VEHICLE electronics

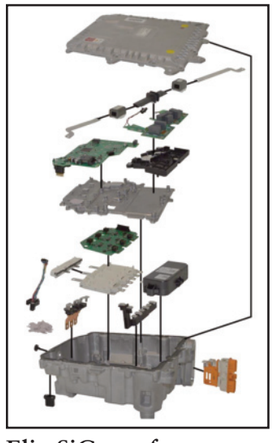
The monthly magazine for automotive electronics engineers

Magna invests $40m in OnSemi SiC plants

Magna will invest around $40m for the procurement of SiC equipment at OnSemi's New Hampshire and Czech Republic facilities to ensure access to future supply.

OnSemi and Magna are investing jointly in silicon carbide (SiC) manufacturing for the electric vehicle (EV) market.

Magna is integrating OnSemi's EliteSiC into its traction inverters to improve the range and efficiency of EVs.



EliteSiC mosfet technology to improve performance of Magna's eDrive

"We recognise the importance of securing a stable supply of SiC material in order to continue delivering innovative and efficient eDrive systems for our customers," said Diba Ilunga, president of Magna Powertrain. "As the electric vehicle market continues to grow, we are taking proactive steps to secure access to future SiC supply to help support our electrification strategy and outpace the competition."

Magna hopes the long-term supply agreement will mean its eDrives will have better cooling and faster acceleration and charging rates, improving efficiency and increasing EV range.

Additionally, OnSemi's end-to-end SiC manufacturing capability, combined with its ability to ramp production quickly, should improve Magna's vertical integration and simplify its supply chain to meet the growing demand for its SiC-based products for EVs.

"With range anxiety still a top deterrent to EV adoption, our technology enables them to go further, easing the transition to an electrified future," said Asif Jakwani, senior vice president at OnSemi. "Our latest EliteSiC mosfet technology enables increased power density and higher efficiency in traction inverters, resulting in improved gas-equivalent miles per gallon without compromising driving dynamics and safety."

• OnSemi and BorgWarner are expanding their collaboration for SiC, making the total agreement worth over $1bn in lifetime value. BorgWarner plans to integrate EliteSiC 1200 and 750V power devices into its Viper power modules.

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August 2023

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Mahindra to explore NXP portfolio

Indian car maker Mahindra & Mahindra has signed a memorandum of understanding (MoU) with NXP to explore electric and connected vehicles, covering utility vehicles, vans, farm equipment and tractors.

Mahindra plans to explore NXP's portfolio and expertise in zonal and domain controllers, electrification, vehicle networks, and secure car access technologies for its upcoming platforms.

The step is in line with Mahindra's commitment to deliver innovations that enhance the safety, eco-friendliness and overall enjoyment of the commuting experience for its customers.

"We are thrilled to explore opportunities to leverage NXP's advanced technologies to build SUVs that are safer, highly connected and environmentally friendly," said Rajesh Jejurikar, executive director of Mahindra's auto and farm sectors. "At Mahindra, we are driven by our mission to elevate people's quality of life through innovative and cutting-edge technology. Together, we endeavour to shape the future of smart electric mobility and deliver extraordinary experiences to our consumers."

Kurt Sievers, CEO of NXP, added: "We are excited to collaborate with Mahindra & Mahindra, a company with a rich history of transforming the fast-growing automotive space in India and a focus on striving to improve quality of life through mobility. By working together and leveraging our rich portfolio of technologies and expertise, NXP and M&M are charting a course to build a brighter tomorrow."

Mahindra will also get access to NXP's partner ecosystem, comprising tier ones, ODMs, IDHs, module vendors and integrators. This will provide insights into NXP's technology roadmap, encompassing synergistic areas such as the smart home and industrial sectors.

Vicor powers Dutch racers



Vicor is providing high-performance power modules to University Racing Eindhoven (URE) helping it achieve its lightest vehicle ever for the team's 20th anniversary. Chosen for their small and lightweight characteristics, the modules step down the high voltage accumulator's power from 400-600V to 27-38V.

URE is a student team from Eindhoven University of Technology dedicated to designing and building high-tech, innovative electric and autonomous Formula-style racing cars. It participates in the Formula Student competition.

Using the modules, the team was able to achieve a 15% decrease in weight. With seven low-voltage circuits powered, including accumulator and radiator fans, these modules helped URE produce a more compact design with improved functionality including reduced cooling and lighter components.

Mikroe puts Toshiba IC in click board

Toshiba has teamed up with MikroElektronika (Mikroe) to accelerate automotive motor control development.

This has seen the integration of Toshiba's TB9053 DC-motor driver IC into the DC Motor 26 click board to accelerate development of automotive applications.

The TB9053 provides a dual H-bridge output stage that can drive two motors at up to 5A or a single motor up to 10A. Protection and diagnostic features are built-in, as well as additional circuitry to save external components such as charge-pump capacitors.

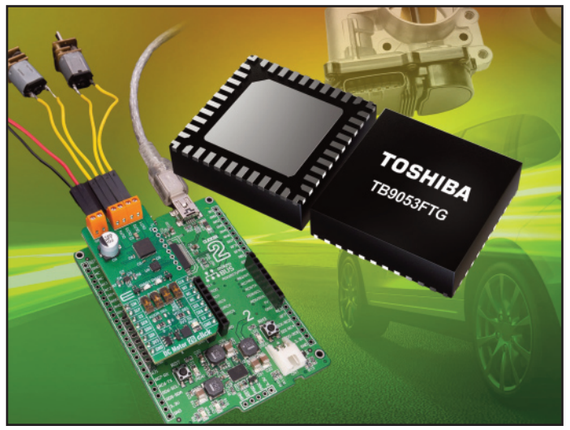
It comes in a thermally enhanced QFN40 package.

The IC can be designed into automotive subsystems such as throttle valves, engine valves, powered mirrors, grille shutters, and door opening and closing mechanisms. It can also be used for powering seat heaters.

The board connects directly to microcontroller development boards that support the standard MikroBus interface. The motor can be controlled through the MikroBus socket using a PWM signal (CLK) or the TB9053's SPI serial interface.

PWM or SPI control is selected by user-accessible switches that also govern selection of single- or dual-motor modes. Additional header pins allow motor forward, reverse, brake, drive and stop commands depending on the control mode.

The board accepts a 3.3 or 5V input voltage and allows a separate supply to power the motors at a voltage from 4.5 to 28V.



TB9053 DC-motor driver IC and click board

The built-in diagnostic capabilities of the IC allow ongoing performance and functional observation.

Current monitoring and current limiting features are incorporated. If the IC detects overtemperature, overcurrent or under-voltage, a series of red LEDs indicate the fault to the user.

The click board comes with a software library from Mikroe that contains easy-to-use functions and example code to accelerate development. Users can also take advantage of the MikroSDK software development kit, which contains open-source software libraries, a unified API and software development tools.

Automotive electronics to see 4.6% CAGR

The automotive electronics market will reach $250bn in 2023 and then increase at a CAGR of 4.6% to $400bn by 2033, according to Future Market Insights.

Demand was up due to the increased integration and implementation of modern safety systems, including automated airbags, parking assistance, emergency braking and lane departure warning to reduce traffic accidents.

In-vehicle passenger safety features such as alcohol ignition interlocks, emergency call systems and accident data recorder systems are being quickly implemented, and they are anticipated to propel market expansion for automotive electronics.

The growth of IoT and AI has changed car functionalities, improved the ride assistance systems and boosted driver communication with the vehicle. The rise is fuelled by the inclusion of cameras and sensors in cars, which aid drivers in parking or using other nearby features.

Safety regulations are becoming more stringent in different parts of the world, and consumers are becoming more aware of car safety features.

The most expensive models have autonomous emergency braking and sleep recognition.

AI helps self-driving cars recognise danger and gauge the tension of the driver.

Radioline provides IVI for GWM Europe launch

Great Wall Motor (GWM) has selected Access and Radioline to provide streaming radio and podcasts for in-vehicle infotainment.

Access will deliver the Radioline audio entertainment app for car maker GWM's European launch vehicles.

The Radioline automotive application is integrated with the Access Twine for Car (Twine4Car) platform powering in-vehicle entertainment. This lets GWM unlock audio content for drivers and passengers in a single branded IVI system.

"Access and Radioline have a shared vision of providing enhanced and seamless experiences to connected car users," said Xavier Filliol, COO of Radioline. "By integrating our app with the Acess Twine4Car, we enable GWM to increase engagement and build brand loyalty with drivers and passengers. We look forward to European drivers and passengers of GWM cars enjoying a world of radio and podcast entertainment that extends far beyond traditional FM and Dab."

Radioline's car application is based on over 15 years of expertise in mobile, OTT and IoT integration and is compatible with Linux and Android platforms for in-car entertainment. It offers over 110,000 radio channels, web radio stations, national and local programmes, and podcasts from 161 countries.

Custom metadata delivers content information to passengers, including access to titles, descriptions, cover and album names. The user interface adapts to the driver's needs at the time, ranging from safety standards to entertainment offerings.

GWM is an established Chinese car company expanding into the EU and other regions.

"The aim of Access Twine4Car is to enable auto manufacturers to quickly integrate and enable services for their drivers," said Aono Masahiro, CEO of Access in Europe. "With Radioline, GWM will provide an incredible audio experience for their European vehicles."



Enhanced Integrated PTC for Next Generation User Interfaces

Driven Shield Plus and Functional Safety for Best-in-Class Water Tolerance and Reliable Operation

The automotive industry is constantly looking for ways to improve the user experience for drivers and passengers, including high expectations for touch interfaces to work well in moisture and noise, while requiring Functional Safety features. Touch controls provide a more intuitive and modern way of interacting with a vehicle, making it easier to access information and control various functions. With enhanced Peripheral Touch Control (PTC) technology, the touch controls are even more responsive and accurate, providing a smoother and more enjoyable user experience.

Our PIC32CM JH MCU family features integrated PTC that provides moisture tolerant, noise immune, highly responsive and accurate touch for next generation user interfaces. Additionally, the FuSa features that come with this family can be used to implement ISO 26262, IEC 61508 and IEC 60730 applications.

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ADI and Foxconn MoU to develop digital cockpit

Analog Devices and Foxconn have signed a memorandum of understanding (MoU) to develop a digital car cockpit and battery management system (BMS).

The two plan to advance software-defined and more sustainable, feature-rich vehicles.

"The global automotive industry continues to digitalise and differentiate at the semiconductor level to deliver a more personalised, immersive and sustainable driving experience," said Vincent Roche, CEO at ADI. "ADI is delighted to work together with Foxconn to create a smarter mobility ecosystem and accelerate the breakthrough innovations the industry needs."

ADI's hardware and software, combined with Foxconn's expertise in electronic design, system-level integration and manufacturing, have the potential to deliver scalable vehicle platforms.

ADI's portfolio includes system-level products for BMS, electric powertrain and power management to enable smarter, more efficient and longer-range EVs.

Automotive cabin applications such as infotainment, smart cockpits and autonomous driving would leverage ADI's A^{2}B, gigabit multimedia serial video links, and Sharc DSPs, as well as innovations in edge processing, to realise the potential of software-defined vehicles.

"Foxconn actively collaborates with international partners to link ecosystems and unlock greater value in electric car technology and smart transport," said Young Liu, Foxconn CEO. "We are looking forward to working with ADI to leverage its high-performance automotive electronics, enabling our clients to overcome obstacles and seize emerging possibilities."

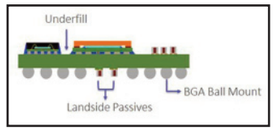
Foxconn has a strategy for advancing the EV industry, encompassing vehicle design, components, global manufacturing and supply chain services. This holistic approach caters to the demands of customisation and rapid development.

With ADI's system level products, technology platforms and engineering support, Foxconn can give automotive users access to vertically-integrated R&D resources.

• Analog Devices has invested $1bn to expand its semiconductor wafer fab in Beaverton, Oregon. The site, built in 1978, is ADI's largest wafer fab by volume and serves users in industrial, automotive, communications, consumer and healthcare.



Analog Devices and Foxconn MoU signing ceremony



Compute module

USI collaborates on smart cockpits

Universal Scientific Industrial (USI) is collaborating with multiple automotive SoC providers to accelerate the development of smart cockpits by leveraging expertise in systems-in-package (SiPs) and systems-on-module (SoMs).

These are reducing the size of automotive compute modules while ensuring high operational speed of DDR memory.

Modern smart cockpit systems have evolved beyond limited infotainment functions such as CD players, USB and Bluetooth.

These let drivers experience a cockpit similar to that of an aircraft, enhancing driving comfort, improving handling performance and reducing driver fatigue.

USI adopts underfill, BGA mounting, embedded passive components and high-density SMT process technology to develop automotive compute modules.

These encompass crucial control components such as SoCs, DDR and PMICs, which are independent of the mainboard.

All-in-one adas targets heavy lorries

OtoBrite has developed an all-in-one adas to enhance the safety of heavy commercial vehicles.

Such vehicles have more blind areas than other types of vehicle due to the higher driver seat, so accidents could easily happen while moving off or making turns.

Besides, there are many driving scenarios that may lead to fatal crashes, such as distracted driving, improper following and erratic lane changing.

According to the IIHS 2023 report, 4714 people died in large lorry crashes in 2021, a 17 per cent increase over 2020. Therefore, enhancing the safety of heavy commercial vehicles is urgent.

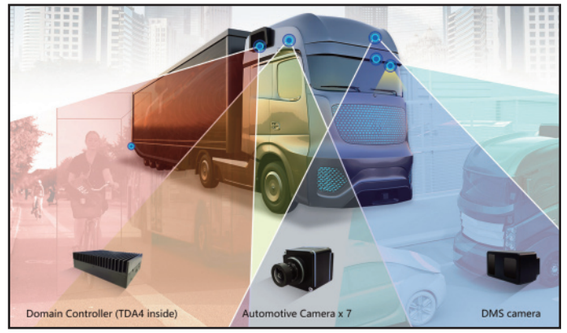
The OtoGuard is adas for such vehicles. With one Texas Instruments TDA4 automotive processor, it can enable more than ten adas features and comply with multiple UN regulations.

With deep learning core technology as a tier-one supplier, OtoBrite launched the first automatic parking system with only surround-view cameras using vision-AI technology and a TDA2 processor in 2017 and shipped over 200,000 systems in China.

In Japan, it has licensed vision-AI deep learning models for over 300,000 adas products.

OtoGuard uses a centralised architecture with one domain controller using the TDA4 processor and eight cameras to achieve multiple adas features and reduce installation space, costs and the complexity of supply chain management.

It includes built-in multi-sensor time-synchronised event-triggered recording functions, which help fleet operators achieve more effective vehicle monitoring and management.



OtoGuard uses centralised architecture

TÜV certifies Renesas cyber security

TÜV Rheinland has certified Renesas' automotive cyber-security management system (CSMS) at its design centre in Musashi, Japan.

The centre develops MCUs and SoCs and has been defined and implemented according to ISO/SAE 21434:2021.

Renesas helps car makers obtain vehicle type approval as part of the recent UNR155 regulation.

All Renesas automotive MCUs and SoCs developed after January 2022 will sequentially follow this certified ISO/SAE 21434:2021 CSMS development process.

This includes the company's 16bit RL78 and 32bit RH850 MCUs as well as its R-Car SoCs.

"With this certification, validated by an independent third party, customers can have confidence that our management of the CSMS process is meeting the requirements defined by ISO/SAE 21434:2021," said Takashi Yasumasu, vice president at Renesas.

• Renesas and Wolfspeed have signed a wafer supply agreement including a $2bn deposit by Renesas to secure a ten-year supply commitment of SiC bare and epitaxial wafers from Wolfspeed.


Renesas has TÜV approval for cyber security

Kontron buys Telit modules

Kontron has acquired Telit Cinterion's cellular automotive module unit for €24.5m.

The assets of the module unit achieved revenues of slightly above €100m in 2022.

The acquisition presents an opportunity for Kontron to prepare for the increasing demand for 4G and 5G technology.

"This acquisition marks another milestone in Kontron's journey towards becoming a global leader in IoT," said Hannes Niederhauser, Kontron CEO.

Autocrypt goes to university for fuzz testing

With help from RWTH Aachen University, automotive cyber-security and mobility provider Autocrypt has developed a fuzzer for hardware-in-the-loop (HIL) simulation.

The AutoCrypt security fuzzer was jointly developed by Autocrypt and the university as part of their industry-academia partnership.

As an add-on version of the existing Autocrypt security fuzzer, the tool enables fuzz testing in the HIL simulation environment.

HIL simulation is a test platform created by generating a virtual simulation of the in-vehicle architecture so all systems and operations can be pre-validated before producing and conducting tests on the physical vehicle.

Given a modern vehicle contains over 1000 semiconductors, being able to pre-validate the systems through a virtual simulation reduces the complexity and costs of early-stage testing.

The fuzz testing option is optimised for vehicle HIL simulations, fuzzing against the virtual operations of the vehicle systems and ECUs to detect and report vulnerabilities. It complies with ISO 21434 and UN R155 vehicular cyber-security standards, and functional safety standard ISO 26262 regarding electrical current stability.

"Existing HIL tests mainly verify system integrity in certain specific scenarios, but AutoCrypt security fuzzer for HIL detects unprecedented vulnerabilities by exploring unexpected system abuse cases," said Autocrypt CEO Daniel Kim. "We are excited to partner with one of the leading European universities."

Nio opens Berlin innovation centre



EV specialist Nio has opened a 1500m² innovation centre in Berlin in response to the need for software that's central to the user experience. The centre will be responsible for the development of technologies and local testing and validation.

It will be the home for five teams – digital systems, digital development, digital cockpit, autonomous driving and power. Nio's power infrastructure in Europe will also have its R&D hub in the centre, with a focus on power grid service, and it will act as the operational control centre for all European power swap stations.

The centre will help develop Nio's user-experience defined vehicles, with regular over-the-air updates to deliver new functions throughout a vehicle's life.

"Nio's user experience defined vehicles are much more than software-defined vehicles," said Mark Zhou, Nio's executive vice president. "We design our digital architecture to be able to apply very quickly the new maturing technologies such as chipsets, sensors, algorithms, training models, cloud, connectivity, safety and security."

The location was chosen to attract Europe's software engineering, machine learning, AI and voice systems talent, ahead of greater expansion in the region.



Nextbase opens dashcam research centre in Wales

Dashcam brand Nextbase has opened a research and development centre in Wales dedicated to connected car technology.

The facility, which more than quadruples the brands' R&D footprint, is part of an expansion as Nextbase scales up for its largest product launch to date, the Nextbase iQ.

"Global demand for dashcams is exploding, and our mission to bring to all drivers the smart, connected technology they are used to enjoying in their homes has never been more timely," said Richard Browning, chief marketing officer for Nextbase. "The business is preparing for a step-change with the launch of iQ, a product that will easily beat anything currently on the market and will continue to evolve through over-the-air updates to deliver the world's first aftermarket connected car platform."

The company has expanded the size of its technical workforce by 280% since 2021, and engineering and R&D investment has increased 320% since 2020 as the company plans to launch more than three dozen products in the next two years in pursuit of 345% revenue growth by 2027.

Nextbase has more than 228 patents including pending, design rights and protection. Revenue has grown 150% in the past four years.

Alongside the brand's new London headquarters and offices in USA, Japan, Australia, Netherlands, Germany and China, the laboratory will serve as a vertically integrated product-development compound, focusing on hardware and software engineering, design, UX, app development, and in-house technical supports.

The laboratory houses an AI innovation team, connected services and data teams. It is also home to a full-motion crash-testing suite. There will be a renewal centre where in-house techs will service previously purchased dashcams.

Loxo deploys Innoviz lidar on delivery vans

Loxo, a Swiss provider of zero-emission autonomous delivery vehicles, is to deploy InnovizOne lidar units on its delivery vehicles.

Innoviz's automotive-grade lidar potentially allows retailers to transport goods from local distribution hubs to end consumers.

This year, Loxo and Innoviz went through evaluation and testing, which led to this expanded order of InnovizOne units and a signed deal for the 2024 fleet.

"Our lidar is purpose-built to be lightweight and easily integrate with vehicles of all shapes and sizes, from passenger cars to commercial fleets to last-mile delivery vehicles," said Omer Keilaf, CEO of Innoviz.

Amin Amini, CEO of Loxo, added: "There is ample opportunity to optimise the exchange of goods from local distribution centres to a customer's doorstep to elevate the logistics experience for consumers. Innoviz's automotive-grade lidar is a key component in facilitating optimised and autonomous last-mile delivery."

The solid-state lidar sensor was designed for automakers but can also be used for robotaxi, shuttle and delivery companies requiring an automotive-grade, mass-producible way to achieve autonomy.

It is purpose-built to integrate seamlessly into levels three to five autonomous vehicle designs.



Integration of InnovizOne lidar sensor on Loxo zero-emission delivery vehicle



Test vehicle at Ohio State University

How to make a car think that it is on a real road

Researchers at Ohio State University have developed software to aid in the development, evaluation and demonstration of safer autonomous or driverless vehicles.

Called the vehicle-in-virtual-environment (VVE) method, it allows the testing of driverless cars in a perfectly safe environment, said Bilin Aksun-Guvenc, co-author of the study and a professor of mechanical and aerospace engineering.

Imagine a driverless car is placed in the middle of an empty parking lot. Although it is driving, it isn't reacting to the real world, but to input from the software, which tells the car what the road looks like, and what cars, pedestrians and hazards it is meeting along the way.

"With our software, we're able to make the vehicle think that it's driving on actual roads while actually operating on a large open, safe test area," said Aksun-Guvenc. "This ability saves time, money, and there is no risk of fatal traffic accidents."

The study, published recently in the journal *Sensors*, found that by immersing self-driving machines in a virtual environment, the technique could help the car learn to avoid possible car collisions, increase pedestrian safety, and react to rare or extreme traffic events.

Researchers replaced the output of high-resolution sensors in a real vehicle with simulated data to connect its controls to a realistic 3D environment, much like giving the machine a VR headset or virtual reality glasses. After feeding the data to the autonomous driving system's computers and syncing the car's real motions with the simulations, researchers were able to show it behaves as if the virtual environment were its true surroundings in real time.

"When actual senses are replaced by virtual senses, the model can be easily changed to fit any kind of scenario," said Levent Guvenc, co-author of the study.

Because VVE can be calibrated to maintain the properties of the real world while modelling rare events in the virtual environment, it could easily simulate extreme traffic scenarios, such as someone jumping in front of a vehicle, to mundane ones such as pedestrians waiting to cross.

Additionally, with the help of a communication app for vehicle-to-pedestrian connectivity, the software can use Bluetooth to communicate between a pedestrian with a mobile phone and a phone in the test vehicle.

The researchers had a pedestrian dart quickly across a simulated road a safe distance from the test vehicle. But the Bluetooth signal told the car the person was darting right in front of it.

"The beauty of the method is that road users can share the same environment at the same time without being in the same location at all," said Guvenc. "We could see this technology becoming a staple in the industry in the next five or ten years. That's why we're focusing on building more applications for it."

Flexium picks Ansys to test adas antennas

Flexium is using Ansys simulation to explore design ideas and develop and test antenna modules for high-frequency signal transceiver designs used in adas and autonomous vehicle (AV) applications.

With support from Ansys tools, the PCB manufacturer's R&D team can also test the durability and reliability of its boards, as well as explore design ideas through layout and material experimentation at a relatively low cost.

Within Flexium's PCB layouts are numerous flexible printed circuits (FPCs) responsible for critical connections that enable 5G communication in adas and AV applications.

Any design deficiencies within these layouts can negatively impact FPC transmission characteristics responsible for vehicle perception.

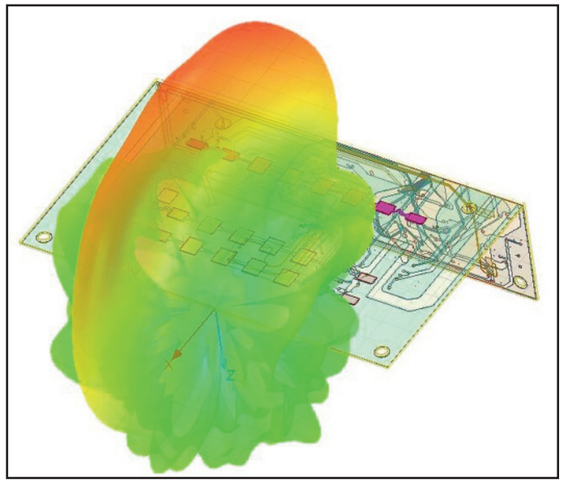
To address this, Flexium uses Ansys simulation software for the electromagnetic, thermal and mechanical optimisation of its FPC designs through efficient layout and material changes. Ansys tools also helped Flexium set parameters for board layout and materials, then create a reference library for mm-wave design verification.

"Ansys delivers the greatest predictive accuracy and yields the strongest results for us during PCB layout analysis critical to today's adas and AV applications," said Ming-Chi Cheng, president of Flexium. "Looking beyond 5G, we will continue to reference Ansys simulation to discover new methods for optical integration and communication that will help shape the future of our mm-wave antenna module designs."

John Lee, vice president at Ansys, added: "With Ansys, global PCB industry leaders like Flexium realise the freedom to explore possibilities in board application design, and successfully develop forward-thinking antennas for high-frequency signal transceiver applications.

"As the momentum behind miniaturisation continues to build, our simulation solvers will accelerate the satellite, driverless and related wireless signal modules powering this trend."

• The latest release from Ansys, 2023 R2, combines a range of enhanced numerics capabilities, performance improvements, and cross-disciplinary engineering to equip organisations with physics solvers, scalable GPU-based computing and seamless workflows.



Flexium uses Ansys' simulation technology to design FPC modules

Infineon and Semikron agree chip supply

Infineon and Semikron Danfoss have signed a multi-year volume supply agreement for silicon electromobility chips.

Infineon will supply chipsets consisting of IGBTs and diodes to Semikron. These are mainly used in power modules for inverters for the main drive in electric vehicles.

"Our IGBTs and diodes play a major role in the industry's electromobility transformation by enabling efficient power conversion in the electric powertrain," said Peter Schiefer, president of automotive at Infineon.

Claus Petersen, president of Semikron Danfoss, added: "Semikron Danfoss provides automotive customers with power modules based on the most advanced assembly technologies that fully exploit the capabilities of IGBTs and diodes to enable further decarbonisation of the transportation sector."

The IGBTs and diodes will be manufactured by Infineon in Dresden, Germany, and Kulim, Malaysia. Semikron makes its power modules in Nuremberg and Flensburg in Germany, in Utica, USA, and, as of next year, in Nanjing, China.

TTTech and ZettaScale unify communications

TTTech Auto and ZettaScale have combined technologies to deliver a unified communication platform for the automotive industry, initially focusing on making serviced-oriented architecture (SOA) communication safe, performant and predictable.

Called Zetta Auto, it is paving the way for unification across the cloud-to-microcontroller communication continuum.

To unlock software-defined vehicles, communications need to be interoperable with automotive frameworks, so software and hardware can evolve independently.

Zetta Auto achieves this by combining the power of the DDS data distribution service, time sensitive networking (TSN) and Zenoh for pub, sub, query. Through the unified integration of these protocols, its capabilities are tailored to the needs of the automotive industry, and deliver adaptable communications for current and future vehicle architectures.

It leverages and extends ZettaScale's open-core Cyclone DDS, empowering vehicle applications to exchange information across operating systems, development languages and complex processor architectures and microcontrollers.

Seamless interoperability and developer-friendly flexibility are achieved while ensuring predictable quality of service, throughput and low latency. The result is an enhancement to end-to-end vehicle performance and robust networking capabilities, suitable for domain-based and zonal electronic and electrical architectures.

Zetta Auto helps car makers harness the benefits of TSN, facilitating real-time communications within vehicles. This feature plays a pivotal role in unlocking software-defined vehicles, enabling seamless software integration, validation and verification through end-to-end communication properties. With the inclusion of the TSN tool suite and integration capabilities, car makers can achieve functionality with speed and efficiency.



Salvador Rodriguez



Angelo Corsaro

The integration for microcontrollers builds on Zenoh Pico, a lightweight implementation of Zenoh, to reduce CPU and memory usage, resulting in an optimised footprint. It seamlessly integrates with Autosar Classic, simplifying the development process with its included toolchain, and reducing the need for software component modifications.

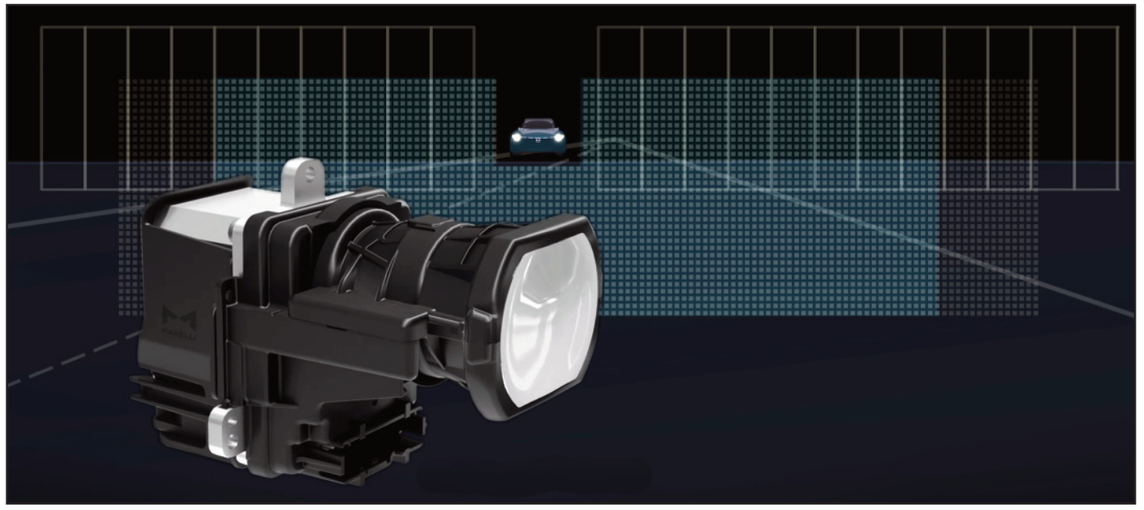
"With this launch, we are bringing mature technology already proven in other industries to the automotive industry and combining it with time-sensitive networking capabilities," said Salvador Rodriguez, head of product management at TTTech Auto. "In this way, we can unleash the potential of DDS for development teams while keeping system integrability under control. Zetta Auto is our first step in making service-oriented architecture a reality in the automotive industry."

Angelo Corsaro, ZettaScale CEO, added: "With Zetta Auto, we are truly harnessing the best-in-class technologies to offer the best in-vehicle platform, along with paving the way to next-generation cloud-to-microcontroller communication and data integration."

Zetta Auto is compatible with MotionWise, TTTech Auto's safety middleware on the road in millions of vehicles, and enables interoperability with established and standardised software stacks such as ROS2 and Autosar, to ensure smooth and efficient integration throughout all development phases.

The plan is to extend Zetta Auto with Asil-D certification for in-vehicle communication in early 2024.

"With Zetta-Scale, we will develop the next industry standard for safety and reliability in the rapidly evolving field of autonomous driving," said Friedhelm Pickhard, CGO at TTTech Auto.



H-Digi microLED module based on a matrix illumination system

Marelli develops intelligent front lighting

Marelli and AMS Osram have developed automotive front lighting based on an intelligent multipixel LED that enables adaptive, dynamic headlight operation and image projection.

The h-Digi microLED module is in series production and is based on a matrix illumination system featuring around 40,000 LED pixels, or 20,000 per lamp. This manages the LEDs selectively to create flexible low-beam and high-beam light distributions, adapting to various driving situations.

It also provides dynamic curve light and very precise glare-free high beam block out zones, to avoid blinding oncoming drivers.

For safety, it can project warnings or driver assistance images on the road, directly in the driver's field of view. Other advantages include the compact design and high energy efficiency.

The system is based on AMS Osram's Eviyos 2.0 light source, see page 40. Its combination with an optical lens system and an electronic control engineered by Marelli, enables the enhanced level of adaptability of the illumination field.

This is the first time that LEDs with a size of 40 by 40μm have been introduced as pixel elements in vehicle headlamps.

With pixels smaller than 0.1 degree, the resolution of this illumination matrix system is ten times more precise than conventional LED glare-free high beam systems currently on the road.

Two micro-LED options are available: an aspect ratio of 1:4, resulting in 25,600 pixels, or an aspect ratio of 1:3, providing 19,200 pixels per lamp.

"AMS Osram and Marelli are cooperating to transform the future of automotive front lighting," said Didier Thalgott, senior vice president at Marelli. "The module enables us to develop for global car makers providing more safety and comfort for drivers at night. In addition, thanks to its compactness, improved power consumption and affordable pricing, the system opens doors to applying the technology also in mid-level car segments."

Wolfgang Lex, senior vice president at AMS Osram, added: "High-resolution adaptive forward lighting is set to become the next big differentiator for vehicles from the world's premium brands. Eviyos 2.0 is the enabler of the most precisely controllable forward lighting systems, and is a major new value creator for the automotive industry. We are excited to be working with Marelli to co-create the future of automotive mobility and enhance the driver safety and experience."

This is Marelli's second generation of high-resolution projection systems. It follows the path kicked-off with the h-Digi, a headlamp with a high-definition projector introduced in 2018, which was based on digital micromirror technology, in series production for premium OEMs.

V2X



DAWN OF AN ARCHITECTURE

Danish Aziz, Fionn Hurley and Chris Bohm present a connectivity architecture for 5G-V2X and DSRC

The present-day wireless connectivity architecture in a commercial vehicle might be suitable up to the standard level-two automated driving. However, it is still questionable if it will fulfil the performance requirements for level three and above.

In this context, consider a connectivity architecture for autonomous vehicles that is based on the remote radio head (RRH) concept using a software-defined radio (SDR).

The architecture can provide two-fold gains.

On one hand, it can fulfil the performance requirements of future use cases and, on the other hand, it enhances reliability by facilitating the use of multiple wireless access for a given service.

The overall approach is to exploit the power of software, which aligns with the future of in-car computing technologies.

Introduction

For the wireless connectivity architecture in an ever-evolving connected vehicle, most services have two-way communications and rely on multiple and hybrid wireless communication standards or multiple frequency bands, mainly to ensure reliability and quality of service.

Designing an RF system for covering multiple bands and multiple wireless standards for vehicle connectivity is difficult.

First, there are the challenges of designing vehicle connectivity units using a conventional RF approach. This helps develop an understanding that some of these services are suboptimal in many aspects, for example radio performance. Learning from the drawbacks of conventional RF design has led to a new architecture for commercial vehicle radio connectivity units.

This architecture is based on the RRH concept using a sub-6GHz, four-channel multiband SDR-based transceiver RF IC. This can be extended with an example that uses the RRH concept and a single SDR RF IC, from which can be built a dual-band V2X connectivity unit for 5G and DSRC.

This unit can not only provide enhanced radio performance, but can also enable the implementation of coordination and cooperation algorithms for V2X wireless access.

Account

Services in a modern vehicle, such as infotainment, navigation, communications and broadcast, require wireless access systems. The RF spectrum range for the systems delivering these services is very broad, from 90MHz broadcast radio to 5.9GHz for V2X and wifi. Future systems are targeting frequencies corresponding to millimetre waves, for example 5G mm-wave, 24 to 29GHz. Fig. 1 illustrates multiple wireless systems that are used to deliver a single service.

A commercial radio connectivity unit provides the interface between the application space and the corresponding wireless systems. The following list highlights the functions and the frequency bands of operation for some of these wireless systems:

- **GNSS and GPS:** Provides location services and positioning information. It often provides service to other wireless systems for synchronisation. There are multiple regional standards and allocated frequency bands ranging from 1176 to 1602MHz.
- **Cellular 2G, 3G, 4G and 5G:** Used for voice and data services such as telematics, infotainment, over-the-air updates and V2X communications. It covers a huge number of cellular bands and channels from 300MHz to 5.9GHz.
- **Wifi:** For multiple applications including over-the-air updates, diagnostics and data download. Different regions have different allocations of bands and channels specified for internal and external use. Most common are the channels in the 2.4 and 5.8GHz bands. In Japan, some channels are allocated in the 5GHz band.
- **ITS-G5 and DSRC:** For V2X communications, the 70MHz spectrum is allocated in 5.9GHz in most of the regions in the world.
- **Radio broadcast:** From 90 to 240MHz, there are different channels and bands in different regions. Please note broadcast systems could also be covered by a radio connectivity unit, but usually they are implemented separate from the two-way communication systems.

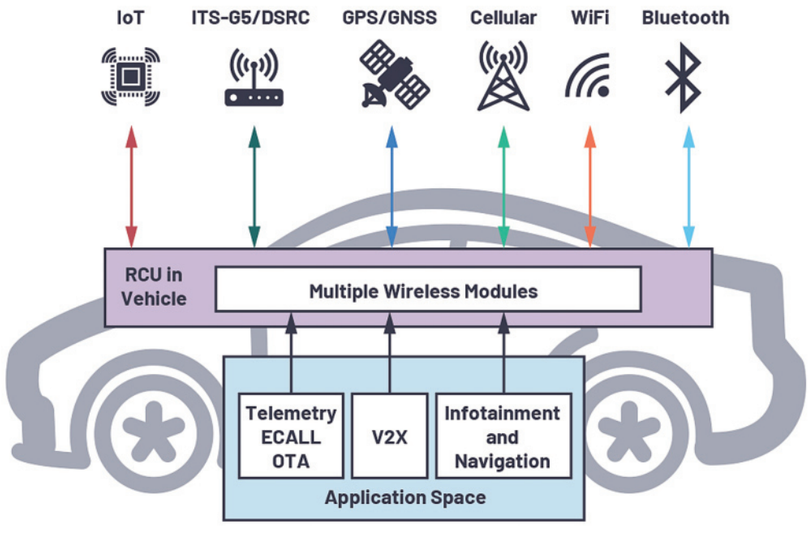


Fig. 1: Major wireless systems in a vehicle

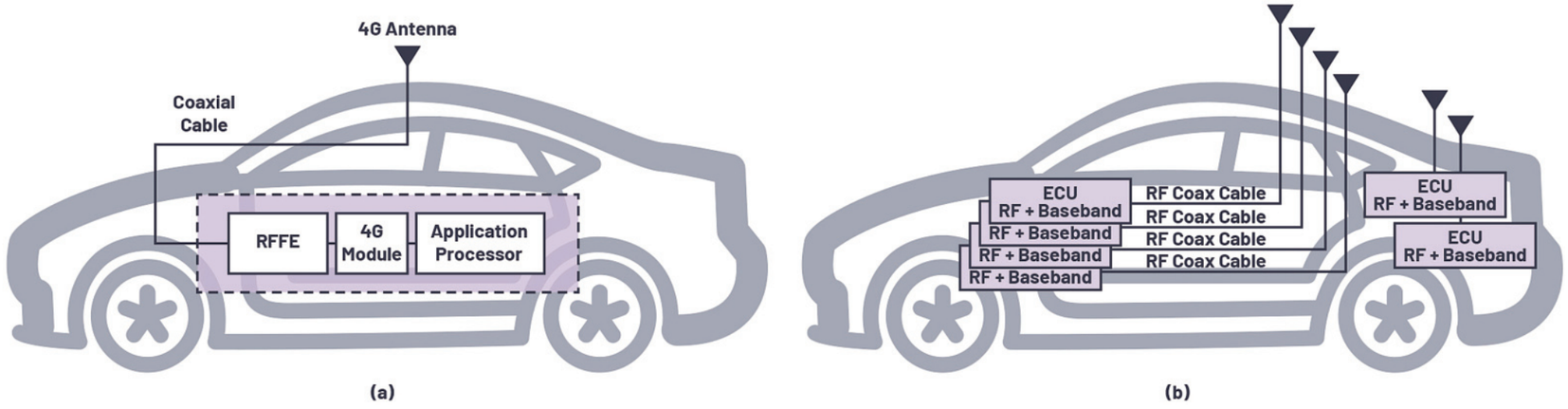


Fig. 2: Classical architectures for cellular wireless connectivity and other wireless systems

Classical

Due to all the wireless systems present in a vehicle, it is evolving like a smartphone on wheels. However, there is a huge difference between a smartphone and vehicle user equipment (UE) when it comes to the implementation of functionalities.

Consider an example of a 4G cellular system implementation architecture in a commercial vehicle. In Fig. 2a, a wideband antenna covering 4G bands is put on the outer side of the body of the vehicle, usually on the rooftop. The antenna is connected to a coaxial transmission line cable that runs through the body of the vehicle to the control unit hosting the 4G module.

Now, focus on the RF front end (RFFE) in the receiver RF path. After filtering the bands, the low noise amplifier (LNA) with a very low noise figure (NF) and high gain amplifies the incoming RF signal. After single or multiple stages of amplification, the signal is fed to the 4G module for baseband and higher layer processing.

After the 4G protocol stack, the data go to the application processor.

Now, a simplified RF analysis of this architecture shows the overall RF chain has very poor noise performance. The signal loss in a coaxial cable is proportional to the signal frequency and the length of the cable. Hence, due to the cable loss, the combination of the cable and LNA will result in a lower signal-to-noise ratio.

Additionally, noise cascade analysis shows the NF of the complete RF chain is overweighted by the NF of the first component in the RF signal chain. Hence, even an LNA cannot overcome this problem.

To save cost and reduce weight, normally a lighter cable is selected, which unfortunately adds to the RF problem. The overall noise performance could be improved by bringing the RF front-end components closer to the antenna, but the impact of the coaxial cable will be present in the system.

Any transmitting device connected to a cellular network must also get the approval of the network operator. Hence, proper design is required in both receive and transmit RF paths.

Fig. 2b outlines how other wireless systems are normally implemented. This is to demonstrate how much coaxial cable is used to connect relative antennas and how much RF signal loss – attenuation in dBM – occurs in each system. This loss increases rapidly if there are multiple antennas for a single system.

In addition, achieving synchronisation among the signals on multiple antennas and running them through the coaxial cable is not an easy task. Moreover, in the case of 5G mm-wave frequencies (24 to 29GHz), the RF signal loss in the coaxial cable will be higher than the sub-6GHz frequencies.

Architecture

The concept of RRH is well established and in use for base station implementations to overcome the problems caused by the coaxial transmission line cables. The strategy is to transport the digital signal instead of the RF signal.

For this purpose, the RFFE and the transceiver (RF IC) is moved closer to the antenna. The RF signal is converted into digital I/Q bits that are transported using a high-speed digital data link. Further processing of digital data is done in the general-purpose baseband processing pool.

A similar RF architecture can be used in the vehicle.

Fig. 3 depicts this architecture where coaxial cables are replaced

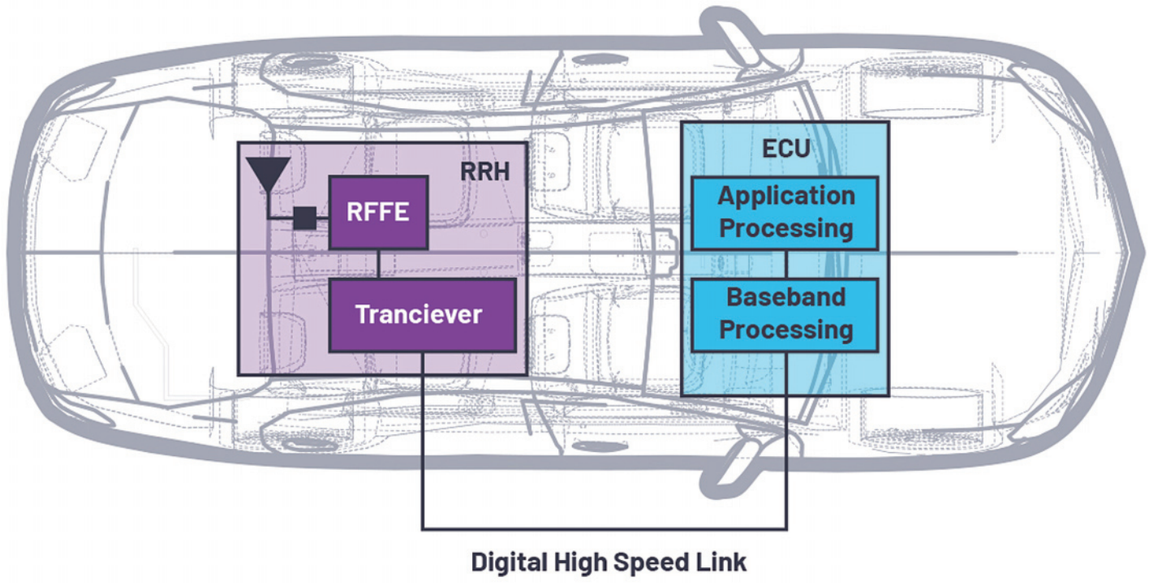


Fig. 3: Future connectivity architecture

by a high-speed link.

Moreover, for the conversion of RF signal into digital I/Q samples, an RF IC can transform RF to bits and vice versa. These bits are transported between the RF IC and the baseband processor by the digital link, for example Gigabit Ethernet. Further processing is done by the application processor.

These processors could be hosted by a radio connectivity unit or by a centralised computing platform. Computational resources and the trend of centralised computing in a vehicle are increasing at a great pace, hence a gradual change towards this architecture is well aligned with the future computing architecture in vehicles.

Keeping only the RF-to-bits functionality close to the antenna has two-fold gains. First, only the minimum required transformation to avoid RF signal loss will be done close to the antenna where space and power are already a problem. Secondly, the requirements on the digital high-speed link will be relaxed in terms of data rates.

Implementation

The benefits of RRH architecture can be enhanced by using a multiband RF IC. The V2X communications service is a perfect example to exploit this combination.

V2X service can use two different wireless access technologies: one is based on DSRC or ITS-G5 (IEEE 802.11p), and the other on cellular technology (C-V2X), be it 4G-LTE or 5G. It can use both access types in a coordinated and cooperative manner to guarantee required reliability and safety.

A single-chip multiband V2X system could be designed with the help of an RF IC. Fig. 4 shows this could be integrated into the RRH, which could be placed on the rooftop antenna box.

It contains four main transmit and four main receive channels, each with the possibility of four independent digital data paths to the baseband processor.

Using the local oscillator architecture, it can transmit and receive simultaneously in multiple frequency bands below 6GHz. Using the V2X wireless access management (WAM) function, both wireless access types can efficiently share 70MHz in the 5.9GHz band allocated in most regions of the world for V2X service.

In line with the future trends, assume that centralised computational resources are available in the vehicle, see Fig. 4. Baseband processing, modem protocol stacks and application processing could be implemented using the centralised platform.

The IC complies with the JESD204B and JESD204C protocols for serial data transmission and reception. Off-the-shelf cables are available that can be used to transport 10Gbit/s at up to 1m. In case more flexibility and data rates are required, one can use any processing hardware to convert the JESD-based serial data into any other suitable format, for example Gigabit Ethernet or PCIe.

As shown in Fig. 4, two transmit and two receive channels have been allocated each for DSRC V2X and 5G cellular. The 5G can use the two channels for full 5G communications including the cellular V2X service.

With two channels, a 2x2 mimo scenario could also be implemented. Unlike current architectures, it requires that the modems for each wireless standard are implemented in the centralised computing platform.

The I/Q samples of respective wireless standards are processed by their software modems. Such a change could be challenging to adopt for current generations. However, increased software and virtualisation can deal with this.

Conclusion

In the classical vehicle connectivity architecture, each wireless system is implemented individually by installing antennas, cables, RF processing hardware and software processing hardware. Based on qualitative analysis, there are negative impacts on service performance due to the classical architecture.

With the help of the RRH concept and dual-band RF IC, a new architecture approach for vehicle connectivity can produce multiple benefits for this architecture, such as a reduction in the use of coaxial cables thus enhancing RF performance and radio link reliability, compliance with the software architecture of future vehicles, the ability to manage some new features through software updates, multiple standards realised with a single RF IC, enhanced control of quality of service guarantee, better coordination possibility for services applying multiple wireless standards, and ready to adopt new wireless standard implementations in future vehicles such as 5G mm-wave.

This approach provides the higher performance required by automated driving and the possibility of multiple wireless systems being implemented with a common hardware. The V2X service, which is essential for automated driving use cases such as platooning and teleoperated driving – both requiring high reliability in wireless connectivity – could exploit the benefits of this architecture.

Danish Aziz is field applications engineer, Fionn Hurley is marketing manager and Chris Bohm is systems and software engineering manager, all with Analog Devices

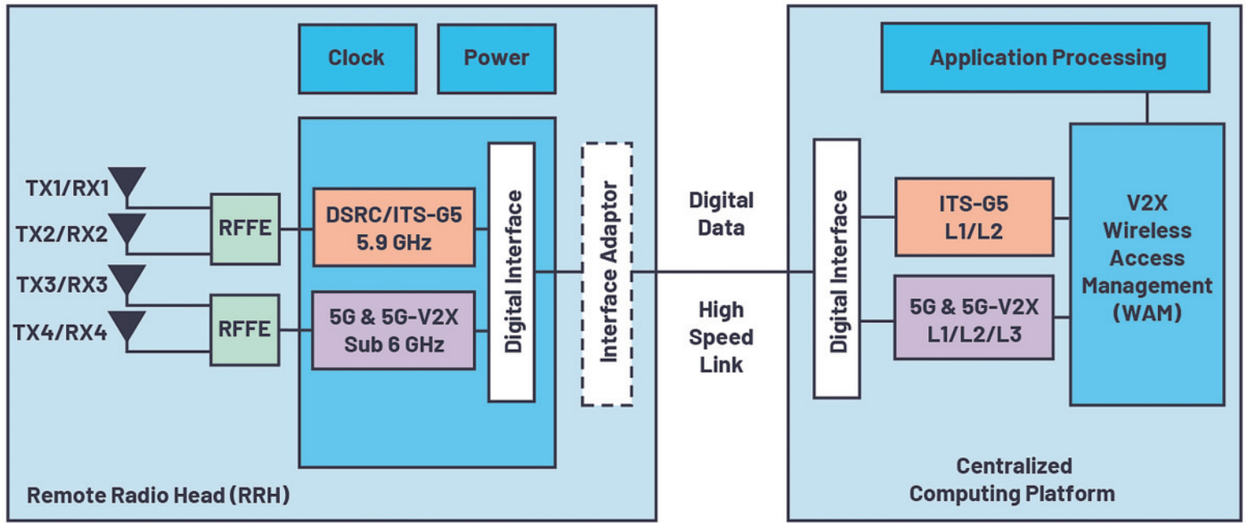


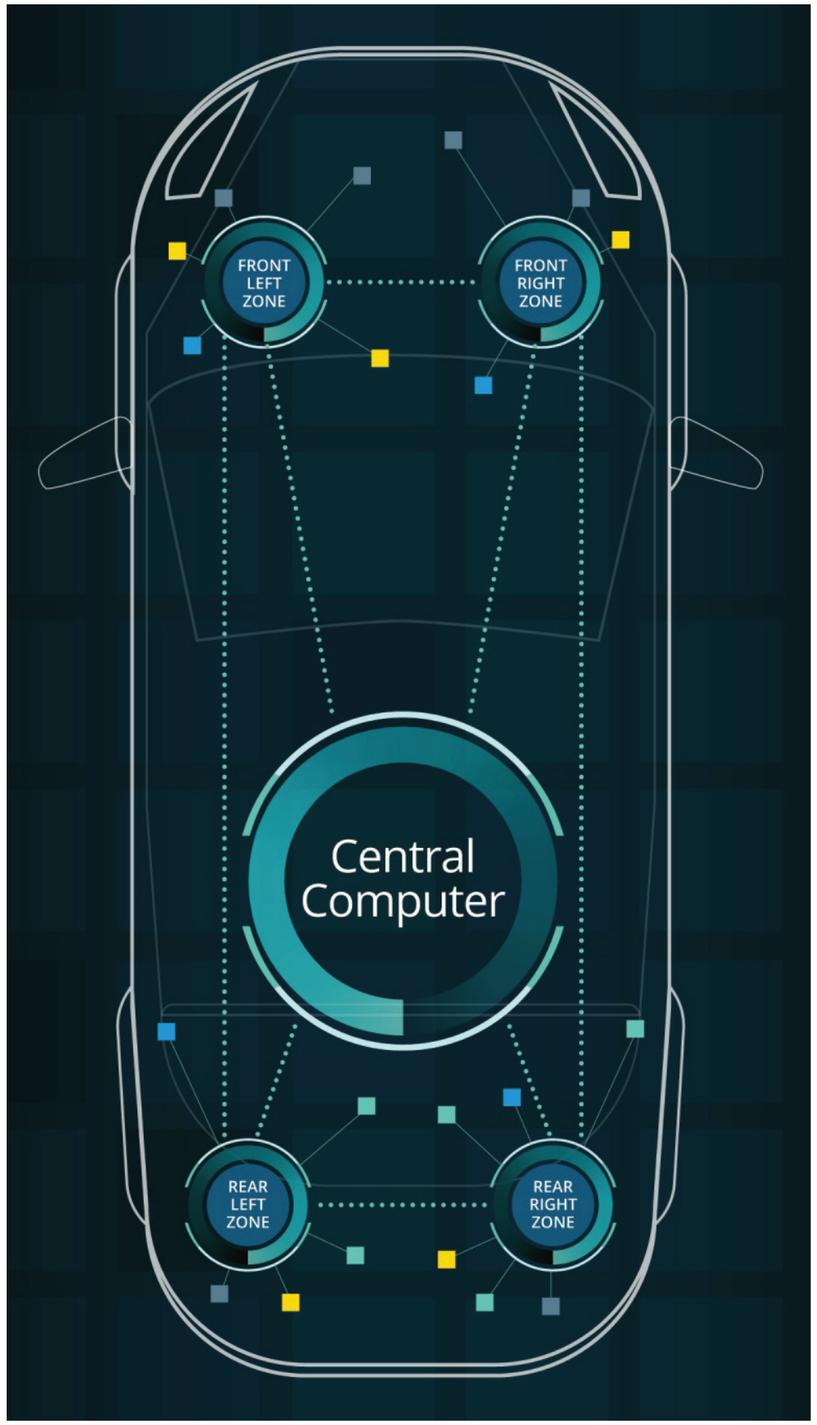
Fig. 4: Advanced 5G and V2X connectivity using SDR-based RRH architecture

CONNECTORS

Kyle Glissman shows how optimising connector construction can meet exacting automobile industry demands

JOINED UP

Image by Devran Topallar from Pixabay



Communication between zonal gateways and the central computer more closely resembles a computer network than an automotive harness

The amount of electronic content built into automobiles has increased significantly over the past two decades and is expected to rise further in the years ahead. Recent projections published by McKinsey estimate that by 2030, the global automotive software and electronics market value is expected to reach $462bn, representing a 5.5 per cent compound annual growth rate (CAGR) from 2019 to 2030.

This expansion of vehicle electronics was first evident in luxury cars, but the growing consumer demand for technological capability now affects both mid-range and economy models too.

Advanced comfort and infotainment capabilities, combined with more sophisticated safety features, have contributed to the increase in electronic content.

Vehicle electrification and the move towards higher levels of system autonomy are also becoming important considerations for automakers.

The net result is greater demand on the constituent hardware incorporated into automobile designs, particularly the connectors and cabling through which data and power are transferred.

Consumers rely on technology in their homes, offices and while on the move. They now expect similar levels of technological support in their vehicles, enabling them to enjoy various multimedia and internet-based services within the vehicle.

Consumers also want the ability to customise the vehicle environment to suit their preferences, with personalised settings being stored on their smartphone and automatically synchronised upon entry.

This means previously isolated systems, such as ambient lighting, seat positioning and climate control, now have to be far more interconnected to fulfil the promise of personalisation.

Connectivity will also play a pivotal role in reducing traffic congestion and the risk of accidents. Through the advent of vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications, information on traffic problems, adverse weather conditions, obstacles on the road ahead and other issues can all be shared across a network of vehicles.

All these factors will have a significant influence on the volume of data moving around vehicles, whether these are data passing between vehicle control units or via communications with the many on-board systems, including sensors, actuators, valves, relays, infotainment devices and battery management systems.

In response, the capabilities of automotive interconnects must be augmented and this needs to be accomplished while reducing the size of these components to meet increasingly tighter space constraints.

Similarly, the amount of cable harnessing needs to be reduced. As one of the largest contributors to the overall weight of a vehicle, cable harnesses have a major impact on the vehicle's efficiency for both vehicles with internal combustion engines (ICEs) striving for optimal fuel efficiency and electric vehicles (EVs) aiming for increased range.

Implications

To support the adoption of more autonomous functions, the number of integrated data acquisition sources is set to expand considerably. Even partially autonomous driving will require an array of high-resolution cameras and 3D imaging, such as lidar and radar. Fully autonomous vehicles will push this requirement further, as additional sensors and redundancy measures impact design.

Ambient lighting and weather conditions are further factors affecting sensor operation. And this is why reliance on just one imaging mechanism is simply impractical. By capturing data simultaneously from multiple sources, the on-board computer can verify that what is being perceived is valid, and thus make the most appropriate decision, such as applying the brakes or making an evasive manoeuvre.

For example, in low-light situations, video cameras can perceive a fog bank as a solid wall, but by cross-referencing these data with the output from a lidar system, the vehicle's computer can ascertain its true form.

The safety implications of many of these applications makes redundancy an essential requirement. With higher levels of autonomy being implemented, driver intervention also diminishes, and that makes it vital to provide assurance that the sensor is operating properly and to provide assurance that the



Connectors must tolerate vibration while providing higher speeds

providing useful data. If the data are incorrect, the vehicle needs to use information from other sensors to assess the situation accurately.

Looking forward, it's challenging for automotive OEMs to predict accurately what functionality they will need. In terms of the supporting data connectivity, there should be enough provision in place. However, building in additional functionality needs to be balanced against reducing excess because inclusion of large components and extra cabling will add to the vehicle's cost and weight.

Engineering

There are many attributes that modern vehicle interconnects must possess. First, the connector's specifications must meet resilience requirements for the demanding environmental conditions of automobiles, including everything from vibration and high temperatures to dust and liquid ingress.

Next, as designs add more functionality, the total available space for components is being reduced, so more compact methods are needed. Given the increasing system communication demands, connectors with higher pin-counts and smaller physical size are required to support the greater data transfer rates and individual component count.

With interconnects that deliver power, close pin placement poses a challenge.

Preventing arcing between tightly situated pins and maintaining sufficient creepage and clearance on the backside are both paramount.

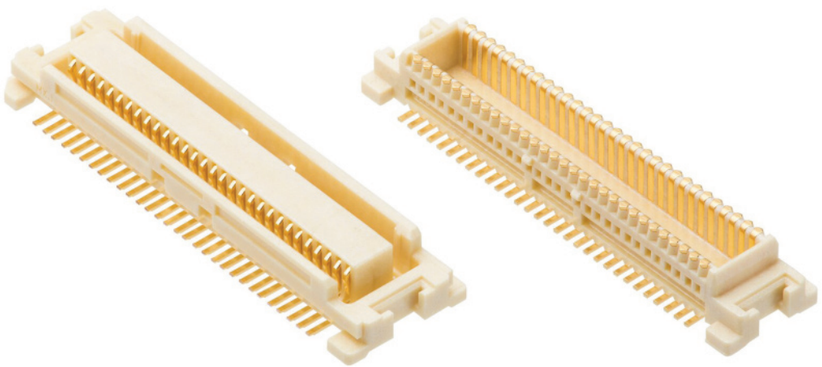
Inversely, data interconnects benefit from pins that are closer together, as it enables easier implementation of twisted pairs, reducing crosstalk.

Within a vehicle, each and every connector application will have its own physical considerations that should be closely matched.

Extended vehicle life and miniaturisation both impose increasing demands on connectors, making material selection critically important. Connector contacts must be made from a material that will deliver high-quality signals while being durable to vibration, temperature and exposure to the elements.

With power connectors, the contacts also need elevated electrical conductivity characteristics to help mitigate potential losses.

The selected materials for all interconnects must be cost-effective for OEMs, while meeting the application's specifications.



Fine-pitch board-to-board connectors with high pin counts help shrink designs in automotive applications

Quality

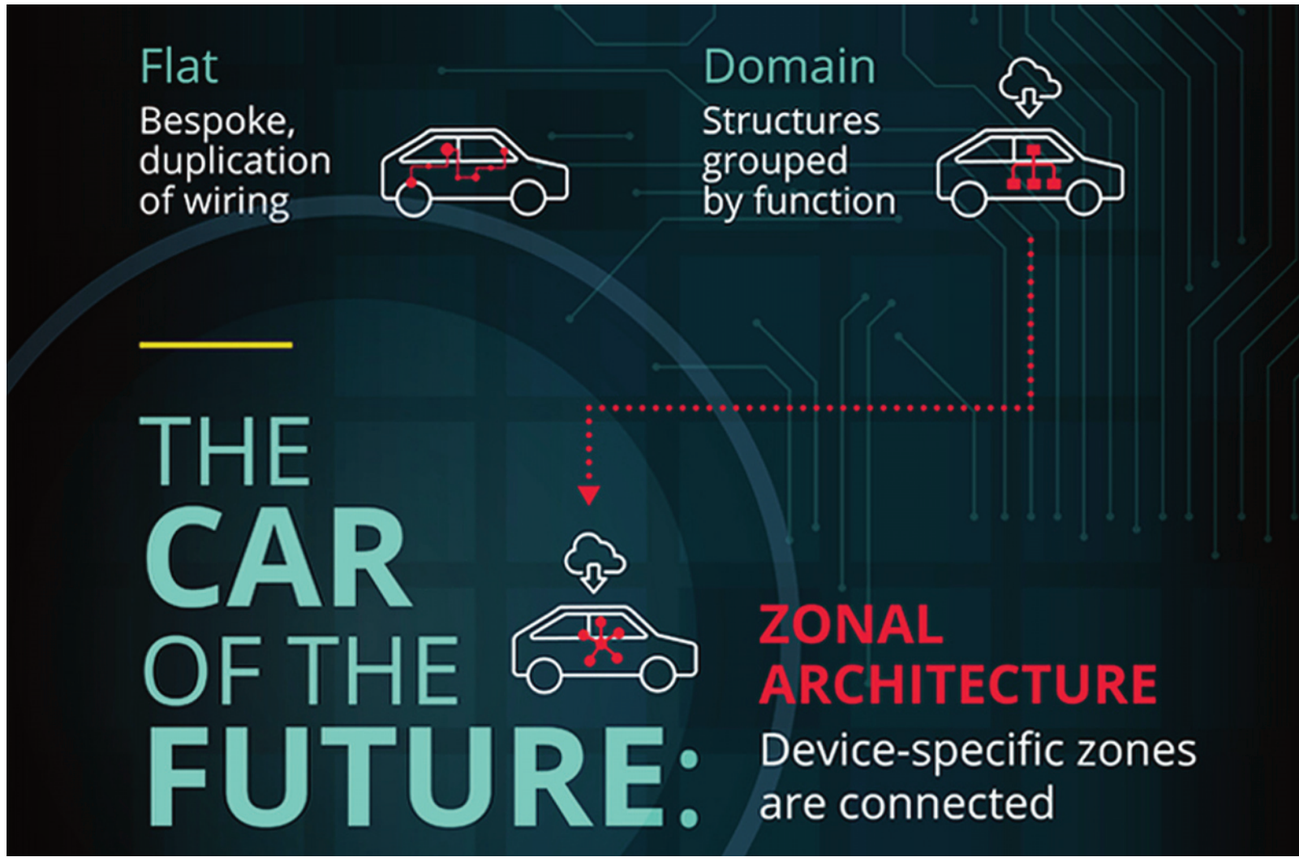
As connector terminals continue to reduce in size sometimes to the point where a microscope is needed to see some features, staying within manufacturing tolerances while still supporting high-volume production becomes a tougher prospect.

For manufacturers, a sophisticated production environment is key to producing consistently high-quality components that meet the latest industry requirements.

Interconnects are not the only components increasing in quantity within a vehicle. The deployment of more sophisticated electronic systems has increased the number of PCBs as well, creating a further need for suitable connectors.

Networking

The move from domain-based to zonal-based architectures will bring enormous benefits to vehicle connectivity, dramatically rationalising networking infrastructure. Data from sensors won't have to go all the way back to a centralised control hub before being passed on to the relevant actuator, with transmission



Wiring architectures are evolving from traditional flat structures to domain-oriented design and zonal approaches in the future

remaining much more localised.

In addition to accelerating response times, this design change reduces the individual system complexity by creating smaller zones and decreasing the vehicle's overall weight through significantly shorter cable runs.

Conclusion

The automotive industry is undergoing significant transformation. With the movement towards electrification and ever-increasing vehicle data demand, automotive OEMs are working to future proof their vehicles to meet evolving market expectations without frequent expensive redesigns. To stay ahead of the curve, vehicle manufacturers should collaborate closely with their interconnect suppliers from initial concepting through deployment.

This cooperative approach enables automotive OEMs to leverage the extensive experience of connector manufacturers. By starting the collaboration early in development, a better grasp of the exact requirements can be determined and an optimal method recommended.

This approach reduces development costs and can help increase the standardisation of connectors for specific recurring applications. Improved synergy and knowledge sharing between vehicle OEMs and connector suppliers can positively impact the design of interconnects and deliver products optimised for critical applications.



Kyle Glissman is global product manager at Molex

TEST & MEASUREMENT

How Atesteo handles drivetrain testing for automotive manufacturers

What's on the bench?

TEST & MEASUREMENT

The pace of development of drivetrain technologies is as fast as it has ever been, and it is possible to look forward to the day when the traditional petrol- or diesel-fuelled combustion engine will no longer be produced.

Its demise will be the result of government regulations aimed at reducing carbon emissions from the transportation sector; electrification is the new watchword for the car industry.

This is leading manufacturers of passenger cars and commercial vehicles to ramp up investment in the development of new electric motor technologies: both hybrid electric and fully electric drivetrains, and the multitude of systems and components that support them.

At the heart of the development, testing and validation work taking place globally in the vehicle sector is Atesteo, an automotive-specialist independent testing services provider that has more than 800 employees operating 170 test benches across nine locations in Germany, USA, China and Japan.



Atesteo provides a wide range of drivetrain testing services

Atesteo provides a wide range of drivetrain testing services, including noise, vibration and harshness (NVH) measurements and environmental simulation, as well as tests of an entire vehicle on a dynamometer or on the road.

The measurement results Atesteo reports to car and automotive systems manufacturers steer the progress of development of the drivetrains, which will be embedded in future faster, more efficient and more dynamically effective vehicles.

The accuracy, stability and traceability of these measurements are of critical importance to Atesteo's customers, and that means it makes exhaustive and detailed evaluations of test instruments before deploying them in its test benches.



WT1800E power analyser from Yokogawa

Background

An independent provider of testing services and engineering consultancy to automotive manufacturers, Atesteo has achieved success by maintaining a high level of agility and responsiveness to customer demands. These customers range from suppliers of specialist components for the powertrain or transmission, up to the world's leading car manufacturers.

So the test benches Atesteo maintains need to be flexible enough to cope with a wide variety of test specifications and set-ups. In addition, the growth of the company has taken it into new markets, which can take advantage of its expertise in drivetrain testing, such as marine systems and renewable energy generation.

A typical parameter that needs to be measured is the efficiency of an electric drivetrain, or of its components. Here, precise and accurate measurements of the input voltage and current are essential.

Compared with the actual traction power of the motor, these measurements allow the manufacturer to measure power losses, locate their cause, and take measures to reduce or eliminate them to increase system efficiency.

But this is just one of many types of measurement Atesteo might be called on to make. Every user and every new test project are different, and require a fresh test set-up.

So the business model calls for the flexibility to adapt its more than 170 test benches to each new project.

At the same time, automotive users require very high accuracy and traceability; the measurements the company provides are intended to validate the performance and reliability of a design, and so it is crucial the user has high confidence in the measurement results.

The test benches include facilities for advanced power measurements. Atesteo serves many users from across the global automotive sector, as well as manufacturers of marine and renewable energy equipment. Every project has its own test specification, so it is continually tearing down the test set-ups of completed projects and reconfiguring test equipment and software for new projects. This means it requires flexible test instrumentation that can readily be repurposed for each project.

At the same time, Atesteo is liable for the accuracy of its measurements, so needs to use



Every user and every new test project is different

test instruments that provide traceability for the validation of measurement outputs.

Measurements

At its drivetrain test centre in Kassel, Germany, Atesteo has built its platform for power measurements on the WT1800E power analyser from Yokogawa. It also deploys a DL950 scopecorder. These instruments are backed by engineering support provided directly by Yokogawa.

These instruments meet its requirement for flexibility and accuracy. The WT1800E is a modular test platform with up to six input channels, as well as a wide range of display and analysis features, and PC connectivity. Engineers can use it to make simultaneous measurements on up to six inputs at a rate of 2MS/s; all current and voltage measurement inputs are synchronised. A mechanical channel can acquire either analogue or pulsed signals.

The high-resolution 21.3cm XGA display allows split-screen viewing of up to six waveforms. This makes it suitable for efficiency tests of inverter driven motors, renewable energy technologies and traction applications. The unit can display measurements in vector format or trending in time.

The instrument guarantees power accuracy of 0.05% of reading plus 0.05% of range. It is capable of harmonics analysis up to the 500th order of a 50 to 60Hz fundamental frequency. The built-in motor evaluation capability means it can measure more than just electrical parameters; measurement of rotation speed and direction, torque, mechanical power, synchronous speed, slip, electrical angle, motor efficiency and total system efficiency can be derived from the analogue or pulse outputs of rotation and torque sensors.

Atesteo follows a regular 12-month calibration cycle for the WT1800E and DL950 at Yokogawa's ISO/IEC17025 accredited European Standards Laboratory in Amersfoort, Netherlands. This lets it maintain full traceability of its measurements, and validates the results it supplies to its customers.

Conclusion

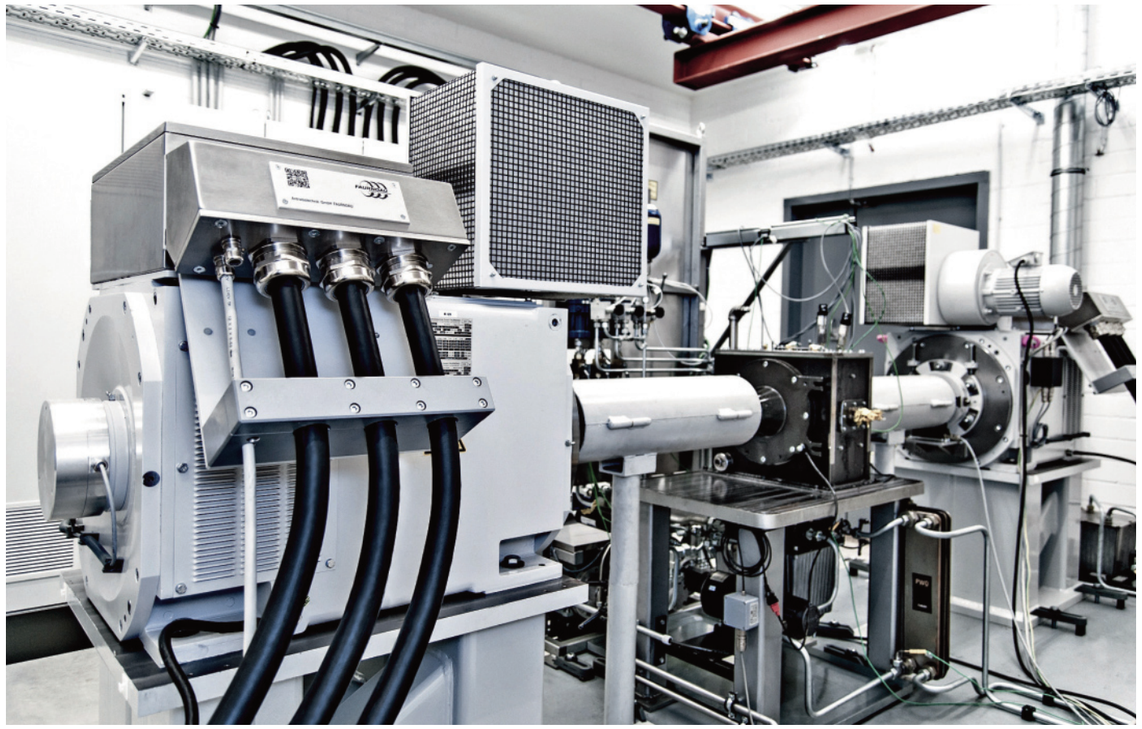
The move to electrify the drivetrain of vehicles has prompted the automotive industry to embark on a huge innovation effort. From traction systems to transmissions to energy storage, car manufacturers are responding to the demand from road users for vehicles that allay range anxiety and which provide better dynamic performance.

Atesteo's test benches provide manufacturers with critical data points so they can experiment with new design approaches, validate their success, and implement them with confidence in production units.

"Atesteo's success is in large part due to the expertise we have developed in the testing of drivetrains," said Andreas Olf, branch manager at Atesteo's Kassel facility. "We are the leading specialists in this field of technology, and customers benefit from the knowledge and flexibility we provide. Underpinning our service is our confidence that the measurement values that we supply to customers for efficiency, power output, NVH and the rest are true and accurate. That is why we choose to use Yokogawa products for power analysis. Over many years of operation, we can see the results from the Yokogawa equipment are stable, accurate and reliable, and so we have no hesitation in continuing to rely on the WT1800E and DL950."

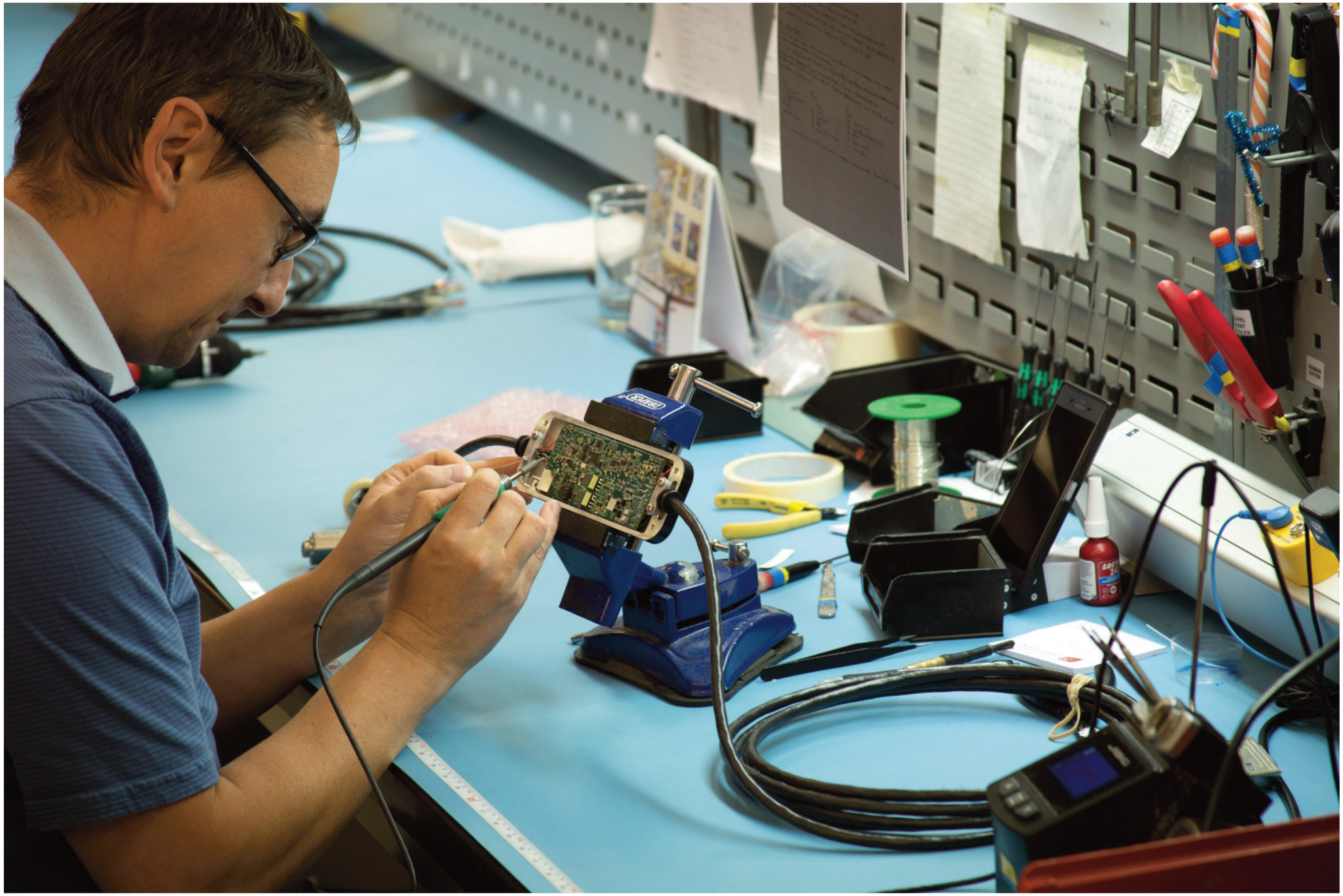


Yokogawa DL950 scopecorder



Atesteo needs to be flexible to cope with a wide variety of test set-ups

SUPPLY CHAIN



ROAD TO RECOVERY

Phil Simmonds addresses lead times and supply in electronics manufacturing

It has been a turbulent few years for the electronics industry. The fallout from the Covid-19 pandemic started a domino reaction across the electronics supply chain, made worse by the logistical and economic difficulties caused by the war in Ukraine.

UK manufacturers are also suffering from the lingering impact of Brexit.

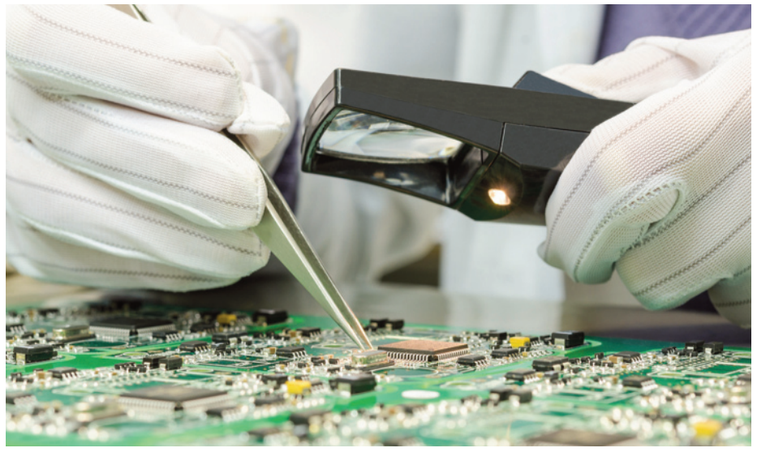
Still, many electronics companies have remained resilient. The demand for the latest technology is increasing across sectors, with Precedence Research's report on electronics predicting that the market would grow at a compound annual growth rate (CAGR) of 5.1% between 2022 and 2030.

However, with logistics issues still impacting the availability of key components, electronics manufacturing service (EMS) providers and OEMs must consider how they can mitigate supply and pricing constraints to continue meeting this demand.

Reasons

ICs and semiconductors have been particularly affected by extended lead times in recent years, presenting many obstacles to electronics design and development. Why?

Passive and discrete passive components – resistors,



capacitors, diodes and inductors – are integral to the design of ICs, semiconductors and PCBs. So, any disruption in the manufacture of these components will have a knock-on effect on supply availability, leading to product-on-allocation arrangements and delays across the board.

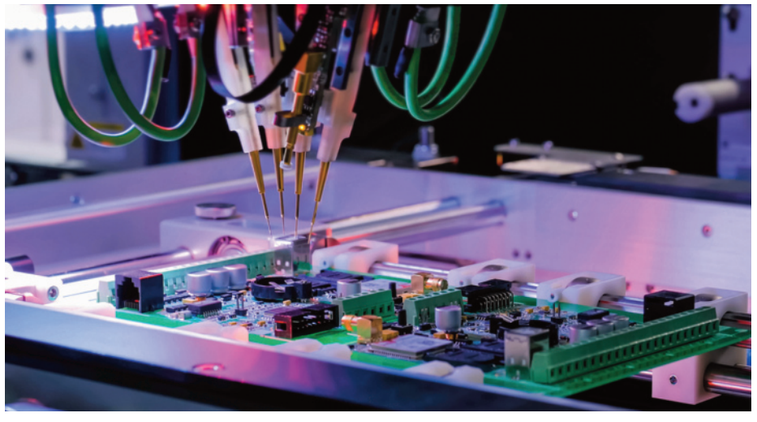
Consumer electronics such as smartphones and automotive electronics equipment are the biggest market drivers for passive component volumes.

Manufacturers have so far managed to increase their capacities to meet these sectors' demands by downsizing components and making performance improvements. As a result, standard small-case micro lead-frame chip carriers (MLCCs) and chip resistors have remained available within regular lead times, making it possible to deliver the consumer electronics that are around today.

However, supply problems still exist for many components due to the explosion of complex electronics in every application, driven by two macro trends: sustainable energy supply and the electrification of transportation.

These applications require performance components with higher voltages and increased reliability. Typically, the production processes for these products involve more time and labour, meaning yield volumes may be lower. Manufacturers are investing to meet demand but, in some cases, backlogs are over 18 months, creating even longer lead times.

So, how is all of this impacting the availability of electronic components?



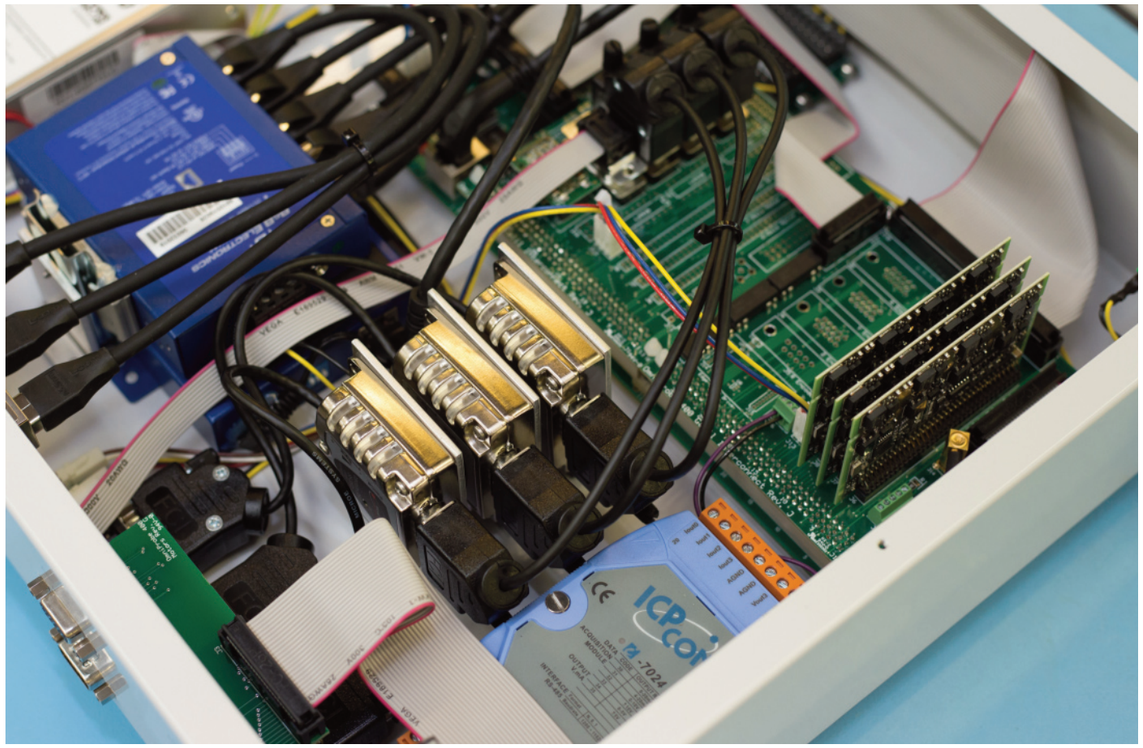
Lead times

Lead times are component and manufacturer-specific, and the situation is constantly changing.

For example, despite disruption in ruthenium and alumina supply chains following the conflict in Eastern Europe, lead times for thick-film chip resistors have declined steadily between mid-2022 and April 2023 due to lower consumer electronics demand from China. Still, the availability of high-power thick-film parts remains tight due to increased demand from the electric vehicle (EV), infrastructure and defence sectors.

The fluctuating availability of various passive components is also impacting PCB production. PCB manufacturers have faced inventory adjustments due to the changing cost of raw materials such as copper, foil, resins and glass fabrics. Additionally, the dampening demand for PC and consumer electronic devices has led to a deterioration of conventional materials suppliers' businesses, further compounding supply issues.

As a result, from Q1 to Q3 2022, the average PCB quotation lead time was over 20 weeks. However, towards the backend of Q4 2022, this figure dropped to 18 to 20 weeks, marking a slight improvement.



Overall, the quote signs from Q1 2023 are positive. Progress can be seen on some lead times, with the average PCB quote time dropping to 14 to 18 weeks.

There is a combination of factors in play that are contributing to these improvements. Perhaps most significantly, companies are becoming increasingly forward-thinking with their PCB designs, replacing conventional and hard-to-procure components with more available alternatives. This is evident with the amount of small-quantity prototypes being quoted for PCB projects.

Still, the industry is not quite back to normal conditions yet. So, EMS providers will need to take a cautious approach to remain resilient to changing market conditions.

Outlook

While the current supply shortages will likely continue impacting operations for the foreseeable future, electronics manufacturers, supply chain managers and OEMs can still work together to mitigate any disruption they might cause.

Planning ahead will be crucial throughout the rest of 2023 and beyond, especially considering the unpredictability of supply chains. Transit times from the Far East are stabilising, but delays are still to be expected.

Therefore, forecasting, advanced procurement and vendor-managed inventory should all help streamline operations across the board.

It will also be important to continue realistically quoting on demand and ensuring lead times are accurate to avoid over-promising on delivery. OEMs and other EMS companies should order well in advance to help manufacturing processes run smoothly.

By staying organised, evaluating supply channels, reimagining electronics designs and seeking practical alternatives to more high-demand materials and components, companies can continue producing innovative new products while managing expectations and keeping costs down where possible.



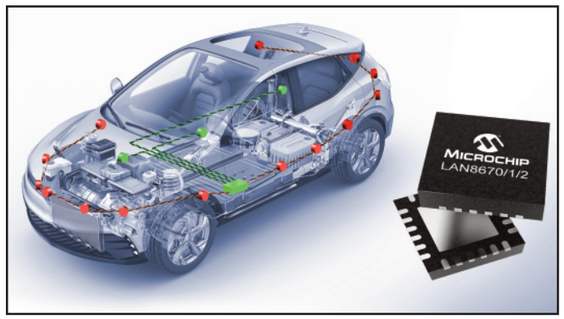
Phil Simmonds is CEO of EC Electronics

Ethernet devices simplify architecture

Microchip has introduced is first automotive-qualified 10baseT1S Ethernet devices.

The Ethernet phys simplify the architecture to connect low-speed devices into a standard Ethernet network.

Automotive designers are looking to replace legacy gateway subsystems with technology that can migrate applications to an Ethernet network to access information from the edge to the cloud.



The LAN8670, LAN8671 and LAN8672 devices have AEC-Q100 grade-one qualification.

They are functional-safety ready and designed for use in ISO 26262 applications. They make it possible to connect low-speed devices that previously required their own communication systems into a standard Ethernet system in automotive applications.

The ability to connect multiple Ethernet phys to a common bus line makes it simpler to implement automotive applications on a single, well-known architecture and saves implementation costs by reducing cabling and switch ports.

They let the network edges use Ethernet and IP to communicate with the rest of the network infrastructure. These devices include phy diagnostics to provide troubleshooting capabilities. In addition, sleep-wake functionality allows for low-power modes.

Specifications include 10Mbit/s, half-duplex mode, flexible topology with multidrop bus line and point-to-point. They use a single balanced pair of conductors.

They also have enhanced EMC and EMI performance.

Time sensitive networking (TSN) support allows for synchronised timing across Ethernet networks. Time synchronisation is critical for many applications in automotive zonal architectures.

They are supported with the EVB-LAN8670-RMII, EVB-LAN8670-USB and MPLab Harmony v3 development tools, and are available to purchase now.

Motor driver optimises thermal valves

A motor driver from Melexis optimises thermal valves on electric vehicles for accurate battery temperature control and expansion valves for heat pump refrigeration loops.

This enables longer range for EVs.

The MLX81334 complements the firm's embedded motor drivers with extended memories and OTA (over-the-air) support for premium software features.

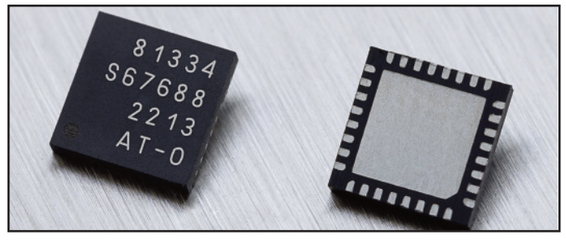
The Lin-based 1A-rated motor driver is for deployment in mechatronic thermal management systems. This single-chip device drives small DC, BLDC or stepper motors.

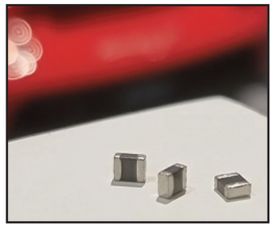
Each IC has an embedded microcontroller with a 16bit application processor and a separate communications processor, four fet half-bridge drivers, data conversion circuitry, plus Lin or serial interfaces.

The 64kbyte on-chip memory provides capacity that allows more safety diagnostics to be incorporated, as well as essential calibration data.

Using high-voltage silicon-on-isolator (SoI) technology, it combines operational robustness with elevated levels of functional integration.

The drivers are supplied in 5 by 5mm 32-pin QFN packages. They are suitable for use in 12 and 24V automotive systems. Over-temperature, over-current, over-voltage and under-voltage protection functions are included.





Power inductors

Samsung has begun mass production of power inductors for electric and autonomous vehicles.

The power inductors provide stable power to semiconductors that process autonomous driving information by preventing sudden current changes. The company has developed two types of 2016 size (2.0mm long and 1.6mm wide) inductors with capacities of 1.0 and 2.2μH.

They are thin film products where thin coils are formed on the package substrates, which has the advantage of higher productivity and miniaturisation than the wire wound type where the coils are wound on magnetic substances.

Photo-resist technology developed for MLCCs where circuits are engraved using light is used in semiconductor package substrates to form precisely coils with minute spacing.

They meet AEC-Q200 and can be used in applications such as adas and in-vehicle infotainment.

Mosfets contribute to efficiency

In static switching applications, power designs focus on reducing conduction losses, optimising thermal behaviour, and achieving compact and lightweight systems while ensuring high quality at a low cost.

To meet these needs, Infineon is expanding its CoolMos S7 family of high-voltage superjunction mosfets.

The devices are aimed at electric vehicle onboard chargers and other applications.

The extension includes QDPak top-side cooling packages. They suit low-frequency switching. $R_{DS(on)}$ is 10mΩ.

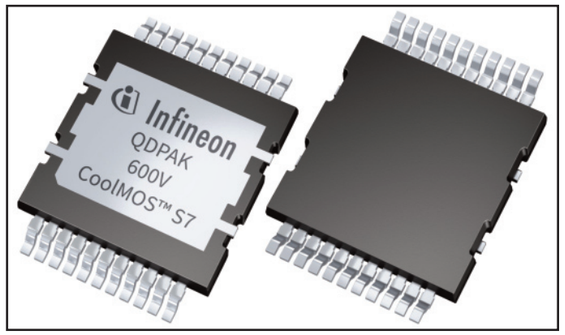
By reducing conduction losses of the mosfets, the S7 and S7A contribute to higher overall efficiency and provide an easy and cost-optimised way to improve performance.

The power switches also manage heat dissipation with improved thermal resistance. They reduce or even eliminate the need for heat sinks in solid-state designs, resulting in more compact and lighter systems.

The mosfets feature high-pulse current capability, enabling them to handle sudden surges of current. In addition, they exhibit body diode robustness to ensure reliable operation during AC line commutation.

They enable shorter reaction times, particularly when breaking a current, facilitating smoother and more efficient operation.

The 600V industrial grade S7 and automotive grade S7A for static switching are available in top-side and bottom-side cooling variants.



Software stack accelerates design

A software stack from Lattice Semiconductor can help with the accelerated development of flexible automotive system designs and applications.

Expanding the company's application-specific software stack portfolio to the automotive market, Lattice Drive is designed for automotive applications including in-vehicle infotainment display connectivity and data processing, adas sensor bridging and processing, and low power zonal bridging applications for driver, cabin and vehicle monitoring.

The initial release focuses on in-vehicle infotainment display connectivity and data processing, enabling multi-resolution scaling and supporting display sizes up to 4K.

It supports DisplayPort up to HBR 3 at 8.1Gbit/s per lane.

Image and video enhancement are provided with scalable full array local dimming.

Features include multiple display connectivity, and it can process or co-process data to offload the CPU.

The stack provides application-specific options that combine reference platforms and designs, demos, IP building blocks, and FPGA design tools to accelerate application development and time to market.

Ethernet switch improves safety

Two central Automotive Ethernet switches from Marvell help computing architectures improve safety and deliver software-defined services.

The Brightlane Q622x switches can coordinate data traffic between zonal switches, which aggregate traffic from devices within a physical zone of a car. These include processors, sensors, actuators and storage systems.

The Q6223 delivers 90Gbit/s bandwidth. The non-blocking 12-port design can be configured from among the eight integrated 10G serdes ports, four integrated 2.5G serdes ports and two integrated 1000baseT1 phys.

There are nine ports on the Q6222 for 60Gbit/s, with five integrated 10G serdes ports, four integrated 2.5G serdes ports and two integrated 1000baseT1 phys.

Both switches are single-chip devices to reduce cost, power and latency.

They incorporate IEEE 802.1AE-2018-compliant media access control (Macsec) link security on every port, up to 10G, for encrypting data traveling between automotive components to prevent man-in-the-middle and other attacks.

Patent-pending ternary content addressable memory (TCAM) implementation for deep packet inspection (DPI) provides for wire-speed packet classification to ensure packet validity and the ability to filter and classify more than 4000 IPv4 or IPv6 flows for heightened intrusion detection.

Additionally, they incorporate a hardware security module for encryption, Macsec key management and trusted boot functionality to secure the in-vehicle network.

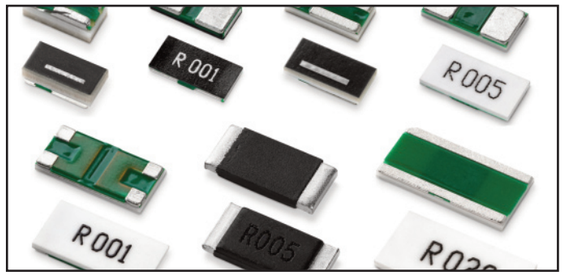
The Arm dual-core R52 processor provides lockstep redundancy for mission-critical applications.

Time-sensitive networking supports the latest TSN standards to reduce latency and ensure quality of service for essential vehicular connectivity, including the IEEE 802.1CB standard for data redundancy.

Sensing resistors add protection

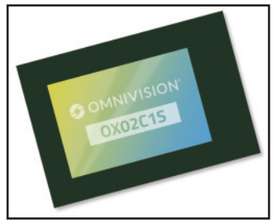
Current sensing resistors (CSRs) from Littelfuse can be more cost-effective for measuring current within circuits, enabling voltage monitoring, control and power management of functions such as battery charging and motor speed, while also providing overcurrent protection.

They suit automotive and consumer electronics markets with applications such as automotive electronics and electric vehicles, including two- and three-wheelers. Features include current measurement, voltage monitoring, power control and overcurrent protection.



Each of the eight CSRs is either a metal foil, metal strip or metal plate resistor used for measuring currents in circuits due to its high precision and low resistance rating.

They are available in tape-and-reel quantities of 5000.



NIR sensors

Two additions to Omnivision's Nyxel near-infrared (NIR) family are the OX02C1S 2.5Mpixel RGB-IR BSI global shutter sensor for in-cabin driver and occupant monitoring systems; and the OX01H1B 1.5Mpixel mono IR GS sensor for driver monitoring.

With a pixel size of 2.2μm, both sensors have an NIR quantum efficiency at 36%, an increase in modulation transfer function over the previous 3.0μm FSI GS pixel design, and low power consumption.

Both use OmniPixel 4-GS technology, which enables simultaneous image detection in all pixels to reproduce rapid motion accurately without any deformation.

They have integrated Asil-B and cyber security to meet latest standards.

Both come in a stacked a-CSP package, and are available in a reconstructed wafer option.

The OX02C1S sensor has 2.5Mpixel resolution in a 1/3.55in optical format, while the OX01H1B has 1.5Mpixel resolution in a 1/4.51in format.

GaN fet gate driver in single package

A power-through isolated gate driver from Allegro Microsystems creates a single-package way to drive gallium-nitride (GaN) fets with up to a 50% smaller footprint and a 40% efficiency improvement.

The clean-energy movement requires power system designers in automotive and industrial markets to generate, store and use energy more efficiently. Wide-bandgap silicon-carbide (SiC) and GaN fets offer efficiency benefits at the system level but often come with integration difficulties.

A traditional gate driver implementation requires an isolated gate driver and a separate isolated power supply. When assembled, connections between the driver, power source and fet can add unwanted noise and create pathways of EMI that can degrade performance.

Mitigating these effects can create design complexity, adding time and cost to a project schedule as well as size and weight.

The AHV85110 gives engineers and designers access to high-power isolated gate driving technologies that provide multiple system level benefits.

The gate driver combines traditionally separate components – the isolated gate driver and isolated power supply – into a single, compact package. It reduces EMI pathways and simplifies integration, resulting in faster time to market, efficiency gains and production cost savings.

It eliminates bootstrap circuits and isolated supplies while reducing common-mode capacitance, which reduces EMI filter design efforts and improves overall efficiency.

By providing a reliable, scalable design process across platforms, it eliminates the need to redesign a power module when working with multiple GaN fet suppliers.



Op amp stablises input offset

A high-precision op amp from Diodes uses input offset (VOS) stabilisation for automotive signal conditioning applications.

The micro-power AS333Q, a single-channel version of the dual-channel AS2333Q op amp, is for current sensing and signal detection in a broad range of in-vehicle functions, including airbags, position sensors, vehicle occupant detection sensors, on-board chargers (OBCs) and wireless chargers, and battery management systems (BMS).

Automotive designs are increasingly employing brushless DC (BLDC) motors and ECUs for adas. These require precision op amps for accurate analogue signal conditioning.

The chopper-stabilised low input offset voltage (VOS = 8μV) and almost-zero temperature drift (0.02μV/°C) enable it to maintain high accuracy across the full common-mode input voltage range.

In addition, the device's ability to handle beyond-the-rail-to-rail common-mode inputs lets it support supply and ground-referenced inputs.

The 1.1μV/√Hz low-frequency noise helps improve signal-to-noise ratios (SNR), while a quiescent current of 17μA typical means it can be used in equipment that must continue operating while a vehicle's engine is off.

The device is qualified to AEC-Q100 grade one, manufactured in IATF 16949 certified facilities, and is PPAP capable. It is in a sot-25 package.



Voltage trackers check anomalies

An automotive voltage tracker from Ablic is for sensors in connected, autonomous, shared and electric (case) vehicles.

The S-19721 is in a class of ICs with low offset voltage and provides accurate sensor readings for ECU external sensors and components.

Each can output up to 250mA and cope with the high current output required by high-performance sensors or groups of sensors.

A notification function detects IC anomalies and makes them known. This copes with overvoltage and overcurrent, as well as IC thermal shutdown.

Other circuits protect ECUs even in the event of a wire harness failure to improve safety.

It is PPAP capable and planned for compliance with AEC-Q100 grade one.

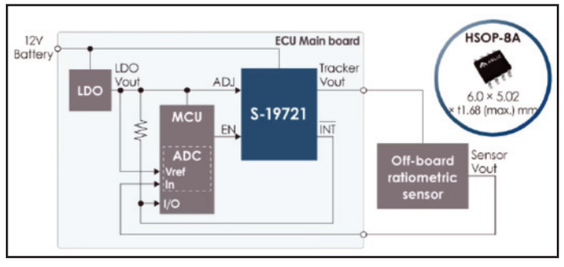
The IC has achieved an offset voltage as low as ±4.5mV. A low voltage tracking tolerance improves sensor reading accuracy.

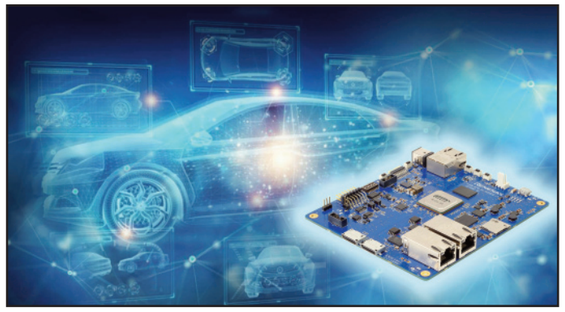
It offers 36V operation and 250mA output, and can be placed in a standard HSOP-8A package, a high-heat dissipating TO-252-9S package or a compact HSNT-8 (2030) package.

By limiting reverse current from the V_{out} pin to the V_{in} pin to -5μA, it protects devices from damage from short to supply and short to ground faults.

The high-withstand voltage product has an input voltage of 36V and a rating of 45V, and can be directly connected to a 12V lead-acid battery.

The IC can act as a sensor for current, temperature, torque, steering angle, ambient light and fuel, and can be used in engines, transmissions, suspensions and ABS, and in EVs, HEVs and PHEVs units such as inverter, on-board charger, BMS, EPS, ESC and body control module.





Starter kit suits vehicle gateways

Renesas has announced a development board for automotive gateways.

The R-Car S4 starter kit is a low-cost board for building software using the R-Car S4 SoC.

The SoC delivers computing performance and an array of communication features for cloud communication and safe vehicle control.

The starter kit is less-expensive than the existing S4 reference board, which provides a full-scale development environment including an evaluation board and software.

Engineers can take advantage of the new kit to start their initial evaluation of car servers, connected gateways, connectivity modules and more, for rapid application development.

The kit includes R-Car S4 interfaces such as Ethernet TSN switch and Can-FD, as well as 4Gbyte of LPDDR4, 128Gbyte of universal flash storage and 64Mbyte of quad SPI flash memory.

Users can expand peripheral functions by using expansion connectors and customising the hardware.

Also available is the R-Car S4 Whitebox SDK, an open-source automotive development environment for the S4, which can be combined with the S4 starter kit.

The SDK consists of free software and can be used without the need for complicated licence agreements.

It includes sample software, test programmes, resource monitoring tools for OTA updates, intrusion prevention system, and intrusion detection system for network security, allowing for prototyping and evaluation.

Engineers can use the sample software as a base to develop their own applications.

Multipixel LED enables dynamic headlights

An intelligent multipixel LED from AMS Osram enables fully adaptive, dynamic headlight operation and image projection.

The Eviyos 2.0 can selectively illuminate the road ahead to increase the driver's view in high-beam mode without creating glare.

The chip's 25,600 individually controllable LEDs with a pixel pitch of 40μm can also project high-resolution images on to the road surface, for instance to display warning symbols to the driver or other road users, or to guide the driver past obstacles.

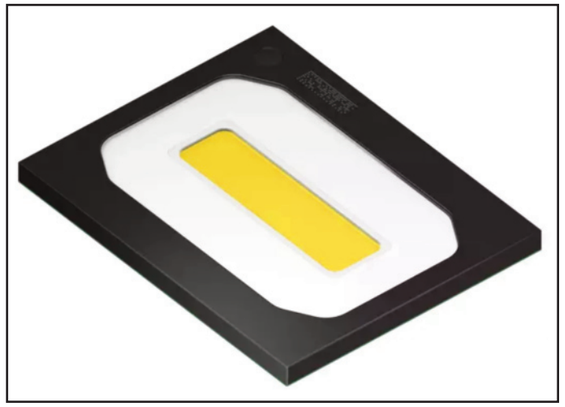
This is the result of ten years of continuous engineering development and it is now in volume production.

The 25,600 pixels are fabricated in a monolithic μ-LED chip array to improve uniformity of colour and brightness.

The product consists of the multipixel emitter and a driver that individually controls the operation of each of the 25,600 LEDs.

In adaptive driving beam systems, the multipixel headlamp is mounted in a lensed headlamp assembly, and combined with an intelligent camera for scanning the scene in front of the vehicle. This enables the headlamp in high-beam mode to switch off enough LEDs dynamically to avoid glare for other road users while increasing the driver's view of the road.

Dynamic control of individual LEDs also enables the headlight to project accurately along curves, extending the driver's view of the road ahead.



The high-output, high-efficiency automotive light source enables energy saving in vehicles: only those LEDs are energised that are required to increase the driver's view safely, so light is not wasted.

The LED chip has a 40mm^2 footprint to ease integration in sleek headlamp assemblies and is available with a 1:4 (25,600 pixels) or 1:3 (19,200 pixels) aspect ratio.

Several car manufacturers and tier-one suppliers are designing it into product concepts. For instance, Marelli has announced its first multipixel LED headlight module to be based on Eviyos 2.0: the h-Digi microLED, see page 12.

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