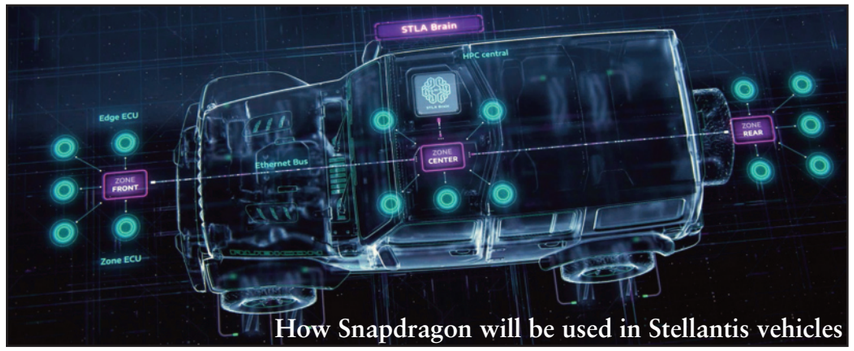
VEHICLE electronics

The monthly magazine for automotive electronics engineers



How Snapdragon will be used in Stellantis vehicles

Qualcomm to power Stellantis in-vehicle experiences for years

In a multi-year deal, Stellantis is to use Qualcomm Snapdragon technology for intelligent, customisable and immersive in-vehicle experiences in millions of vehicles across its 14 automotive brands beginning in 2024.

Leveraging the platforms and 5G capabilities for telematics, Stellantis hopes to meet expectations for personalised experiences that are continually upgradeable.

This will facilitate Stellantis' plan to merge all software domains into high performance computers, leveraging the Snapdragon platforms across all major vehicle domains as well as contribute to securing Stellantis' supply chain on strategic components.

The first application will be to power the infotainment system in the Maserati brand.

"Our technology collaboration with Qualcomm is another example of how we are identifying industry leaders to work alongside our passionate and talented internal teams as we transform our vehicles through a software-defined approach," said Carlos Tavares, Stellantis CEO.

Stellantis will use Snapdragon to power the in-car communication and infotainment for STLA SmartCockpit, which is being designed and engineered with Amazon and Foxconn. The platforms are engineered for high-definition graphics in touch- and voice-controlled cockpit consoles, and to deliver an immersive in-cabin experience, enabling premium audio and crystal-clear voice communications throughout the vehicle's cabin.

Snapdragon will also be used to enhance STLA Brain, increasing digital intelligence for convenience and safety, and helping enhance the in-vehicle personal assistant capabilities with intuitive artificial intelligence.

• **Qualcomm completes Arriver buy, p10.**

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May 2022

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Magna and Seeing Machines monitor drivers

Computer vision technology company Seeing Machines has collaborated with Magna on a demonstrator that features a fully integrated driver monitoring system (DMS) combining camera, electronics and interior mirror technology.

Seeing Machines designs AI-powered operator monitoring systems to improve transport safety,

The demonstrator combines Magna's mirror technology, camera design, integration and packaging know-how with Seeing Machines' approach to optimised and co-designed optical path, embedded processing and AI vision algorithms for DMS.

This technology addresses the critical OEM problem associated with managing vehicle electronics integration and cost, with the need for seamless camera packaging across a diverse line of vehicle models.

Seeing Machines' Fovio eDME embedded driver monitoring engine algorithms and processor optimised and accelerated software produce an optimised processing footprint, low thermal dissipation and small overall mechanical size and weight for a viable all-in-one mirror-based DMS.

The company says it has addressed the difficulties associated with a movable mirror-camera combination through vision-based dynamic real-time detection and calibration techniques.

While providing an effective and simplified DMS, the integrated mirror location also offers cabin camera position and field of view for driver and occupant monitoring for many passenger vehicles, with the camera not too high in the vehicle cabin to obtain information critical for NCap and regulatory standards associated with driver distraction and impairment, and not too low for an expanded interior occupant view, enabling a range of safety and convenience features inside the cabin.

Get smart and personal



The Smart #1 compact electric SUV revealed in Berlin in April is being called an "urban companion" that owners can connect with "on a purely personal level".

Away from the hype, the joint German and Chinese developed car has a dedicated app and customisable infotainment that offers connections in real life and virtually, protected by the latest in cyber security. The app lets users connect with friends and includes a digital key with a peer-to-peer-system.

The centralised computing architecture ensures dynamic over-the-air updates so more than three-quarters of all ECUs in the car can be continuously iterated and updated remotely.

By integrating the customisable ambient lighting and operating menus, the aim is to make driving and interacting with the car a natural and immersive experience.

It has a 200kW peak performance and will be capable of AC charging from ten to eighty per cent with 22kW in three hours. With DC super-fast charging, this can be done in under 30 minutes.

TÜV Nord approves ADI wireless BMS to ISO/SAE 21434

A wireless battery management system (wBMS) from Analog Devices has been certified to ISO/SAE 21434 for cyber-security risk management throughout the lifecycle of the vehicle from concept, product development and production, to operation, maintenance and decommissioning of electrical and electronic systems.

TÜV Nord Mobilität affirmed that the wBMS is the first automotive system it has certified for ISO/SAE 21434. The assessment confirmed that ADI performed appropriate assurance measures within the product development to fulfil the Cal 4 requirements.

Since announcing the industry's first wBMS with General Motors in 2020, ADI has brought this technology to mass production as a turnkey offering for vehicle manufacturers with security designed in at every level.

The transition of battery packs from wired to wireless connectivity enables automotive manufacturers to scale their electric vehicle fleets into volume production across a range of vehicle classes, and wBMS provides the modularity, flexibility and scalability to streamline the design and assembly processes with connector-free batteries.

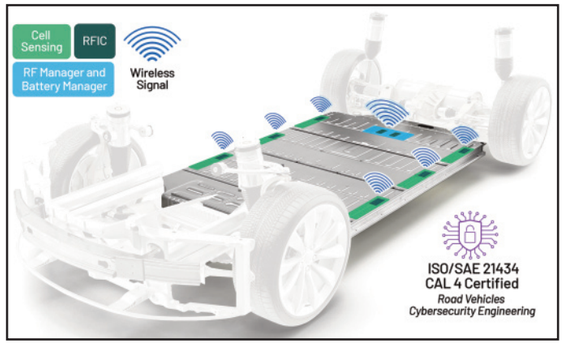
With this reliance on wireless communication, ensuring transparency, security and ease of deployment for the system can be critical.

"We conducted an intensive assessment to verify that ADI's wBMS conforms to ISO/SAE 21434 requirements," said Leif-Erik Schulte, senior vice president at TÜV Nord Mobilität. "With ADI considering the Cal 4 classification conditions throughout product development, the cyber-security assurance measures complied with the highest requirements. This system certification is a key element to build trust across the full electrification ecosystem – from energy storage to OEMs to consumers – to support EV adoption and help reduce emissions."

According to a recent McKinsey report, cyber security is becoming a new dimension of quality for automobiles: "Cyber security will be non-negotiable for securing market access and type approval."

The Cal 4 classification according to ISO/SAE 21434 requires strong risk assessments to identify proactively any component, API or software function that could be vulnerable to a cyber attack.

"Personal vehicles are a major contributor to global warming and accelerated EV adoption plays a critical role in achieving a sustainable future," said Roger Keen, general manager of battery management systems at Analog Devices. "Improving the security and accuracy of EV batteries removes roadblocks in end-users' buying considerations and advances OEMs' decisions to expand their EV offerings. With this certification, ADI can provide ongoing transparency and seamless deployment within the EV battery supply chain to progress our vision of a greener world. It further accelerates the speed to market for our customers by saving their cyber-security development time and associated infrastructure investment."



ADI wireless BMS meets ISO/SAE 21434

Range Rover picks ZKW smart lights

The latest Range Rover illuminates the road with a lighting system from ZKW that produces stepless, glare-free high beams that automatically block out oncoming or other road users.

The digital light processing LED headlights also enable animated images to be projected onto the road.

The dynamic projections are made possible by LED modules with 1.2 million pixels whose light is directed via microscopically tiny, electronically controlled mirrors. The slim headlights provide a stepless, glare-free high beam, which is controlled via a front camera and can enhance road safety.

The system is made in Austria using a three-component injection moulding technology, which allows the implementation of a daytime running light concept.

Khronos and Intellias strengthen Autosar ties

Khronos is collaborating with Autosar to encourage standardisation in automotive and future intelligent mobility.

And Intellias, a provider of software development services for the mobility industry, has become an associate partner of Autosar.

Khronos and Autosar plan to coordinate common requirements and developments with a focus on accelerated graphics and computing in safety-critical markets.

"We look forward to a deeper understanding of Autosar's requirements to help ensure that Khronos standards such as Sycl, Open CL and Vulkan SC are effective in satisfying demanding automotive use cases," said Neil Trevett, Khronos president.

Both parties have agreed to align standardisation activities.

"This will allow us to leverage Khronos' industry-leading expertise in parallel computation for embedded applications to visualisation on high-performance computers," said Rinat Asmus, chairperson of Autosar. "It will strengthen automotive software and methodology development using safe parallel computation in open EE system architectures."

Intellias will get early access to the latest Autosar concept work, documentation and standard specification. The company will be able to leverage these insights in customer projects covering the whole embedded EE architecture of modern vehicles and safety-critical systems such as autonomous driving and digital cockpits.

"The Autosar Classic and Adaptive platforms have become an important industry-wide standard for embedded software projects that enable software-defined and highly-automated vehicles," said Oleksandr Odukha, vice president at Intellias. "Through our membership as an associated partner, our customers can benefit from double expertise: our many years of experience in software engineering and our up-to-date Autosar know-how."



RFPro expands simulation services to Japan

Simulation software specialist RFPro has expanded its operations into Japan with the establishment of a facility in Yokohama.

A dedicated, engineering team will provide local, native-speaking, technical support for the company's customers and partners in Japan and the Apac region.

The facility will form part of the firm's international sales, engineering and support team, supported by the company's technical centre in the USA and UK HQ.

"Simulation is revolutionising the automotive industry and the technology providers in Japan are at the forefront of this," said Peter Daley, managing director of RFPro. "With simulation forming a critical part of vehicle testing and validation, we want to have a team on the ground ready to support our customers and technical partners in the region. Our Japanese base gives RFPro a truly global reach with facilities now in Asia, North America and Europe."

The company has seen growth in Asia, with revenues up by more than 100% in the region over the past four years. This has largely been driven by the accelerated use of simulation in automotive applications, including adas and autonomous vehicle technologies.



Digital twin of the Shuto Expressway

Tatsuji Moriwaki has more than ten years' experience in the automotive industry and will be the business development lead in Japan.

"RFPro is the world's leading simulation software provider so it is an honour to be joining the company," said Moriwaki. "We are at the leading edge of vehicle development, particularly for autonomous technologies. This has led to extraordinary growth in the region and we are aiming to continue this going forward."

The company library of digital twins includes race circuits, proving grounds, city centres and public roads, and a digital twin of Tokyo's famous Shuto Expressway. The 35km section of road has been modelled using survey-grade lidar scan data to create a vehicle dynamics grade road surface, which is accurate to within 1mm in the vertical direction. This helps accurately simulate the effects of every bump, drain cover and expansion joint around the full route.

Littelfuse buys Embed and C&K Switches

Littelfuse has purchased C&K Switches for $540m and transport software firm Embed.

Founded in 2005, UK firm Embed provides embedded software and firmware for transportation applications.

"We are excited to welcome the Embed team to Littelfuse," said Matt Cole, Littelfuse SVP. "The addition of Embed will help us better serve our customers by expanding our software engineering expertise and technical capabilities. With the increasing complexity of electronification within transportation, the inclusion of Embed will help Littelfuse respond quickly to customers' evolving needs."

Founded in 1928, C&K Switches designs and makes electromechanical switches and interconnects for industrial, transportation, aerospace and datacoms . Headquartered in Massachusetts, it has annual sales of $200m.

"Our complementary go-to-market models through a combination of direct sales and channel distribution and expanded product portfolio will serve as a platform for future growth," said Deepak Nayar, SVP at Littelfuse.



Bosch takes Five to extend automated driving software

Bosch hopes to accelerate software development for automated driving with the acquisition of Five, a start-up for self-driving cars.

At six locations in the UK, Cambridge-based Five has around 140 staff working on self-driving vehicles. There were other takeover bidders.



Bosch has acquired self-driving start-up Five

"Automated driving is set to make road traffic safer," said Markus Heyn, member of the Bosch board. "We want Five to give an extra boost to our work in software development for safe automated driving, and offer our customers European-made technology."

Since it was set up in 2016, Five has built a team of experts in cloud software, safety assurance, robotics and machine learning, and has placed itself at the forefront of developing software and artificial intelligence for autonomous driving up to SAE level four.

"Scale matters in building automated driving technology," said Stan Boland, CEO of Five. "Bosch is a global leader in driving assistance technologies, with core technologies and vast data lakes that will be essential in bringing safe self-driving systems to market."

The start-up now focuses primarily on a cloud-based development and testing platform for the software used in self-driving cars. This offers engineers programmes to create automated driving software at pace, and to test it before and during its deployment in test vehicles.

The platform can analyse real data from a fleet of test vehicles, create testing scenarios, and build a simulation environment that makes it possible to assess and validate system behaviour at hyper-scale.

Five should strengthen Bosch's agile project structure for developing self-driving cars.

The two teams' software engineering environments complement each other and will be merged.

"Five is the perfect fit for our engineering activities, not least due to its associates' mindset and agile approach," said Mathias Pillin, president of Bosch's cross-domain computing division. "This brings us closer to our aim of getting safe automated driving onto our roads."

Financial details have not been disclosed and the acquisition is still subject to approval by anti-trust authorities.

Bosch also recently acquired Atlatec, a specialist in high-resolution digital maps.

Car makers struggle to meet connectivity costs

Car makers are struggling to recoup connectivity costs as the number of connected vehicles soars, according to ABI Research.

Connectivity will be available in over half of new vehicles sold in 2022 and over 70% in 2028.

However, car makers have not found an effective strategy to recoup the connectivity and airtime costs.

Connected services adoption is low, especially among lower-tier vehicles, and the increase in free trial periods means the ratio of paid subscriptions will contract 20% between 2021 and 2028.

"Due to the prevalence of high traffic phone data plans, end consumers have little motivation to pay for connectivity and rarely renew subscriptions after the free trial period, which car makers are constantly extending," said Maite Bezerra, research analyst at ABI Research. "This is especially true for infotainment services that compete with free phone mirroring. This reality signals it will be challenging for car makers such as Stellantis, Ford and GM to achieve their recently announced goals to generate $20bn in software and services revenues annually by 2030, at least 13 times what they generate today."

The average free trial period in the USA is increasing from three to six months, in Europe from one to three years, and, in China, many car makers offer free for life connectivity.

Infineon expands production in Indonesia

Infineon Technologies is expanding its existing backend operations in Indonesia in response to the automotive chip shortage.

The company has bought real estate from Unisem close to its existing backend manufacturing site. This includes manufacturing buildings to double Infineon's production area in Batam when fully operational.

The site will increase its focus on the assembly and test of automotive products.

Thomas Kaufmann, COO of Infineon's automotive division, said: "In view of increasing demand for automotive semiconductors and to the benefit of our customers, this purchase is allowing us to add backend capacities faster than with the greenfield construction of a new site."

Production is expected to start in 2024.

The expansion in Batam is part of Infineon's long-term investment strategy, which foresees investments of approximately €2.4bn for the 2022 fiscal year.

In Batam, it employs more than 2000 people within the Batamindo Industrial Park, part of the Indonesia-Singapore-Malaysia growth triangle.

"Infineon is making another step in strengthening its global operations network," said Alexander Gorski, executive vice president at Infineon. "We are committed to investing into continued structural growth and to strengthen the resilience of our supply chain."

Car makers out of touch, says VNC chief

The automotive industry's rush to replace conventional controls with touchscreen interfaces is at risk of alienating customers, compromising safety and drawing the ire of regulatory bodies, according to software company VNC Automotive.

"Car manufacturers are locked in a race," said Tom Blackie, CEO of VNC. "Not the kind that demands ever-increasing power outputs or shrinking zero-to-sixty times, however. Instead, the results of this contest are measured in inches."


Touch screens can distract drivers

When the touchscreen arrived, it appeared the industry had settled on a winner, even if, said Blackie, the user interface seemed to have been modelled on an ATM.

Since then, tablet-sized screens atop the dashboard were soon joined by digital instrument clusters.

But in 2012, Tesla moved to everything being controlled by a giant screen in the middle of the dashboard. That meant even the most basic interaction required delving into a menu, from changing the radio station to turning on headlights.

Soon everyone was at it, said Blackie. Volvo launched the Sensus infotainment system based around a central portrait display that incorporated almost everything into its touchscreen interface.

"Having a giant touchscreen interface is really about saving hardware costs by implementing everything in software," says Blackie. "Recently, though, there's been growing disquiet as years of ergonomic study and usability experience are abandoned in the rush to cram everything onto a single screen."

He said the sluggishness that plagued early systems had largely been addressed, but the lack of physical feedback on activating a touchpoint still demanded that drivers glance at the screen for visual confirmation.

"With many cars lacking a convenient surface to brace against, the task of aiming at a small control with an extended arm in a car that's bouncing around can quickly become a repetitive one, prolonging the time spent diverting focus from the road," said Blackie.

He said frequently-used controls should be styled to stand out from their surroundings; icons should be easily discernible; the status of a function should be readily apparent at a glance; and colours should be chosen to avoid wash-out in sunlight.

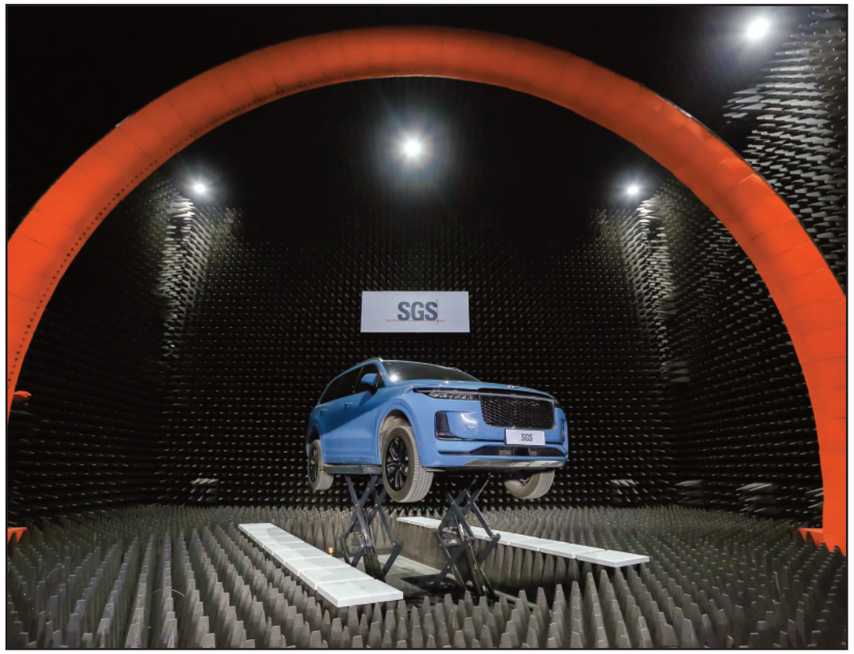
SGS opens OTA test laboratory in China

Test house SGS has opened a vehicle over-the-air (OTA) laboratory in Suzhou, China, to help car makers test, validate and comply with wireless standards and regulations.

The lab provides integrated one-stop testing and certification for electric and connected vehicles and their networks in the Apac region.

It can provide technical verification, product certification, quality improvement and technology development services to shorten the R&D cycle.

The third-party laboratory uses the standard all radio wave scheme to perform vehicle OTA testing, and supports vehicle-level and component-level testing. It meets 5GAA and CTIA requirements.



SGS OTA test system in China

Capabilities include in-vehicle networking terminal test and out-vehicle networking terminal test, such as 5G regulatory certification for mobile communication: CE, FCC, IC, MIC and ITA, which cover more than 180 countries.

Operator 5G test requirements cover GCF and PTCRB.

Testing can be carried out for e-call, ultra-wideband (FiRa), V2X, logo certification (Bluetooth, wifi, UWB, USB type-C and HDMI), product compatibility, interoperability (Carplay and Android Auto), voice recognition, signal measurement, software verification, global telecom operator network entry certification and other wireless technologies and related RF testing, automotive safety and mechanical reliability, environmental simulation verification, automotive EMC and other fields.

The lab uses an MVG SG3000, multi-probe antenna measurement and OTA test system for component to full-scale vehicle testing.

This test system supports OTA measurements for 5G FR1 NSA/SA, GNSS, C-V2X and the emerging UWB technology for automobiles in compliance with the 5GAA VATM vehicular antenna test methodology standard.

The antenna performance test scheme adopts the spherical near-field multi-probe test system, which can verify vehicle 2G, 3G, 4G, 5G, GNSS (including GPS, Beidou, Galileo and Glonass), V2X, UWB and other technologies covering frequencies from 400MHz to 10GHz.

This improves driver safety, through cooperative vehicle infrastructure, and user experience through the improved stability of Bluetooth and wifi connection and the accuracy of navigation and positioning.

"With the expansion of wireless communication networks in automotive systems and the increasing regulations that guide them, the MVG SG 3000 will allow us to support our customers in performing antenna and OTA testing on not only subsystem components, but full-scale vehicle systems," said David Chu, SGS vice president. "It is of utmost importance to our customers to obtain accurate test results in a timely matter in order to meet rigorous automotive test standards."

Qualcomm completes Arriver acquisition

Qualcomm has completed its acquisition of Arriver from SSW Partners, enhancing its ability to deliver open, integrated and competitive adas to automakers and tier-one suppliers at scale.

"As we become a key technology partner to the automotive industry, Arriver's driver assistance assets will accelerate our efforts to deliver a leading adas as part of our Snapdragon Digital Chassis platform," said Nakul Duggal, SVP at Qualcomm. "We remain committed to offering advancements for all vehicle tiers and levels and with Arriver's driver assistance assets now part of the Snapdragon Ride platform, we are better positioned to power the future of autonomous driving."

Qualcomm plans to incorporate Arriver's computer vision, drive policy and driver assistance assets into the Snapdragon Ride portfolio, building on its previous collaboration with Arriver, when owned by Veoneer.

Snapdragon Ride, a portfolio for central compute and vision systems, features the Snapdragon family of SoCs and accelerator products. It addresses the automotive ecosystem's needs for a scalable and upgradeable integrated software SoC aimed at providing functional safety.

In addition to its ability to scale across a range of vehicle types, Snapdragon Ride's modularity provides the flexibility to leverage software functionality developed by automakers.

Veoneer and Qualcomm will also expand their collaboration. The parties have signed an agreement that ensures the continuation of service and support for customers and details their future collaboration on roadmap alignment and technology cooperation in adas development.

Audi and Navistar test C-V2X to improve safety near schools

Audi and Navistar have demonstrated potential safety enhancing C-V2X technology in emergency vehicles and school buses.

The partnership allows for both companies to develop use cases and safety enhancing demonstrations in collaboration as members of the Volkswagen group.

First deployments are expected to begin this summer.

Audi and Navistar, working with Applied Information & Traffic Control, have partnered to research how to improve safety and driver information in school zones, at school bus stops and in emergency vehicle situations.

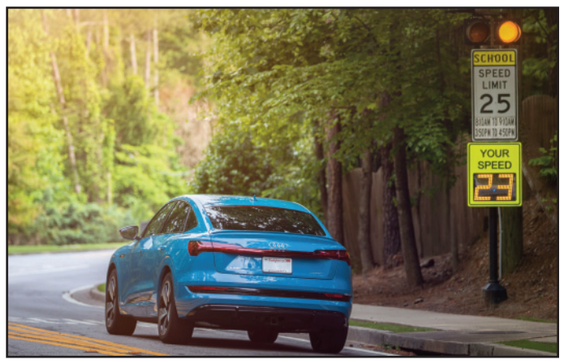
While Audi and Applied Information have already demonstrated the potential uses of school zone technologies, the partnership with Navistar will allow school bus drivers to receive a visual and audible warning signal of a vehicle approaching a school bus stop in a situation that the vehicle may not be able to stop.

The warning is designed to enable the school bus driver to intervene and advise the passengers exiting the bus not to enter the roadway, or get on or off the bus only when it is safe to do so.

To help improve safety for emergency vehicle operators and drivers as a whole, Audi and International Truck, a subsidiary of Navistar, as well as technology partners Applied Information and Commsignia, will demonstrate a new C-V2X application.

When an emergency vehicle is on call, vehicles with the software can receive an audible and visual warning from the direction from which an ambulance or other emergency vehicle is approaching.

The directional warning can help drivers get out of the way sooner than in where the emergency vehicle is only visible when in direct line of sight.



C-V2X can improve safety near schools

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Venue: Makuhari Messe, Japan

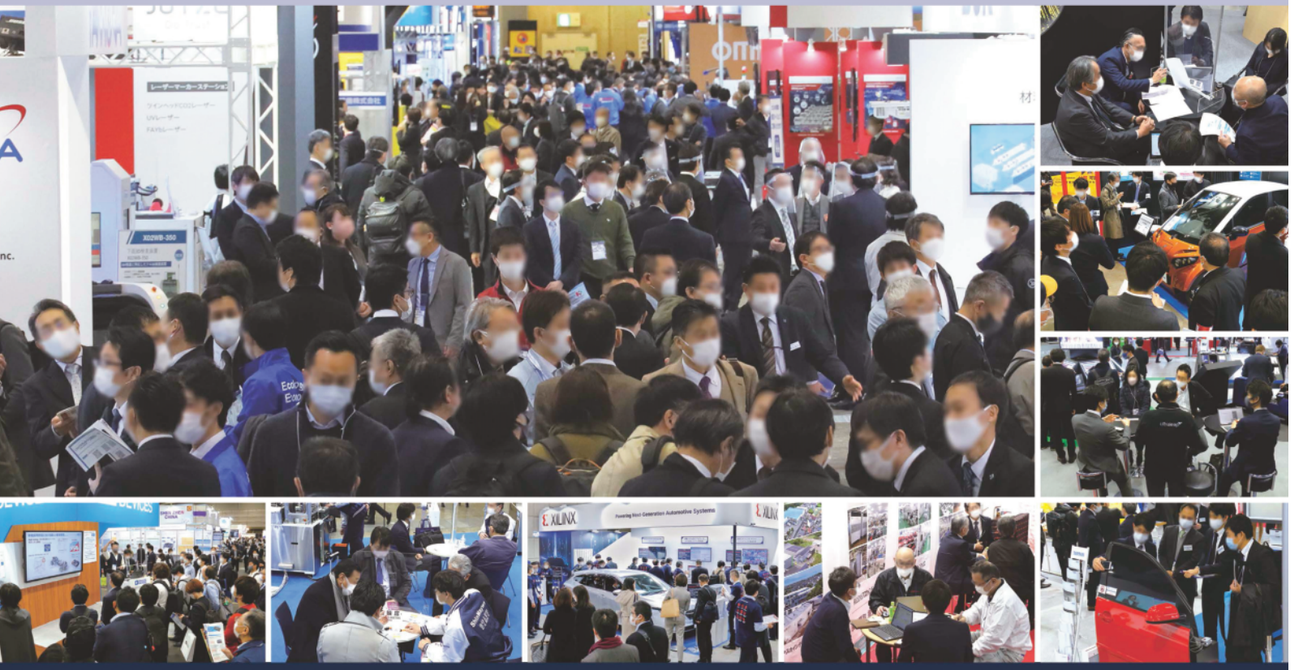
Nagoya Show
Dates: Oct. 26 (Wed) – 28 (Fri), 2022
Venue: Portmesse Nagoya, Japan

Digital Show
Dates: Nov. 30 (Wed) – Dec. 2 (Fri), 2022
Venue: Online

Tokyo Show -January-
Dates: Jan. 25 (Wed) – 27 (Fri), 2023
Venue: Tokyo Big Sight, Japan

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Volvo extends OTA updates to all models

All new Volvo cars from model year 2023 will be available with over-the-air (OTA) software update capability. Updates are available in Australia, Hong Kong, India, Malaysia, New Zealand, Singapore, South Korea, Taiwan and Thailand.

The OTA capability comes to the latest XC90, S60 and V60 models, and follows the technology's introduction on its fully electric cars.

This means the company's full portfolio can receive an update of the car's complete operating system over the air.



OTA updates have been extended to the XC90

Volvo owners will get an upgrade of their infotainment system to the latest version of Android Automotive OS, Android 11. They will also get access to new app categories on Google Play, including navigation, charging and parking, while video streaming is expected to be added later in the year.

The OTA update brings feature improvements, ranging from better energy management to improved climate timers, and updates to mobile app functionality and in-car applications.

The energy management improvements help to maintain battery performance on cold and warm days, boosting driving range.

The Volvo app will also receive more frequent updates from the car on the charging percentage during an ongoing session.

The latest OTA update is the company's eighth complete car update and will reach more than 190,000 cars across the globe.

"By making all Volvo models able to receive over-the-air updates, we make important progress towards our ambition of making our customers' cars better every day," said Henrik Green, chief product officer at Volvo Cars. "This is a significant milestone: we're now updating cars of all models in a majority of our markets, bringing the benefits of remote continuous updates to an ever-increasing number of customers."

It will also offer its infotainment system with Google apps and services such as Google Assistant and Google Maps built-in across all new models. The infotainment system was jointly developed with Google.

Blockchain could provide automotive protection

SourceLess Blockchain has what it claims is an impenetrable system for the automotive industry.

Implementing SourceLess Blockchain into the car's computer creates a node in the system that has a memory size below 1Mbyte and works in a way that any security issues will be cancelled and any virus or malware will be unable to execute.

This node is the encryption core system.

Frauds and deficiencies that show up could be verified or accessed by the owner of the SourceLess Blockchain fork, which will provide limited access to the owner and/or manufacturer.

Issues covered include changes to the real mileage, changes to the car's parameters, security, history of generic errors invalidated in the main computer, unique digital identity of the property, car history regardless of the service where it was fixed, instant reporting of vehicle errors to the service, reminders of the various legal inspections that need to be performed, and checks required to eliminate the risk of crashes.

STR.domain is a unique digital identity that allows anyone to connect to the SourceLess platform. Every STR.domain owner will have to complete verification before getting the full functionality of the domain.

Auto nodes will provide efficiency and may protect against cyber threat in car theft, and provide smart computational redundancy and high-processing speed.

Integration with older cars without internet access can be done by communicating with a smartphone and pairing it with the node via Bluetooth.

INFOTAINMENT



POINTING THE WAY

Szukang Hsien, Scott Anderson and Nazzareno (Reno) Rossetti propose a more cost-effective way to enable gesture recognition

Infotainment gesture control enhances driver experience and safety by helping avoid distractions caused by fiddling with touchscreens and poorly located dials. Gesture recognition can complement touchscreens, voice and knobs so the driver can focus on the road. Time-of flight cameras, although fancy, are computationally heavy and expensive.

But there is a way to integrate the use of optics, sensing and an analogue front-end in a single asic, reducing cost and advancing the adoption of this technology in a wider range of automobiles.

Automotive infotainment gesture control, currently only available in luxury cars, increases driver safety and comfort. With gesture control, drivers do not need to risk an accident by taking their eyes off the road while operating touchscreens or dials. With gesture recognition, drivers can adjust volumes and air flow, wave away calls on connected phones, or change a music playlist with a flick of the wrist and more.

Gesture control can reduce the use of touchscreens, making them less distractive, and can complement voice.

For example, drivers can ask a virtual assistant to play a certain song and then, with a rotation of a hand, turn up the volume while their eyes stay on the road the entire time.

In contrast to gesture, the use of voice recognition requires an LTE connection back to a cloud processor to understand all dialects and languages, making a major database necessary. Voice recognition also does not work while windows are down, if a sunroof is open, or music is cranked up in the car.

In addition to advancing traffic safety, gesture recognition helps deaf and mute people who are unable to use voice recognition technologies.

Touch panels are very distracting, requiring drivers to memorise button locations and rely on tactile feel to navigate around the display. Finally, while touch-based commands may inevitably cause some wear of touched surfaces, gesture recognition technology does not wear down controlled devices.

Only luxury cars have adopted gesture control technologies, due to their high complexity and cost. But the benefits of this technology warrant every effort to broaden adoption across mid- and low-end vehicles.

This article discusses a typical application and introduces an approach that is integrated and cost-effective, enabling the adoption of gesture recognition by a vastly higher number of automobiles.

ToF

Fig. 1 illustrates a typical technology that relies on a time-of-flight (ToF) camera to identify

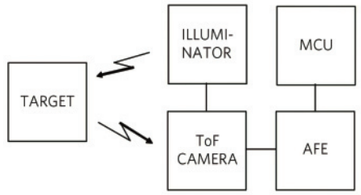


Fig. 1: Typical application using a ToF system

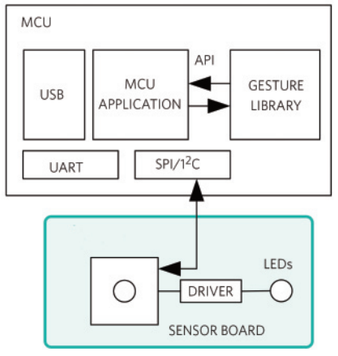


Fig. 2: Integrated gesture sensing system

and scan a 3D scene. The ToF technique consists of sending an infra-red beam to a target to be analysed.

The reflected signal is processed by an analogue front-end (AFE) and the raw data are moved along to the application processor (AP) for gesture recognition.

This system has a high pixel count (60,000) and can perform eye, facial, body and finger tracking, recognise a complex gesture, and have context awareness. It produces a huge amount of data, requiring a complex MCU for processing.

The use of a camera and a complex MCU makes this system versatile but expensive. ToF may offer a lot of gesture possiblities, but the complexity is too much for automotive applications, requiring a manual to programme them and not needed for everyday usage.

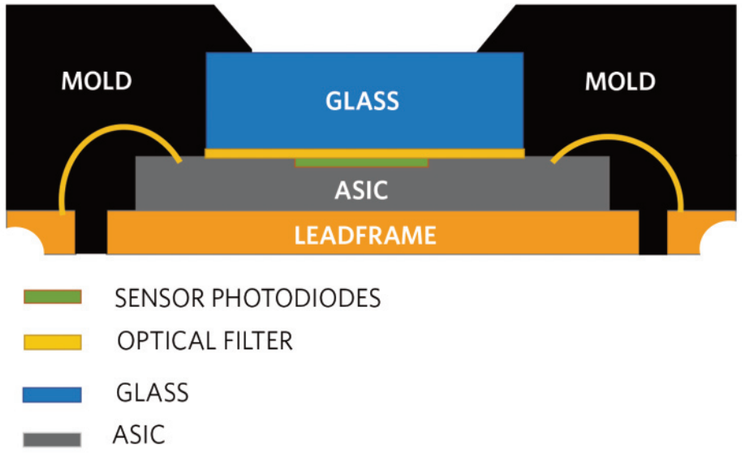


Fig. 3: Integrated optics and AFE cross-section

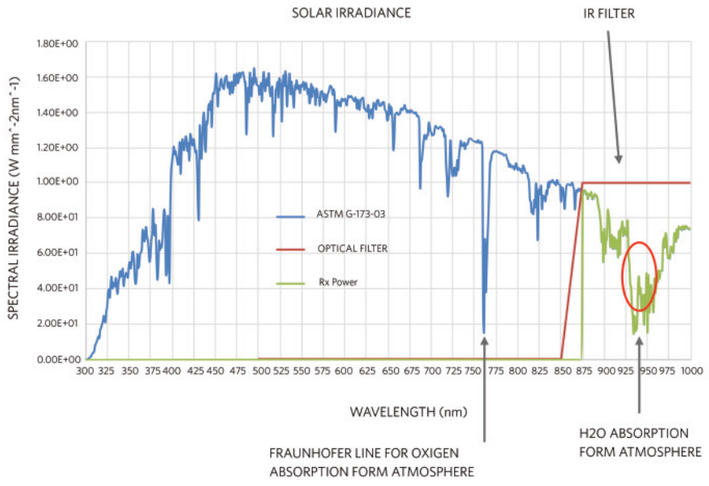


Fig. 4: Protecting the sensor from solar irradiance

Breakthrough

The benefits of infotainment gesture control warrant every effort to reduce complexity and cost by offering simple but important gesture control for broader use. A novel photodiode array asic can integrate optics, a photodetector array and an AFE, as shown in Fig. 2.

The integrated gesture sensor connects to a simple MCU via SPI or I²C bus for the recognition process. This integration is enabled by an optical QFN 4 by 4mm package. Fig. 3 shows the entire ensemble, including the sensor photodiodes on board the asic along with optical filtering.

The array has to be protected from solar irradiance. At 940nm there is a dip in solar irradiance from H_2O absorption in the atmosphere. This is where the sensor operates. An optical high-pass filter eliminates irradiance below 875nm, see Fig. 4.

Four 940nm IR-LED diodes illuminate the target. The reflected light is sensed by a 60-pixel sensor array on board the asic, which also incorporates all the necessary signal digitalisation and control, see Fig. 5.

Operation

The aperture shown in Fig. 3 includes a hole in a layer of black proprietary coating that limits the light intake. The quasi-pinhole camera approach, with a large aperture, creates a blob or blurred image, as opposed to a focused image. The 10 x 6 photodetector array captures the entire blob.

As an example, the IR-diode array emits a sequence of light pulses of 25μs duration, each followed by a 25μs pause. The photodetector array integrates the light during illumination and subtracts it during pause. Subtracting the latter from the former eliminates the ambient light common mode, resulting in an estimate of the blob intensity.

The total conversion period is 20ms which results in 50 frames per second. Each frame is passed to the MCU for processing to calculate the vector motion. The vector data are processed, and a resultant gesture event is output by the algorithm.

With a low pixel count (60), this technique allows for proximity and finger tracking, rotation and other basic but important gestures.

Circuit

Fig. 6 shows the simple application circuit. The low-cost data-acquisition system for gesture and proximity sensing recognises the following independent and important gestures: hand-swipe gestures (left, right, up and down); finger and hand rotation (CW and CCW); proximity detection; linger-to-click; air click; and wave.

A low-power, low-cost, non-floating-point CPU is required to process the data from the sensor. This can be an Arm M0 or spare Mips from another CPU. The BoM for this is low – a few filtering capacitors and a discrete mosfet that drives each IR-LED.

Conclusion

Gesture recognition improves driver safety and experience. It makes for a cool car experience, without the sting of a high price tag.

So far, the high complexity and cost of ToF-based systems has limited the adoption of this technology to the higher-end automobiles.

In this design, we briefly discussed the limitations of the ToF approach and introduced a novel gesture recognition asic that integrates optics, sensing and an

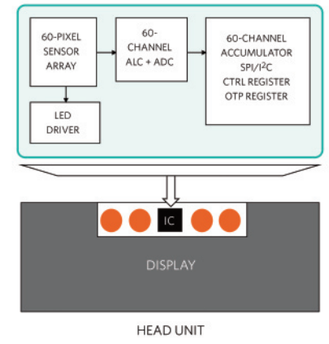


Fig. 5: Integrated gesture sensor ensemble

AFE in a small optical side-wettable QFN package. The asic, with a cheap CPU, not only delivers gesture recognition with less cost and complexity than ToF cameras but helps broaden the adoption of this newer technology to a larger class of automobiles and other consumer products.

Szukang Hsien is executive business manager, Scott Anderson is a product definer and Nazzareno (Reno) Rossetti is an analogue and power management expert, all at Analog Devices

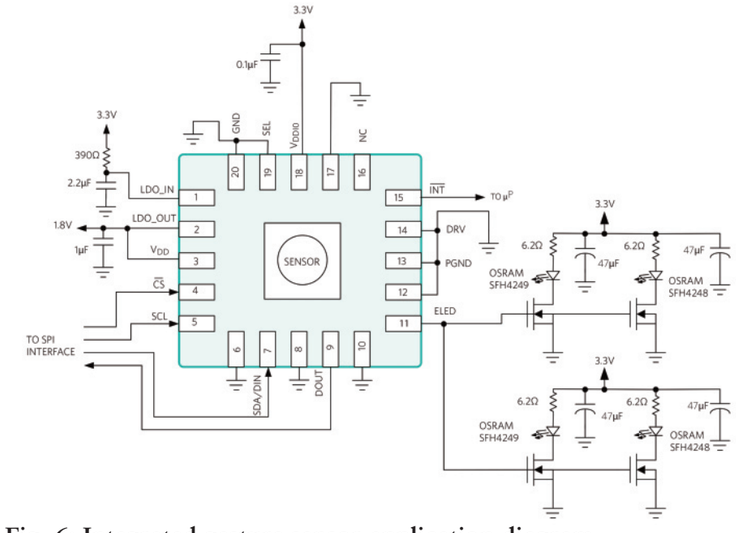


Fig. 6: Integrated gesture sensor application diagram

RADAR

ALL CHANGE



Bhavin Kharadi explains what adas engineers need to know about the new NCap requirements for radar

Vehicle Electronics

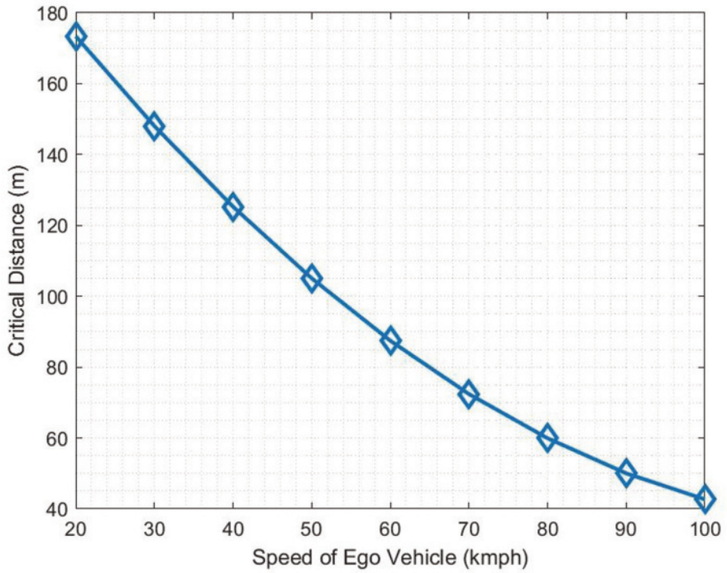


Fig. 1: Plotting the distance and speed needed to make safe critical lane change

The Euro New Car Assessment Programme (NCap) recently updated its standards for radar to improve driver assistance features in new cars.

NCap standards vary by region; in the USA, NCap is governed by the National Highway & Traffic Safety Administration (NHTSA) and the Global NCap is a centralised organisation. However, all organisations have the same goal: to set standards that make cars and driving safer.

The organisations provide ratings in the form of zero to five stars to help consumers make informed new car buying decisions.

In many cases, Euro NCap has been the first to set standards that raise the bar for the auto industry worldwide.

The latest regulation, No. 79, specifies the minimum distance and operation speed for radar in blind-spot detection and lane-change assistance.

For radar, the minimum distance and minimum operation speed section (5.6.4.8) helps finding the minimum operation speed down to which the ACSF (automatically commanded steering function) of category C is permitted to perform a lane change manoeuvre, with minimum distance that radar can support.

In other words, it helps identify how far a blind spot detection radar sensor should detect at a minimal operating speed of 20km/h for an ACSF of category C doing a lane change manoeuvre.

A safe lane change manoeuvre is one where the approaching vehicle has sufficient time to react (decelerate) to ensure at all time a safe driving distance between the two vehicles.

Specifically, the R79 regulation in section 5.6.4.7 defines a potential lane change manoeuvre by an ego vehicle as critical if an approaching vehicle in the target lane would have to decelerate at a higher level than 3m/s², 0.4 seconds after the lane change manoeuvre has started, to ensure the distance between the two vehicles is never less than that the distance the ego vehicle travels in one second.

With knowledge of the distance and speed of the approaching vehicle and the speed of the ego vehicle, it is possible to calculate the critical distance $S_{critical}$ (section 5.6.4.7.1) between the two vehicles at the start of the

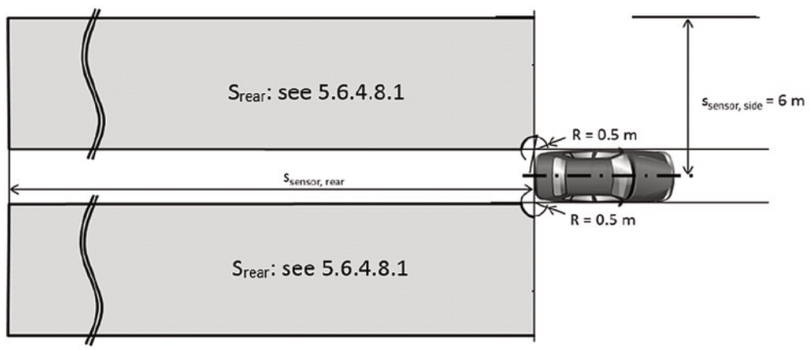


Fig. 2: A depicture of NCap regulations for speed and distance (Image source: UN Regulation No. 79)

lane change.

A lane change manoeuvre is not permitted if the distance at the start of the manoeuvre between the two vehicles is less than $S_{critical}$.

Fig. 1 plots $S_{critical}$ as a function of the speed of the ego vehicle. Note that for an ego vehicle speed of 20kmph, the critical distance is close to 180m.

Thus, detecting an approaching vehicle and estimating its distance is key to an effective lane change. As described in section 5.6.4.8 of the regulations, every manufacturer has to declare the minimum distance (S_{rear}) at which the vehicle can reliably detect an approach from the rear in the adjacent lane; the regulations require a two-wheeler to be used for testing S_{rear}.

Based on the declared S_{rear}, the regulation then defines a minimum operation speed (V_{smin}), which is computed as the lowest speed at which the ego vehicle can perform a lane change, with an approaching vehicle at a distance of S_{rear} and speed of 130kmph, as shown in Fig. 2.

In the absence of any detection by the ego vehicle of an approaching vehicle in the adjacent lane, the regulations make a worst-case assumption that there is an undetected approaching vehicle at a distance of S_{rear} with a speed of 130kmph. In this circumstance, no lane change is permitted at speeds below V_{smin}.

However, should the ego vehicle detect an approaching target at a distance less than S_{rear}, then a lane change can be initiated at a speed less than V_{smin} provided the situation is not deemed critical, that is the distance between the approaching vehicle and the ego vehicle is more than $S_{critical}$ as defined in 5.6.4.7.1.

With longer range high-resolution radar, cars can sense oncoming vehicles faster with detection at larger distances to change lanes and navigate intersections more safely. By helping automakers meet the latest NCap safety requirements, a corner radar can make driving safer worldwide.

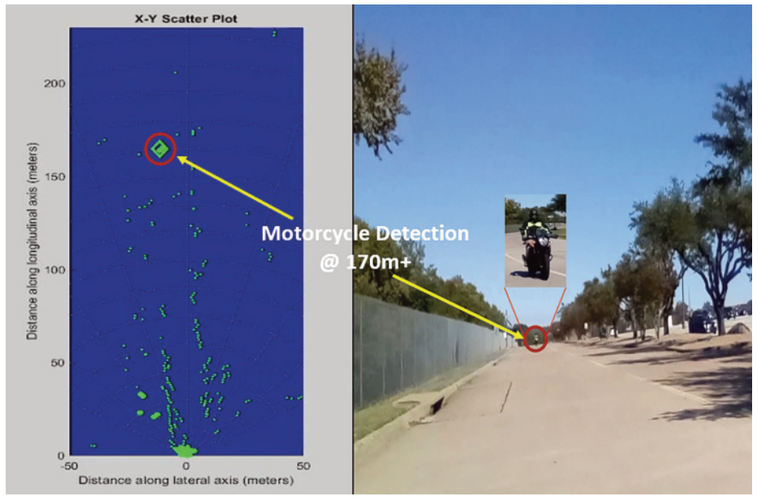


Fig. 3: 170m+ motorcycle detection



Fig. 4: 200m+ car detection



Bhavin Kharadi is automotive product marketer at Texas Instruments

ANTENNAS



SIGNAL CHECK

Geoff Schulteis explains how multiple antennas on a tiny board present RF difficulties for OBD-II designs

The design of a vehicle's OBD-II is interesting because the unit is very small, and it needs to accommodate several different antennas working closely together within the device. Typically, these will be an LTE antenna, GPS or GNSS positioning antenna, Bluetooth antenna at 2.4GHz and, possibly, a wifi antenna.

This article discusses designs for OBD-II using LTE, as this is difficult to achieve on a small PCB, and is interesting in terms of the antennas and wireless design.

With small OBD-II devices for LTE and cellular networks, the challenge is to create a successful design that will pass certification when the components are arranged inside a very small package and the open space available for the antennas is very limited.

There are some constraints as to how an antenna can be placed in a design. Each antenna needs to be placed away from other components that might detune it or impede its performance. Also, each antenna has a recommended position, usually on the edge of the PCB. The antennas also need to be kept away from materials that might affect the signal.

It is best to position the RF circuitry as close as possible to the antenna. This is because longer transmission lines are more prone to reflections and signal losses that can impair the performance of the antenna.

Generally, the key to a successful design is to achieve good isolation between the antennas, especially between cellular and the GPS antennas, because the second harmonic of the LTE frequency can cause interference to GPS signals. This along with antenna coupling can cause interference to the GPS receiver if the two antennas are placed too close to each other and operate simultaneously.

Choice

Some of the most popular available today are surface-mount devices (SMD) antennas. Made from high-grade dielectric laminate substrates, they are tiny and mount directly to the PCB. Generally, these antennas work by radiating against a ground plane on the PCB.

Flexible antennas, also known as FPC (flexible printed circuit) antennas, can be a useful choice as well, as they can save space on the printed circuit board. They can be curved or folded, and placed against the inside of the housing of the OBD thus saving space on the PCB, and then connected into the circuit board by an RF micro coax cable and U.FL style connection. An FPC is light in weight, probably less than 0.5g.

An SMD antenna uses the ground plane where it is mounted to radiate, and it works on the reciprocity principle. A dipole antenna uses two radiators where the length of each radiator is related to the wavelength of the frequency that the antenna uses. Embedded antennas have one radiator within their mass, and they use an area on the PCB as their counterpoise; this area is called the ground plane.

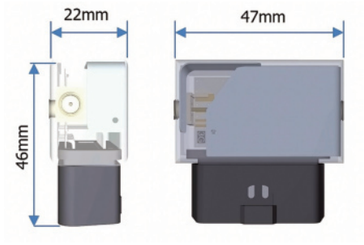


Fig. 1: The size of the average OBD-II is 46.0 by 47.0 by 22.0mm

With an SMD antenna, the length of the ground plane is directly related to the wavelength of the antenna's lowest band of operation, and the correct ground plane length must be provided in the design for the antenna to operate and perform with good efficiency. However, most SMD antennas are a quarter or an eighth wavelength, which will resonate at the desired frequency but will have reduced radiated performance when compared with a full wavelength antenna.

FPC antennas are different. They do not require a ground plane to radiate, and they allow the designer more freedom to arrange the components in the circuit board within the design. However, it is important to remember that the coax cable sometimes becomes part of the antenna, more so at the low frequencies, so the routing of the cable should be designed with care to keep this part of the FPC away from other components that might generate noise on the PCB.

Behaviour

Both SMD and FPC antennas radiate in six spatial directions and ideally require clearance in three to five of these. This is why some SMD antennas perform best on the corner of a circuit board. It also means there are five directions where the antenna can operate as if it were in free space.

Antennas react to their surroundings, so the designer should consider the board layout with care. For an OBD-II where space for components is limited, the design priorities will be:

- Place the antennas in the best position within the device, and allow sufficient length of ground plane
- Take care with other components close to the antenna; keep the antennas away from other components that may cause power and noise issues
- Beware of resonant frequency shifts caused by reflective or absorptive masses placed near the antenna.
- Nearby antennas with similar frequencies or harmonics of those frequencies may detune one another's near-fields; they should be isolated up to -10dB for less than 1GHz and -20dB for 2GHz as a minimum

A commercial software package for RF design can create the transmission line layout, taking into account the PCB thickness, copper thickness and the dielectric

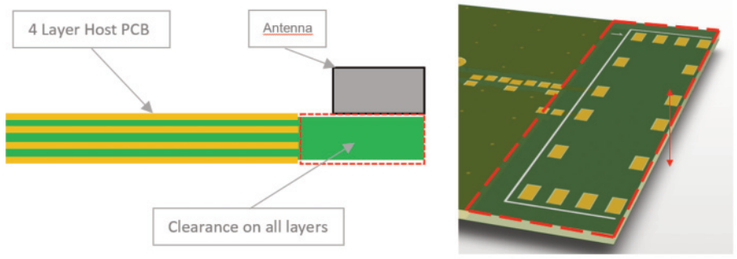


Fig. 2: The footprint of the SMD antenna showing clearance through all layers on the PCB; only the antenna pads, connections to feed and ground are present within the clearance area

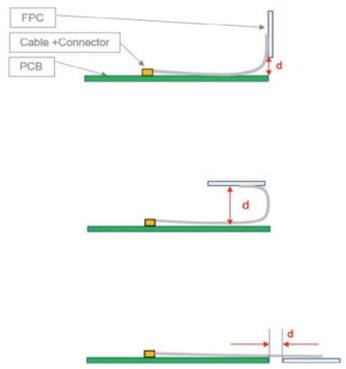


Fig. 3: FPCs are normally placed in one of three orientations – vertical, co-planar or planar to the antenna; the distance d is important for performance

constant. The programme will calculate the recommended width for the transmission line, and the appropriate spaces between the reference ground plane on either side of the antenna feed trace to keep the 50Ω system impedance.

Smaller antennas

The smallest antenna is not always the best. Because of the ground plane length requirement, a longer antenna with a smaller ground plane may be a smarter choice, maybe an FPC antenna.

As mentioned, embedded antennas use ground planes on the host PCB to radiate efficiently.

The length of an antenna's radiator is related to the wavelength of its frequency. Resonance occurs at whole number multiples, or fractions, of the wavelength, and a half-wave is the optimum resonant length of an antenna. This means the length of the ground plane on the PCB is important to the performance of the antenna. If it is too short, the antenna will lose efficiency.

The ground plane constitutes half of the antenna, so respecting the recommendations provided in the manufacturer's data sheets is essential to achieve good levels of radiated performance. In applications that require network certification, following the guidelines in the manufacturer's data sheet for the selected antenna is critical.

This is why antennas have unique keep-out requirements that should be free of any components. Allowing the recommended size ground planes and keep-out areas, as specified in the antenna manufacturer's datasheet, will help the antenna perform correctly.

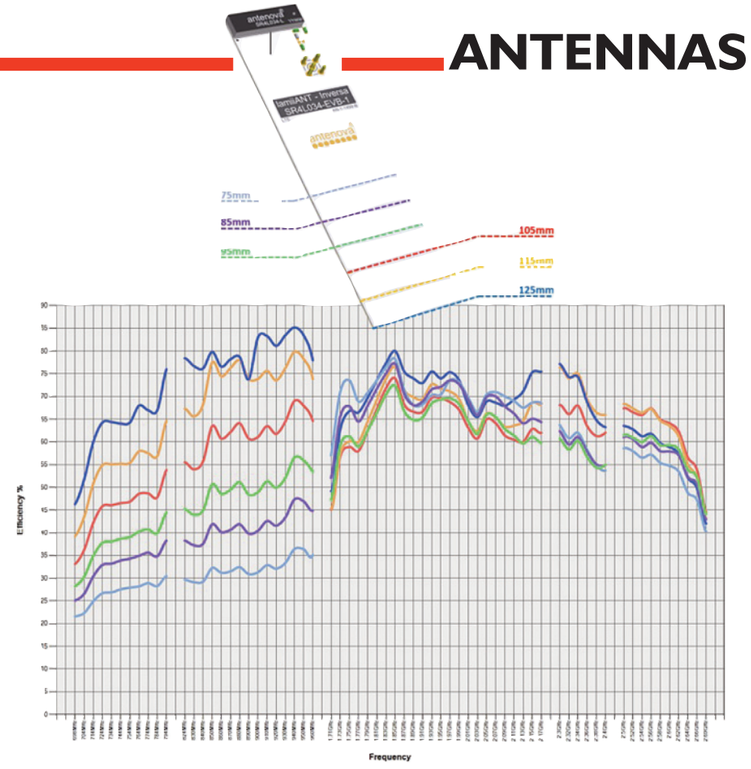


Fig. 4: How antenna performance typically reduces with shorter ground planes

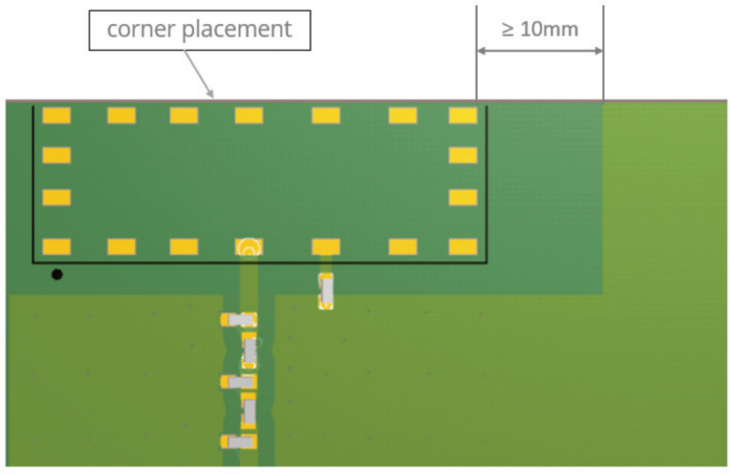


Fig. 5: Antenna with a very small ground and needs a minimum clearance of 15mm between components and traces and the antenna; the antenna is therefore placed in the corner so only one side is affected

Ideally, the antennas should be placed away from other PCB components, but it is possible to have components around the antenna. The distance from the antenna is not set; it varies according to the height of the component.

Besides the discipline of following the advice in the antenna manufacturer's datasheet, antenna designs are improving month by month. New embedded antennas are arriving that will work on shorter ground planes, under a quarter of a wavelength, and these will make these tricky designs much easier to execute.



Geoff Schulteis is senior antenna applications specialist with Antenova

SIMULATION & MODELLING

GO WITH THE FLOW



Michael Ellinger and Max Hauk say the future of climate comfort optimisation lies in virtualisation

With the introduction of electromobility, the issues of air conditioning and climate comfort are becoming massively more important. This is because, unlike with the combustion engine, which can always provide sufficient waste heat for heating and operates all electrical consumers in the interior via the generator, the driver of an e-car pays dearly for any heating or cooling power required with potential range.

In addition, due to increasing competition in the industry, thermal comfort in the vehicle cabin is increasingly coming into focus as a differentiating feature. This makes it all the more important to optimise thermal management in terms of its quality and efficiency.

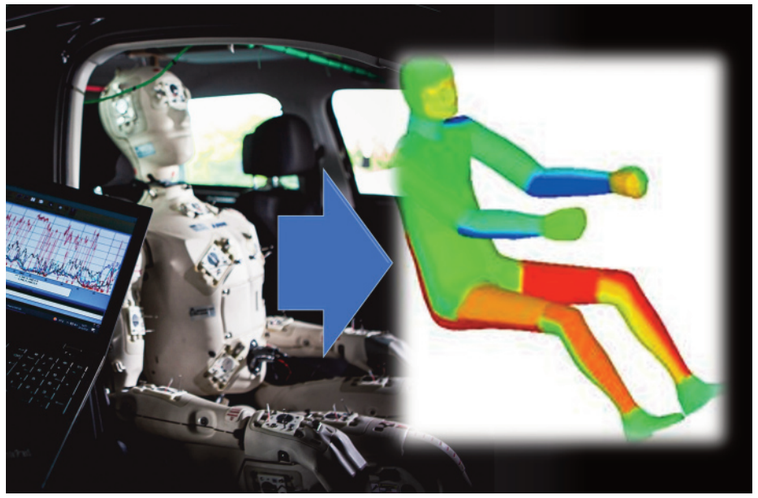
To date, this has required lengthy development processes, the results of which are strongly influenced by the subjective perception of the application engineers involved. These ultimately evaluate the thermal comfort in the vehicle.

Consequently, a way must be found to objectify the development of air conditioning and climate comfort. Work is therefore going on to simulate the complex thermal processes using hardware and software dummies, as well as to create a comfort specification.

Based on these results, the application work is to be virtualised to a large extent in the future, thus not only achieving a more objective result, but also saving development time and costs.

According to the LeasePlan Mobility Insights Report of February 2021, in which a total of around 5400 people from 21 European countries and the USA were interviewed, 34 per cent of participants said the limited range reduced their interest in an e-car. In Portugal and Germany, more than six out of ten respondents suffer from what is known as range anxiety with regard to electromobility.

Whereas in conventionally powered vehicles, all electrical consumers are generally operated via the alternator or, like the air conditioning system, directly by the combustion engine and thus do not usually noticeably reduce the range of a tank of fuel, the e-car supplies all functions – from acceleration to on-board infotainment – from the same energy source. It is therefore



The dummy is equipped with sensors for measuring temperatures in the cabin

essential for electromobility to make the thermal management systems in the vehicle as efficient and intelligent as possible to increase the range actually available.

Another phenomenon has been observed in recent years. Partly due to the growing e-mobility start-up scene, competition within the automotive industry is rising rapidly. To increase competitiveness, developers and users alike are placing more and more emphasis on climate comfort in the vehicle interior, particularly in the Asian market, but recently also in Europe and the USA.

Last but not least, autonomous driving will revolutionise previous air-conditioning concepts, with occupants sitting facing each other instead of facing forward, for example, resulting in the need for a completely different distribution of air flows in the passenger compartment.

For these reasons, it is necessary to develop a virtualisation strategy to map and optimise thermal management concepts much faster and better at the same time.

Efficiency

To a certain extent, virtualisation has long since found its way into thermal management development. Nevertheless, a large part of the comprehensive fine-tuning of the interior climate control still depends on the individual sensibilities of the application engineers involved, who have so far only been able to rely on objective measurement results to a very limited extent when evaluating comfort.

The application tests required for this purpose currently not only provide mainly subjective results, but they can also only take place late in the development process, since large parts of the hardware and software must already have been defined and integrated. In addition, these tests involve running numerous load scenarios in different climatic environments.

For this, elaborate test trips are made to sometimes distant locations such as South Africa or Death Valley with test vehicles and personnel, which is lengthy and cost-intensive.

To meet market demands for a high level of comfort in the vehicle in the future from an economic point of view, a



Thermal comfort in the vehicle cabin is increasingly coming into focus as a differentiating feature

development process for air conditioning and climate comfort is necessary, which instead of being based on classic test drives is primarily based on dynamic models and simulations. In this way, expensive application work is to be reduced in the long term and largely replaced by fully transient calculations.

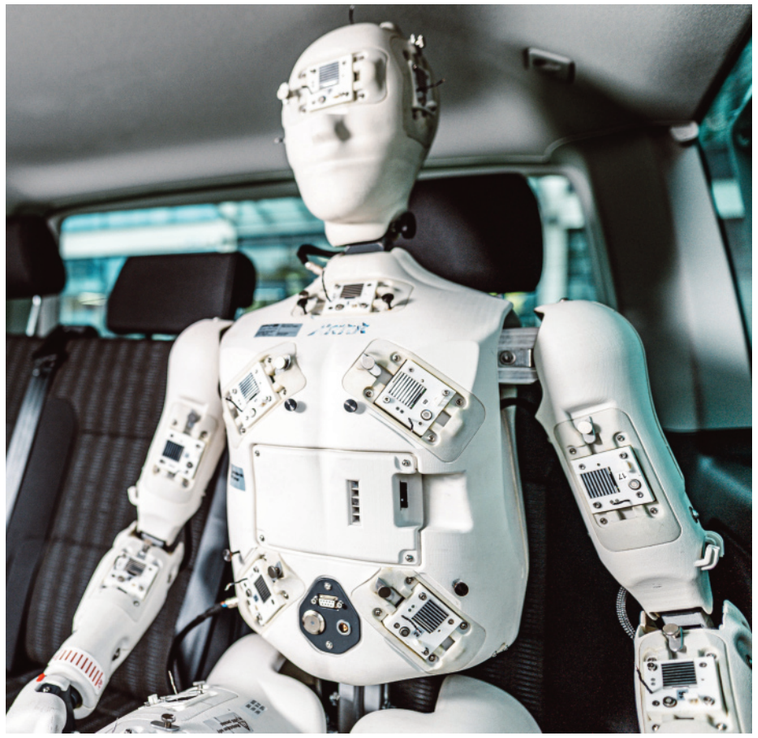
Specialists have designed a general development process that takes into account the individual steps of climate comfort development, starting with benchmark studies, through the design of the circuits and the functional and comfort design of the cabin air conditioning with development of the climate control strategy, to optimisation and validation.

The focus of the current work on the process is on which prerequisites must be created overall to implement the desired virtualisation, and which elements must be worked out in more detail in the simulation.

Dynamics

To close the gaps that still exist, engineers are developing different models to represent all the factors involved. This includes, for example, modelling the hvac component, which is the core component for controlling the air conditioning and air distribution in the vehicle cabin.

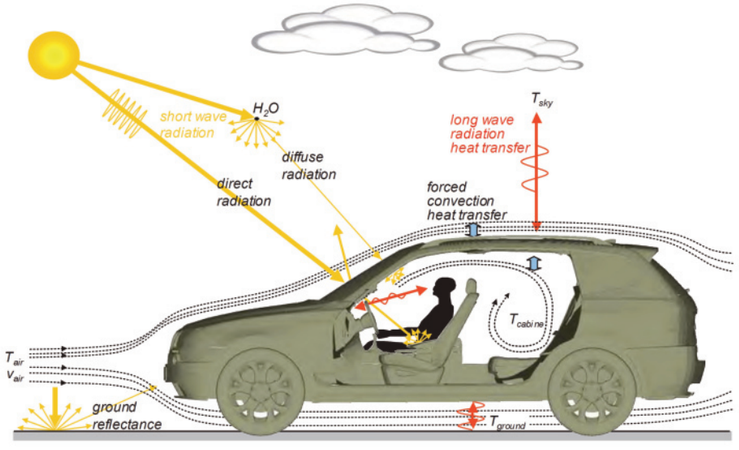
The focus here is on the one hand on mapping the thermal behaviour of the hvac to determine transiently the inlet and outlet temperatures of the cabin air on the simulation model. On the other hand, the focus is on mapping the hydraulic behaviour of the hvac to obtain a statement



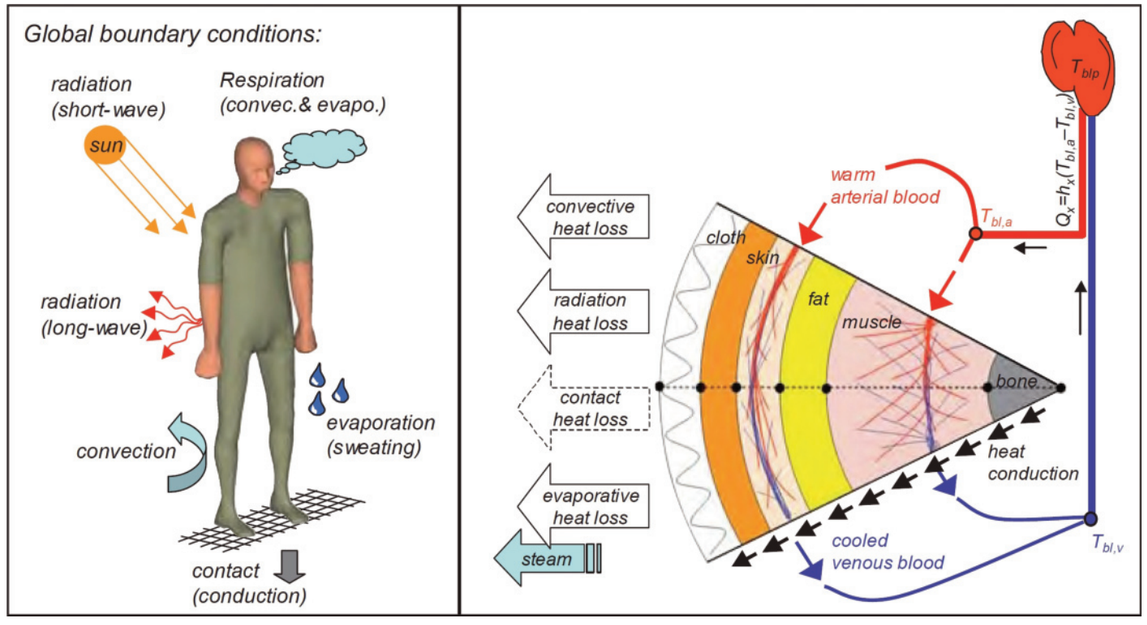
The dummy's sensors are evenly distributed over the body

about the air distribution in the individual ducts as a function of the individual flap positions in the hvac and thus be able to map the air distribution in the vehicle interior.

To determine the information required for this, the hvac module is measured in detail in test bench setups. To transfer the hardware measurements to the simulation, a detailed model of the vehicle cabin and occupant is also required, which is created using



Effects of external climate on a vehicle



Factors measured to simulate human body reactions

simulation software.

To represent the occupants, the tool includes a complex human model that imitates the human body functions relevant for air and heat exchange such as breathing, blood circulation and sweating as well as cold shivering and considers different clothing situations.

To provide detailed boundary conditions on all parts of the body for thermal comfort statements with the human model, the tool enables a very fine and automated discretisation of the total air volume into individual air zones with a newly developed pseudo-3D approach. The simulation speed is enormously increased by the pseudo-3D approach, which is essential for the highly dynamic transient simulations.

Within the air zones, detailed statements can be made in each case about the air velocity, temperature and humidity as well as about the long-wave and short-wave radiation. Of course, in summer load cases, the position of the sun and the areas illuminated or shaded by it are automatically determined as a function of the vehicle and window geometry as well as the vehicle orientation. Since the air and surface temperatures influence each other, radiation, flow and heat conduction processes are considered on a defined component as a coupled system.

Finally, the comfort index according to ISO 14505-2, which describes the thermal sensation in vehicle cabins on the basis of the equivalent temperature, represents the basis for the evaluation of the measured and modelled thermal comfort. With the help of this index, objective statements about the influence of different dynamic factors on the climate comfort in the vehicle interior can be made. These should be available for the definition of general comfort and air conditioning targets, and consequently for the creation of universal specifications.

Development

Once the individual models have been correlated, the resulting simulations will have to be compared with real driving data in the coming months and any sources of error and inaccuracies in the calculations identified and compensated for. To this end, test drives have already been carried out with the dummy.

This is equipped with 31 sensors evenly distributed over the body for measuring air temperature and humidity, long- and short-wave radiation, and wind speed. A revised version of the dummy is under development. In the future, it will not only have around three times the number of sensors, but will be able to record additional values such as contact heat flows.

The effects that interact during journeys are caused by the external climate, the course of the road intraurban or out of town, and changing direct and indirect solar radiation from different angles and directions. In addition to external factors, which affect the occupants and the thermal comfort they perceive depending on their age, physical condition and body mass, the respective number of people in the passenger compartment also plays a role.

Once the simulations have been verified, the focus shifts to the final project: the numerous factors influencing the vehicle interior climate and thus the comfort value are to be evaluated and objectified in all their facets.

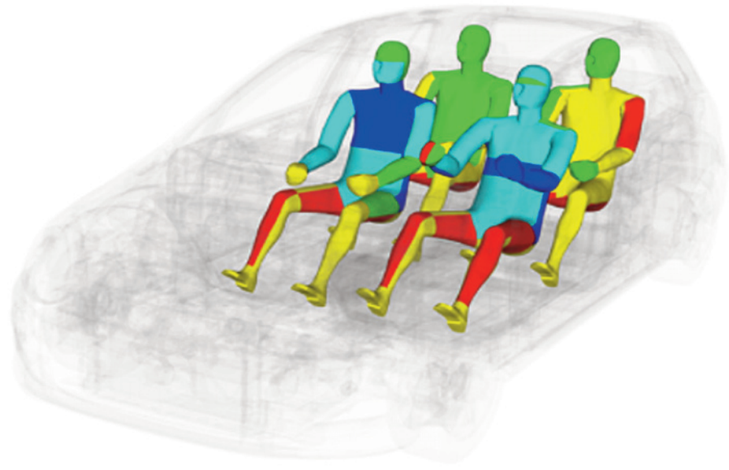
Future

As soon as engineers can simulate these dynamic journeys with sufficient precision and speed, the last major step in the development process for air conditioning and climate comfort will be tackled.

After all, when all the pieces of the puzzle necessary for calculating the transient load cases can be reproduced virtually, this puts the specialists in the promising position of being able to derive concrete effects on the climate-related well-being of the occupants from these values.

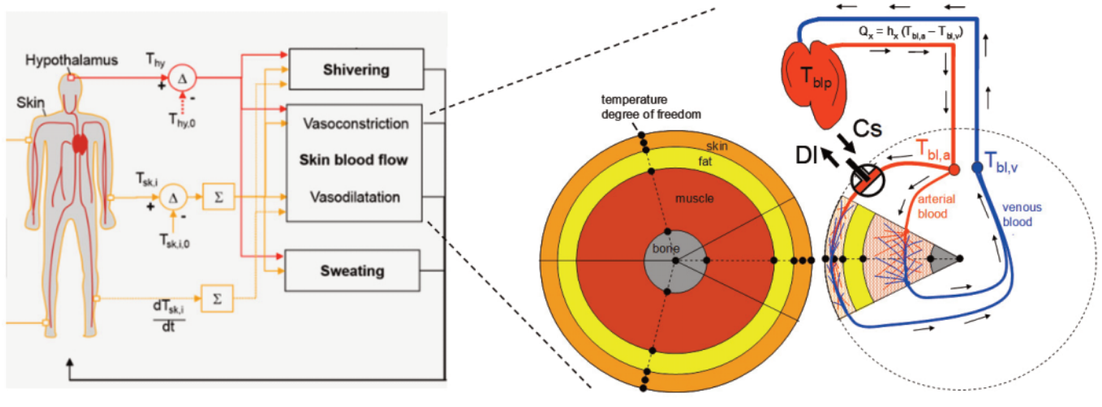
Accordingly, objectified action instructions for the thermal management system with integrated control of the hvac system can follow. Once these dynamic processes are recorded in a comfort specification, the actual application work in the test vehicle can be reduced, namely only the fine-tuning on the final vehicle. In this way, the use of the virtual application, which can be used to address changed load cases and boundary conditions early, quickly and easily, will result in significantly reduced development time compared with manual application.

This will fundamentally change the future approach to thermal comfort assessment and application in automotive development.



It is important to consider the number of people in the vehicle

Michael Ellinger is a group leader and Max Hauk a senior expert on thermal management, both at Arrk Engineering



Thermoregulation of the human body

ELECTRIC VEHICLES

SOWING SEEDS

Steve Hughes looks at the technology needed to electrify farming vehicles



The past decade has been one of rapid growth in the uptake of electric vehicles (EVs) for transportation, with Europe becoming the largest market for electric cars for the first time in 2020. However, this is only the start of the transition to cleaner, greener mobility with industries such as agriculture still relying on diesel-powered vehicles.

A 2020 McKinsey report estimates that over one quarter of global carbon dioxide, methane and nitrous oxide emissions can be attributed to agriculture, forestry and land use change, notably deforestation creating space for agriculture.

While there is little research on how much of the global greenhouse gas (GHG) emissions can be attributed to non-road mobile machinery for farming, energy use in agriculture to power machinery is responsible for 1.5 per cent of GHG emissions. This may seem small but, it could be as much as 690,000 gigatons of gases per year.

Electrification of farming vehicles could go some way to reduce agriculture's environmental burden. However, modern farming relies on fleets of heavy-duty vehicles that can weigh more than 25,000kg with added attachments. All this weight, combined with long working days and large acreages, adds to the challenge of electrification.

Diesel is still the popular fuel choice for farmers because it packs approximately 27 times more energy per full tank compared with batteries and therefore can work all day without having to refill. If EVs are to compete in this sector, the vehicle components need to be efficient to extend the battery runtime for as long as possible.

Braking resistors

When a driver applies the brakes on a tractor, heat is one of the main excess energies produced and lost. Regenerative braking involves recovering this energy and feeding it back into other vehicle processes, reducing losses and the amount of required battery power.

Braking resistors with good heat dissipation are needed to make sure excess energy is used productively and doesn't overload the system. They can, for example, use water-cooling for increased heat dissipation, allowing more energy to be reclaimed into alternative processes.

Because of the increased torque needed, braking resistors for heavy-duty farm vehicles must be able to manage a higher wattage than those used for normal EVs. They must also be small, because any additional, unnecessary weight-bearing on the vehicle could compact the soil and make it less viable for crop growth.

Some big agricultural vehicle manufacturers are currently trialling cable powered EVs to eliminate the need for a battery and save on weight. However, these EVs would require better infrastructure and could be limited to small driving ranges.

Infrastructure

If a farmer has large acreages spread across a vast geographical area, a vehicle may have to leave its base for several days or weeks during harvesting seasons. Therefore, if the infrastructure isn't in place to accommodate EV charging, farmers can't be expected to remain productive.

Improving the infrastructure will involve installing more charging points on farmland, fitted with harmonic filters. One of the challenges of increased EV charging is the threat of harmonic currents, which occur when AC power system voltages are converted to DC voltages.

A harmonic filter can prevent harmonic currents from damaging the grid and overheating the capacitors and transformers in the vehicle. They operate by administering a counteracting frequency, which removes signal distortions and increases the reliability of the charging point, as well as the network stability.

To sow a more sustainable future for farming, EVs will play an important role. To accelerate the switch, EV manufacturers need to choose vehicle components that will prolong battery lifespans and protect the integrity of the charging infrastructure.



Steve Hughes is managing director at Reo

GREENER TRAVEL



Stewart Goulding discusses how micromotors are aiding the decarbonisation of transport

Transitioning to more environmentally friendly modes of transport and improving fuel economy will be crucial in reducing greenhouse gas emissions from transport.

Micromotors are supporting the switch to electric vehicles (EVs) and improving the efficiency of commercial aircraft.

Transportation is responsible for 24 per cent of direct carbon emissions, according to the International Energy Agency. Because of this, the decarbonisation of transport has become a crucial part of the climate crisis strategy of governments.

For example, in 2020, the UK government released a report on decarbonising transport, which detailed what must be done to reduce transport emissions to reach net zero by 2050. Efficiency improvements in aircraft technology and switching to EVs are two strategies covered in the document, and innovative motor technology can catalyse progress in these areas.

Charging ahead

As part of its decarbonisation strategy, the UK government has banned the sale of new internal combustion engine (ICE) cars and vans from 2030, enforcing a shift to EVs. Despite EVs producing around 50 per cent less greenhouse gas emissions than ICE vehicles, increasing EV adoption has been challenging, as many drivers believe EVs cannot preform as well as ICE vehicles, or have concerns over the inconvenience of charging.

Micromotors are helping combat these apprehensions, as they're being used in applications that can make EV charging quicker and simpler. For example, micromotors can be incorporated into an EV charging port to allow electronic opening of the flap, providing easy access for the driver.

This design feature also allows the port to be secured at the touch of a button, thus preventing physical damage and tampering of the internal components.

Shifting gear

Micromotors also play a vital role in EV gear shifts. ICEs require multi-speed transmissions, as they can only operate within a narrow revolutions per minute (RPM) window at each gear before stalling. On the other hand, the electric motors in EVs have a much larger operating window, so a single speed transmission can work for both high and low acceleration.

While EVs don't need a multi gear system, that doesn't mean they can't benefit from it. A single-speed transmission will work for a wide range of acceleration, but there is a degree of trade off that can impact torque and efficiency. For heavy vehicles such as buses and lorries especially, a multi-speed transmission can improve the EV's efficiency and performance.

However, multi-speed transmissions are larger than single-speed, which can be problematic in commercial vehicles that require increased space to carry goods or passengers.

Fortunately, automotive engineers can make the transmission system more compact by using small and power-dense micromotors in the integrated actuation system.

Aircraft

While there are fewer travelling commercial aircraft than road vehicles at any given time, planes have a higher fuel consumption rate and should also be prioritised in the transport decarbonisation strategy. For example, a Boeing 747 jumbo jet can burn around four litres of fuel every second.

A crucial area where airlines can reduce plane weight and improve fuel economy is in motorised systems. Motors are found in a range of cabin equipment to add comfort and a touch of luxury, such as in reclining seats, motorised television screens and electric window blinds.

They're also found on board in safety-critical applications, playing a key role in locking cabin door mechanisms, emergency exits and the pilot's seat. Motors are also used to adjust the valves that regulate the plane's air-conditioning.

With a number of motorised systems on board, aerospace engineers can shave grams off aircraft by switching to more compact alternatives.

Conclusion

The transport sector can capitalise on advancements in motor technology to reduce greenhouse gas emissions. High performance micromotors can help accelerate EV adoption and improve the fuel economy of aircraft, assisting the transition to greener travel.



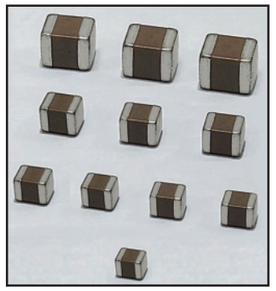
Stewart Goulding is managing director of EMS

MLCCs suit hot powertrains

A range of high-temperature MLCCs from Samsung Electro-Mechanics can be used in automotive powertrains.

The firm has developed 13 types of automotive MLCCs with guaranteed use in a +150˚C environment.

They come in various sizes and capacitances, ranging from the 3225 size that is 3.2mm wide and 2.5mm long with a capacitance of 22μF to the smaller 1608 size at 220nF.

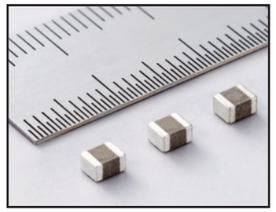


There are three types in the 3225 size at 22, 4.7 and 2.2μF, at 3216 are 10, 2.2 and 1μF versions, at 2012 there are 10, 4.7, 2.2 and 1μF, plus 470 and 220nF units, and at 1608 there is the 220nF model.

The capacitors control the stable current flow within electronic circuits in products such as smartphones, home appliances and automobiles.

The powertrain requires reliability for internal components as the operating temperature can rise up to +150˚C due to high power consumption and heat generation from powering the core driving system of a vehicle, such as an internal combustion engine or the motor of an electric vehicle.

Above the guaranteed temperature, MLCCs tend to lose their capacitance to store energy. These MLCCs are capable of normal operation without reduced capacitance even at +150˚C.



Metal inductors

Metal power inductors from Murata are for high-temperature applications up to +150˚C.

For use in DC-DC converters and power management circuitry in automotive applications, the DFE32CAH R0 components are supplied in 3.2 by 2.5mm metal cores.

They suit in-vehicle applications beyond infotainment systems to the powertrain and adas.

DC superimposed current rating (Isat) is 8.7A.

The DFE32CAH R47-MR0L has a 0.47μH inductance, with an RDC of 14mΩ maximum and an Isat of up to 8.7A.

For the R68MR0L, the main values are 0.68μH for inductance, 17mΩ maximum for RDC and up to 7.0A for Isat. The 1.0μH-rated 1R0MR0L and 1.5μH-rated 1R5-MR0L have respective RDC values of 22 and 30mΩ, with Isat figures of 5.9 and 4.8A.

The 2R2, 3R3 and 4R7-MR0L inductors have respective inductance ratings of 2.2, 3.3 and 4.7μH with RDC figures 43, 67 and 101mΩ and Isat values of 4.0, 3.3 and 2.8A.

Footprint halved for OBD-II antenna

Antenova has halved the footprint of its 4G cellular antennas with its Pharaoh SMD antenna that can be used in OBD-II designs.

Designed for small PCBs, the P/N SR4L073 antenna covers all 4G frequencies: 698-824, 824-960, 1710-2170, 2300-2400 and 2500-2690MHz.

It suits small circuit boards such as found in miniature pet trackers, wearables or OBD-II designs.

This antenna was tested with evaluation boards of 50 by 40mm and 60 by 40mm and its performance-to-footprint ratio is claimed to out-rank competing 4G antennas for small circuit boards.

Its performance on small PCBs is above the level required to pass PTCRB tests for cellular networks.

At the lowest 4G frequency, 698MHz, the wavelength for electromagnetic radiation is 42.95cm. Most antennas require a ground plane of a quarter wavelength, which means they need a space of 107mm to operate effectively. The Pharaoh antenna uses about half this area.

The antenna is supplied with a reference design and matching network to help integrate the antenna into a device and shorten the design cycle.



Virtual environment speeds development

A virtual environment from Renesas enables development and operational evaluation of automotive application software to support the latest requirements of electrical-electronic architectures.

The environment includes a virtual turnkey platform that lets engineers develop application software before devices or evaluation boards are available.

Additionally, the environment offers a multicore debug and trace tool, so users can analyse and evaluate the operation of their software as if it were running on an actual chip.

These tools should help users kick-start development and get software to market faster.

The integrated environment can be used across gateway systems, adas and xEV development with Renesas products such as R-Car and the RH850 family for software and hardware.

The combination of the R-Car virtual platform development environment and a software development kit includes pre-tested software libraries and sample code.

This is based on virtualiser development kits from Synopsys, and integrates virtual models of IP specific to R-Car. By overlaying the SDK on this platform, engineers can immediately start development of application software virtually.

The platform recreates the behaviour of the actual chip, eliminating the need to build up a development environment with a physical evaluation board.

Multiple users can develop software simultaneously on separate PCs or servers.

The multicore debug and trace tool simplifies the process of analysing and identifying the causes of errors occurring from the interaction of the multiple hardware resources in R-Car SoCs.

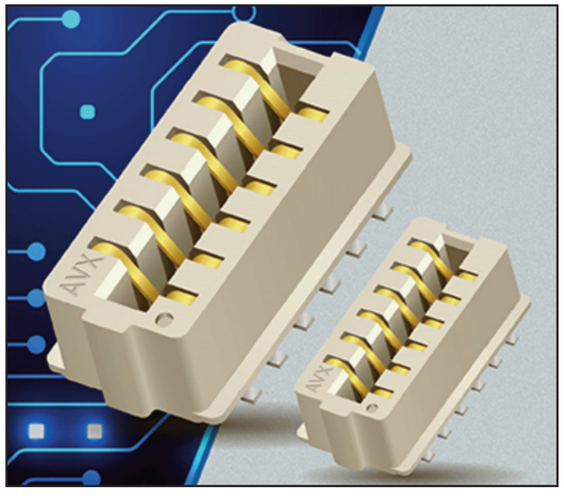


This enables synchronous and simultaneous debugging of the entire heterogeneous architecture of R-Car without using the actual device. This helps identify potential problems and thus accelerates the development process.

Connectors double contacts in harsh environments

Dual-row top-entry card-edge connectors from Kyocera AVX extend the current rating to 2.5A per contact to improve reliability and signal integrity performance in harsh automotive, industrial and lighting applications.

The 9159-650 connectors have twice as many gold-plated beryllium copper (BeCu) compression contacts as the 00-9159 they are based on in roughly the same form factor.



Designed to provide functionality in a broad range of perpendicular, PCB-mating applications, they have high-temperature thermoplastic insulators rated for UL94 V-0 flammability.

The vertical connectors are available with four to twelve contacts rated for a full 2.5A each and arranged in a staggered, dual-row configuration.

They accept 1.6mm-thick mating PCBs with gold-plated pads and offer options for polarisation, in which case the mating PCB layout is modified to form a key that prevents improper insertion, and compatibility with automated pick-and-place and SMT termination equipment, in which case Kapton tape is applied prior to reeling.

The connectors are rated for 300V AC and ten cycles operating from -40 to +125˚C.

Gate driver boosts motor control flexibility

An integrated automotive three-phase gate driver unit (GDU) from ST Microelectronics operates in 12, 24 or 48V systems and has flexible input and output channels to fulfil applications in conventional and hybrid and full electric vehicles.

Dedicated source connections to the high-side and low-side fets of each half bridge let users configure the output channels independently to drive various types of loads.

In addition, six separate PWM input pins allow independent management of the pre-driver stages for different motor-control strategies.

Accuracy is improved with three differential current monitors for ground-referenced measurements and three channels for real-time phase-voltage monitoring. There is also a set of diagnostic and protection features.

By combining high integration, flexibility and accuracy, the L9908 can simplify design, save space and enhance control of low-voltage fluid pumps, pumps and blowers in ventilation and cooling systems, and electronic seat controls.



It can be also used in traction inverters for mild-hybrid internal combustion engine vehicles and 48V full-electric city cars.

Moreover, its built-in diagnostics allow use in safety-related systems such as autonomous emergency braking and electronic power steering, simplifying certification to ISO 26262.

The safety features include SPI-programmable dead-time insertion with shoot-through diagnostic and protection, open-load detection, and short-to-ground and short-to-battery diagnostics.

There is also an SPI-programmable temperature warning and SPI-readable junction-temperature measurement.

Other diagnostics include ground-loss detection, over-voltage and under-voltage detection on the power supply pins and FET-driver supply, system-clock monitoring, SPI window watchdog, and a fault-status flag.

The flexibility to use the gate driver in single (12V), dual (24V) and 48V battery applications comes from its motor supply-voltage range, from 4.5 to 75V, with the ability to tolerate -14 to +95V on motor-connection pins.

The on-chip logic is supplied from an internally generated 3.3V supply and digital IOs are 3.3 and 5V compatible.

AEC-Q100 qualified, it is available in a thermally enhanced TQFP48 package.



Fuse protects up to 1kV

An automotive-grade fuse from Littelfuse has a rating of 1kV DC.

The EV1K is designed and tested to meet the overcurrent circuit protection needs of the e-moblilty market, specifically electric vehicle (EV) applications.

It provides overcurrent protection in EV high-voltage power supply applications, including on-board chargers, battery distribution units, battery packs, DC-DC converters, traction motor inverters and auxiliary loads.

There is a need for more robust safety as the e-mobility market transitions from 500 to 800V DC pack voltages.

The fuse can withstand severe automotive environments, providing 1kV rating with amperages from 60 to 125A. Fuses up to 600A are also under development.

Interrupting rating is 30kA.

Body size is 25 by 73mm with end caps incorporating integrated bolt-down terminals. This is durable against mechanical vibration and shock.

Operating temperature is from -55 to +125°C and humidity resistance provides protection in a wide variety of environments. It is RoHS compliant, halogen-free and 100% Pb free.



Embedded flash

Kioxia is sampling automotive embedded flash memory devices. The UFS version 3.1 line uses the company's BiCS 3D flash memory and is available in capacities from 64 to 512Gbyte to support evolving automotive applications that elevate driver experiences.

The devices support a temperature range from -40 to +105°C and meet AEC-Q100 grade two.

Universal Flash Storage (UFS) is a category for embedded memory products built to the Jedec UFS specification. Due to its serial interface, it supports full duplexing, which enables concurrent reading and writing between the host processor and UFS device.

Both the sequential read and sequential write performances of the device have been improved by approximately 2.2x and 6x, respectively, over previous generation devices. These gains contribute to faster system start-up and OTA updates.

Sample shipments of the 512, 256, 128 and 64Gbyte devices have started.

Neural processor IP tackles adas

Addressing increasing performance requirements for artificial intelligence (AI) SoCs, Synopsys has announced a neural processing unit (NPU) IP and toolchain for complex neural network models for adas and other applications.

The DesignWare Arc NPX6 and NPX6FS NPU IP address the demands of real-time compute with low power consumption for AI applications.

To accelerate application software development, the DesignWare Arc MetaWare MX development toolkit provides a compilation environment with automatic neural network algorithm partitioning to increase resource use.

Adas, surveillance, digital TVs and cameras, and other emerging AI applications that implement complex neural network models, put more demand on compute and memory resources, often for safety-critical functions.

The Arc NPX6 NPU IP scales from 4K to 96K macs, and delivers, in a single instance, up to 250Tops at 1.3GHz on 5nm processes in worst-case conditions, or up to 440Tops by using sparsity features, which can increase the performance and decrease energy demands of executing a neural network.

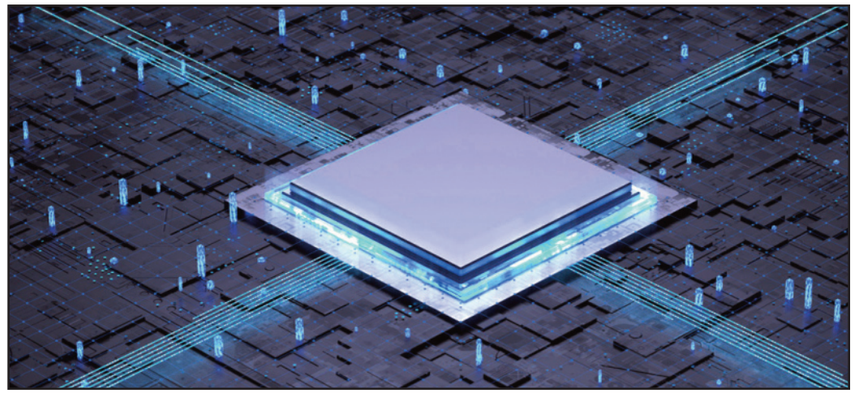
It integrates hardware and software connectivity features that enable implementation of multiple NPU instances to achieve up to 3500Tops of performance on a single SoC.

Optional 16bit floating point support inside the neural processing hardware increases layer performance and simplifies the transition from GPUs used for AI prototyping to high-volume power- and area-optimised SoCs.

The NPX6FS NPU IP meets random hardware fault detection and systematic functional safety development flow requirements to achieve up to ISO 26262 Asil D compliance. The processors, with safety documentation included, have dedicated safety mechanisms for ISO 26262 compliance and address mixed-criticality and virtualisation requirements for zonal architectures.

The MetaWare MX development toolkit includes compilers and debugger, neural network software development kit (SDK), virtual platforms SDK, runtimes and libraries, and simulation models. It offers a single toolchain to accelerate application development and automatically partitions algorithms across the mac resources.

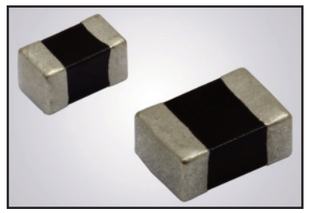
For safety-critical automotive applications, the toolkit includes a safety manual and a safety guide to help developers meet ISO 26262 requirements and prepare for compliance testing.



NTC thermistor range extended

Vishay has extended its NTCS 0603E3xT and 0805E3xT series of automotive grade, glass protected NTC thermistors in the 0603 and 0805 case sizes with more electrical resistance values at +25˚C.

The AEC-Q200 qualified devices are available with lower R25 values of 1 and 1.5kΩ, in addition to an added 5kΩ value for protecting IGBT and power mosfet modules in electric and hybrid electric vehicles.



Fully glass coated and protected, the thermistors have tolerances down to ±1% for both the R25 and beta (B25/85) values for temperature sensing, protection and compensation over a temperature range of -40 to +150˚C.

Smaller than MELF resistors, while offering easier mounting and more resistance to bending, the series can be used in automotive buck-boost converters, LED modules and battery packs; EV charging infrastructure; inverters for windmills and solar panels; and office equipment.

Featuring an SMD construction with NiSn terminations, the thermistors are suitable for wave or reflow soldering. RoHS-compliant and halogen-free, the devices are delivered on punched paper tape on reels in packages of 4000 units.

Samples and production quantities are available now, with lead times of 20 weeks for large orders.

GaN fet suits ToF lidar applications

Efficient Power Conversion (EPC) will use May's PCIM show in Germany to introduce the latest addition to its family of automotive qualified transistors and ICs for time-of-flight (ToF) lidar applications including robotics, drones, 3D sensing and autonomous cars.

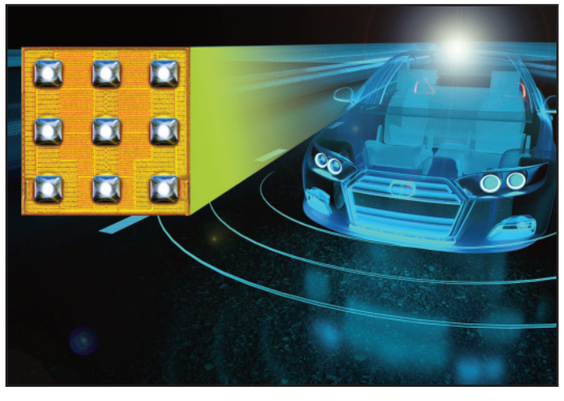
The EPC2221 is a common-source dual gallium nitride (GaN) fet rated at 100V, 58mΩ, and 20A pulsed current.

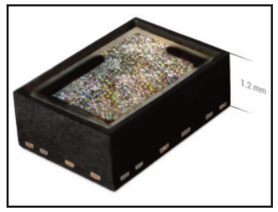
The low inductance and capacitance allow 100MHz switching and 2ns pulse widths to improve resolution and efficiency. Size is 1.35 by 1.35mm.

The device has completed AEC-Q101 qualification testing including humidity testing with bias, high temperature reverse bias, high temperature gate bias and temperature cycling.

As well as automotive applications, it can be used for for high-frequency DC-DC conversion, wireless power applications and synchronous rectification.

Designers interested in replacing their silicon mosfets with a GaN device can use the firm's cross reference tool to find a replacement based on operating conditions.





Laser module

A 940nm vertical-cavity surface-emitting laser (VCSEL) flood illuminator module from II-VI has been qualified to AEC-Q102 for in-cabin applications.

Transportation safety regulators are recommending driver and occupancy monitoring in vehicles, fuelling demand for high-performance 2D and 3D infra-red cameras.

The flood illuminator modules are said to emit higher optical power with a narrower spectral width than infra-red LEDs in driver monitoring, enabling improvements in 2D imaging performance.

The infra-red light emitted can be modulated to frequencies greater than 100MHz, making them suitable for high-resolution 3D time-of-flight cameras for driver and occupancy monitoring systems.

In-house gallium arsenide laser technology was used to achieve economies of scale.

The modules come in surface-mount packages with diffuser optics with either a 60 x 45˚ or 140 x 110˚ field of view.

Sensor monitors Li-ion battery pack health

Metis Engineering has revealed the beta version of a production battery safety sensor to monitor the health of a Li-ion battery pack and detect cell venting, an early sign of catastrophic failure.

The sensor can pick up environmental parameters, including volatile organic compounds, pressure change, humidity and dew point, and has an optional accelerometer to record shock loads. These data can be used to cross-check with other inputs, such as cell temperatures, to check for cell venting.

The sensor relays the data over a configurable Can interface to a control unit, such as the vehicle's ECU, to alert the driver that cell venting has occurred. The sensor can also trigger the process to cut the circuit to the battery pack, so it can cool down to prevent thermal runaway.

This safety sensor typically detects venting within seconds.

There are several stages to a cell going into thermal runaway. First, there is an increase in temperature, often caused when a battery is overworked, has a manufacturing fault or is aged. The rise in temperature causes the pressure inside the battery cell to rise. Eventually that pressure, if high enough, causes venting from the sealed battery cell. If load is not removed from the cell then a thermal runaway can occur.

If a battery is driven to failure after venting, it can catch fire in a self-oxidising reaction, which can result in a runaway reaction, setting off the cells around it, and causing the total loss of the vehicle.



The optional accelerometer can monitor shock loads up to 24G and impact duration the battery pack may experience. Should the EV be in a collision, the sensor will show whether the pack experienced loadings above safe levels and for what duration.

Battery packs get warm when they are charged or discharged. To prevent overheating, most packs are cooled in some way. If they are cooled below the ambient temperature, they can dip below the dew point, which could lead to shorting and thermal incidents.

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