bosch and TSI have agreed not to disclose any financial details of the transaction, which is subject to regulatory approval.

Sony develops sensor models for RFPro simulation

Sony is developing high-fidelity sensor models to integrate into RFPro simulation software.

The collaboration will focus on reducing the need to collect physical data during sensor development. It will let perception systems for adas and autonomous vehicles be developed, trained and tested in a virtual environment.

Signal processing, LED flicker mitigation, spectral effects and image sensor control, such as motion blur and rolling shutter, are examples of the phenomena replicated by Sony's sensor model.

The interface between the model and the rendering system is efficient and allows high-fidelity simulations to run quickly. The interface is also common across all Sony's automotive image sensors so users can transition to new sensor models as they become available.

Continental and Aurora sign autonomous trucking deal

Continental and Aurora are working together to create commercially scalable autonomous lorries.

They have entered a partnership to deliver the first commercially scalable generation of Aurora's flagship integrated hardware and software, the Aurora Driver.

The organisations will jointly design, develop, validate, deliver and service the scalable autonomous system for the trucking industry. It is expected to be available for carriers and commercial fleet operators across the USA.

Continental will leverage its experience to industrialise the Aurora Driver and deliver the entire hardware set as well as a fallback system. In the unlikely event of a failure in the primary autonomy system, the fallback system is designed to ensure a driverless truck can continue the driving task until it reaches a safe position.

Additionally, Continental will manage the complete lifecycle of its supplied autonomous hardware kits for the Aurora Driver, from the manufacturing line to decommissioning.

Production is expected to start in 2027, following the expected launch of Aurora Horizon, a subscription trucking service underpinned by the Aurora Driver, in 2024.

"In this exclusive partnership, we bundle our systems competence with Aurora's industry-leading autonomous technology for our common goal to jointly realise the first commercially scalable autonomous trucking systems," said Nikolai Setzer, CEO of Continental.

Continental will be responsible for the autonomous driving system kits which will leverage a wide spectrum of its automotive product portfolio from sensors, automated driving control units, high performance computers and telematics, to the complete fallback system.

Continental will integrate these hardware components into pods which will be supplied to Aurora's vehicle manufacturing partners.

"Delivering autonomous vehicles at scale has the potential to dramatically transform modern transportation, bringing new accessibility, safety and efficiency to the movement of goods and people," said Chris Urmson, CEO of Aurora.

Autonomously powered trucks have the ability to operate around the clock opening up the possibility for, say, cargo between Dallas and Los Angeles to be delivered within less than 24 hours. As a result, fuel consumption can potentially be reduced by around ten per cent, while the delivery time can be shortened up to three times compared with that of a human driver.

Continental and Aurora have agreed a hardware-as-a-service business relationship, based on distance driven, to deliver safe, reliable, uptime-optimised and commercially scalable autonomous driving systems through the Aurora Horizon platform.

Aurora Horizon was developed to offer a safer, more reliable, predictable and cost-efficient driver service to supplement human driver supply. Using this service, carriers and fleet operators can better use the potential of their vehicle fleets, scale business on demand and help address the driver shortage.

Continental and Aurora plan to provide this scalable offering to Aurora's vehicle manufacturing partners.

Continental parts are expected to be produced and assembled in its new manufacturing facility in New Braunfels, Texas, as well as others around the world.



Continental will bring Aurora autonomous trucking to market

Hyundai headlamps display signs and crossings on road ahead

Hyundai Mobis has developed headlamps that show road signs on the road ahead in real time.

The technology is expected to reduce nighttime car accidents for drivers and pedestrians.

The HD Lighting System technology visualises road signs in text or shapes and projects them on the road surface. For example, the lamp shows there are road works ahead using relevant symbols to drivers. And it can project a crossing on the road surface with lamp lights to help pedestrians cross safely.

The system is comprised of HD micro LEDs that are light sources and a digital micro mirror device (DMD), a collection of tiny mirrors that together act as a reflector.

Information obtained from the front sensor (camera) and GPS navigation can also be integrated.

It has about 25,000 micro LEDs with a width of 0.04mm. This is 250 times as many LEDs as the 80 to 120 installed in LED headlamps. This enables the lamp to control light more sensitively. It helps the lamp locate objects and pedestrians more accurately.

The DMD is a precise controller that reflects light using microscopic mirrors measuring 0.01mm. Lights emitted from densely-packed LEDs are reflected using 1.3 million digital mirrors to project desired shapes and symbols on the surface of the road.

LEDs can be controlled individually to project clear, precise information on the road regardless of road conditions.

It reflects data fed by the camera sensor and GPS navigation in real time. For example, when a vehicle approaches road works, the system displays a symbol that is 1.5m big 15m ahead of the driver and can inform the driver of the speed limit.

The driver can also be shown when the car approaches a speed bump and where highway entries and exits are while looking ahead.

The camera sensor recognises pedestrians and displays a virtual crossing on the road when the car stops.

A Hyundai Mobis representative said: "In the era of autonomous driving, software technology capable of integrating numerous auto components into a single device will be more important than ever. Hyundai Mobis is taking the lead in development of cutting-edge lamps and securing technology capable of controlling them."



Top: the system warns the driver of upcoming road works and, bottom, displays a virtual crossing for pedestrians

ADI invests €630m to expand Irish semiconductor facilities

Analog Devices is investing €630m at its European regional headquarters in Limerick, Ireland, to build a 4000 square metre research, development and manufacturing facility.

The facility will support signal processing innovations for automotive, industrial, healthcare and other sectors. It is expected to triple the firm's European wafer production capacity and aligns with the company's goal of doubling its internal manufacturing capacity.

This investment should create 600 jobs on top of its current 1500 employees in Ireland and 3100 in Europe as a whole.

"This massive €630m investment is great news for local employment with lots of jobs being created during the construction phase, and 600 high-end graduate jobs," said Ireland taoiseach Leo Varadkar.

The news comes a year after it announced a separate investment of €100m in ADI Catalyst, a 9000 square metre custom-built facility for innovation and collaboration at Limerick. Ireland is also home to the firm's main European R&D centre, which has generated more than 1000 patents since its inception and has seeded R&D sites in Spain, Italy, UK, Romania and Germany.

"Since 1976, Ireland has been a critical innovation centre for ADI, thanks to its strong academic and research organisations, business ecosystem, and progressive government leadership," said Analog Devices CEO Vincent Roche. "This next-generation semiconductor manufacturing facility and expanded R&D team will further extend ADI Limerick's global influence."



Analog Devices' campus in Limerick

The investment is part of a collaboration within a European Union initiative, and will support cross-border collaborative research. This is subject to final approval from the European Commission, and is supported by the Irish government through IDA Ireland.

"The technology that ADI will develop at this facility in Limerick is at the very forefront of innovation and has the potential to revolutionise the lives of billions of people across the world," said Michael Lohan, IDA Ireland CEO. "This investment by ADI is intended to strengthen our supply chain resilience for advanced semiconductor processes."

Kamic acquires AGW Electronics

Kamic Group has acquired AGW Electronics, founded in 1975 and a manufacturer of customised wound magnetic components such as transformers, inductors and associated assemblies.

The company is based in Derbyshire, UK, where operations are carried out in a purpose-built production facility of approximately 2800m^2.

AGW has over 60 employees and annual sales of approximately £5m. The company serves industry sectors such as aviation, telecommunications, audio, military and automotive.

AGW has become part of Kamic's magnetics business led by Dan Phelan.

"AGW has strong skills in the design, development and production of wound magnetic components and the company enjoys a high level of trust among its many customers," said Phelan.

The sellers are Nigel Godwin, who is the company's managing director, Tony Godwin, Anette Godwin and Sara Boulton.

"We are very pleased to be able to join our company to the Kamic Group," said Nigel Godwin. "We have a lot in common regarding technology and skills and we complement each other well in terms of the customers we serve. As part of Kamic's magnetics business, we will have access to contacts, support and tools that in the long term will benefit AGW, our employees and our customers."



Mitsubishi integrates users with vehicle

Project Jabiru from Mitsubishi is an in-cabin system that integrates users and vehicle seamlessly.

From interior and exterior sensors that continuously monitor the outside environment and all occupants, to a customisable cluster and centre display, the system provides high levels of safety and connectivity.

"Our in-cabin system balances ground-breaking features that optimise the performance and potential of the in-cabin system," said Mark Rakoski, vice president of engineering at Mitsubishi in the USA. "Many of these safety and connectivity technologies are expected to be in production vehicles within the next two to five years."

Filament Labs, a Mitsubishi innovation group, developed the in-cabin system that prioritises user safety and well-being. It is optimised for performance by leveraging an Asil-B-capable multi-domain controller, which is responsible for managing infotainment features, the control cluster and the occupant monitoring system.

Machine-learning techniques detect on- and off-road hazards such as pedestrians, potholes and traffic cones, and provide real-time information to drivers, so they can make informed decisions and stay safe on the road. Additionally, it monitors weather-related road conditions by leveraging up-to-the-minute, accurate road-condition data and exterior sensors.

In-cabin monitoring analyses the driver and occupants' status. Sensors such as cameras, radars, thermal cameras and directional microphone arrays provide additional monitoring.

It can detect and notify users if a seat belt is unbuckled, regardless of location in the vehicle. It also monitors body temperature, drowsiness, phone use, hands on the wheel and smoking.

In case of an emergency, such as an accident or a drowsy driver, the infotainment centre displays the driver's health information, including blood type and allergies, to assist emergency responders.

The in-cabin micro-movement radar monitors all movement inside the cabin. It can differentiate between an adult or a child and notify a connected device while automatically activating the hvac if a child is left alone in the vehicle.

Focus mode detects if the driver is distracted, helping the driver stay focused on the road by limiting HMI interactions and providing access only to the main in-cabin features such as hvac, media and navigation.

Users can tailor their in-cabin environment with a customisable cluster and centre display, as well as ambient lighting. Navigation map styles and layouts are customisable and can be scaled across multiple screens.

A high-definition locator automatically recommends available nearby parking structures and can detect the vehicle's exact space number. It also allows for cashless, in-vehicle payments.

"The integration of safety and convenience for all vehicle occupants continues to be at the forefront of current and future developments," Rakoski said.

keeping PACE

Steve Rogerson reports from last month's DSpace World Conference in Munich

dSPACE WORLD CONFERENCE 2023 MUNICH

When the automotive industry first started its serious push towards autonomous driving, there were some optimistic predictions of how soon it would be before self-driving cars were an every-day site on the roads.

Since then, car makers have lengthened these predictions. Yes, there are self-driving trials in China, the USA and other places but the vision of robot cars dominating the roads seems further away than it has ever been. Car makers instead now say their efforts are on pushing adas features to help human drivers with the nod that one day these could be used, with



Bixuan Jin: "We have encountered more challenges."



Stefan Schmerler: "Standardisation is so important."

improvements, in self-driving vehicles.

The reason for this change is simply that the more researchers and developers dug, the more they realised just how complicated was the task.

The goal now is to make this development simpler and to share knowledge across car makers. This was a common theme of May's DSpace World Conference in Munich where speaker after speaker called for more



Martin Zeilinger: "Complexity is getting more dramatic."

standardisation and a simpler design cycle.

"Standardisation is so important to us as we will have high complexity if we don't follow standards," said Stefan Schmerler from Mercedes-Benz. "The developments in autonomous driving and telematics are seeing unprecedented complexity. This will be very difficult."

This was a theme picked up by many speakers during the two-day event. Bixuan Jin from Chinese car maker Human Horizons, for example, said the company still had the goal of end-to-end autonomous driving, but admitted: "We have encountered more challenges. The software needs to handle more complexity. Due to the increase in software complexity, we have had to change our development process."

This, she said, involved moving to an automated SIL (software-in-the-loop) system as a verification platform.

"We partnered DSpace for this," she said. "We have ensured the rapid iteration of the software results in improved performance. This helps a lot."



Carsten Hoff: "You can validate the software in the cloud."

Martin Zeilinger, executive vice president at Hyundai, added: "The more technology, the more complexity. The complexity in the EE world is getting more dramatic. If you add ECUs, you get too many wires so you need networks but it is still more complex with time-critical data flowing around."



Rupert Stuetzle: "Generative AI has significant potential."



Christian Pahike: "Trust is brought by clear standards."

As most in the industry have now realised, the answer, said Zeilinger, was moving to a more zonal architecture.

"That is the way to software-defined vehicles," he said.

Rupert Stuetzle, a partner at consultant McKinsey, agreed. "We are on the way to a centralised architecture with zonal controllers," he said. "This is the way to handle the complexity we are seeing."

He added that generative AI had significant potential to support testing and documentation and could be used to generate multiple test cases.

Carsten Hoff, who only took over as CEO of DSpace in April,

said zonal architectures would help in the task of regularly updating a vehicle during its lifetime with functionality being added once a month or once a quarter.

"This means you have to do continuous testing in the cloud," he said. "You can do software development in the cloud and validate the software in the cloud."

This theme was picked up by Christian Pahike from testing and certification body TÜV SÜD who said the use of software updates challenged the approval process.

"These must be secured by continuous homologation," he said. "The number of updates expected will not be able to be handled by normal processes. We need a fast time for the software update approval process."

He said as there would be continuous software over-the-air updates across the entire product lifecycle, there was a case for establishing simulation as an accepted and recognised method.

"We need new ways to present the evidence," he said. "We are exploring ways to let car manufacturers and authorities continuously validate over-the-air software updates."

He said it was important to ensure reliability for the whole lifecycle of a vehicle and that approvals needed to take in the wide range of conditions that automated cars would face, such as different weather conditions, presence of pedestrians and cyclists, and specific urban tasks such as parking, as well as rapid decision making if there was an accident.

Gathering data to train AI



DSpace has been gathering real-word data for about a year using this test vehicle with six cameras at the front and three at the rear as well as 360° lidar and radar.

"We can use the data to train your AI," said André Rolfsmeier (pictured), director at DSpace. "We find scenarios from real traffic to add to the simulation environment."

GPS technology on the vehicle pinpoints the location to match with the acquired data.

The firm's Simphera tool allows cloud-based verification and Aurelion provides physics-based sensor simulation.

"A big challenge with adas testing is having a model that outputs realistic simulation data," said Rolfsmeier. "We are the best in the market for that."



Falco Schuck: "The vehicles are becoming more and more complex."

"Strong expertise is needed for engineers to overcome the challenges and validate in the right way," he said. "Trust is brought by clear standards and clear regulations. The goal is the acceptance of the technologies."

Falco Schuck from BMW agreed standards were a good starting point to simplify development.

"We need to standardise the tools and the tool chains used in vehicle development," he said. "The vehicles are becoming more and more complex. That is quite obvious. Real-life use cases might be much more complex than devised by any test scenario."

Standards can also be a reason for more firms to cooperate on developing automated driving, according to Benjamin Engel from standards body Asam.

"There is a need to collaborate," he said. "Standardisation can be used as the reason for companies to come together and collaborate.



Benjamin Engel: "Collaboration is key and standards are key for collaboration."



Kirsten Matheus: "The only way to reduce complexity is through harmonisation and standardisation."

Collaboration is key and standards are key for collaboration."

But he said while it was great to have standards, the standards also had to be trusted.

"If standards are not clear or accessible, or they are conflicting, people will say they don't need them," he said.

And while competition in industry was good, he said competition between standards was not.

"Standards organisations need to align and collaborate better," he said. "Standards need to be open and freely available."

Kirsten Matheus from BMW said the number of standards was "huge", adding that "crazy" would be a better word.

"Each technology has to meet severe requirements, and that causes a respective handling effort at the car manufacturer," she said. "But the only way to reduce the

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complexity is through harmonisation and standardisation."

On top of that, without standards, testing was more complicated.

"One of the reasons for standardisation is to be able to test properly and completely," she said. "Testing is crucial."

Schmerler called for more digital test drives, which he said would reduce the validation effort significantly. He went as far as saying that fully virtual validation has high potential but it could not be seen as a cure-all.

He said there was still a need for real test drives but these should be done in "very intelligent ways" using AI-based data analytics.

"We need to analyse all the data and not just when the test driver sets a trigger," he said. "We have to analyse everything."

Taking test drives further is the aim of researchers at the Technical University of Munich where they have put technology into autonomous racing cars and actually have them racing each other.

"This is pushing it to the limit," said Johannes Betz, a professor at the university. "There are a lot of challenges on a racetrack that can help us achieve levels four and five vehicles. We have to model the vehicle limits if they are to operate everywhere, every time, under every condition."

The university is using neural networks to help understand different driving behaviours.

"We have to learn defensive and aggressive behaviour so it can be more human like," said Betz.

Finally, as mentioned, Hoff has only just taken over at DSpace and was being guarded about his plans. "The company is really well positioned," he said. "I am not talking about targets yet, but maybe in three months."



Johannes Betz: "This is pushing it to the limit."

Charging validation



As well as validating driving experiences, DSpace can also help in the design of charging equipment using its Scalexio tool.

"We can simulate and emulate all the different kinds of charging station," said Frank Puschmann (pictured), product manager at DSpace. "We can test AC and DC charging. We can define the behaviour of the charging station with simulation."

The simulation tools can also mimic a battery for testing battery management systems. It can show how the BMS deals both with new batteries and old batteries that have developed problems.

TEST & MEASUREMENT

RACING AHEAD

EV test specialist Intertek relies on Yokogawa power analyser to provide in depth analysis of powertrain performance

The manufacturers of electric vehicles (EVs) are constantly pushing the boundaries of performance. Whether in racing cars or the everyday vehicles that consumers rely on, EV technology needs to demonstrate high efficiency, maximum range between charges, reliability and high dynamic performance.

By showing that EVs can offer the same advantages and specification to drivers that conventional vehicles can, manufacturers can secure the future of a technology that is a major building block of a more sustainable society.

To instil confidence in consumers, manufacturers need the assistance of specialist companies who can help them test and refine the designs of electric motors, drivetrains, batteries and control systems.

Such a company is Intertek. At its EV testing centre in Milton Keynes, UK, Intertek plays a role in the industry's efforts to develop technology for road going vehicles and for Formula E racing cars. Its work can include tests of electric racing vehicles that can accelerate from 0 to 100km/h in 2.8s and reach a top speed of 280km/h.

To meet the demands of its testing regime, Intertek needs measurement technology that can achieve three requirements. It needs to measure motors rotating at very high speeds; be easy to use and so ensure increased productivity for testing staff; and allow rapid integration with Intertek's LabView test platform.

Intertek chose the Yokogawa WT5000 precision power analyser. Its high resolution, 25.6cm display enables split screen viewing of up to 18 waveforms and can display up to 12 pages of various measurement parameters, making it suitable for efficiency tests of inverter-driven motors and electric vehicles.

Intertek uses the WT5000 to achieve traceable measurement of high-speed power signals. Particular needs include the measurement of motors rotating at up to 27,000rpm, enabled by the unit's maximum sampling rate of 10MS/s. The units also perform high-frequency harmonic analysis up to the 500th order, providing side-by-side comparison of harmonics from two different input sources.

Full traceability of these measurements is ensured by calibration of the WT5000s conducted at Yokogawa's ISO/IEC17025-accredited European standards laboratory in Amersfoort, Netherlands.

The WT5000 provides ease of use and productivity, notably the ability of the instrument to perform complex efficiency calculations.

"The efficiency map calculations in the WT5000 save us a lot of time," said Intertek test engineer Raju Rajaneethan. "We now go directly from the torque transducer straight to the Yokogawa unit, and both speed and torque measurements are read directly from the WT5000. Previously we would have done these calculations for efficiency



Yokogawa WT5000 precision power analyser



Intertek's EV testing centre in Milton Keynes

manually. This is a huge boost to the team's productivity."

The instrument also brings easy integration into test cells, which are continually reconfigured for new user applications. A plug-in for Intertek's LabView platform allows easy integration into the data acquisition and control system.

Benefits include reliability. With a guaranteed accuracy of ±0.03%, harmonic comparisons up to the 500th order, and custom computations, the WT5000 produces multi-channel measurements.

It is also versatile, featuring seven slots for user-swappable input elements, diverse mainframe options, and simultaneous evaluation of up to four motors. This enables the user to expand or reconfigure the instrument as applications and needs change, while raw data can be streamed to a PC for more detailed analysis.

With a full touchscreen, supported by hardware hotkeys and powerful software for remote measurements, it makes connecting, configuring and measuring power easier.

The features and performance are also backed up by customer service from Yokogawa representatives in the UK.

"The customer service from Yokogawa has been really good," said Ben Mitchell, senior EV test engineer at Intertek. "The Yokogawa people are always available. We can call or text them, and they will respond straight away. Even if our direct contact does not know the answer to our question, they are really good at finding the right person who can give us a helpful answer."

Yokogawa has been developing measurement technology for 100 years, finding new ways to give R&D teams the tools they need to gain insights from their measurement strategies.

Its standards laboratory in the Netherlands offers accredited power calibration, at frequencies up to 100kHz. ISO 17025 accreditation demonstrates the international competence of the laboratory.

Founded in Tokyo in 1915, Yokogawa works towards a sustainable society through its 17,500 employees in a global network of 119 companies spanning 61 countries.

POWER TECHNOLOGIES



General Motors pioneered wBMS in its modular Ultium battery platform

Stephan Prüfling and Norbert Bieler describe how wireless battery management systems enable smart battery ecosystems

WIRELESS WORLD

Most current electric vehicles (EVs) are still considered as expensive or less attractive when compared with conventional combustion engine cars. Consequently, cost reduction and improved performance are key to ensure a successful and sustainable market growth.

Reduction of size, weight and cost impacts the competitive edge of battery systems over a vehicle's complete lifecycle. On the other hand, the extension of the driving range will also have a significant impact on their market attractiveness and competitiveness.

Furthermore, as the increasing numbers of EVs reach the end of their life, car manufacturers will even be competing for the value to be derived from second life batteries recovered from scrapped vehicles.

Out of this demand, news about battery innovations tends to highlight the new battery packaging concepts and new materials that might one day be able to store more charge than today's lithium technology.

A different part of the battery – the battery management system (BMS), which monitors the state of charge (SoC) and state of health (SoH) of the battery – tends to go under the radar but needs to follow and support battery innovation.

Here, wireless BMS (wBMS) technology gives car manufacturers a competitive edge across the whole of a battery's life, starting from when battery modules are first assembled, to operation in an EV, beyond to disposal and, even, if needed, into the battery's second life.

Complex

The intention for wBMS technology development was based on an analysis of the drawbacks of the communications wiring in today's conventional EV battery packs, where each cell is measured by a battery management IC. Data from the battery management IC are then communicated back to the pack ECU through wiring.

This requirement for communications inside the battery reflects the complex architecture of a large battery pack; it is typically made up of modules, each of which contains multiple cells. Natural production variations mean each cell has individual characteristics that vary within a specified tolerance range.

To increase battery capacity, lifetime and performance, the key parameters of battery operation – voltage, charge and discharge current, and temperature – need to be monitored and logged individually for each module.

This is why an EV's battery requires a means to transfer data from each module or cell, where voltage and temperature are measured, to the ECU processor, see Fig. 1. Traditionally, these connections have been made with wires; wired connections have the advantage of being familiar and well understood.

Disadvantages

However, there are disadvantages related to wires; a copper wiring harness adds extra weight and occupies space that, if filled by a battery cell, would provide extra energy capacity. Additionally, the wiring needs to be fastened on battery housing structures and connectors can potentially suffer from a mechanical failure, especially under vibration and shock conditions.

In other words, wires increase development effort, manufacturing cost and weight while reducing mechanical reliability and usable space. This

results in reduced driving range. By removing the wiring harness, the car manufacturer gains flexibility to meet a vehicle's design requirements for the form factor of its battery pack.

The complexity of a battery's wiring harness also makes the assembly of a battery pack difficult and expensive; wired packs have to be assembled and the connections have to be terminated manually. This is a costly and hazardous process because high voltage EV battery modules are supplied charged.

To maintain the safety of the assembly process and to protect production line workers, rigorous safety protocols are applied.

There are, then, strong reasons for OEMs to introduce robust wireless technology in new EV battery platforms.

Wireless

A wBMS is easier for an automotive manufacturer to integrate into a battery pack design. It includes a wireless cell monitoring controller (wCMC) unit for each battery module and a wireless manager unit to control the communications network, which connects multiple battery modules wirelessly to the ECU.

Beside the wireless section, each wCMC unit includes a BMS that measures various battery parameters so the applications processing unit can analyse the SoC and SoH of the batteries.

While wBMS technology takes advantage of eliminating the wiring harness design and assembly issue, there are further areas within the battery lifecycle where additional value can be generated.

One is battery assembly. The only connections a battery module requires are the power terminals, which can readily be made in a highly automated process. By eliminating manual labour for assembly and testing, this avoids safety risks to assembly line workers, see Fig. 2. Furthermore, the modules can be tested and matched before installing inside the battery.

Secure wireless capability means the condition of the battery pack can be conveniently analysed by diagnostics equipment in an authorised garage without touching the pack. If a malfunction is detected, a faulty module can easily be removed and replaced.

A wireless configuration simplifies installation of a new module in the battery system.

By the increasing number of vehicles, a market is emerging for second life batteries recovered from scrapped EVs and repurposed for applications such as renewable energy storage systems and electric power tools. This additionally creates a new source of value for EV manufacturers, which are responsible for the recycling or disposal of the batteries in scrapped EVs since wBMS allows a simpler integration of the modules for second life applications.

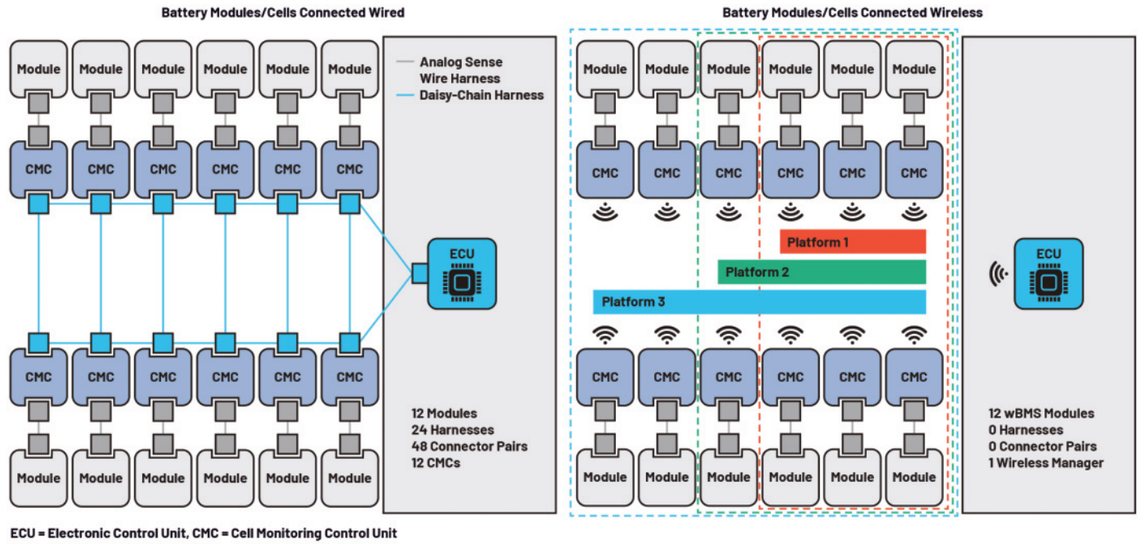


Fig. 1: A typical multicomponent wired BMS network (left) and the simpler arrangement made possible by wBMS technology (right)

The recyclable metal and potentially hazardous materials inside a battery pack require approved and regulated disposal arrangements. The simple connections and absence of a communications wiring harness make removal of battery modules easier and quicker than that of a wired battery.

WBMS makes it easier to read out critical battery data from each intelligent module. This means the condition of the batteries can be determined individually. These data can, for instance, provide information about the SoC and SoH of a module.

Combined with data from when the module was originally produced, this allows the optimal usage in its second life application and the provision of a detailed set of specifications for each module on sale. The ready availability of these data increases the resale value of the modules.

Production

The use of wBMS in a mass production EV from General Motors is a proof of its reliability in the harshest environments. The wBMS-based battery has been run over hundreds of thousands of kilometres in more than 100 test vehicles, on-road and off-road, and in environments ranging from a desert to the frozen north and under the toughest conditions.

The radio technology and the networking protocol have been developed in such a way the system is resilient in noisy environments and provides secure communication between the monitoring units and the manager using encryption technology.

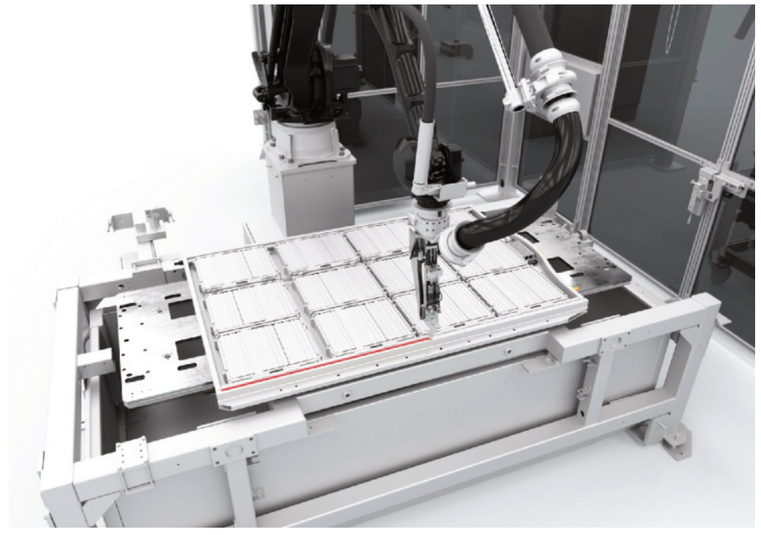


Fig. 2: The wBMS eliminates the BMS signal wiring harness to enable automated, robotic production of battery packs

The security measures avoid spoofing of data transmitted on the wireless network by an unintended recipient such as a criminal or hacker. Furthermore, the transmitted data are received without any modification of the contents, and the intended recipient knows exactly which source has sent a message.

Lifetime

Across the entire battery pack's lifetime, from initial assembly through disposal to second life, the wBMS capability embedded in the battery pack ensures the vehicle's manufacturer and its owner can easily track the condition of the battery, maintain the performance and safety, and increase the value.

Battery lifecycle insight service (BLIS) technology provides edge-based and cloud-based data software to support traceability, production optimisation, monitoring in storage and transit, early failure detection, and lifetime extension.

Together, wBMS and BLIS technologies let automotive manufacturers gain higher returns on their investments in battery pack development and production, improve the economics of their EV business strategies, and help accelerate the market's shift towards a low carbon, sustainable future for personal mobility.



Stephan Prüfling is a product manager at AVL



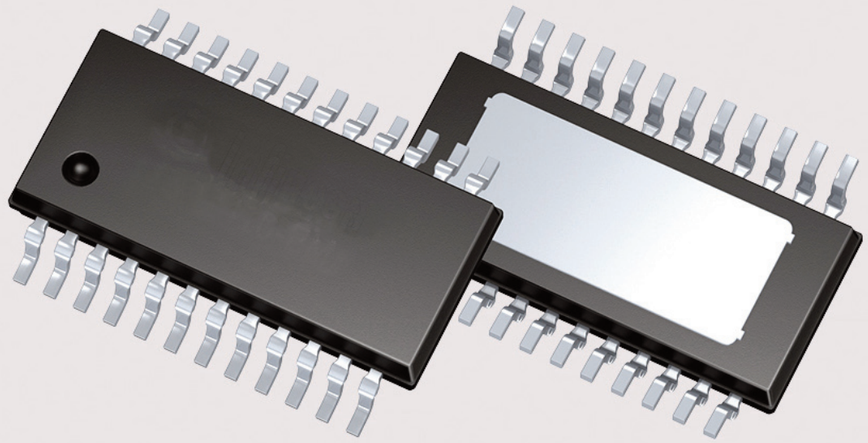
and Norbert Bieler is a business development director at Analog Devices

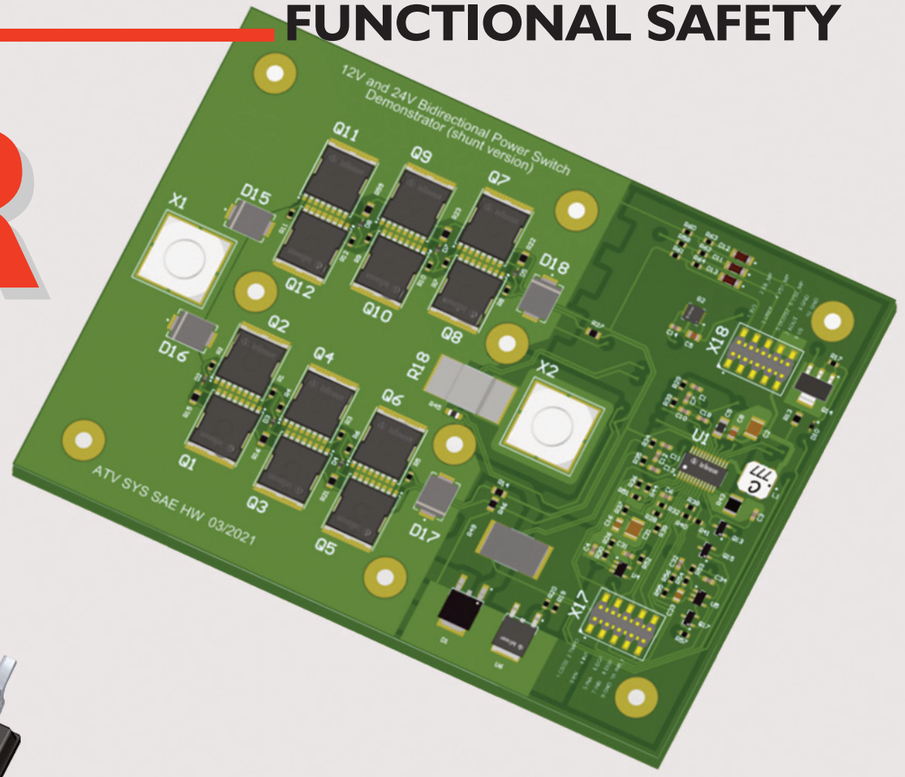
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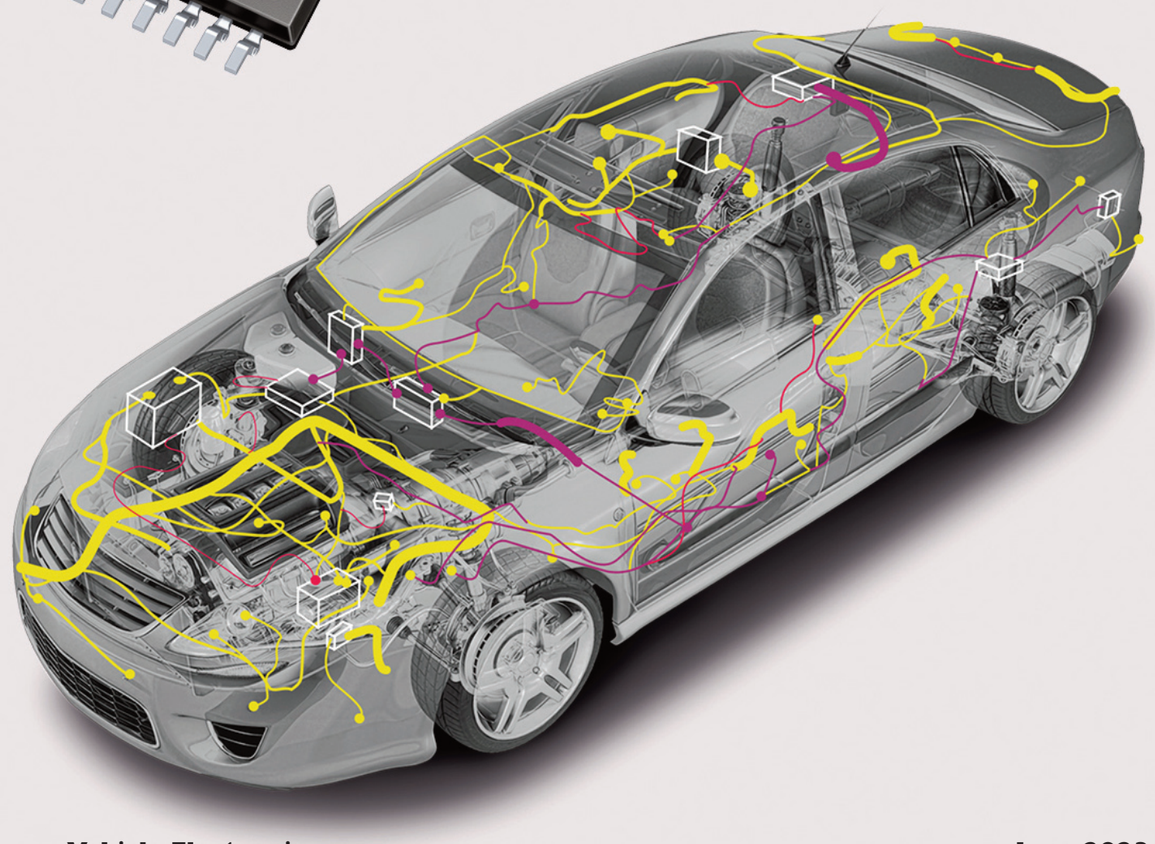
SAFE POWER

Christoph Schulz-Linkholt and Thomas Blasius explain how semiconductors achieve safety in power distribution









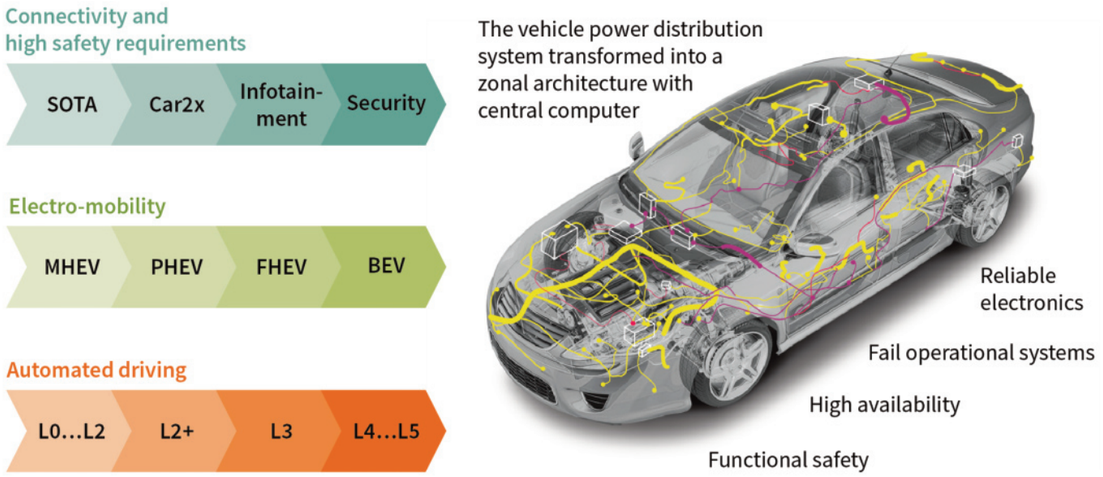


Fig. 1: The interplay of automotive megatrends is transforming the vehicle PDS into a zonal architecture of highly available subsystems; zone controllers form the interface between signal and data distribution and power distribution in the EE architecture

Semiconductor switches used as safety elements enable highly available power distribution. During development, however, freedom from interference must be considered, which is achieved by fast failure isolation. Additionally, the switches provide cable protection.

Far-reaching driver assistance systems, x-by-wire and automated driving result in functional safety requirements for developers.

According to ISO 26262: 2018, this also includes the provision of a high availability power supply for driver assistance from the power distribution system (PDS). Equally important is the freedom from interference of other components to the PDS, which can be achieved by introducing safety elements that isolate failures in less than 100 to 500μs. Semiconductors can help.

Megatrends

This is an age of increasing digitalisation, which also affects mobility. Modern vehicles are constantly connected to the cloud and receive software updates at regular intervals. This in turn has a significant impact on the communication level of the electric-electronic (EE) architecture, which is increasingly evolving into a zone concept with a central computer.

Drivetrain electrification is leading to a PDS with multiple voltage classes and sources, enabling new concepts of decentralised power distribution in the vehicle.

However, the greatest influence on the PDS and the associated electrical and electronic systems is the increasing number of modern automotive applications such as driver assistance, x-by-wire and automated driving.

To implement these, every aspect of functional safety must be considered.

People using these vehicles must feel safe and be able to trust the interaction of the systems. This is referred to as dependable electronics, in other words, electronics that are highly available, reliable, robust and safe under all conditions.

At first glance, each of these trends only affects subareas of the EE architecture. However, viewed as a whole, they have an enormous influence on the architectural development of the PDS, see Fig. 1.

Distribution

Today's systems are usually designed to be fail-passive. This means, in the event of a fault, the individual section goes to a safe state without power and is isolated from the overall system.

In this way, negative interference effects on the overall system are avoided.

But the driver must be able to take control immediately as fallback and, depending on the type of malfunction, bring the vehicle to a safe state.

For this, the driver needs mechanical access, which is no longer possible with x-by-wire and automated vehicles.

Therefore, in these cases, all systems must be highly available – also spoken of as fail-active or fail-operational – to bring the vehicle independently to a safe state within a certain time.

This way, highly available systems not only avoid or mitigate potential cases of failure, but also allow safe, automated driving under all conditions.

The PDS is particularly important for high availability. It enables the power supply of the individual safety-relevant vehicle features, including braking, steering and perception of the environment and must therefore also be highly available. Due to the safety-relevant vehicle functions, the increased safety requirements, and the corresponding development requirements according to ISO 26262, are inherited by the vehicle power system.

The requirements for a high availability power supply, in turn, have an impact on the architecture of the vehicle PDS, which requires semiconductor-based approaches and functionalities.

Functional safety requirements, for example automated driving and x-by-wire, lead to an availability requirement of the on-board power network in Asil D.

Fig. 2 shows a schematic and exemplary decomposed 12V PDS consisting of a QM domain and two available, sufficiently independent power distribution (PD) channels in Asil B(D).

The three PD channels are colour-coded according to their Asil assignment. The safety-relevant functions, which must be highly available, are designed with corresponding redundancy and are each supplied from the available PD channel. These are shown with the colour code "available".

At the same time, the safety-related functions can be the source of an overvoltage or undervoltage in the PDS. None of these failure sources may have an effect on the PDS and the interference must be prevented

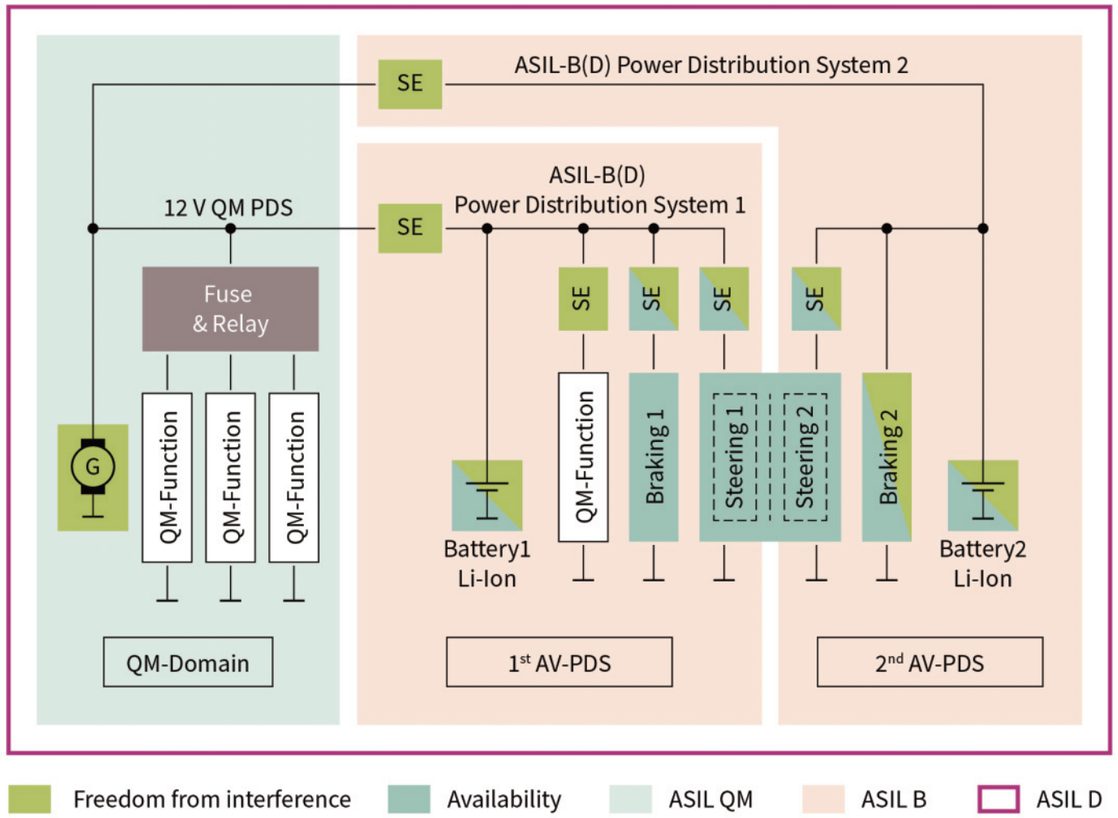


Fig. 2: Conceptual architecture diagram of a decomposed PDS in two times Asil B(D) including the assignment of availability and freedom from interference

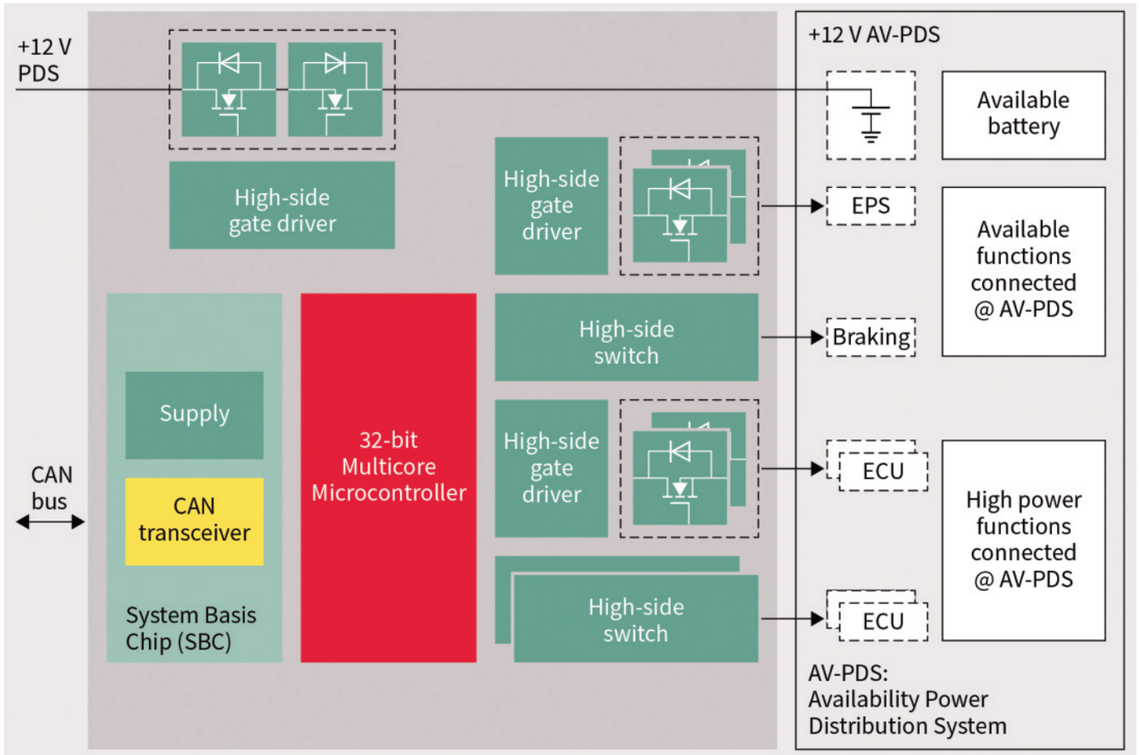


Fig. 3: Schematic structure of electronic power distribution centre in a highly available PDS; supply lines with particularly high currents are set up with discrete combination of gate driver and mosfet

with Asil B integrity in accordance with the availability requirement for the PD channel.

The freedom from interference must be ensured and is shown accordingly with the colour code “freedom from interference”.

One energy storage device per available PD channel ensures energy and power to perform at least the minimum-risk manoeuvre after an initial malfunction until the vehicle reaches a safe state. Continuous monitoring of the states of charge and health and power prediction are essential. Again, in case of a failure, there must be freedom from interference on the PDS.

Fig. 2 shows the required energy in the normal state is classically supplied via the generator, without a dedicated availability requirement. However, its freedom from interference regarding undervoltage, but also overvoltage, on the available PDS must be safeguarded.

In addition, numerous standard loads without dedicated safety requirements – in this case labelled as QM functions – are connected to the power distribution system. For various reasons, these must be supplied by the available PD channel. At the same time, the functions often can’t ensure the freedom from interference to the PDS with the corresponding Asil-B integrity.

For all loads with insufficient freedom from interference to the PDS, so-called safety mechanisms or safety elements (SEs) are introduced in accordance with ISO 26262. These SEs are also required to ensure the freedom from interference between the PD channels.

The SE must protect the available power distribution channel against failures such as undervoltage as well as overvoltage and enable the safe transmission of energy to the available, safety-relevant functions.

Semiconductors

Essential requirements for a safety element are fast detection, fast response and secure isolation of failure. For this reason, the SE must measure the current or voltage, interpret the value, and act accordingly to isolate the flow of energy to the fault.

Standardisation such as ISO 16750-2 or specific OEM delivery specifications for electrical and electronic components in vehicles dictate that failures must be isolated within 100 to 500μs. However, neither a classic fuse nor a relay is suitable for this purpose.

A fuse isolates a fault current within 10 to 100ms, a relay requires 1 to 10ms. By contrast, semiconductor switches can typically achieve disconnection times in the lower two-digit μs range.

In addition, intelligent semiconductor switches integrate the functions of measuring, interpreting and acting without additional components such as microcontrollers. Compared with a relay, they can autonomously disconnect the energy flow based on an overcurrent or undervoltage. This complies with ISO 26262: 2018 including the extended diagnostic capability to cover failure modes.

Intelligent semiconductor switches operating as SEs in the PDS can replace other components. For instance, they can also replace the fuse and take over wire protection.

In a smart semiconductor switch, the integration of cable protection is implemented based on a current-time function which optimises costs. For this, the protection must be based on a current measurement in the time domain and a transformation into the temperature domain by a digital processing according to the cable isotherm.

Due to a very accurate current measurement, adjustable cable isotherms and significantly lower production variation and aging effects, intelligent semiconductor switches achieve significantly lower cable protection tolerances compared with fuses. In some cases, increased accuracy allows a thinner cable cross-section to be selected for the same load conditions. As a result, the solid-state switch not only takes over the function of the fuse, but also improves it and enables reduced costs.

As more OEMs are evaluating a thermal event under this standard, the feature must be compliant with ISO 26262: 2018.

Compared with the fuse, an intelligent semiconductor switch has a certain amount of inherent current consumption to conduct energy. However, its consumption should be kept as low as possible, especially if the vehicle is in parking mode where individual loads must be supplied permanently at a low power consumption via the semiconductor switch. For this purpose, a special operating mode, the idle mode, is implemented in the intelligent semiconductor switch.

Idle mode has an intrinsic current consumption in the lower two-digit μA range, typically less than 30μA. While in parking mode, the idle mode should not lead to a restriction of the integrated protection features and functionalities. The cable protection must therefore still be in place.

On top of that, there can’t be any significant voltage drops should the load require its nominal current.

Implementation

Fig. 3 shows a block diagram of an electronic power distribution centre in the high availability PDS. Electronic power distribution centres replace the classic pre-fuse box, relays and fuse boxes, and include safety elements that enable freedom from interference. They have the structure of an ECU with a power supply, microcontroller, communication interface, and either a gate driver plus mosfet or a high-side switch as safety elements.

Outlook

By connecting to the cloud, software-defined vehicles will enable continuous optimisation of vehicle functions and vehicle safety in the future. Predictive maintenance of systems or failure anticipation of components is already standard in aviation and will also become increasingly important in automotive.

Especially interesting could be diagnostic cycles during charging. For example, diagnostic data could be collected at the semiconductor interfaces, processed in the cloud, and compared with the fleet to draw conclusions about aging or optimise maintenance intervals.



Christoph Schulz-Linkholt is principal system architect



and Thomas Blasius a senior director, both at Infineon Technologies

READY OR NOT

Steve Rogerson visits Harman to find what the firm is doing with its Ready range

Back in 2017 when Samsung acquired Harman, there was much speculation about what the Korean electronics giant would do with the audio company, especially in the automotive market.

The appearance though, for the years that followed, was not a lot, but there were subtle changes and these built up over time to the point that now the two companies are far more closely integrated than perhaps many realise.

This was all too obvious at a recent customer showcase held at the firm's offices in Garching just outside Munich, where the in-car range was on full display and the Samsung influence was there for all to see. Take displays as a good example.

Most in-car displays use TFT LCD technology, and they are edge lit. The quality here is a little lacking.

"The blacks are not real black and the colours are not saturated enough," said Jay Badvel, Harman's senior product manager for displays. "And when there is a lot of brightness you can't distinguish between orange and red, for example."

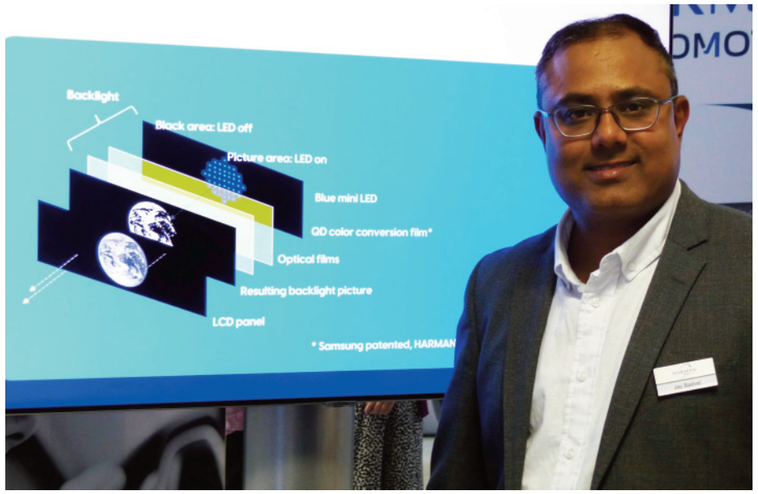
This would not be so much a problem if consumers were not used to high-quality displays at home and on their smartphones. Their expectations are higher.

For high-end cars, the answer is OLED, but this is expensive.

"OLED is amazing, but can we afford it for cars?" said Badvel.

What Harman set out to do with help from Samsung and its vast experience in display technology was to bridge the gap between TFT LCD and OLED, so the quality was there but the price was affordable. What they came up with was Neo QLED; the Q stands for quantum.

This gives OLED-like performance at a lower cost. The local dimming backlight leverages blue LEDs and quantum dot (QD) film to produce a wide colour range with near perfect black and a reduced halo effect.



Jay Badvel: "We are ready."



Ke Dong: "The OEM chooses which features to have."

"This has deep blacks, saturated colours and excellent brightness," said Badvel. "It is similar to OLED on quality at a price between LCD and OLED."

He said it was about 30 to 40% dearer than TFT LCD whereas OLED could be more than double the price.

Harman is working with car makers with a view to this technology appearing in vehicles from 2025 onwards.

"But if an OEM comes and says they want it next year, we are ready," said Badvel.

Vision

The company has also been working hard to reduce the size of the hardware for its head-up displays (HUDs). And it has succeeded, with the hardware coming down from about twenty litres to slightly more than ten. And on the augmented-reality software that goes with the HUDs, there is a catalogue of features from which users can choose.

Such AR features include the magic carpet showing where to drive and what lanes to be in, time to destination, land-departure warning, blind-spot warning, current speed limit and so on.

"The OEM chooses which features to have," said Ke Dong, Harman business developer for adas. "It is very intuitive to make it obvious what you are being warned about. There can be audio warning too."

One problem of this is to achieve the right balance between helping and distracting the driver.

"With AR, you can have too much," said Dong. "But due to our no latency, you can have the right image at the right time. It will only show you what you need to see at the time to enhance your focus."

The Audi Q4 E-Tron has had some of these features and the software platform since last year.

Upgrade

One of the much talked about features for future vehicles is the ability to provide updates in a similar way that happens with a smartphone.

Harman's Ready Upgrade approach puts forward a suite of production-ready technologies to provide hardware and software upgrades throughout the life of the vehicle. A good example is the firm's cockpit domain controllers that will have a new version every 18 to 24 months. On software, there are annual Android automotive updates.

"The traditional development model for cockpit and infotainment is not keeping pace with what consumers expect from their smartphones," said Jochen Schatz, Harman business development manager.



Jochen Schatz: "You don't have to write the app from scratch."

"Development cycles are too long, something like four years. Development costs are very high. Sometimes the electronics is not capable of handling new features. Today's cars are not designed to be upgradeable."

The answer, he said, was to scrap project-based models where the OEM would give suppliers the specifications and they would work to them. Instead, a product-based model would let suppliers such as Harman pre-invest in products not for a specific car but which could be sold to all car makers.

"We are standardising it," said Schatz.

This would include a software stack and development tool chain so it could still be customised, but should allow it to be made ready more quickly and at lower cost than a project-based methodology.

With the cockpit domain controller, each model will be backwards compatible making it easier to move to the latest version. This could extend to on-road cars where the owners can upgrade to a new controller at the dealership. Software updates will see quarterly releases.

The tool suite will see low- or no-code software development tools to accelerate the creation of different interfaces.

"We have separated the user-interface layer from the underlying module," said Schatz. "This makes it quicker to design a different interface on the display. You don't have to write the app from scratch, just a few lines of code."

Harman has two car makers going down this road over the next two years.

In a similar move, Harman's Ready On Demand offering is a way to improve the driver and passenger experience.

This is an app that runs on the head unit and can provide different experiences for car owners. For example, Personi-Fi lets users personalise the audio experience in the vehicle to meet their hearing and audio preferences.

"It can compensate for hearing loss," said Florian Schaubschläger, Harman product manager. "Or you can change the sound of the car. Say you have an electric vehicle. You can make it sound like a V8 car from the 1970s."

In-car communications can be personalised such as changing the way a passenger takes a call or chats with others in the vehicle.



Florian Schaubschläger: "You can change the sound of the car."

"Say there are three rows of seats," said Schaubschläger. "You could, say, set it to allow a conversation between the first and third row. It is possible to extend this to larger vehicles such as a bus."



Marcus Futterlieb: "The message we got back was safety."

There are also enhancements that let the user make the audio sound like it is in a specific venue, such as the Boston Symphony Hall, for example.

"Even if you are just talking, it can sound like it is in the venue," said Schaubschläger. "We are in discussions with several venues. It needs to be licensed so we can't just arbitrarily add venues."

This is just available in demonstration vehicles but Schaubschläger said Harman was in talk with OEMs and that it could be deployed quite quickly.

Care

Driver and passenger monitoring is becoming more common but Marcus Futterlieb, principal engineer at Harman, says its Ready Care system offers more than that after asking 5000 customers what they wanted.

"The message we got back was safety," said Futterlieb.

Ready Care manages in-vehicle activity by monitoring eyes, mind and vitals to improve the driver and occupant experiences by focusing on safety and wellbeing. The technology combines intelligent machine-learning algorithms and in-vehicle sensors to detect a driver's personal state and propose a custom, personal in-vehicle cabin response.

"We look at audio or visual cues to tell the driver to focus on the road or take a break," said Futterlieb. "We can also change the lights or the play list, or decrease the temperature in the car."

Cooling down the car might take too long and not be good for other occupants, so Harman is working with seat manufacturers to push cool air at temperature-sensitive areas such as the driver's neck.

Whatever intervention the system chooses, it will not leave it there but check its effectiveness and respond accordingly.

A big talking point is child-presence detection after shocking statistics from the USA showing the number of child deaths from being left behind in vehicles during hot weather.

Harman acquired radar specialist Caaresys last year. This Israeli company develops vehicle passenger monitoring systems powered by contactless, low-emission radar. This allows cabin monitoring including vital signs sensing, passenger localisation and child presence detection.

"The 60GHz radar can penetrate through material and detect movement and breathing," said Futterlieb. "We also have a 24GHz radar in the seat to measure heart rate."

The company is also working with Samsung engineers responsible for the company's wearables range. Information from, say, a smart watch on the driver's state of mind or how much sleep they got the previous night can be taken into consideration when the car measures the driver's wellbeing.

Antennas

There are two main problems with antennas in vehicles. For aesthetical reason, car makers don't like the traditional shark fin antenna. And, secondly, a box under the roof can lead to around six metres of cabling in the vehicle that can be expensive and adds weight, and can lead to a signal loss of around 90%.

Harman started working on this problem around five years ago and came up with what it calls the smart conformal antenna.

"This has the antenna and telematics all in one box," said Gerhard Grossberger, director of product management at Harman. "The box is under the roof and there is no shark fin. Ethernet is the only connection and that has no influence on performance. We eliminate antenna RF cables. We can integrate 14 antennas in one box."

This is in vehicles now and mass production has started with a European OEM.

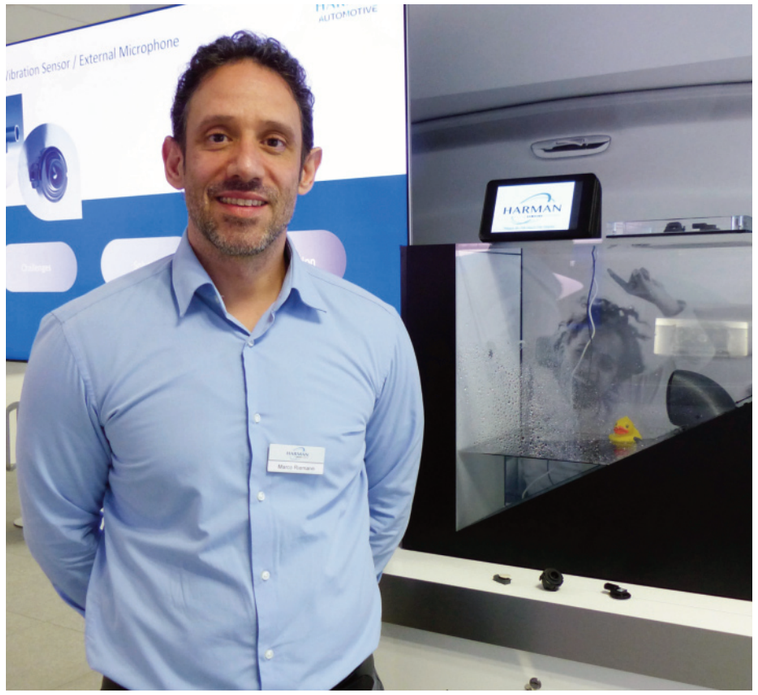
Grossberger added that wireless was not an option for eliminating cables because of security reasons. "Wireless can be more easily hacked," he said.



Gerhard Grossberger: "Wireless can be more easily hacked."

Sensors

Harman has developed its SVS sound and vibration sensor and external microphone. Applications



Marco Riemann: "Traditional microphones are not designed to work with high wind noise."



Jan Geisler: "They want a living room experience in the car."

vary from the car owner calling for the doors to be opened as they approach ladened with shopping, hearing cries for help outside the vehicle or instructions from traffic cops, to being warned by the sirens of approaching emergency vehicles.

"Traditional microphones are not designed to handle the harsh vehicle exterior environment or work with high wind noise," said Marco Riemann, technical manager. "We have addressed this."

The microphones can also be arranged in an array to enable direction sensing for approaching vehicles.

The SVS can be attached to the B side of a surface and can detect glass breakage and vehicle impact.

Design

Though most of the products mentioned here are available off the shelf for OEMs, Harman does have an in-house design team that can work with designers at the car makers to integrate brands into the vehicle. The idea is the audio brand will have the same look as a home product from the company.

"We want the customer to recognise the design," said Jan Geisler, senior industrial designer at Harman.

The company can integrate the likes of Bower & Wilkins speakers into the car or Harman's own Kardon brand.

"Kardon is one of our premium brands for home consumer products," said Geisler. "We integrate that with brands such as Volkswagen. We want a link between the two."

He said he was seeing trends in



Johannes Schüler: "This is not a demo car."

car interiors for everything to be more hidden, as you would find in a living room.

"They want a living room experience in the car," he said.

Vehicle

At the showroom was a car in which nearly all the technologies discussed here were installed.

"This is not a demo car but a real car with fully integrated products," said Johannes Schüler, Harman's senior marketing manager. "It is market ready. We are trying to enhance the customer experience in the car."

While Harman is learning from its parent Samsung in big ways, Schüler acknowledged that automotive demands that things are not always done the same way.

"Smartphones are a different business," he said. "These are outdated every one to two years, so you replace them. That is not what we do with the car. People tend to keep a car for around seven years. But we have the same challenges yet the brain of the car can't deal with software updates."

The answer, he said, was to change the brain of the car in an easy way.

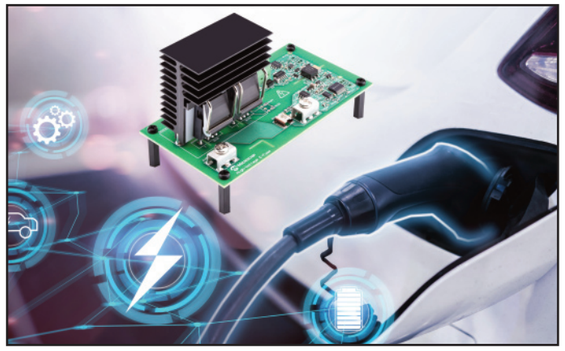
"The OEM can send an alert for the customer when it is ready for the swap, either at a dealer or the users can do it themselves," he said. "When the hardware swap is done, all the old profiles are uploaded the same way as with a smartphone."

Conclusion

While parent company Samsung has been instrumental in bring technology to Harman's automotive range, perhaps a more significant influence has been cultural. This is shown through the Ready range, which is part of a transformation from being a project-based to a product-based company.

The automotive industry is going through radical change. Harman is hoping that Samsung's influence will make sure it is ready.

SiC demonstrator provides protection for EV electronics



To provide battery and hybrid electric vehicle designers with faster and more reliable high-voltage circuit protection, Microchip has announced the E-Fuse demonstrator board, enabled by silicon carbide (SiC) technology.

It is available in six variants for 400 to 800V battery systems and with a current rating up to 30A.

The demonstrator can detect and interrupt fault currents in microseconds, 100 to 500 times faster than traditional mechanical approaches because of its high-voltage solid-state design. The fast response time reduces peak short-circuit currents from tens of kilo-amps to hundreds of amps, which can prevent a fault event from resulting in a hard failure.

With the its resettable feature, designers can package the board in the vehicle without design-for-serviceability constraints. This reduces design complexities and enables flexible vehicle packaging to improve power system distribution.

OEMs can accelerate development of SiC-based auxiliary applications with the demonstrator because of the built in Lin communication interface, which enables the configuration of the over-current trip characteristics without modifying hardware components. It also reports diagnostic status.

The demonstrator uses the firm's SiC mosfet technology and Pic microcontrollers' core independent peripherals with a Lin-based interface.

The companion components are automotive-qualified and yield a lower part count and higher reliability over a discrete design.

The board is supported by MPLab X IDE to develop or debug software. The Lin serial analyser development tool lets users send and receive serial messages from a PC to the board.

Joystick controller receives update

An updated version of Curtiss-Wright's JC8000 joystick controller has a centre detent for enhanced return-to-centre operation and provides high mechanical strength for heavy-duty construction and material handling applications.



These include wheeled loaders, telehandlers and rough-terrain lift trucks.

While maintaining an overall minimum under-panel depth of the joystick body of 83mm, the JC8100's shaft pivot-point position has been designed to be as low as possible to ensure high strength capability in a small space.

The low pivot point reduces the angular deflection while maintaining operator hand movement, and reduces wear on base-to-grip wiring to enhance reliability.

Hall-effect sensor technology eliminates contact wear and provides safety functionality via dual analogue outputs with sense options per axis or J1939 or CanOpen output options.

Electronic robustness is assured with sealing of the internal PCB to a rating of IP66 and IP69k. Simplified connector detailing using standard, integrated sealed connectors ensures integrity throughout the product's five million cycle lifetime.

There is a choice of multi-function grips available, including those with up to four axes of additional proportional control and featuring up to ten finger-thumb controls including push-buttons, rocker and momentary switches, and proportional rollers.

The joystick can also be supplied as base-only, so custom grips can be fitted.

Power module suits EV traction inverters

An automotive power module from Infineon is for EV traction inverters and will be available with different current ratings and 750 and 1200V voltage levels.

The HybridPack Drive G2 builds on the established G1 concept of an integrated B6 package, offering scalability within the same footprint and extending it to higher power and ease of use.

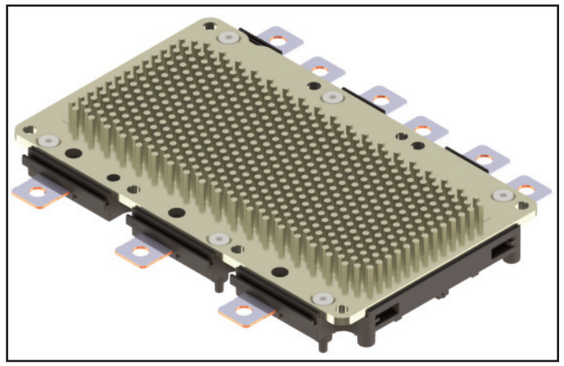
It uses the firm's EDT3 Si IGBT technology and a CoolSiC G2 mosfet.

With a power range up to 300kW within the 750 and 1200V classes, the G2 provides features such as an integration option for phase current sensor and on-chip temperature sensing for IGBT products.

The power module achieves higher performance and power density through improved assembly and interconnect technology. The adoption of chip sintering and a black plastic housing enables higher temperature rating, resulting in higher performance and longer product life.

The G1 was introduced in 2017, using silicon EDT2 technology. It offers a power range of 100 to 180kW in the 750V class. In 2021, Infineon expanded the family with the first generation of HybridPack Drive automotive CoolSiC mosfets, which allowed the inverter design to achieve power up to 250kW within the 1200V class, longer driving range, smaller battery size and optimised size and cost.

The lead FS1150R08, FS01MR08 and FS02MR12 products of the G2 range are in production and available, with additional product variants to follow in 2023 and 2024.



Capacitors stay stable in extremes

With the T598 series, Kemet has introduced capacitors said to have the highest capacitance and lowest ESR values for automotive-qualified polymer capacitors.

AEC-Q200 certified, the capacitors suit applications, in the drive train or chassis. They are available in standard tape-and-reel packaging.

The polymer electrolytic capacitors are surface mountable.

Even under extreme conditions, such as high humidity and temperatures, they have an increased ESR stability and increased capacity.

This means with the same footprint in each case 42% more capacity at 6.3V nominal voltage, 45% more at 2.5V, and 114% more at 10V.

Due to improvements in design and material selection, the service life of the capacitors is extended. As a result, passing qualification tests of 1000 hours at +85°C and relative humidity of 85% at nominal voltage, or up to 2000 hours at operating temperatures of up to +125°C, or +150°C in extended endurance tests, is possible.

They use halogen-free epoxy and are RoHS compliant.

Applications include sensors, radar, central computing units or cameras, up to autonomous driving for example in sensing, data fusion and deep learning, as well as for mobility services, connectivity and infotainment.

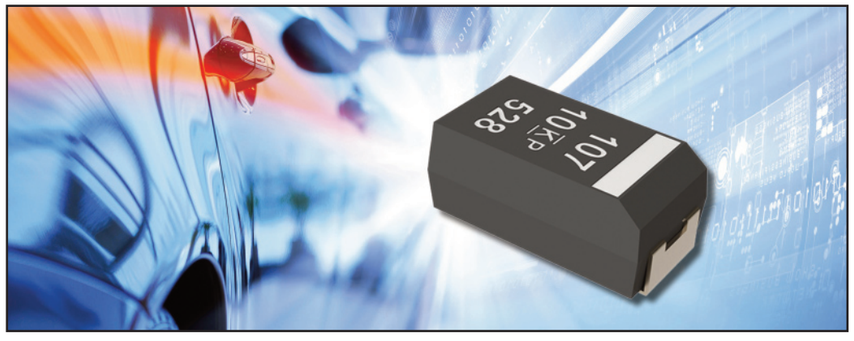


Image sensors achieve 150dB dynamic range

Automotive image sensors from OnSemi have a 2.1μm pixel size, 150dB high dynamic range (HDR) and LED flicker mitigation (LFM) across the full automotive temperature range.

The Hyperlux family is for adas applications, enabling a smooth transition to level 2+ driving automation, which requires the driver to take over only when alerted by the technology.

The family spans products with resolutions from 3 to 8Mpixel, catering to sensing and viewing camera applications.

With an HDR of 150dB, it captures high quality images under extreme lighting conditions without sacrificing low-light sensitivity. The LFM ensures pulsed light sources do not appear to flicker and thereby avoids flicker-induced machine-vision problems.

By using up to 30% less power and having an up to 28% smaller footprint than some devices, the sensors are said to deliver energy-efficient designs with low material costs.

They are designed to meet Asil-D safety requirements, while integrated security protects against cyber-security threats.

A dual output stream at differing resolutions allows sensing and other functions to be performed simultaneously.



Connector links camera modules

A connector from Yamaichi is for automotive camera modules, such as a reversing or rear-view mirror cameras or as a front camera for traffic-sign monitoring and distance control.

The Y-CMC series consists of a coaxial socket that is soldered to the PCB. Diameter is 3.5mm and height 4.7mm.

For the cable side, there are two options. The first is a connector side with a Fakra interface so the user can contact the unit with a standard Fakra cable connector.

The alternative is an over-moulded cable side, which Yamaichi could assemble with an additional plug in at the desired length or offer for free assembly on one side.

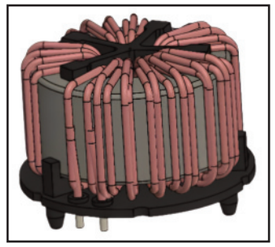
The design provides for a screw connection to the camera housing.

Tolerance compensation is ±0.3mm in all directions. This ensures a reliable joining process even with difficult access.

Transmission rates are 4.3GHz. When plugged in, the Y-CMC system is water-protected to IP69K and can be used in outdoor areas that are at risk from splashing water.

Temperature range is -40 to +105°C.





EMC chokes

Four-phase high-power common-mode chokes from Premo are for EMC noise filtering in on-board chargers of up to 22kW in electric vehicles.

The 4CMCN065R0-16H and -32H automotive-grade chokes are less than 5.8cm^3 and have an efficiency above 98.5%.

The design allows for effective filtering of high-frequency noise in power lines, while reducing EMI.

The efficiency makes them suitable for electric vehicles, where space and energy efficiency are critical. The 16H choke can handle up to 16A of current, while the 32H choke can handle up to 32A.

Operating temperature is from -40 to +125°C. Height is 32mm. They meet AECQ200.

The designs are developed for increased thermal coupling of core and copper with thermal interface materials such as CoolMag.

Quality control uses deep learning and machine vision based on convolutional neural networks.

Gate driver increases EV range

An integrated, functional safety-compliant, isolated gate driver from Texas Instruments can help engineers design more efficient traction inverters and increase electric vehicle (EV) driving range.

The UCC5880-Q1 reinforced driver lets EV powertrain engineers increase power density and reduce system design complexity and cost while achieving safety and performance goals.

Automakers should be able to build safer, more efficient and more reliable silicon carbide (SiC)- and IGBT-based traction inverters by designing with the device, which has real-time variable gate-drive strength, SPI, SiC monitoring and protection, and diagnostics for functional safety.

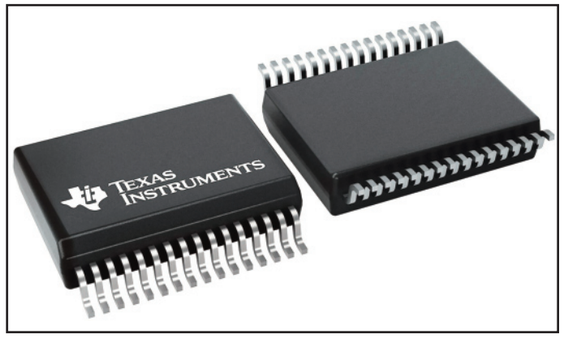
By varying the gate-drive strength in real time, in steps between 20 and 5A, designers can improve system efficiency with the gate driver by as much as 2% by reducing SiC switching power losses, resulting in up to 11 more kilometres of EV driving range per battery charge.

SPI programmability and integrated monitoring and protection features can reduce design complexity as well as external component costs.

Engineers can further reduce components and quickly prototype a more efficient traction inverter system using the SiC EV traction inverter reference design.

This customisable, tested design includes the UCC5880-Q1, a bias-supply power module, real-time control MCUs and some high-precision sensing.

Preproduction quantities of the automotive-grade, ISO26262-compliant device are available in a 10.5 by 7.5mm, 32-pin ssop.



Resin moulding improves MLCCs

Multi-layer ceramic capacitors (MLCCs) draw on Murata's resin moulding capabilities.

The Eva MLCCs are for use in electric vehicles in on-board chargers, inverters and DC-DC converters, plus battery management systems and wireless power transfer implementations.

Developed to IEC60384-14 requirements, the safety-certified Y2 class capacitors can suppress common mode noise.

Housed in surface-mount packages with a 12.7 by 6.0mm footprint, plus a 3.7mm profile, these components have 305V AC, 1500V DC ratings, and support 10mm creepage distances.

Consequently, they can address the greater isolation that migration to 800V powertrains will mandate, yet remain aligned with the need for miniaturisation in modern automotive systems.

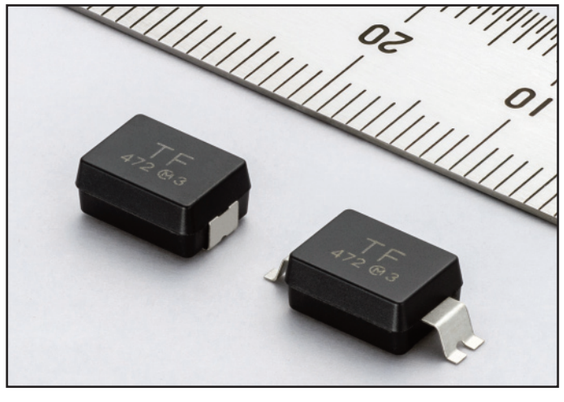
Capacitance values are from 0.1nF to 4.7nF.

They are AEC-Q200 qualified, with an -55 to +125°C operating range.

Withstand voltages are 2kV AC and 4kV DC for 60s.

In addition, they exhibit low equivalent series inductance, so performance is not impaired at high frequencies.

The metal terminal arrangement provides elasticity. Formation of solder cracks and deflection cracks is thereby mitigated, so long-term reliability can be improved.



Networking ECU paves way to software-defined vehicles

An ECU from TTTech has networking capabilities to play a central role in automotive EE architectures, paving the way to software-defined vehicles.

The N4 network controller provides all conditions to ensure cyber security according to ISO21434 and enables functional safety features up to ISO26262 Asil B.

It acts as a central secure gateway in a modern distributed or domain-centralised architecture. It also provides the necessary functionality to build future hybrid or full zonal architectures and enables over-the-air software updates and time sensitive networking (TSN) connectivity.

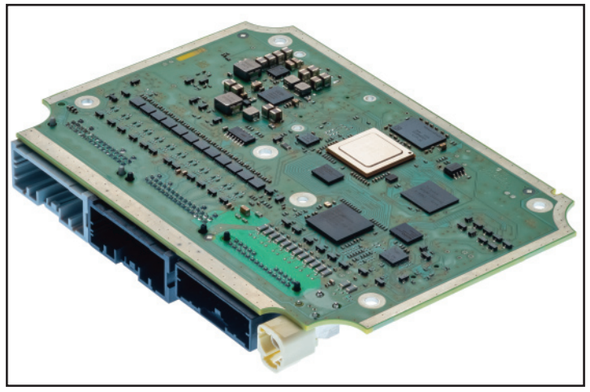
Thanks to NXP's S32G network processor, multiple bus interfaces of types Ethernet, Can-FD and Lin, and multiple gigabytes of flash memory, the N4 can be used for several use cases simultaneously.

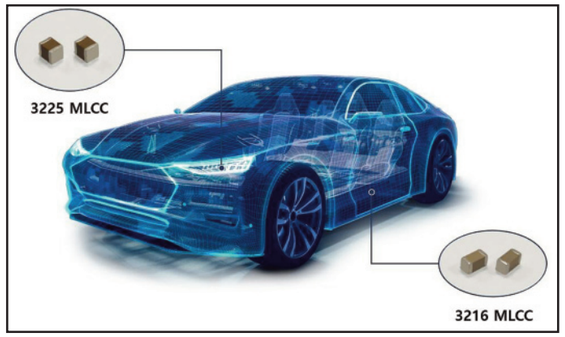
As a secure gateway, it connects different vehicle domains. As a firmware-over-the-air (FOTA) update master, it enables wireless software updates and subscription-based business models. In the future, it can act as a central computer in a hybrid or even a full zonal architecture.

The TSN capabilities enable the use of full bandwidths over Ethernet with dedicated prioritisation of critical communications.

Two CPU clusters combine performance, functional safety and cyber security in one ECU. The combination of the Arm Cortex-A53 and the Cortex-M7 supports both performance and functional safety applications.

Different operating systems, such as Autosar Classic and Linux, can be run in parallel.





MLCCs beat capacity record

Samsung MLCCs are rated at 250V, 33nF with low capacitance change rate according to temperature and 100V, 10μF at +125˚C.

The AEC-Q200 devices are said to have the industry's highest capacity of high-pressure MLCCs in the same voltage class. They are for electric systems and LED headlamps in electric vehicles.

MLCCs in EVs must withstand the high output voltages from the battery for fast charging and power delivery. And, as the number of electronic components in EVs increases, semiconductors must also have high-capacity characteristics so they can operate stably.

The 250V 33nF product is said to have the highest capacity at the same voltage level; 22nF was the highest for existing 250V products. This product improves battery stability by removing high-frequency noise inside the battery module while having the durability to withstand high voltages.

In addition, the 100V 10μF product is used in LED headlamps and its electric capacity has been doubled compared with the previous product.

Semiconductors used in LED headlamps require high power consumption and need high-capacity MLCCs that store a lot of energy and supply it to semiconductors quickly and stably while having high voltage durability.

It is difficult for MLCCs to satisfy voltage and capacitance characteristics at the same time. Designing thicker dielectrics to increase voltage reduces the number of internal electrodes that can be stacked, making it difficult to up capacity.

Samsung has realised high capacity by refining dielectrics as core raw material in the form of nano-level fine powder. Its surface coating method reduces agglomeration between powders, enabling stable operation at high voltages.

Thin shunt resistor for high power use

At 0.85mm high, a 12W rated metal plate shunt resistor from Rohm is claimed to be the industry's thinnest.

The PSR350 is optimised for high power applications in the automotive and industrial equipment markets.

Rohm is also expanding the PSR line to include a 0.2mΩ (PSR100) model along with a 15W type in the industry's smallest size (PSR330).

In automotive, the number of thin double-sided cooled power modules in the main inverters of xEVs – demanding incorporating power device chips, such as IGBTs and SiC mosfets, and shunt resistors to decrease housing size – is rising.

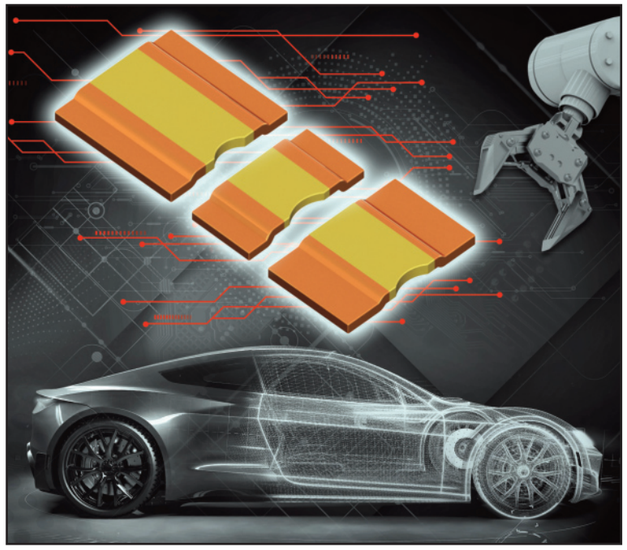
Conventional metal plate shunt resistors reduce the cooling efficiency of power devices due to their relatively high profile.

But decreasing height has proven difficult, as it is necessary to prototype and evaluate various welding materials in different configurations.

The PSR350 uses a vertically integrated production system with material and process optimisation to achieve a thickness of 0.85mm, about half that of conventional products in the 12W class.

The same technology is used to develop the 6.4 by 6.4mm 15W rated PSR330 shunt resistor.

This decreases size by about 65% compared with conventional products in the same class, helping reduce mounting area in a wide range of high-power applications.



At the same time, the PSR100 will be available in a 0.2mΩ model that extends the lower limit from the existing 0.3mΩ to enable detection of higher currents.

These products are suitable for high current sensing in applications equipped with motors or Li-ion batteries.

These include electronic power steering, electric compressors, main inverters, on board chargers, DC-DC converters and battery management systems.

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