VEHICLE electronics

The monthly magazine for automotive electronics engineers

Toyota buys Lyft self-driving division

Toyota has acquired Level 5, the self-driving division of ride-hailing company Lyft, for $550m.

This will become part of Toyota's recently established Woven Planet Holdings subsidiary.

The deal will bring together scientists and software engineers from Level 5 and Woven Planet with researchers from Toyota Research Institute (TRI) to create a team of 1200 people.

Woven Planet will have an expanded footprint beyond its Tokyo headquarters, with offices and engineering teams in California and London.

Woven Planet and Lyft have signed commercial agreements to use the Lyft system and fleet data to accelerate the safety and commercialisation of the automated-driving technology that Woven Planet will develop.

Lyft will receive approximately $550m in cash, with $200m paid upfront subject to certain closing adjustments and $350m of payments over a five-year period.

"This acquisition advances our mission to develop the safest mobility in the world at scale," said James Kuffner, CEO of Woven Planet. "The Woven Planet team, alongside the team of researchers at TRI, have already established a centre of excellence for software development and technology in the Toyota group."

Logan Green, chief executive officer of Lyft, added: "This announcement launches Lyft into the next phase of an incredible journey to bring our mission to life. Lyft has spent nine years building a transportation network that is uniquely capable of scaling autonomous vehicles. This deal brings together the vision, talent, resources and commitment to advance clean, autonomous mobility on a global scale."

Inside Woven Planet's office

Issue 90
June 2021

IN THIS ISSUE

Key Foundry develops 0.13µm automotive process

Key Foundry, the only pure-play foundry in Korea, has completed the development of its first automotive semiconductor using its Gen2 0.13µm embedded flash process and will begin full-scale mass production this year.

Key Foundry has mass produced consumer products, such as MCUs, with its Gen1 0.13µm embedded flash technology for more than five years. The Gen2 0.13µm embedded flash process can be applied to automotive parts, satisfying the reliability criteria of AEC-Q100 grade one.

The embedded flash technology passes all the AEC-Q100 grade-one tests by adding ECC memory in the embedded flash IP.

This design increases the flash memory reliability of the technology and makes it suitable for automotive applications.

This process is being first applied to an MCU product for a toll transponder of one of its Korean customers. The 128kbyte e-flash IP is embedded in the product; mass production will begin in full swing this year.

"We are excited to complete the first product development applying the Gen2 0.13µm embedded flash technology and begin mass production," said Tae Jong Lee, chief executive officer of Key Foundry. "We will take full advantage of our accumulated technological strengths to offer highly reliable and cost-competitive foundry services and continue to increase the portion of automotive semiconductors in our portfolio."

Key Foundry expects to expand the technology's applications to touch ICs, wireless charge ICs and other various automotive products.

In addition, Key Foundry is also developing an embedded flash process in 0.11µm.

The plan is to provide a flash IP with a memory density as high as 4Mbit by reducing the size of flash cell in response to increasing demand for higher memory density.

Ouster lidar guides mining trucks

Lidar sensors from Ouster are being used in autonomous mining trucks from Chinese firm Waytous.

"Mines are relatively safe spaces to deploy autonomous driving technology because they are located in places with few people and limited external interference," said Long Chen, CEO of Waytous. "Such an enclosed environment is ideal for the early deployment of autonomous driving technology."

Large mining equipment has many blind spots, similar to big tractor-trailers, long-haul lorries or large forklifts. With long hours of operation, the risk of fatigue while driving equipment is quite high. By fully or semi-automating mining equipment with lidar technology that can 3D map the environment and detect objects in and around the path, these operating problems can be reduced.

Ouster's OS0 and OS1 lidar sensors have a cold start function and can operate in an environment of -40°C, which meets the automotive specifications for cold weather performance.

The digital lidar passes strict shock and vibration tests before leaving the factory so it can operate and provide accurate lidar data in bumpy, unpaved environments.

Soliton controls racing car over 5G

Soliton Systems and 5G Hub have joined forces to demonstrate the remote control of a racing car via 5G.

Soliton Systems makes low latency streaming products over cellular networks. It is working with with Vodafone Ziggo and Ericsson Telecommunication as part of the 5G Hub initiative to demonstrate a remotely driven racing car. It will be controlled using a video live stream where it will be remotely driven using 5G.

"With the 5G Hub, we want to show something spectacular that could really demonstrate the reliability and capabilities of our ultra-low latency units for live streaming, combined with the power of 5G," said Go Ito, managing director of Soliton Systems in Europe. "We thought what could highlight our competencies better than remotely controlling a high-speed race car. Even a few milliseconds delay or loss of video could be catastrophic."

Soliton's encoding technology with its secure Rascow2 transmission protocol uses multiple networks simultaneously for improved connectivity and redundancy. Operations such as remote driving, remote heavy machinery operation, remote drone control and remote surgery could all become normal.

"Soliton is a major contribution to the ecosystem of the 5G Hub," said Edwin Dijkstra, architect at Ericsson. "Our partnership allows us to jointly showcase futuristic applications with low latency. The 5G Hub's aspiration is to be a breeding place for new technologies, and this is being achieved by our ambitious remote driving car demonstration."

Soliton shows how 5G can control racing cars

The 5G Hub is a consortium of four founding fathers – Vodafone Ziggo, Ericsson, Brainport Development and High-Tech Campus. Based in Eindhoven, the 5G Hub has a testing laboratory, training facilities and a demo studio with 5G and IoT capabilities.

Valens tapes out Mipi A-Phy chipsets

Semiconductor company Valens has completed a successful tape-out of its VA70XX chipsets, said to be the first to comply with the Mipi A-Phy standard for long-reach, high-speed automotive video connectivity.

The samples are set to be evaluated by OEMs and tier-one suppliers, some of whom have included Mipi A-Phy connectivity in their product roadmaps.

System-on-chip and camera sensor vendors have also begun to integrate the device into their modules.

"Our chipsets lay the groundwork for the next stage in the adas and autonomous evolution, as the industry transitions towards level-two-plus and beyond," said Valens CEO Gideon Ben-Zvi.

With more sensors being integrated into cars, there is an increasing need for high-speed video links that are impervious to electromagnetic interference, data loss and latency. The chipsets offer a high immunity to EMI with a packet error rate of 10-19, equivalent to one packet error per 10,000 car lifetimes.

The family includes serialiser and deserialisers, operating with link speeds of up to 8Gbit/s. The chipsets support connectivity of multiple CSI-2-based cameras, radars, lidars and other sensors for up to 15m, with four inline connectors.

Integration of the chipsets should reduce costs by implementing an industry connectivity standard, lowering harness costs through simpler connector and wiring infrastructure, and shortening design cycles through automatic tuning of the serdes to the given cable.

"There is tremendous momentum building for Mipi A-Phy compliant chipsets," said Valens SVP Gideon Kedem. "With leading industry players behind A-Phy and additional standardisation bodies like the IEEE adopting it, this technology is quickly becoming the de facto standard for in-vehicle sensor connectivity."

TriEye and Continental bring SWIR to driver monitoring

Israeli start-up TriEye, a developer of short-wave infra-red (SWIR) sensors, is working with Continental Engineering Services on implementing SWIR imaging in driver monitoring systems.

Fabless semiconductor company TriEye's sensing is effective in difficult visibility conditions, such as high-glare from the sun, shade patterns from the surroundings, or approaching vehicle headlights. These scenarios are paramount for the safety and reliability of in-cabin monitoring.

Beyond enhanced visibility, the companies will evaluate the value of SWIR for remote material sensing compared with other sensors.

With TriEye's technology, Continental will be able to offer its customers sensing options such as enhanced user identification capabilities or precise seat belt detection.

"Continental is working to integrate safety and vehicle dynamics technologies to realise safe and enjoyable driving," said Uwe Mühlberger, director at Continental Engineering Services. "When integrating TriEye's SWIR sensing technology, our advanced interior sensing and driver monitoring benefit from its high robustness and reliability."

InGaAs-based SWIR cameras have been around for decades, serving the science, aerospace and military industries, but have not yet been used for mass-market applications due to their high costs and large form factor.

Based on nanophotonics research, TriEye and its manufacturing partner enable the fabrication of a cost-effective, cmos-based HD SWIR sensor at scale, that is mass-produced and small in size.

"We are proud and delighted to announce our collaboration with Continental, which marks another meaningful step in solving the vision challenges of automotive systems," said Avi Bakal, TriEye's CEO. "Our joint work on designing superior in-cabin monitoring is bearing fruits and we already see significant interest from the market."

Among companies that are collaborating with TriEye are sports car maker Porsche and automotive supplier Denso.

Stellantis and Foxconn form in-cabin electronics venture

Car maker Stellantis has formed a joint venture with Foxconn to develop in-vehicle electronics.

The Mobile Drive 50-50 joint venture will combine Stellantis' vehicle design and engineering expertise with Foxconn's development in software and hardware for smartphones and consumer electronics.

The aim is position Mobile Drive at the forefront of efforts to deliver in-cabin information and entertainment capabilities, seamlessly connected inside and outside the vehicle.

Stellantis and Foxconn hope to change the in-cabin experience

"Today, there's something that matters just as much as beautiful design or innovative technology, it's how the features inside our vehicles improve the lives of our customers," said Carlos Tavares, CEO at Stellantis. "Software is a strategic move for our industry and Stellantis intends to lead with Mobile Drive, a company that will enable the swift development of connectivity features and services that mark the next great evolution of our industry."

All development by Mobile Drive will be co-owned by Stellantis and Foxconn. The Netherlands-based joint venture will operate as an automotive supplier, competitively bidding to supply software and related hardware for Stellantis and other car makers.

"The vehicles of the future will be increasingly software driven and software defined," said Foxconn chairman Young Liu. "Customers today and in the future demand and expect ever increasing software driven creations to connect the drivers and passengers with the vehicle inside and out."

Foxconn will participate through its FIH Mobile subsidiary.

"Leveraging Foxconn's extensive knowledge of user experience and software development in mobile ecosystems, Mobile Drive will offer the disruptive smart cockpit that will seamlessly integrate the automobile into the driver's mobile-centric lifestyle," said Calvin Chih, chief executive officer at FIH.

Mobile Drive will focus on infotainment, telematics and cloud service platform development.

Software innovations are expected to include artificial intelligence-based applications, 5G communications, upgraded over-the-air services, ecommerce opportunities and smart cockpit integrations.

Foxconn and Stellantis previously partnered in the development of the Airflow Vision design concept.

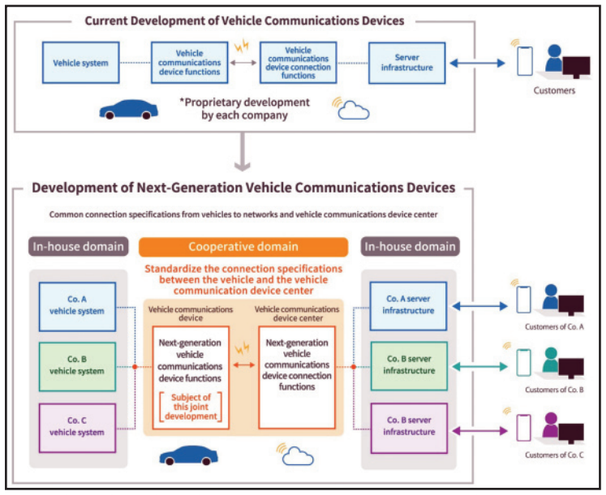
"With this partnership, we will push the boundaries in connected car technology and bring immersive experiences yet to be imagined," said Yves Bonnefont, chief software officer at Stellantis. "Mobile Drive ultimately gives us the agility we need to provide the digital experience of the future at the speed our customers demand."

Car makers team up on communication devices

Suzuki, Subaru, Daihatsu, Toyota and Mazda are jointly developing technical specifications for vehicle communications devices.

They aim to promote the common use of communications systems by using connected services to link automobiles and society for early provision of safer and more convenient connected services.

Within the field of Case (connected, automated, shared and electric), advances are being made in the connected domain, in relation to the communications and data aspects of technology and business including cloud services, IoT, big data and AI.



Plan for developing communications devices

Individual automobile manufacturers are independently developing vehicle communications devices and, even where the same connected services such as remote operation functions are provided, each company is adopting a different approach in proceeding with development and deploying relevant resources.

In response, this group aims to provide safer and more convenient connected services to customers as early as possible, by positioning the development of vehicle communications devices, which are basic functions of the connected car, as a cooperative domain.

Suzuki, Subaru, Daihatsu and Mazda, while incorporating their own technologies into the base vehicle communications technologies developed by Toyota, will together build systems for connected cars with common connection specifications from vehicles to networks and the vehicle communications device centre.

As a result, by stabilising the communication quality between vehicles and vehicle communications device centre, it should be possible to provide more convenient connected services to users, such as clearer calls between users and operators and faster connection speeds.

At the same time, it will be possible to reduce the development burdens of each company and simplify operation and version upgrades that include additional functions.

Autocrypt goes to university to secure vehicles

Electric and autonomous vehicle cyber-security provider Autocrypt has partnered the Shield Automotive Cybersecurity Centre of Excellence at Canada's University of Windsor to develop secure connected and autonomous vehicles.

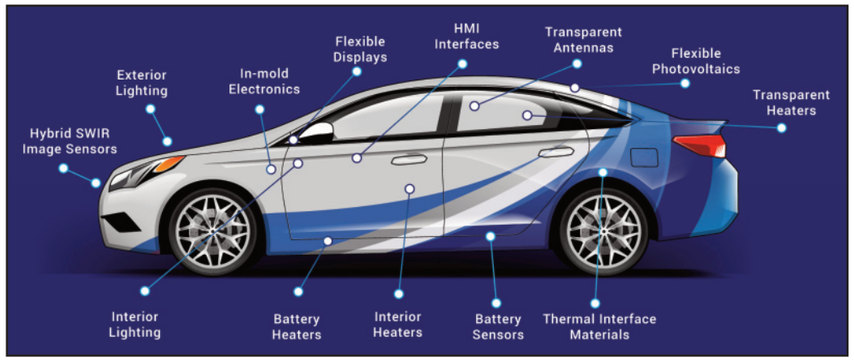
Autocrypt is an automotive security provider focused on raising awareness of prioritising and providing security to mitigate risks.

It has secured over 5000km of smart highways and roadways on the Korean peninsula, winning C-ITS contracts for the nation. Its security operations centre provides coverage of the internal vehicle system and V2X communications.

By detecting and preventing unwanted access, its offerings ensure a secure environment for electric, connected and autonomous vehicles.

Shield focuses on research and innovation of cyber-security technology as well as education and training for students and corporations to raise awareness for the need to prioritise cyber security.

"The goals of Shield and Autocrypt align together exceptionally well," said Sean HJ Cho, Autocrypt's director of business development. "This partnership will allow us to work more closely with the connected and autonomous vehicle security landscape in Canadas."



Applications for printed and flexible electronics in vehicles

EV shift drives growth in printed electronics

The shift to electric vehicles and autonomy will drive the printed electronics automotive market to $12.7bn by 2031, according to IDTechEx.

The report says that technological transitions towards electric vehicles and increased autonomy occurring simultaneously create opportunities for many new technologies, including printed and flexible electronics. For example, the ability to make electronics on thin flexible substrates enables weight to be reduced, key for electric vehicles.

Furthermore, the conformality associated with flexible electronics suits emerging automotive interior design trends with organic curves replacing flat surfaces.

The report is structured around three technological transitions: electrification, autonomy, and an increased focus on the interior for differentiation.

With EVs, battery capacity is strongly dependent on temperature. This means printed arrays of temperature sensors can provide local monitoring and printed heaters can be integrated within the same functional film.

Vehicles across the price range now contain adas functions. Over time, the level of autonomy will increase, with full level-five autonomy expected in some vehicles within a decade.

This creates opportunities for multiple sensor technologies and features such as transparent heaters, integrated antennas, and even low-resolution flexible displays for the exterior to interact with pedestrians.

Car makers are increasingly turning to interior design and features to differentiate their products. Given their lightweight and conformable nature, this transition means that interior applications provide an opportunity for printed and flexible electronics.

This trend is already being seen with the rapidly increasing adoption of displays, which is set to continue and extend to curved and flexible displays.

Human machine interface (HMI) technologies, more simply described as pressure or touch sensors, are especially promising. Already widely used in seat occupancy sensors, printed pressure sensors are likely to find their way into control panels to provide a wider range of inputs than purely capacitive touch sensors without the expense of mechanical switches.

Mix updates telematics AI offering

SaaS provider Mix Telematics has updated its Vision AI telematics offering to help fleets improve driver safety and reduce operating costs.

Vision AI uses machine vision technology to detect and alert drivers and managers of unsafe or risky driving behaviour.

Driver monitoring includes for fatigue, phone use, distraction, smoking and seat-belt use, while passive adas includes forward collision and lane departure warnings.

In-cab, audible alerts warn drivers in real time so that immediate corrective action can be taken, while video footage is made available to managers via online software and mobile apps for driver coaching.

"We're excited about the significant value this brings to our customers, as well as the growth opportunity it presents to Mix," said Catherine Lewis, Mix EVP. "Reducing driver distraction and fatigue is key to improving driver, passenger and road safety, and reducing crashes. Evidence based footage also provides context to improve driver behaviour and coaching, and enables companies to exonerate claims and reduce costs."

Volkswagen and Argo test self-driving vans

Volkswagen and Argo AI are starting international trials of commercial vehicle autonomous driving.

With development already underway, the first self-driving prototypes based on the future ID Buzz will commence operations in Munich this summer.

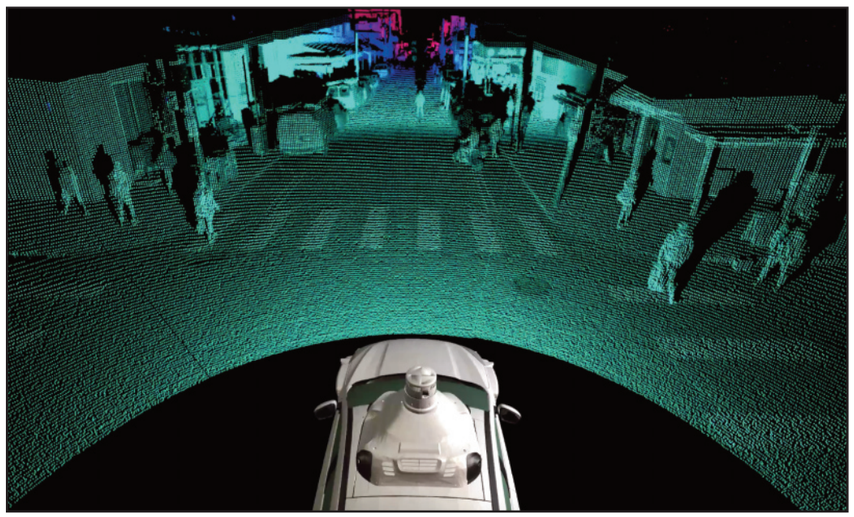
This is a milestone in the group's international collaboration, as part of which Volkswagen Commercial Vehicles is facilitating the development of level four autonomous driving technology for self-driving vans.

Light commercial vehicles are a logical place for using autonomous transportation of people and goods.

"Our aim with the self-driving version of the ID Buzz is to facilitate commercial deployment of transport and delivery services starting in 2025," said divisional director Christian Senger. "In select cities, customers will be able to have a self-driving vehicle take them to their destination.

"The delivery of goods and packages will also be made much easier through our autonomous driving service."

For the integration of the technology into the all-electric ID Buzz AD, Volkswagen has founded a dedicated business section and partnered with Argo AI, a US-headquartered autonomous vehicle technology company that is developing the self-driving system.



VW will use Argo lidar technology in AD trials

Earlier this year, Argo integrated its self-driving system with a Volkswagen vehicle prototype to begin testing in Germany.

"We believe Argo AI has the largest urban self-driving testing footprint, with operations in six cities in the USA," said Bryan Salesky, CEO of Argo AI. "We are excited to begin testing our self-driving system on European roads later this year, building on the initial work we're doing now at a new test track we established next to Munich airport."

Volkswagen and Argo AI regard the use of a combination of sensors – including lidar, radar and cameras – essential for safe autonomous driving capability.

Argo AI recently unveiled its latest lidar sensor, which allows it to see objects from 400m away.

Argo's proprietary Geiger-mode lidar has the ability to detect the smallest particle of light – a single photon – which is key to sensing objects with low reflectivity.

"This technology will be integrated in the self-driving system of Volkswagen Commercial Vehicles' autonomous driving vehicles," Salesky said.

There are also plans for the commercial use of the technology for transport service providers. Volkswagen subsidiary MOIA will in 2025 become the first user of the self-driving ID Buzz AD.

"MOIA has extensive experience in the field of mobility services and fleet management," said CEO Robert Henrich. "Within a very short time, we have set up Europe's largest, all-electric ride-pooling service and provided mobility to millions of passengers. We bring this expertise to the cooperation with Volkswagen Commercial Vehicles and Argo AI."

Hamburg will be the first city to offer autonomous ride-pooling with an ID Buzz. MOIA is the largest ride sharing provider in Hamburg and employs 1200 people.

Apex picks Axivion for static analysis

Apex AI, a company developing safety-certified automotive software, has chosen the Axivion Suite as its preferred tool for static analysis, mainly because of its coverage of the Autosar C++ 14 standard and continuous integration.

Axivion provides software for static code analysis and protection from software erosion.

It is helping pave the way for autonomous driving and software-defined vehicles.

Axivion Suite supports the development of Apex OS, a safe, secure and reliable software communication layer for self-driving applications, and Apex Middleware, a complete and integrated offering for intra- and inter-ECU communications

The suite also supports the certification of Apex OS and Middleware to ISO 26262 Asil-D.

Apex AI was founded in 2017 and investors include Toyota, Volvo, Jaguar Land Rover, Airbus and Hella. Recently, Toyota's Woven Planet announced its cooperation with Apex AI for developing and deploying a production-ready autonomy stack for its Arene vehicle development platform.

Apex OS has been forked from ROS 2 and has been developed into a real-time deterministic safety framework and middleware for safety-critical applications for all mobility systems from autonomous vehicles to robotaxis and automated trucking.

Apex Middleware is based on ICEoryx, another open-source offering resulting from a collaboration between Bosch and Apex AI engineers in Germany, and serves applications from powertrain over adas to automated driving.

The static code analysis tool convinced Apex with its coverage of the Autosar C++ 14 standard. It integrates with the cross-platform IDE CLion and the firm's continuous integration workflows.

With the suite, Apex can analyse its control and data flow and add exceptions and suppressions to rule violations in C++. This helps engineers continuously analyse their source code in the build process and safeguard their software's quality.

Apex OS has been certified by TÜV Nord to ISO 26262 Asil-D.

"We have evaluated several static analysis tools, and Axivion Suite clearly stood out in our tests," said Dejan Pangercic, CTO of Apex AI. "The tool performed best in terms of Autosar C++ 14 coverage and convinced us through its ease of use, control flow and data flow analysis, and report generation. Axivion Suite has already become a mainstay component in our development workflow and a valuable component of our devops pipeline."

Apex AI uses Axivion in software development for autonomous cars

Innoviz and Vueron design lidar-only cars

Innoviz, a provider of solid-state lidar sensors and perception software, and Vueron Technology, a South Korean developer of lidar perception software and autonomous driving technology, are building an autonomous platform for lidar-only self-driving vehicles.

Vueron received one of the few self-driving permits issued by the South Korean government in January. Following this, it executed a 414km fully automated, lidar-only drive from Seoul to the southern port city of Busan, at a maximum speed of 100km/hr.

The mandated safety driver on board did not hold the steering wheel at any time during the five hours of the drive.

"We are impressed by Vueron's high-performance lidar perception software and appreciate their unique understanding of the automotive lidar market in South Korea," said Omer Keilaf, CEO of Innoviz.

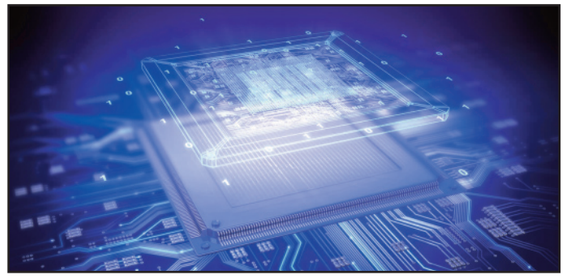
Joseph Kim, CEO of Vueron, added: "Both companies are fortunate to have had the same early-stage investor, Naver."

Siemens acquires Fractal Technologies

Siemens Digital Industries Software has acquired Fractal Technologies, a provider of production signoff-quality IP validation in the USA and the Netherlands.

With this acquisition, Siemens EDA users can more quickly and easily validate internal and external IP and libraries used in their IC designs to improve overall quality and speed time to market.

Fractal's offerings include a suite of IP validation and comparison checks used by top-tier foundries, IP providers, integrated device manufacturers and fabless semiconductor companies to accelerate time-to tapeout and improve silicon results by enabling design data quality and integrity.



"Today's semiconductor design teams are seeking every possible advantage to deliver advanced, high-quality SoCs to market as rapidly as possible," said Ravi Subramanian, senior vice president at Siemens Digital Industries Software. "Our acquisition of Fractal Technologies, combined with the Solido product family, provides customers a tremendous advantage with comprehensive IP validation that can speed design schedules, improve power, performance and area, and identify sources of silicon failure before design tapeout."

Siemens plans to add Fractal's technology to the Xcelerator portfolio as part of its suite of EDA IC verification offerings. Fractal's products will join the Solido software product family, including the Solido characterisation suite, which remains a standard for machine-learning acceleration of IP validation and characterisation.

The machine-learning technology within Solido enables variation-aware design and library validation for IP, from mature technologies to process nodes.

"Semiconductor IP such as standard cells, memories, IOs and other specialised custom IP are the critical foundation upon which the world's chips are built," said Rene Donkers, chief executive officer for Fractal Technologies. "Being part of Siemens allows us to accelerate our R&D efforts, support a growing customer base, and further our vision to help enhance design closure predictability and turnaround time."

Siemens' acquisition of Fractal Technologies closed last month. Terms of the transaction were not disclosed.

Taiwan show tackles e-mobility

In response to the changes in the global automotive industry, Taiwan industry body Taitra has created a new trade show called 2035 E-Mobility Taiwan.

Due to be held from 20 to 22 October 2021, the show aims to help industries connect with the world, realise the vision of future mobility, and seize the business opportunities in the global smart mobility market that is projected to become a trillion-dollar industry.

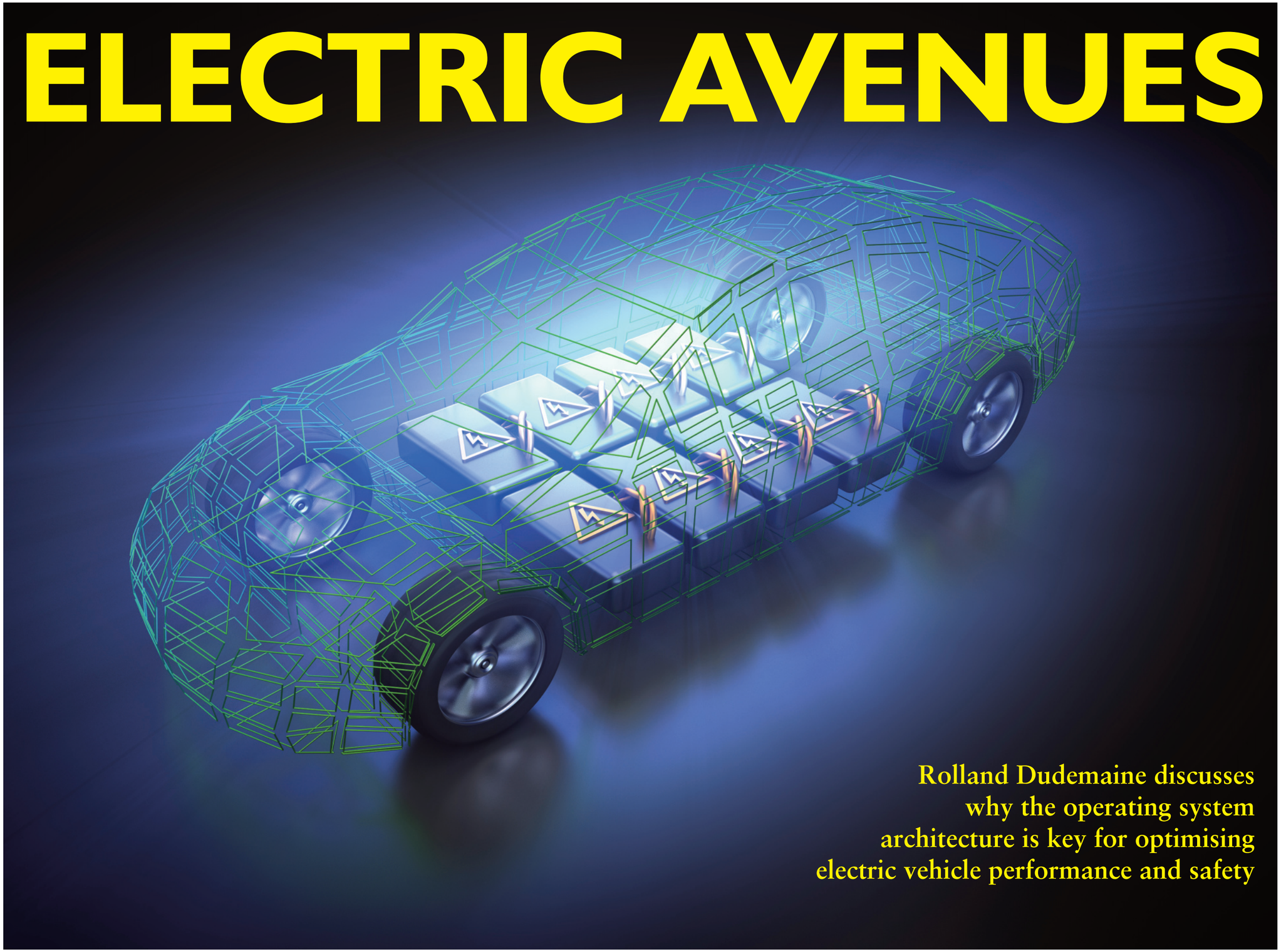
Domestic and foreign manufacturers will be invited to exhibit battery module, electric machine, electrical control units, adas, lidar, IoV, 5G, information security, human-vehicle communications, service software, in-vehicle entertainment, sharing platforms, MaaS, PaaS, and others, with the goal of presenting the electric vehicle and self-driving car ecosystem.

The event will be held at the Taipei Nangang exhibition centre alongside the existing Taitronics electronics show and AIoT Taiwan.

James Huang, Taitra chairman, said: "What's next, for Taiwan and for the world? A computer, on wheels, on the roads of every city, always connected, and always ready to help people move towards their goals. The e-mobility dream. The dream of kids who grew up in the 80s. Taiwan will help make it happen."

James Huang: "What's next, for Taiwan and for the world?"

ELECTRIC AVENUES



Rolland Dudemaine discusses why the operating system architecture is key for optimising electric vehicle performance and safety

As the world moves towards greater adoption of the electric vehicle (EV), design engineers are having to shift their focus from factors that have traditionally governed the design of internal combustion engine (ICE) vehicles. It is clear that significant changes to hardware and software are required.

Many governments around the world accept that climate change is a major issue and they have looked to the widespread adoption of electric vehicles as one way of reducing environmental pollution. Some governments have already signalled that sales of new ICE vehicles will be banned in the near future.

This presents a challenge when designing the electrical infrastructure of vehicles because – in the absence of a powertrain based around an ICE – new ways must be developed to power alternators, operate heating systems within the vehicle, manage infotainment and more.

The shift in vehicle propulsion from combustion engines to electric motors, combined with the requirements of autonomous driving, has also resulted in an overdue upgrade of the entire E/E architecture and the appearance of software defined architectures (SDAs), see Fig. 1.

Infrastructure

When designing an electrical infrastructure for use in EVs, a host of new priorities emerge. These include optimal efficiency of electric energy throughout the vehicle and safe battery management to ensure maximum longevity and performance. For

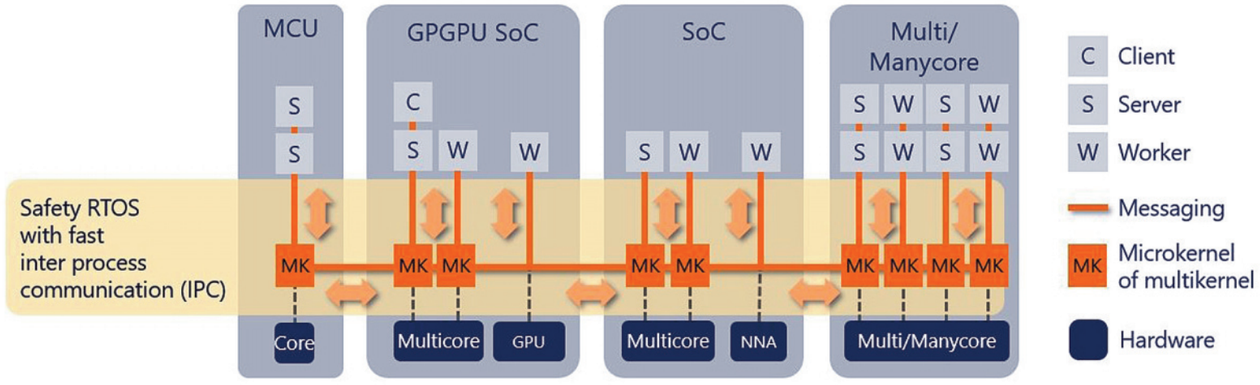


Fig. 1: Modern software defined architecture (SDA)

example, it becomes more important than ever to monitor a battery's condition, including cell balancing and internal temperature. Safety becomes even more of a priority with EV batteries since they generally operate at higher voltages than a 12V lead-acid battery.

Drivetrain electrification means that a greater emphasis on centralised vehicle electrical infrastructures is required.

The same goes for other factors such as the trend towards autonomous driving capabilities and the introduction of V2X connectivity.

Centralisation reduces the need to have several separate electronic control units (ECUs) distributed throughout the vehicle and improves performance, quality and cost ratios by making vehicles more software-defined. In EVs, this aggregation and integration of previously multiple domains enables designers to reduce the complexity and weight of wiring systems while saving a battery's energy. The result is a longer driving range.

This move towards centralised control of demanding vehicle systems has driven the market for low-power, high-performance computing, which in turn has led to the development of highly efficient, heterogeneous, many-core processors capable of handling such diverse workloads.

At the same time, scalability and flexibility in a vehicle's electrical infrastructure have become paramount. OEMs understand the importance of this when they are looking to develop differentiated product ranges cost-effectively by executing a variety of applications and features on different EV models, using various hardware platforms across their product ranges, and bringing new models to the market within the shortest possible timescales.

Due to the new software-based development strategy, OEMs must provide permanent wireless software updates over the air (OTA). But wireless networks have a big attack surface for hackers, therefore cyber security is becoming an increasingly important issue. With vehicles featuring ever-growing levels of autonomy and connectivity, the potential for hacking also gets bigger, threatening a person's safety and even compromising national security.

Existing standards such as ISO 26262 may no longer be enough when it comes to autonomous driving, for example, which is why new standards such as Sotif (safety of the intended functionality) and UL4600 have been created. It's clear that OEMs and tier-one suppliers need hardware and software architectures they can trust if they are to meet the many challenges that the new EV market brings.

Software

While changes to the hardware are one element design engineers must focus on, equally important is the software platform that drives the hardware and, ultimately, the vehicle. Bringing all the various computing elements in a vehicle together is the operating system (OS) architecture.

Fig. 2 shows an automotive software platform that uses the Autosar Adaptive Platform (AP). Designed with the demands of EV modern E/E architectures in mind (Fig. 3), this platform is intended for use in systems certified up to

ISO 26262 Asil D. By standardising foundation-layer software and enabling planned dynamics, Autosar AP makes adaptability possible without having to compromise on how safety-critical processes are managed.

To achieve planned dynamics, it is important to ensure all processes are registered during system integration and privileges are restricted for starting processes. Also, Autosar AP oversees all communications between application processes and a range of external entities according to strict policies that are established through system integration.

The platform illustrated is based on a service-oriented architecture (SOA), which is particularly suitable for the kinds of centralised and zone-based electrical architectures that operate within EVs. Flexibility and transparency are provided by the SOA in terms of implementation and mapping because it facilitates distributed computing by ensuring the location of the server providing the service is independent of its use.

Furthermore, transparency delivers a solid foundation for freedom from interference (FFI) – one of the key components in functional safety. However, delivering FFI requires a physical mechanism such as a processor's memory management unit. To counter this, the operating system provides a virtual alternative to the mechanism through its OS processes, which are the physical instances of the services and applications.

In the architecture shown in Fig. 2, many components operate as processes and frequent interaction between them is essential if, for example, an application process has to use a service that is being run as another process. While functional safety has traditionally been based on protecting processes from each other, Autosar AP creates as an OS feature reliance on inter-process communication.

This can not only mean poorer performance than provided through intra-process communication, but it can also become a significant performance issue for the system once software integration is complete.

Microkernel

It is becoming clear that traditional operating systems will fail to provide the level of functionality required to service all the parts of a centralised hardware architecture and maintain the performance that EVs demand. They will simply be unable to cope with the need for unimpeded inter-process communication or the numbers of intercommunicating processor cores in multi- and many-core CPUs.

Unlike traditional systems, a multikernel or distributed

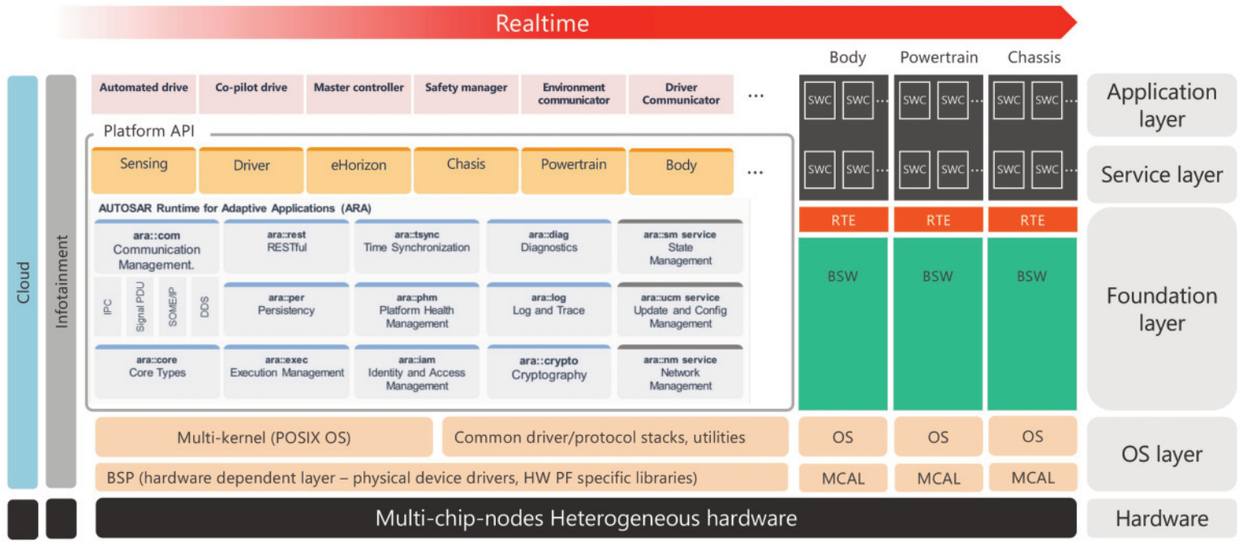


Fig. 2: Software platforms of the future must support safety, scalability and real-time determinism

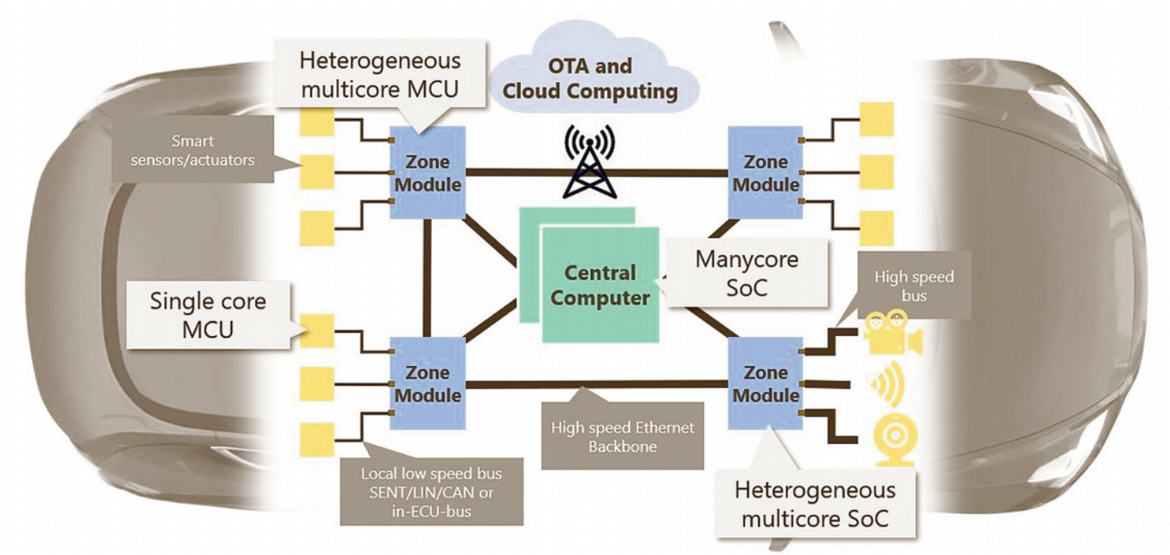


Fig. 3: Hardware used in modern E/E architectures

microkernel real-time operating system (rtos) is suitable for servicing large numbers of interlinked cores and processes. Such a system ensures a rapid and deterministic response, which is vital when dealing with real-time control applications in such areas as the powertrain.

What makes a distributed microkernel rtos different from a microkernel rtos is the elimination of cross-core kernel locks that prevent concurrent accesses and can impair performance. A distributed architecture makes sure that parallelism is maintained.

A distributed microkernel rtos can satisfy the demands for safety, scalability, high-performance and real-time determinism in the automotive industry. It becomes possible to scale in a variety of ways to handle small or large sets of functions, applications can be connected between microkernels, and users can customise the adaptation layer to suit their own requirements.

Applicable for use with multi- and many-core processors, such an rtos can enable dynamic Autosar AP and static Autosar CP (Classic Platform) to run on the same chip by supporting inter-cluster message passing.

At the same time, a layered scheduling mechanism can deliver hard real-time determinism, which makes high-throughput computing and load balancing possible. Also, standard support is available for multi-process Posix and Autosar programming interfaces and there are special-purpose APIs for functions such as distributed shared memory, fast messaging, non-uniform memory access management, thread-pool and others.

Conclusion

The move towards EVs is putting increasingly tough demands on vehicle electrical infrastructures and these will intensify as the industry shifts to full-electric powertrains. As centralisation and aggregation increase for functions that were traditionally handled by individual ECUs, multi- and many-core CPUs are being adopted as a means of achieving a well-balanced mix of low power consumption, high-performance computing and energy efficiency.

The issue is these are not best served by conventional operating systems and designers must appreciate the importance of selecting the correct OS. They should consider a distributed microkernel rtos if they want to increase the advantages of using multi- and many-core processing in the vehicles of tomorrow.

Rolland Dudemaine is vice president of engineering for eSol in Europe

BATTERY CHECK

Christopher Gobok looks at how a low-voltage battery monitor can help high-voltage electric vehicles

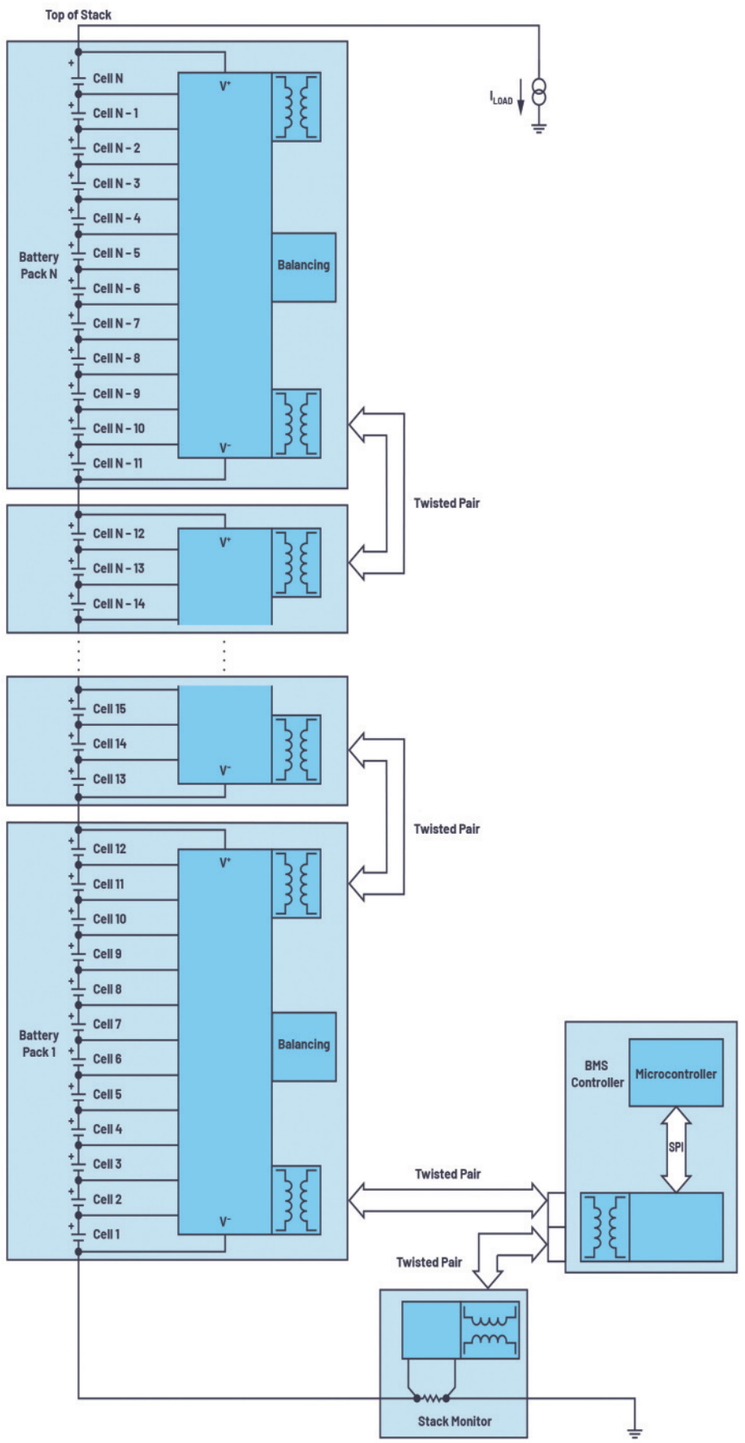


Fig. 1: Distributed EV BMS monitoring topology

Chances are those who are not already driving an electric vehicle (EV) – hybrid electric vehicle (HEV), plug-in hybrid vehicle (PHEV) or all-electric vehicle – soon will be. Range anxiety has become a thing of the past. Drivers can now help preserve the environment without worrying about being stuck in it.

Governments around the world are offering generous financial incentives to offset the premium prices of EVs, hoping to steer drivers away from buying internal combustion engine (ICE) vehicles. Some governments have taken the step of mandating auto manufacturers to build and sell EVs, hoping the market will eventually be dominated by them, while others have drawn a more distinct line in the sand; Germany, for example, is already pushing to ban ICE vehicles by 2030.

For much of the automobile's history, innovation has focused on improving fuel burning efficiency of the ICE, cleaning up emissions while providing a comfortable user experience. However, the vast majority of recent innovations in ICE automobiles are a direct result of advancements in electronics, such as improvements in chassis systems, powertrains, autonomous vehicles and adas, infotainment, and safety systems.

EVs have many of the same electronic systems as ICE vehicles, plus, of course, the drive train itself. According to Micron Technology, the electronics portion of an EV's value is as much as 75%, with that portion increasing as advances in semiconductor technology

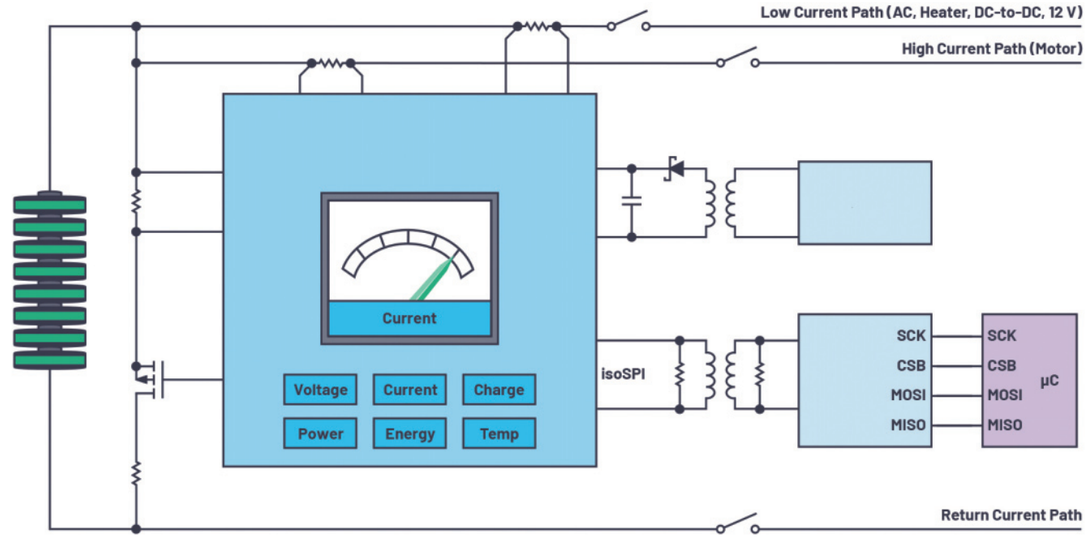


Fig. 2: Typical hook-up of a floating EV battery monitor in high-side current sense configuration

continue to drive down the cost of various electronic modules and subsystems. Even non-traditional automotive players, such as Intel, are looking for a piece of the action.

BMS

Not surprisingly, of all the electronic subsystems in an EV, manufacturers and consumers alike focus on the heart of the EV, the battery system. The battery system includes the rechargeable battery itself, Li-ion being the current standard, and the battery management system (BMS), which increases battery usage and safety. A BMS's primary function is to monitor the state of a battery or, in the case of EVs, a very large pack or stack of batteries.

A BMS typically monitors individual cell and pack voltages, currents, temperatures, state of charge (SoC), state of health (SoH), and other related functions, such as coolant flow.

In addition to the obvious safety and performance benefits afforded by BMS, accurately monitoring these parameters generally translates to a better driving experience, where drivers are well-informed of real-time battery conditions.

To be effective, the BMS measurement circuits must be precise and fast, have high common-mode voltage rejection, consume low power, and securely communicate with other devices. Other EV BMS responsibilities include recovering energy back into the battery stack (that is, regenerative braking), balancing cells, protecting the battery stack from dangerous levels of voltage, current and temperature, and communicating with other subsystems, for example, chargers, loads, thermal management and emergency shutdown.

Multiple BMS monitoring topologies are used by auto manufacturers to meet their need for accuracy, reliability, ease of manufacture, cost and power requirements. For example, the distributed topology shown in Fig. 1 emphasises high accuracy with local smarts, high manufacturability with series-connected battery packs, and low power consumption and high reliability via low power interfaces for inter-IC communications.

Here, a battery pack monitor IC is used in a low-side current sensing configuration, where the SPI communication lines are parallel with the bottom battery monitor. For enhanced reliability, a dual communication scheme can be realised by connecting a second SPI transceiver to the top of the battery stack and creating a ring topology that can communicate in both directions.

Isolated communication with the SPI master controller is implemented via a signal

Table 1: Configuration options for the three data-acquisition channels

Channel	Configuration		
	Single shunt	Dual shunt	
1	Slow	Slow	Fast
2	Fast	Slow	Fast
Aux	RR/fast	RR/fast	RR/fast

converter.

Fig. 2 shows a block diagram of a battery pack monitor used in a high-side current sensing configuration.

Here, the monitor uses an adjustable floating topology, enabling it to monitor a very high voltage battery stack, unfettered by its own 14.5V voltage rating. Power to the monitor is supplied via an isolated flyback converter with VCC connected to the positive battery terminal.

To simplify setup, the monitor's five ADCs form three data acquisition channels. Each channel can be configured for one of two speeds, depending on the application, as shown in Table 1.

For example, two channels can be used to monitor a single shunt resistor: one channel for slow (100ms) high precision current, power, charge and energy measurements; the other for fast (782μs) snapshots of current, synchronised to battery stack voltage measurements for impedance tracking or pre-charge measurements.

Alternatively, two different sized shunt resistors monitored by two separate channels (again, as shown in Fig. 2) allow users to balance accuracy and power loss for each shunt. Meanwhile, the third auxiliary channel can take either fast measurements of selectable buffered inputs or auto-round-robin (RR) measurements of two configurable inputs, stack voltage, die temperature, supply voltage and reference voltage.

When any of the three data acquisition channels are configured for fast mode (782μs conversion time and 15bit resolution), the monitor can synchronise its battery stack voltage and current measurements with cell voltage measurements from a multicell battery monitor to infer individual cell impedance, age and SoH. With this information, stack battery life can be assessed, since the weakest cell ultimately determines the SoH of the entire stack.

Since SoH is a point in the life cycle of a battery or battery stack and a measure of its condition relative to a fresh battery, it is important to use accurate EV BMS monitors not only to increase driving range, but to reduce unexpected battery failures.

Because the monitor can track the minimum and maximum values of current, voltage, power and temperature data, the bus and host can spend clock cycles on other tasks, instead of continuously polling the monitor. In addition to detecting and storing the minimum and maximum values, the monitor can issue an alert if any user-defined thresholds are exceeded, again releasing the host controller and bus from polling duties. Some monitors can also generate an overflow alert after a specified amount of energy or charge has been delivered, or when a pre-set amount of time has elapsed.

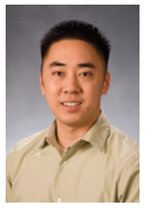
To ensure monitoring accuracy, a monitor can provide programmable gain correction factors to compensate for the tolerances of measurement components: two for shunt resistors, a battery voltage divider and four multiplexed inputs. These correction factors can be stored in external eeprom to enable a modular approach to factory calibration of battery packs.

By continuously compensating for both tolerance and temperature effects, not only is monitoring accuracy enhanced, but lower cost external components can be used.

Conclusion

EVs have gone mainstream, leading to an inflection point of high-volume adoption. To stay competitive, system designers need to keep a close eye on both battery and BMS technologies, which profoundly affect the end-user experience.

Christopher Gobok is a product marketing and operations manager for power systems management products at Analog Devices



Biometric sensors are revolutionising car safety

Pia De Los Reyes asks if one of these six technologies could replace the seat belt as the greatest vehicle safety invention

As the automotive industry makes strides towards success with autonomous vehicles and car connectivity, it's important to discuss how car safety will evolve with the times.

In the sixty years since its invention by Volvo engineer Nils Bohlin, the three-point safety belt has saved over one million lives and solidified its place as the greatest traffic safety invention to date. With automotive transportation achieving greater autonomy each year, new car safety upgrades are helping reimagine the protection of passengers in the same way the seat belt did.

To keep a pulse on what high-tech car upgrades may be in line to usurp the seat belt as the greatest traffic safety mechanism of all time, take a look at these six technologies.

1. External airbags

Currently, airbag systems exist and operate inside cars to protect passengers from crash impacts with the car interior. An external airbag system would deploy outside of the vehicle and help absorb crash impact and ideally prevent other vehicles from entering the interior.

This invention by ZF Friedrichshafen has been shown to reduce penetration of an intruding vehicle by 30 per cent.

External airbags are intended to provide added protection in a side-impact crash. These crash scenarios are often deadly, but the ZF external airbags were shown to mitigate injury severity by up to 40 per cent in side-impact situations.

The system uses a combination of lidar, radar and other sensors to determine quickly if an external airbag would provide adequate protection to car occupants and, if deemed beneficial, triggers one to inflate on the correct side just before impact.

2. Non-pneumatic tyres

Flat tyres can cause limited handling of vehicles and result in

dangerous, even fatal, auto accidents.

It's possible to eliminate this risk altogether with the advent of non-pneumatic or airless tyres. Airless tyre technology from Bridgestone has designed a spoke structure capable of supporting a vehicle's weight without having to refill with air.

Because this technology makes it impossible for a tyre to get a flat, it has a host of safety and eco advantages.

Drivers will never again have to drive with the risk of dangerous handling or be put in the precarious position of changing a tyre on the side of the road.

Airless tyres also have benefits for the environment.

Cars with non-pneumatic tyres will be able to conserve energy thanks to less rolling resistance and end up emitting less carbon dioxide. The need for spare for tyres will also be eliminated and, when the tyres need to be replaced, their materials can be recycled into new ones in a cradle-to-cradle system.

3. AR infotainment

Current in-car infotainment systems provide drivers and passengers with access to navigation, music and the internet all on one dashboard. Although this car upgrade has been shown to increase driving distractions, augmented reality (AR) infotainment systems have the potential to promote safety as well.

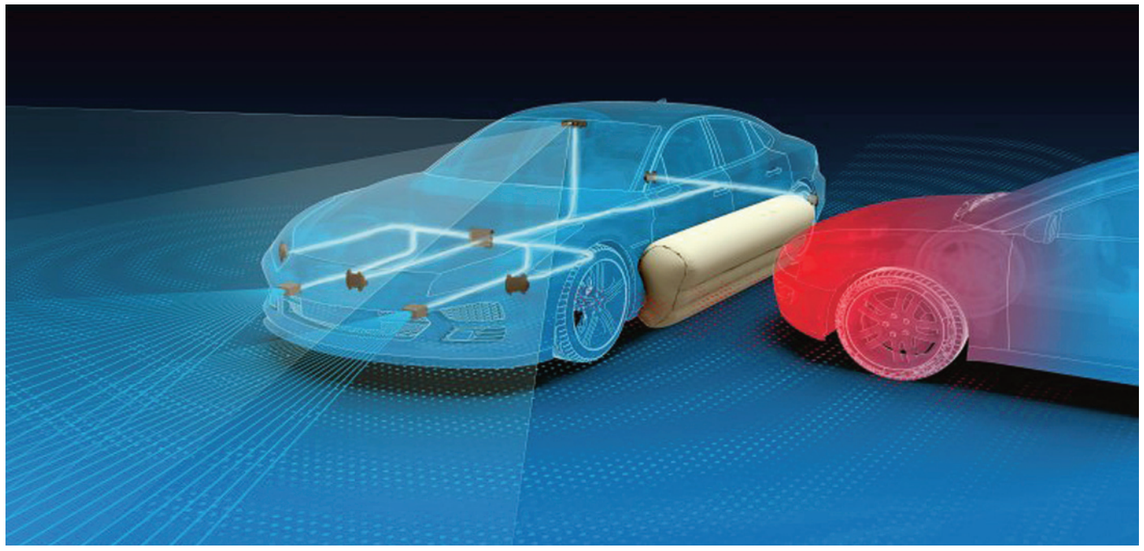
Sensor data from 3D AR systems can be used to collect information about the condition of the road and surrounding vehicles. This information can help inform adas-like automated cruise control and blind spot monitors. With 3D AR working with adas, safety systems in vehicles can be improved.

4. Safety blankets

Keeping up with its history of ground-breaking traffic safety inventions, Volvo is pioneering safety blankets as a protective mechanism for passengers in self-driving cars. Inspired by first-class air travel, safety blankets were developed to accommodate various passenger positions during travel.

The safety blanket functions the same as a seat belt and protects passengers whether they are lounging, working or sleeping. As a passenger is laying down, the blanket monitors the body and adapts to secure the strongest parts. Ultimately, this invention is intended to provide the utmost safety and protection for passengers, while also allowing for optimal comfort during travel.

Volvo has created safety blankets to protect sleeping passengers



ZF is developing external airbags to protect vehicles

5. Biometric sensors

While biometric technology is nothing new, the introduction of mobile fingerprint technology, heart rate monitors and facial recognition to vehicles is revolutionising car safety. All these technologies will be used as real-time emotion adaptive driving (READ), which will be able to gauge the emotional and physical states of the driver and passengers.

READ instantly adjusts the interior environment of the vehicle to provide better conditions for everyone in the car. Occupants will receive enhanced comfort through their seat, sound, lighting, temperature and scents. Drivers' emotional states and vital signs will also be monitored to help with reactions to driving conditions.

6. Shared AVs

With many companies already piloting versions of autonomous vehicles (AVs), the introduction of 5G will make AVs more reliable and keep the technology safe. Fully autonomous cars remove the need for human input, thus removing the risk of human error on the road. This is especially a perk for individuals with disabilities who can't drive independently or elderly people who shouldn't be driving anymore.

Self-driving cars will also revolutionise the concept of car ownership. With many vehicles sitting unused about 80 per cent of the time, shared AVs will become more mainstream. Car co-ownership will make self-driving car technology more accessible and affordable to the masses, while society benefits from safer roads.

Conclusion

The automotive industry continues to make advancements for the future, but it's important to put an emphasis on how safety factors into the future of transportation. Even with less driving activity during the Covid-19 pandemic, traffic deaths still rose eight per cent since 2019.

To save future human lives, it's imperative that automotive technology succeeds at reducing and ultimately removing human error from the road.

Shared autonomous vehicles, airless tyres, biometric sensing, external airbags, AR infotainment systems and safety blankets are all high-tech car safety upgrades to watch as transportation evolves. These technologies represent how engineers can optimise travel for efficiency, safety and accessibility while still increasing comfort and pleasure in the experience.

As these upgrades are introduced to the market, time will tell which ones will join the seat belt as one of the greatest traffic safety mechanisms of all time.

Pia De Los Reyes is a writer and content marketer

ON THE ROAD

BEACH BUDDY

A look at the technology inside Volkswagen's long-wheelbase Tiguan

The Volkswagen Tiguan was given an update in autumn 2020 and now it is the turn of the long-wheelbase version. Revised design, control and assist systems, premium features such as interactive IQ.Light LED matrix headlights, and touch panels to control the standard automatic air conditioner take the Tiguan Allspace to the next level.

Currently, more than every second Tiguan (55 per cent) that rolls off the production line worldwide has a long wheelbase. The XL version of the Tiguan Allspace can be fitted to become an SUV with seven seats or boast 1920 litres of storage space. Pre-sales start in the next few weeks. In Germany, it is available in the latest specification packages Life, Elegance and R-Line.

Since the start of production of the long version in 2017, around 1.5 million units of the long-wheelbase version (LWB) have been sold worldwide. The long version offered in Europe as the Tiguan Allspace is optionally available with a third row of seats – a rare specification option in this segment. This feature makes it a suitable partner for families and people with an active lifestyle.

After the major visual and technological update of the Tiguan, the Allspace is now next in line, with a sharper look, digital cockpit, added technologies, equipment matrix and connectivity. Its virtues as a spacious SUV remain unchanged; with a five-seat configuration, it offers a luggage compartment volume of 760 to 1920 litres, with the seven-seater offering 700 to 1755 litres.

The optional seats in the third row can be folded like the rear bench seat and backrest in the second row. They can be dropped to fit flush into the luggage compartment floor thus creating an even loading area.

There are three TSIs and two TDIs engines available. Upon request or depending on the equipment, a seven-speed dual clutch gearbox ensures fast, efficient gear changes and the optional 4Motion all-wheel drive offers better traction.

Due to its redesigned front, the Allspace has grown to a length of 4723mm (22mm longer); all the interior measurements are unchanged. With its newly designed front featuring an independent radiator grille and elegant signature light, VW hopes the vehicle exudes premium quality.

For the first time, the Allspace can now be ordered with IQ.Light LED matrix headlights. A further added feature is the sweeping indicator function of the LED turn signals. On either side of the redesigned Volkswagen logo, an illuminated strip in the radiator grille adds a striking visual note.

Options

Volkswagen has reconfigured and optimised the equipment matrix of the Allspace. In future, it will be available in the versions Life, Elegance and R-Line in Germany. The Elegance equipment showcases the Allspace with numerous chrome-plated elements in the interior and on the exterior as well as 19in alloy wheels.

Sporty drivers can order the Allspace in the R-Line version. A multifunction leather sports steering wheel with touch operation and R-Line logo, decorative trims in Carbon Grey, Digital Cockpit Pro and 19 or 20in wheels are some of the distinctive features.

When it comes to comfort, the front seats can be ordered in the ErgoActive version with electric four-way lumbar support adjustment and massage function.

All air conditioning, heating and ventilation functions of the standard three-zone automatic air conditioner are operated via a digitalised module in the centre console. Touch panels and sliders take the place of rotary knobs and buttons. The driver can now also choose to receive information via the full-colour head-up display.

It projects driving-related information such as speed, directions and warnings in the driver's field of vision. The already proven optional Trailer Assist system supports the driver when manoeuvring a trailer. The maximum trailer weight is up to 2.5 tonnes with the 4Motion all-wheel drive.

Automated driving

Partly automated driving is made possible by IQ.Drive Travel Assist that is used for the first time in the Allspace. Depending on the gearbox type, the system can take over steering, braking and acceleration at speeds starting from 0km/h with dual clutch gearbox or 30km/h with manual gearbox up to 210km/h. To do this, Travel Assist relies on familiar systems including adaptive cruise control (ACC) for longitudinal guidance, and lane assist fitted as standard for lateral guidance.

Digitalisation

For smart connectivity, the Allspace has a number of new infotainment systems – latest generation MIB3 – that are linked up to a wide range of online services.

An online connectivity unit (OCU) with integrated eSIM allows users to benefit from the online services of We Connect set up for an unlimited usage period and We Connect Plus set up for free use for one or three years in Europe.

Depending on the equipment level, the range of MIB3 systems is supplemented with features such as natural voice control, access to streaming services and cloud-based personalisation via Volkswagen ID. Additionally,

The Tiguan Allspace has more control and assist systems

apps can be integrated wirelessly via App-Connect Wireless for Apple CarPlay and Android Auto.

The optional sound system that Volkswagen has developed with Harman Kardon ensures fascinating acoustic experiences. A subwoofer, a digital 16-channel amplifier, eight-plus-one high-performance loudspeakers and an amplifier with a 480W total output provide crystal clear treble and deep, rich bass sounds. Four sound scenarios, surround mode and razor-sharp speech reproduction guarantee high- end sound at all seats.

Volkswagen

Volkswagen passenger cars are present in more than 150 markets worldwide and the car maker produces vehicles at more than 30 locations in 13 countries. It delivered around 5.3 million vehicles in 2020. These include bestsellers such as the Golf, Tiguan, Jetta and Passat as well as the fully electric models ID 3 and ID 4.

Around 184,000 people work at Volkswagen worldwide. In addition, there are more than 10,000 trading companies and service partners with 86,000 employees. With its Accelerate strategy, Volkswagen says it is advancing its development into a software-oriented mobility provider.

Magnetic sensor hits Asil-D for adas uses

A magnetic position sensor from Allegro for adas applications delivers the accuracy and performance to meet Asil-D.

The A31315 is part of the 3DMag family of rotary and linear magnetic position sensor ICs.

These combine planar and vertical Hall-effect technologies to measure magnetic field components along three axes.

The sensor suits safety-critical steering, braking, transmission and throttle applications.

The 3D Hall front end and configurable signal processing architecture enable accurate, absolute linear position and rotary position measurements up to 360°.

On-chip diagnostics ensure safe operation. Native angle error over temperature in any plane is less than 1.2° over -40 to +150°C.

The device is available as a single die in a soic-8 package and as a redundant stacked dual die in a tssop-14 pack.

Following SEooC functional safety guidelines, the sensor supports ISO 26262 Asil-B (single die) and Asil-D (dual die) and is qualified to AEC-Q100 grade 0.

The stacked die construction aligns the sensing elements of both die, ensuring the measurement of nearly identical magnetic fields.

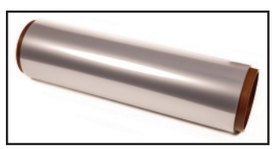
Programmable channel trim and linearisation can be adjusted to the magnetic circuitry.

They support flexible low-voltage programming regardless of the interface, for example analogue, SAE J2716 Sent, PWM and I²C, allowing direct programming by a microcontroller in embedded designs and simplifying the interface for end-of-line calibration.

Film aids SiC transition

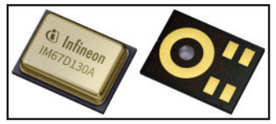
Sabic has introduced 5μm dielectric film for high-temperature, high-voltage, professional-grade capacitor applications, such as traction inverters for hybrid, plug-in hybrid and battery EVs.

The Elcres HTV150 film performs from -40 to +150°C and can help support the transition from conventional semiconductors based on silicon to wide-band-gap technologies based on SiC.



The film is for high-voltage, high-temperature DC link power capacitors that can store large amounts of electricity for long periods without significant current leakage or loss of charge. This offers dielectric and insulative properties, as well as low loss.

Based on internal testing, the film demonstrated a lifespan of 2000 hours at 500V and +150°C. It is self-healing in the event of a breakdown caused by excessive voltage.



Microphone

A mems microphone from Infineon has an operating range from -40 to +105°C to enable its use in harsh automotive environments.

The Xensiv IM67D-130A low-noise mems microphone has a high acoustic overload point of 130dB SPL so it can capture distortion-free audio signals in loud environments. Because of that, it can be placed inside or outside the vehicle.

The AEC-Q103-003 device suits in-cabin applications such as hands-free systems, emergency calls, in-cabin communication and active noise cancellation. It can also be used for exterior applications such as siren or road condition detection.

These features enable the use of sound as a complementary sensor for driver assistance and predictive maintenance.

The signal-to-noise ratio of 67dB combined with a low distortion level improves speech quality and speech intelligence for applications based on speech recognition. Additionally, the microphones have tight sensitivity matching allowing beamforming algorithms for multi-microphone arrays.

Accelerometer boosts non-safety use

A three-axis linear accelerometer from ST Microelectronics can bring enhanced resolution, temperature stability and mechanical robustness to non-safety automotive applications.

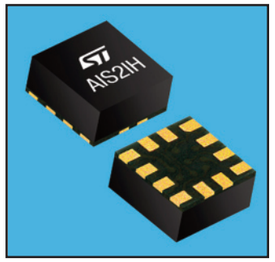
These include anti-theft, telematics, infotainment, tilt and inclination measurement, and vehicle navigation.

The AIS2IH also paves the way to performance-demanding applications in automotive, medical and industrial segments.

Leveraging the firm's knowledge in mems and automotive technologies, the device can improve reliability while delivering motion sensing over a -40 to +115°C operating range. It comes in an LGA-12 land grid array package.

With one high-performance mode (HPM) and four low-power modes (LPMs), the device supports switching between modes on the fly to optimise resolution and power consumption for the application requirements.

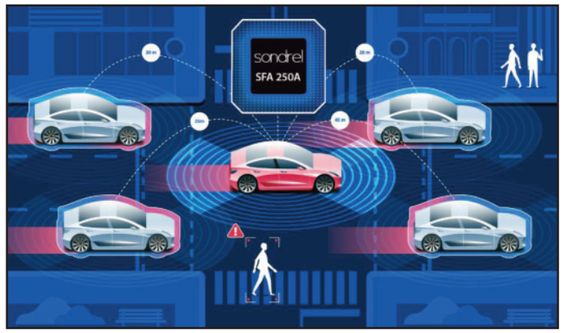
It can address emerging automotive applications such as digital drive recorders, driver monitoring, vertical level sensing in vehicle suspension and door automation.



The accelerometer has user-selectable full scales of ±2, ±4, ±8 and ±16g, and can measure accelerations with output data rates configurable from 1.6Hz to 1.6kHz, with embedded configurable digital low-pass and high-pass filters.

Typical noise density is 90μg/√Hz when operating in HPM. Operating current at 3V is 110μA in HPM and 0.67μA in LPM at 1.6Hz. The embedded 32-level fifo and the motion- and activity-detection functions help reduce system-level power consumption.

The AEC-Q100 qualified device is sampling now in a 2 by 2mm LGA package with wettable flanks.



Reference design provides asic framework

The second in Sondrel's family of reference designs for asics provides a framework to support a user's IP, which can result in a faster time to market and lower risk.

The SFA250A is aimed at functional safety (FuSa) applications such as adas and contains an independent FuSa monitor compliant to ISO 26262 Asil D for an asic safety subsystem.

Individual subsystems are responsible for the detection and, where applicable, the correction of errors. The SFA 250A has been designed to be easy to adapt to suit the support needs of the user's IP as it is scalable, both in terms of function and performance, as well as modular as multiple versions can be combined.

Power-over-coax inductors

AEC-Q200-compliant inductors from Murata have broadband impedance for in-vehicle power-over-coax (PoC) systems on a serdes interface.

The LQW21FT_0H inductors comply with AEC-Q200 and combine broadband impedance and high current.

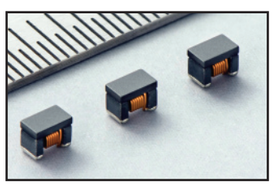
Using ceramic materia, they are housed in a 0805 case with 2 by 1.2 by 1.6mm dimensions.

As well as their elevated broadband impedance, they exhibit good saturation properties.

Inductances from 0.47 to 2μH can be specified, with respective current ratings of 1 and 0.45A.

The heightened operating temperatures these inductors can support makes them suitable for automotive implementation up to 125°C.

To accelerate the transition towards safe, autonomous driving, the number of built-in cameras in vehicles continues to increase. The popularity of PoC for in-vehicle applications is thus rising steadily, enabling reductions in cabling weight by transmitting imaging data and electrical power over one coaxial cable.



Option extends scope for Ethernet

The K88 option for the Rohde & Schwarz RTO and RTP oscilloscopes enables compliance testing on the next evolution of the Automotive Ethernet standard.

The IEEE 802.3ch standard addresses the need for high-speed networking and data transfers within the car.

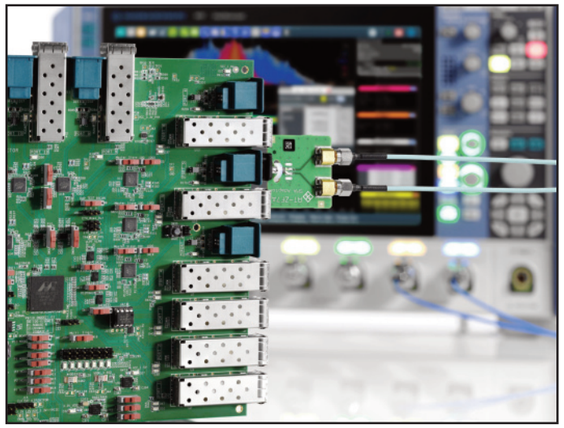
Most requirements for higher data rates stem from sensors such as cameras around the car, 5G telematic units and networking backbones for multiple domain controllers. The MultiGbaseT1 Ethernet standard meets these needs by including 2.5G, 5G and 10G speeds.

Compared with 1000baseT1, MultiGbaseT1 uses Pam4 (four levels) modulation with symbol rates of 1.4, 2.8 and 5.6GHz.

The Open Alliance TC15 PMA compliance test specification addressing this standard is still in a draft state.

With the K88 option, the oscilloscopes provide full transmitter compliance for MultiGbaseT1 based on the IEEE-802.3ch spec for the phy layer (layer one).

R&S offers a complete Automotive Ethernet compliance test including using a vector network



analyser such as its ZND for MDI return loss measurements. Control of the measuring instruments, calculation of the results and documentation can be automated with the ScopeSuite test software.

A test wizard guides the user step by step through the test procedure with illustrated instructions.

Automatic test sequences allow for a fast, reliable test execution and reduce the probability of user error. A configurable test report documents the test results.

ScopeSuite is a standalone application that can run on the oscilloscope or a separate PC.

4D imaging radar detects obstacles

Vayyar Imaging has launched the multi-range XRR chip, a single RF 4D imaging radar IC with a range of 0 to 300m, for passenger cars, lorries and motorcycles.

Supported by a 48-antenna mimo array, the platform provides radar imaging with accuracy for safety applications without the need for external processors.

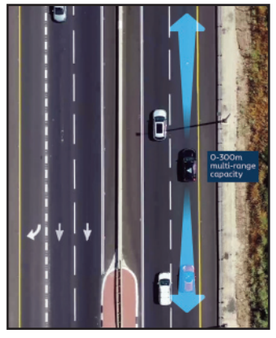
AEC-Q100 qualified and Asil-B compliant, it has a wide field of view and 4D point cloud imaging for adas and rider assistance systems. This eliminates the need for multiple, costly vehicle sensors and can reduce costs, complexity, hardware, software, power consumption, wiring and integration efforts.

The chip differentiates between static obstacles such as dividers, kerbs and parked vehicles, and between vulnerable road users, moving vehicles and other hazards.

In low-speed environments such as parking lots, the chip's uSRR and SRR sensing supports parking assistance, scanning the vehicle's surroundings for pedestrians and obstacles. On the open road, MRR and LRR capabilities facilitate adas and autonomy applications such as lane change assist, adaptive cruise control, blind spot detection, collision warnings, cross traffic alerting and autonomous emergency braking.

There are 48 transceivers in one chip.

Two XRR chips earn a vehicle 33 Euro NCap safety points, while replacing over ten traditional adas sensors. The platform supports nine Euro NCap adas requirements for 2023, protecting pedestrians, cyclists and motorcyclists, while increasing safety ratings.



Thermal gel

The Chomerics division of Parker Hannifin has launched Therm-A-Gap Gel 75, a 7.5W/m-K single component dispensable thermal interface material for automated production as found in telecoms equipment, automotive safety electronics modules, power supplies, and memory and power modules.

When applied to a heat generating electronic component, the gap-filling gel provides low stress and pressure due to its low compression force and is the highest thermal conductivity dispensable available from the company.

Its flow rate is nearly three time faster than the next closest performing material in the family.

Gel dispensing systems support multiple size and thickness requirements with a single configuration. While thermal gap pad placement can be automated to an extent, the equipment and fixturing required to do so is typically quite specialised and may not be readily adapted from one job to another.

It is available in different sizes of syringes, cartridges and pails.

Level shifter covers two ports

A bi-directional dual-supply autosensing level shifter IC from Diodes has the flexibility that can be vital for modern automobile design.

The PI4ULS3V304AQ addresses the challenge of lower voltage microprocessors and microcontrollers incorporated into automotive systems, which are required to drive external devices operating at different voltage levels to their own. These include sensors and EMI filters.

Enabling high-speed operation, this configurable 4bit IC supports a guaranteed data rate of 140Mbit/ps. It offers bi-directional voltage-level translation, allowing increasingly common push-pull type applications to be addressed.

Through its A and B ports, two different power supply rails can be tracked.

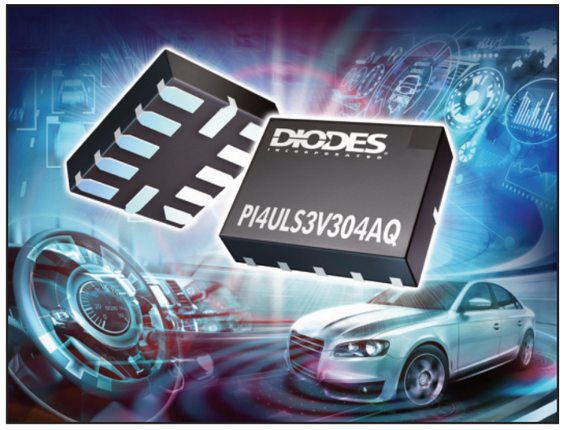
The IC can provide 0.9 to 2.0V translation on the A port and translation from 1.65 to 3.6V on the B port. Propagation delay is 13ns while running at full 100pF capacitive drive.

AEC-Q100 grade-one qualified, its applications include infotainment, driver assistance and telematics.

An operational temperature of -40 to +125°C is covered and 2kV ESD protection has been incorporated. The output enable function means either of the IO ports can be shut down when not needed to lower the power draw.

Automated bi-directional operation eliminates the need for inclusion of a direction control pin.

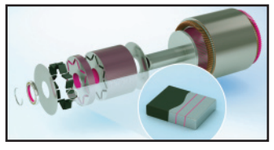
It comes in a 12-pin UQFN package.



Adhesive shear strength hits 20MPa at +180°C

Developed for automotive and mechanical engineering, Delo's Monopox adhesive has compression shear strength of 20MPa at +180°C.

It has been optimised for bonding magnets in electric motors. The bonded joints remain thermally stable over time. Even after 10,000 hours of storage at +180°C, the bonded magnets achieve a stability of 20MPa.



The maximum operating temperature of electric motors is generally +180°C. This is because the rare earth magnets used in the motors demagnetise at higher temperatures. The adhesive can be used up to +220°C.

It reduces eddy currents in electric motors, lowering heat development and increasing performance. Integrated spacers are provided. These ensure a uniform bonding gap of 50μm for magnet stacking. This allows the use of more magnetic material.

The one-component epoxy resin takes ten minutes to cure in an air convection oven at +150°C.

Shunt resistors cut size for high power

Shunt resistors from Rohm have a rated power of 10W for applications in automotive, industrial equipment and home appliances.

The GMR320 is the largest rated power product in the firm's high-power low-ohmic GMR line. Resistance range is 5 to 100mΩ and they are suitable for automotive engine ECUs and headlamps.

The structure and materials allow the device to reduce surface temperature rise by 23% over standard products, ensuring high ruggedness against overcurrent load. The metal alloy of the resistive material provides low TCR to increase reliability and current detection accuracy even at low resistance values.

For the PSR series, widely used as high-power shunt resistors, the maximum rated power has been increased by up to 15W and the TCR value has been improved by applying the terminal temperature derating method.

Resistances value from 0.1 to 3.0mΩ can be offered, and higher rated power and accuracy of current detection comes in a compact package.

From October, thermal simulation models for shunt resistors will be available on the firm's web site. This will make it possible to perform simulations before designing the actual products, even in high power applications where thermal design is particularly difficult.

Both series are qualified to AEC-Q200, ensuring a maximum operating temperature of 170°C.

Flyback switcher ICs provide EV headroom

Power Integrations' automotive-qualified InnoSwitch3-AQ flyback switcher IC family is available with a member rated to 900V, providing headroom for 400 and 800V electric vehicle inverter, battery management and climate control applications.

The family combines primary and secondary controllers plus safety-rated feedback circuitry in a single IC. This allows accurate output voltage regulation, low component count and configuration options for operation over the input range 30 to 1200V.

The constant voltage regulated AEC-Q100-qualified ICs achieve up to 90% efficiency across the load range and consume less than 15mW under no-load conditions. Output power is up to 20W at +85°C ambient temperature and 400V DC input for the 900V family.

Devices incorporate a multi-mode quasi-resonant, CCM and DCM flyback controller, 900V switch, and the firm's high speed FluxLink communications link that enables accurate regulation in the InSOP24 package and provides reinforced isolation up to 5500m altitude.

The ICs operate down to 30V DC, letting automotive designers use the device in traction inverter emergency power supply applications.

Devices include multiple protection features for automotive applications including input over-voltage and under-voltage protection, output over-voltage and over-current limiting, and over-temperature shutdown.

Design reference DER-889Q describes a 15W supply that supports 30 to 1200V DC input and 12V, 1.25A output.

Another resource, the 30 to 921V DC DER-859Q, describes the operation of the InnoSwitch3-AQ in 800V bus applications up to 30W.

Buck controllers optimise EMI in power supplies

Designers can optimise the size and EMI of the power supply in industrial and automotive electronics with buck controllers from Texas Instruments.

The synchronous DC-DC buck controllers have an integrated active EMI filter (AEF) and dual-random spread-spectrum technology.

The LM25149-Q1 and LM25149 help engineers halve the area of the external EMI filter, lower the conducted EMI of the power design by up to 55dBμV across multiple frequency bands, or combine reduced filter size and low EMI.

By integrating the AEF, the buck controllers enable engineers to meet EMI standards while increasing their design's power density.

They help engineers meet Cispr 25 class-five automotive EMI specifications by mitigating conducted EMI across multiple frequency bands. The integrated AEF helps detect and reduce conducted EMI in the low-frequency band of 150kHz to 10MHz, enabling engineers to attenuate EMI by up to 50dBμV at a switching frequency of 440kHz, relative to a design with the AEF disabled, or as much as 20dBμV when compared with a design with a typical passive filter. In both, DRSS helps mitigate EMI by an additional 5dBμV across low- and high-frequency bands.

Both feature frequency synchronisation to an external clock, helping mitigate undesired beat frequencies in applications sensitive to EMI.

By lessening the filtering burden on the passive elements, the integrated AEF reduces their size, volume and cost.

They can increase power density by enabling interleaved dual-phase operation and by integrating the bootstrap diode, loop compensation and output-voltage feedback components, which in turn reduces design complexity and cost. Engineers can also use external feedback and loop compensation to optimise designs.

Preproduction quantities are available now in a 3.5 by 5.5mm thermally enhanced, 24-pin VQFN package.

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

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

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

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

Web site: vehicle-electronics.biz
Twitter: @velectronicsmag

ISSN 2055-1177

Vehicle Electronics is available to readers worldwide. It will be published twelve times a year in a digital-only format.