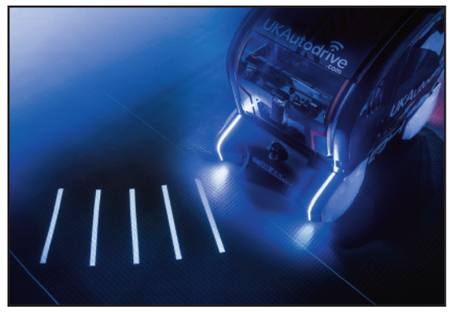
VEHICLE electronics

The monthly magazine for automotive electronics engineers

Jaguar shows pedestrians what autonomous vehicle is about to do



Lines show in which direction the vehicle is planning to move

Jaguar Land Rover has developed a system that projects the direction of travel onto the road ahead of self-driving vehicles to tell other road users what it is going to do next.

The intelligent technology beams a series of projections onto the road to show the future intentions of the vehicle – for example stopping and turning left or right – as part of research into how people can develop their trust in autonomous technology. In the future, the projections could even be used to share obstacle detection and journey updates with pedestrians.

These projections, tested on autonomous pods developed by Aurrigo, feature a series of lines or bars with adjustable spacing. The gaps shorten as the pod is preparing to brake before fully compressing at a stop. As the pod moves off and accelerates, the spacing between the lines extends. Upon approaching a turn, the bars fan out left or right to indicate the direction of travel.

Trials were set up by a team of engineers in JLR's future mobility division, supported by cognitive psychologists, after studies showed 41 per cent of drivers and pedestrians are worried about sharing the road with autonomous vehicles.

The system was tested on a fabricated street scene at a Coventry facility with engineers recording trust levels reported by pedestrians both with and without projections.

The trust trial programme – which also included fitting virtual eyes to the intelligent pods in 2018 to see if making eye contact improved trust in the technology – was conducted as part of JLR's government-supported UK Autodrive project.

"The trials are about understanding how much information a self-driving vehicle should share with a pedestrian to gain their trust," said Pete Bennett, research manager at JLR. "Just like any new technology, humans have to learn to trust it and, when it comes to autonomous vehicles, pedestrians must have confidence they can cross the road safely. This pioneering research is forming the basis of development into how self-driving cars will interact with people in the future."

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February 2019

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Volvo invests in stretchable electronics

Volvo cars has invested in Finland start-up Forciot, a specialist in stretchable electronics technology.

"At Volvo Cars we see potentials in Forciot's technologies that can be used for next-generation car interiors," said Andreas Strasser, investment director at Volvo Cars. "These technologies could be the base for new features that would offer innovative safety and comfort improvements."

The stretchable electronics and algorithm product measures and reports accurately force, weight, balance and pressure and the system can also be used as an HMI touch controller.

The investment will let Forciot broaden its international business entry and supply chain operations.

Also investing is German technology group Heraeus, which combines material expertise with technological know-how.

"Stretchable electronics and sensor technology are a future growth market for Heraeus," said Frank Stietz, head of the Heraeus' business area electronics. "Our investment in Forciot allows us to open up this market even more and to continue to learn, and it supports our growing electronics and sensor technology areas."

Forciot also offers the technology for logistics and wearable manufacturers that need stretchable sensors to bring intelligence into their products in difficult measurement environments.

"We are thrilled to have closed the series A investment round with such great companies," said Tytti Julkunen, Forciot co-founder and chairman. "Both Heraeus and Volvo Cars have admirable track records in innovation and both are operating in Forciot's strategic business and learning areas. Forciot is already operating worldwide providing its technology for large scale B2B customers."

Maria Alm, Forciot co-founder and CEO, added: "This investment enables us to scale up Forciot operations further to prepare for the mass volume phase and supports greatly also our global sales, marketing and technology development growth plans."

Bus uses AI to monitor passengers



This autonomous bus made its debut at last month's New Generation Artificial Intelligence Future Development Summit in Shanghai and has already attracted interest from countries in Europe.

With AI technology from DeepBlue Technology, it can detect abnormal behaviour among passengers and uses finger vein recognition to identify commuters. The on-board robot monitors and records suspicious behaviour in real time.

Germany, Greece, Italy and Luxembourg have shown interest in the vehicle and the company hopes it will make it debut in Europe this year.

Other features include autopilot, voice interaction, precise advertising push, intelligent unmanned retail system and intelligent escape emergency handling system, which has never been implemented in public commuter transport until now.

Audi chooses Samsung to power IVI

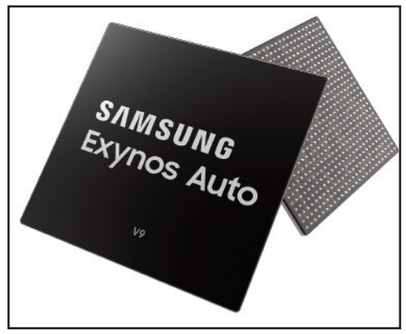
Samsung Electronics' first automotive-branded processor – the Exynos Auto V9 – is to power an Audi in-vehicle infotainment (IVI) system that is expected to make its debut by 2021.

The processor is designed for IVI systems that display content on multiple displays, providing information that assists drivers and passengers for a safer and more enjoyable in-vehicle experience.

Based on 8nm process technology, it has Arm's latest Cortex-A76 CPU cores, Arm Mali G76 GPU, Hifi 4 audio digital signal processor, intelligent neural processing unit and a safety island core that supports Asil-B standards.

The neural processing unit provides a digital concierge service that can intelligently manage a safe and personalised driving environment. It can process visual and audio data for features such as face, speech or gesture recognition.

"Audi thrives to bring the most exciting, yet the safest automobiles when we vision the drive of tomorrow," said Alfons Pfaller, head of architecture development at Audi. "Samsung has been a valued technology partner over the past few years and we are extremely pleased to have the Exynos Auto V9 power our next-generation platform that will shape the future IVI experiences."



Samsung's Exynos Auto V9 processor

To deliver immersive driving experiences, the processor supports up to six displays and twelve camera connections for subsystem content in IVI systems. It is powered by eight Cortex-A76 cores at speeds up to 2.1GHz.

The GPU is arranged in three separate dedicated sets of Mali G76 GPU cores that are able to support seamlessly multiple systems such as the cluster display, central information display and rear-seat entertainment simultaneously. To improve audio quality, the chip comes with four Hifi 4 audio processors that provide captivating audio experiences with vivid and realistic sounds.

"Samsung is fully committed to bringing top-of-the-line automotive processors for safer and more pleasant driving experiences," said Kenny Han, vice president at Samsung Electronics. "We are thrilled to introduce the new Exynos Auto line of products, starting with the Exynos Auto V9, which brings powerful processing performance to the next generation of automotive IVI systems while meeting the industry's strict reliability requirements."

The processor also supports LPDDR4 and LPDDR5 dram.

Aptiv invests in AI software

Aptiv has made a minority investment in Affectiva, a Boston-based MIT Media Lab spin-off, to help future vehicles learn about their occupants.

Affectiva specialises in human perception artificial intelligence (AI). The partnership aims to produce scalable software using deep learning architectures to improve in-cabin safety.

Affectiva's multi-modal interior sensing software can unobtrusively identify, in real time, complex cognitive states of vehicle occupants.

Built with real world data, the technology can unlock deep understanding of the state of occupants in a car to deliver a flexible platform that could scale with evolving safety standards and mobility needs.

"Just as perception and detection of objects outside the vehicle are critical enablers of autonomous driving, there is an increasing need for intelligent sensing inside the cabin," said Kevin Clark, president of Aptiv.

Aptiv and Affectiva plan to work closely in commercialising sensing technology for OEMs and fleets.

"Integrating Affectiva's deep learning-based software into Aptiv's connected vehicle platform will enable OEMs, on-demand mobility providers and fleet management companies to build intelligent vehicles that understand every facet of the human experience within a vehicle," said Rana el Kaliouby, co-founder of Affectiva.

ANALOG DEVICES

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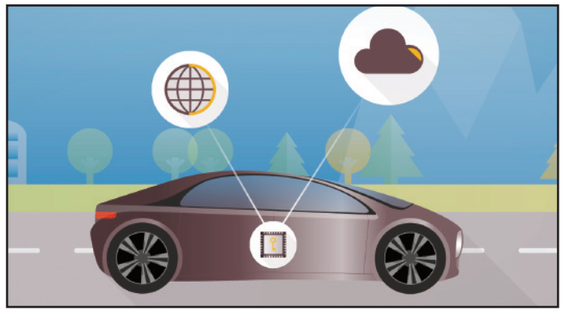
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VW banks on Infineon for connected car security



Infineon offers trusted platform module for cars

Volkswagen is one of the first car makers to deploy the Optiga TPM 2.0 trusted platform module from Infineon Technologies as a security device for connected cars.

The chip can protect the vehicle's communications with the outside world, for example when car-sharing users or third-party services such as parcel delivery into a car's boot require access. Furthermore, the TPM is suited to secure software updates over the air by the car manufacturer.

TPMs have proven themselves in the computer industry for many years and are now increasingly being used in connected devices in the IoT. Infineon says it is the first semiconductor manufacturer to offer an automotive-qualified TPM for the connected car. The chip meets international security standards and is certified by independent authorities.

Like a doorkeeper, the TPM protects the vehicle's external interfaces, for example in the infotainment system or the telematics unit. It checks the identities of senders and recipients of digital data, such as the manufacturer's backend server. It encrypts and decrypts the data and helps make sure that only data the driver or manufacturer actually wants make their way into the car.

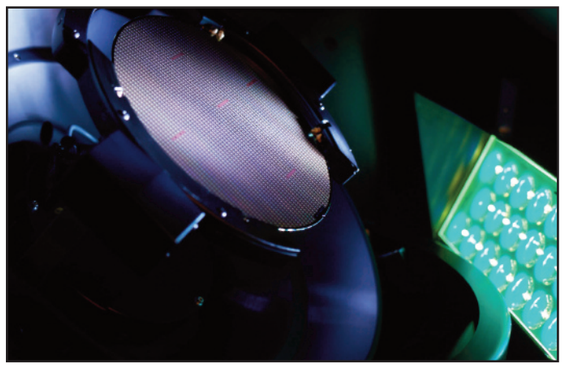
The cryptographic keys needed for these security functions are stored within the TPM as in a safe. Infineon imports the initial keys in a certified security environment. Since all other keys can be generated, used and stored within the TPM itself, they never have to leave it and are protected against being spied on via the network.

The TPM is also hardened against physical attacks. Even if someone removes the chip from the vehicle, the keys are protected from being read.

The Optiga can accommodate the long product life cycles of cars. Its firmware, including cryptographic mechanisms, can be updated remotely.

X-Fab galvanic isolation process goes live

Analogue and mixed-signal foundry X-Fab Silicon has started volume production with its high temperature galvanic isolation semiconductor process. This proprietary technology is automotive qualified at the company's Dresden facility.



X-Fab starts production with galvanic isolation

Galvanic isolation electrically separates circuits to improve noise immunity, remove ground loops and increase common mode voltage. It can also protect human interfaces from contact with high voltages.

An example where this plays an important role is the control of IGBT or SiC power modules in industrial and automotive environments.

Operational temperature is up to +175˚C. The process has been tested up to 6kV RMS at 50Hz and 10kV DC.

The uninterrupted barrier layer has 0ppm residual contamination. The process has demonstrated conformance with the IEC 60747-17 semiconductor coupler draft standard and it supports working voltages up to 1.7kV.

X-Fab offers two types of packaged galvanic isolation devices for evaluation. The capacitive coupler test chip, G3-C1, has an isolation layer thickness of 11μm and was tested to withstand up to 6kV RMS. An inductive coupler test chip, G3-T06, is also available for evaluation and has an isolation layer thickness of 14μm.

Garmin picks Green Hills for instrument clusters

Garmin has selected Green Hills Software's Integrity real-time operating system as the safe and secure software platform for its standalone automotive digital instrument clusters.

As a result, Garmin will add safety-certified instrument clusters to its expanding OEM electronics business through its teams throughout the Americas, Europe and Asia.

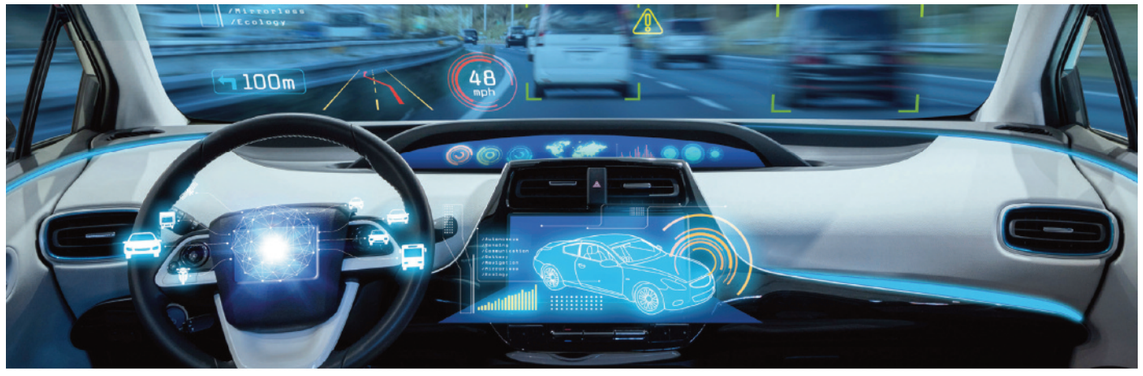
"The growing digital instrument cluster market is another significant opportunity for Garmin as it expands its OEM electronics business," said Matt Munn, Garmin's managing director for automotive OEMs. "The Integrity rtos will allow Garmin to provide the reliability, security and real-time performance demanded for automotive clusters and is a strong complement to our infotainment solutions."

The Garmin automotive OEM group uses the company's experience in user interface and hardware design from its automotive, avionics and marine segments to develop integrated infotainment. The company's manufacturing capabilities support a broad range of in-vehicle electronic strategies tailored to the region-specific needs of car makers.

Green Hills products are used in hundreds of millions of cars today, including for Integrity-powered digital instrument clusters. Integrity is widely adopted in automotive cockpits because of its pre-certified ISO 26262 Asil safety credentials, integrated C/C++ development tools and ecosystem of HMI partners providing GPU-accelerated graphics.

The rtos is suitable for controlling and protecting complex real-time software, such as Garmin's instrument clusters. It was designed for use in life- and mission-critical embedded systems.

It lets software teams partition software running at different levels of criticality on the same multi-core processor while guaranteeing the system resources required for the proper execution of applications.



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Misra and Autosar combine C++ standards

Misra and Autosar have agreed to integrate their standards for best practice in C++ into one publication. The goal is to provide a common set of rules, supporting software development in a number of sectors.

In 2008, Misra, a consortium of manufacturers, component suppliers and engineering consultancies, published Misra C++, a language subset that outlined expert guidance for C++ programming. Based on this publication, Autosar started to develop its own guidelines.

Autosar has released its C++ guidelines as part of the Adaptive Autosar platform twice a year since March 2017. This paved the way for electrical and electronic development with the focus on performance as well as safety and security.

Misra will merge the Autosar guidelines with its own established best practice to develop a single go-to language subset for safety-related C++ development.

The Misra led guidelines will incorporate the latest version of C++ language – C++17 – and, when available, its successor C++20.

"We have a proud history in producing coding guidelines and we are excited to continue developing the industry standard for years to come," said Chris Tapp, chair of the Misra C++ working group. "Our method has always been, quite simply, to provide information written by engineers, for engineers, and these C++ guidelines will be no different."

The new guidelines for the safe and secure application of both embedded control systems and standalone software will provide the framework for C++ use in several fields of application. This includes sectors such as automotive, aerospace, telecoms, medical devices, defence and engineering.

"It is crucial for innovative industries to be supported with a common, understandable C++ language in one place, a gold source for developers," said Rick Flores, chairman of Autosar. "We see the universal growth in C++ usage across some of the most transformative areas of industry, from connected autonomous vehicles to the development of AI underpinning the next generation of software intensive systems. I would like to thank the Autosar community for its efforts to accelerate the development of the merged guidelines."

The Misra consortium was conceived in the early 1990s as a project in the UK government's SafeIT programme to develop guidelines for embedded software in road vehicle electronic systems. Membership now consists of members from other industries in the safety-related embedded systems world, alongside automotive companies.

Misra C was a landmark project that has since gone on to become the de facto standard for embedded C programming in the majority of safety-related industries.

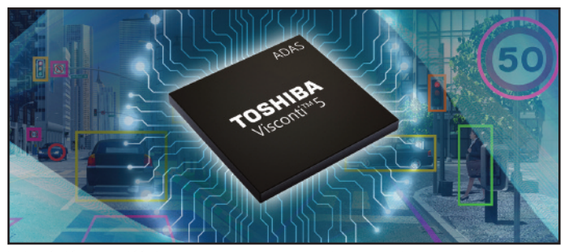
The latest releases of Autosar's Classic Platform, release R4.4.0, and Adaptive Platform, R18-10, integrate several new features into the open system architecture standard.

The release documents were published on the Autosar web site for the first time in a synchronised fashion, at the beginning of November according to its six-month publishing schedule.

Toshiba neural network for adas

Toshiba has developed deep neural network (DNN) hardware IP to help realise adas and autonomous driving functions.

The company plans to integrate the DNN hardware IP with conventional image processing technology and start sample shipments of Visconti 5, the next generation of its image-recognition processor, in September 2019.



Toshiba will integrate DNN into Visconti 5

The DNN hardware IP draws on deep learning to deliver more accurate detection and identification of a wider range of objects than image recognition based on conventional pattern recognition and machine learning. It enables Visconti 5 to recognise road traffic signs and road situations at high speed with low power consumption.



PSA to start autonomous driving tests on open roads in China

PSA gets licence for self-driving tests on open roads in China

The PSA group has been licensed to start autonomous driving tests on open roads in Chongqing, China. This makes it the first French car maker to do so in China.

PSA says its autonomous car experience in Europe will help it adapt to the local environment to meet Chinese market needs. The challenge is to integrate its technology into the Chinese ecosystem with special cases since the environment, infrastructure, map system and road users are different.

PSA was the first car maker to test an autonomous car on open roads in France, from July 2015, as well as the first car maker to obtain the authorisations to carry out autonomous mode tests with non-expert drivers in March 2017.

"Obtaining the licence for autonomous driving tests on open roads in China is a remarkable milestone for Groupe PSA, as China is the largest automobile market in the world and is witnessing the boom in the development of autonomous driving technology," said Carla Gohin, vice president at Groupe PSA. "This marks an important step for our AVA autonomous-for-all programme, which aims to provide safe and intuitive autonomous cars for all customers. From this fresh start, we'll continuously bring our cutting edge technology to Chinese customers."

PSA has five car brands – Peugeot, Citroën, DS, Opel and Vauxhall – and provides mobility and smart services under the Free2Move brand.

Hyundai lets users start cars with fingerprints

Hyundai's smart fingerprint technology lets drivers not only unlock doors but also start the vehicle. It plans to implement the technology in the Santa Fe SUV in select markets early this year.

To unlock the vehicle, the driver needs to place a finger on the sensor on the door handle. The encrypted fingerprint information will be identified and delivered to the fingerprint controller inside the vehicle. The driver can also start the vehicle by touching the ignition.

Matching driver preferences with fingerprint data, the vehicle can automatically adjust seating positions, connected car features and side-view mirror angles.

"In the future, Hyundai Motor plans to further expand the application of the technology to allow the adjustment of temperature, steering wheel position and many other features which will be tailored to the driver's preferences," said Albert Biermann, head of Hyundai's R&D division. "This will ultimately offer a quality driving experience to each and every Hyundai customer."

With capacitance recognition, which detects differentials in the electricity level in various parts of the fingertip, the technology prevents forgeries and faked fingerprints. The chance of misrecognising another person's fingerprint as the driver's is one in 50,000, making it five times more effective than conventional vehicle keys, including smart keys.

Through real-time learning of fingerprints supported by dynamic updates, the system can continually improve its success rate.


Drivers can start the vehicle using fingerprint

Continental collaborates with start-up on virtual simulation

Through a collaboration with German start-up Automotive Artificial Intelligence (AAI), Continental has enhanced its approach for virtual development of its adas and autonomous driving functions.

To develop autonomous driving functions, a more complex, and even real-world, virtual development and test environment is needed including complex simulation of dynamic road-user behaviour.

Simulation with different driving styles is important for approximating reality more closely and avoiding unrealistically monotonous, predictable processes. Continental is responding by developing a scalable, modular development and testing environment.

AAI can create virtual environments based on HD maps and AI-driven road users. The simulation tools developed within the collaboration will be made available to the entire automotive industry.

"Our ultimate goal is always absolute safety," said Karl Haupt, head of adas at Continental. "This is especially true for automated driving. Resources in vehicle test are limited and virtual testing can provide fast feedback for developers. While a real vehicle can drive around 10,000 test kilometres in a physical test in one month, today up to 8000km per hour are possible with virtual simulation. This number will increase."

Real testing continues to be essential for driving function testing, since testing on a purely virtual level is not enough. Virtual tests help reduce risks before real world testing and offer test recording with data analytics and incident replay capabilities.

AAI and Continental have already begun their collaboration, which sets up a clear separation between vehicle simulation and environment simulation. AAI is responsible for the environment, providing software that enables driving vehicles in a virtual world. Individual parameters determine the weather, traffic infrastructure, road markings and objects such as road signs and potholes.

AAI uses artificial intelligence to integrate traffic participants (agents) into the virtual simulation environment and uses machine-learning algorithms to train agent behaviour, resulting in aggressive, moderate and defensive driver profiles.

Continental is building a virtual vehicle with software that masters various driving functions at different levels of automation.

"For our young company, partnering with a technology corporation like Continental is a seal of quality," said Isabel Metz, head of business development at AAI. "Continental's customers will also benefit because a faster test procedure guarantees safer, more robust and more cost-effective products."



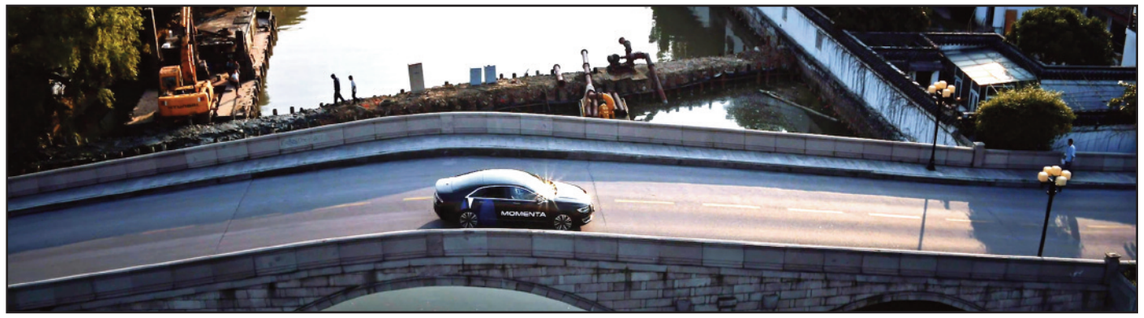
Virtual simulation accelerates adas development

Delphi and TomTom partner on fuel

Delphi and TomTom are collaborating on electronics and software to optimise vehicle fuel efficiency and emissions by using real-time map data.

Delphi's intelligent driving controls will use real-time mapping data to predict changing driving conditions, such as route infrastructure and topography, traffic congestion and weather, which should improve fuel efficiency, reduce emissions and shorten commutes.

"Smart propulsion is the next logical step in transportation," said Mary Gustanski, CTO at Delphi Technologies. "Our collaboration with TomTom will help us to find new opportunities to integrate more information about a driver's route, enhance our proprietary intelligent driving controls and allow vehicles to drive better, cleaner and further."



Analog Devices and Momenta are developing HD maps for autonomous vehicles

Analog Devices and Momenta partner on HD maps

Analog Devices and Momenta, an autonomous driving technology company based in China, are collaborating on high-definition (HD) maps for autonomous vehicles.

HD maps are a critical element of autonomous driving and must deliver accurate, real-time information to help guide the vehicle safely to its destination.

Analog Devices' inertial measurement units (IMUs) will be used to improve the mapping system setup and technology upgrades in Momenta's L3 freeway ramp-to-ramp and L4 full autonomy driving products.

Under poor weather conditions, or when a GPS signal is lost, an IMU becomes essential in delivering high-precision mapping output. IMUs will be used to enhance Momenta's mapping offerings to meet the accuracy requirements of HD maps.

"Analog Devices is committed to the development of differentiated technologies to address high performance, high reliability and safety needs that are critical for autonomous driving," said Chris Jacobs, vice president at Analog Devices. "Our sensors provide autonomous driving systems with reliable, high-fidelity navigational and perception information."

In creating HD maps, crowdsourcing has become a mainstream development tool due to its low cost and timely updating features. This is important, for example, in Asia where infrastructure updates are frequent. Momenta's vision-based semantic HD maps are crowdsourced, accurate and frequently updated. They have the capability to provide map update and localisation services.

Momenta can also leverage modules mounted on taxis, lorries and buses at a large scale to create a crowdsourcing map.

"HD maps are crucially important to launching safe and reliable autonomous driving," said Momenta CEO Xudong Cao. "Analog Devices has extensive experience in developing IMUs, and the company's high-performance, high-precision sensor technologies can help Momenta build accurate, reliable and easy-to-update HD maps."

SST hits UMC AEC-Q100 grade

Microchip subsidiary Silicon Storage Technology (SST) has seen its embedded SuperFlash technology qualified to AEC-Q100 grade one on UMC's 55nm platform.

In automotive applications, SuperFlash provides IC designers with a way to meet high speed and dependability requirements. As electronic content in vehicles rises, the technology's fast access time, power efficiency and fast erase speeds can be crucial.

"SST's SuperFlash technology completed a very high bar in endurance testing, including 700,000 programme-erase cycles and 20 years of data retention," said Mark Reiten, SST VP. "The partnership will enable automotive customers who require low-power, high-endurance embedded flash to keep their production costs down."

Steven Liu, vice president at UMC, added: "UMC customers can confidently utilise SST 55nm SuperFlash technology for their automotive IC designs manufactured in UMC's fabs, which have been IATF-16949 certified to meet automotive quality production standards."

AUTOMOTIVE WORLD 2019

FOUND IN JAPAN

Steve Rogerson reports from last month's Automotive World in Tokyo

Toyota keynote predicts MaaS landing

Nearly 200 years have passed since French physicist Sadi Carnot proposed a theoretical thermodynamic cycle that started a chain of events leading a century later to the first vehicle assembly line that produced the iconic Ford Model T. But none of those early inventors could have envisaged where transportation has reached today or where, in what promises to be an exciting few years, the next vehicle revolution will take the industry.



Toyota's e-Palette concept of mobile shops and services

This was how Keiji Yamamoto, executive vice president at Toyota Motor, set the scene in the show's opening keynote address.

That future, he said, would be one in which cars would drive themselves and vehicles would be shared rather than owned. This is mobility-as-a-service, or MaaS.

"Car sharing is expanding in Japan," he said. "MaaS will impact the value chain of the automotive business. MaaS also means efficient public transport and is expanding to the movement of goods. Electric vehicles are being adapted."

This evolution, he said, was being led by the development of semiconductors. "It is like a chain reaction," he said.

Toyota, he said, had decided to change from being an automotive company to being a mobility company so that it could deal with the direction in which the industry was heading.

"We want to provide mobility for all," he said.

Part of this was Toyota's unveiling at last month's Consumer Electronics Show in Las Vegas of its e-Palette concept, an electric autonomous vehicle that can be adapted for various applications in retail, logistics and ecommerce.

"It will provide an on-demand retail experience," he said. "Travel time will no longer be driving time but increased productivity and leisure time. These will be mobile personal shops selling personal items. They will blur the lines between bricks and mortar, mobile and ecommerce. This is our vision of future mobile services."

Partnering Toyota on this are the likes of Amazon, Didi, Mazda, Pizza Hut and Uber.

The design of the e-Palette vehicle can be changed depending on the application but the core technology of an electric engine, connectivity, artificial intelligence and autonomous driving will carry through all designs.

"Autonomous driving is mobility for all," said Yamamoto. "But there has to be a reduction in cost and an increase in convenience. We have to provide safe and free mobility for elderly people."

For this, he said, artificial intelligence would help the industry move forwards and big data would be important for analysing and predicting traffic information. Together, they will be able to predict road conditions.

"We are facing a once-in-a-century revolution," he said. "We are proposing the way mobility should be and MaaS will be the trigger. Toyota will make every effort to build a new future mobility."

Five-year project prepares Tokyo for Olympics

An intensive five-year R&D programme in Japan looking at automated driving systems and their commercialisation ended last year.

The programme was part of SIP – Strategic Innovation Promotion – and was called Adus, for Automated Driving system for Universal Service. Programme director Seigo Kuzumaki from Toyota looked at what it had achieved and how the second phase will progress.

The programme is part of the Japanese government's Society 5.0 mission, which aims to see the convergence between cyber space and physical space, between the virtual and real worlds. The SIP project had a ¥50bn per year budget.

"They want a high quality of life for people to be realised," said Kuzumaki. "Transport and automated driving are key parts of the agenda. They want to reduce traffic accidents and increase comfort for people."

The goals of SIP-Adus were to ensure safety and traffic jam reduction, realise and deploy automated driving systems, and realise a public bus service for vulnerable people.

"The aim is for level-two automated driving on highways by 2020," said Kuzumaki. "The main goal is the reduction of accidents."

The date 2020 was picked because that is the year Tokyo will be hosting the Olympics and the government wants an improved public transport system in place by then.

Even though the project involves collaboration between a number of companies, Kuzumaki acknowledged that these companies were also competing against each other. However, for dynamic mapping and infrastructure, rules were needed otherwise there would be confusion.

"For changing from manual to automated driving, you need rules too or there will be confusion if different car makers do it in different ways," he said.



Seigo Kuzumaki: "The main goal is the reduction of accidents."

The five-year project focused on five main themes – dynamic mapping, cyber security, HMIs, pedestrian accident reduction and next-generation transportation. In 2017, the consortium carried out large-scale field operation tests using about 300km of existing expressway.

"Dynamic mapping is very important for autonomous driving," said Kuzumaki. "You have to understand your location in a very precise manner. The acceptable error is ±10cm."

This involves high-definition 3D maps overlaid with traffic information such as accidents and jams. Dynamic and static data need to be linked.

"We were able to verify the accuracy of the maps," he said. "In the second phase, we will add regulatory information."

To achieve this, in 2015, the consortium founded Dynamic Map Platform, a company financed by automotive OEMs and the Innovation Network Corporation of Japan (INCJ).

Another activity of SIP-Adus is cyber security.

"This is very important for connected cars," said Kuzumaki. "But it can be difficult for participants to open up and share data. We had very heated discussions, and decided it was important to do it."

The work on HMIs focused on three tasks – investigate the effects of system information on driver behaviour, investigate the effects of driver state on behaviour in transition, and investigate ways to functionalise audio and video to be communicative.

"We had to look at the relationship between vehicles and drivers," he said. "We also developed a driver monitoring system; Japan is taking a leading role in this area."

Japan also has an advantage when it comes to reducing pedestrian accidents as it is unique in having macro data on traffic accident patterns.

"It is all archived," said Kuzumaki. "This is a great resource for us to use. We tried to understand the patterns of types of accidents. We reduced this to 255 patterns so we can test each system against each pattern."

The focus for public transportation was on buses, making them easier to use. For example, by increasing the accuracy of where the bus stops, can help disabled people in boarding. It also looked at a public transport priority system that would give priority to public transport when traffic was heavy.

The project has now entered its second phase.

"This should not just be an extension of the first phase," said Kuzumaki. "It should have clear content and goals."

One of these goals is level-five autonomous driving.

"This will be difficult to implement for all private vehicles," he said. "But it can be done for logistics and mobility services in certain circumstances. We want to test this on public roads and use the Olympics in Tokyo as a showcase."



Tal Shulman (left) and Tal Krzypow

Eyesight makes sure drivers stay awake

Israeli AI computer vision company Eyesight, demonstrated its Driver Sense driver monitoring system (DMS). The announcement comes after Eyesight was given an excellence award for promoting trade relations between Israel and Japan.

Around two people die every minute on the roads and nearly three-quarters of those 1.25m fatal accidents a year are caused by the driver being inattentive three seconds before the accident, said Tal Shulman, Eyesight's director of sales engineering.

"There is adas for outside the system but we provide for inside the car," he said.

The DMS units are sold as aftermarket products for fleets and private consumers but also to tier-one suppliers and OEMs.

The moment someone enters the frame of the camera they are detected. It uses face recognition to work out who they are and this can be used to adjust seats, mirrors and so on.

The DMS tracks head movement, gaze, how open the eyes are, pupil dilation and distance from steering wheel. It also works if the driver is wearing sunglasses.

The camera itself comes from Jabil with Eyesight providing the software.

"We can use different cameras from different companies," said Shulman. "Our software uses deep learning and machine learning. We also have an occupancy monitor to ensure the safety of passengers in the vehicle. It detects who is in the car, their age, gender. It checks the baby seat is in the correct position."

The trade relations award happened a couple of days before the show and came from the Israel-Japan Friendship Society & Chamber of Commerce.

"It was because of our continued work in Japan," said Tal Krzypow, Eyesight vice president. "We have a long list of customers such as Toshiba, Sony and NTT Docomo."

Eyesight was also at the show last year and Krzypow said some of the leads generated have already turned into evaluation projects.

"This is a show with a lot of important OEMs and tier ones," he said. "It is a good opportunity. The visitors are across the board. There are engineers, marketing people, procurement managers and so on."

How to meet the challenges of self-driving cars

There are still fundamental challenges to overcome even to get to level-three autonomous driving, Helge Neuner, head of autonomous driving at Volkswagen, told delegates in his keynote address. And it was also important to look at mobility in the overall context of the city rather than individual vehicles and drivers.

However, many old cities were not easy to adapt to the needs of a V2X infrastructure.

And he reminded the audience that the driver was responsible for many of the accidents and bringing in autonomous driving would make the driver safer.

The first problem comes from the nature of level three where the car can drive itself but the driver has to be ready to take control. But how long will that take?

"We are working with old and young drivers to find out how long it will take," said Neuner.

The research found that the average takeover time was around two to four seconds but in some circumstances it could be more than eight seconds.

"We have to incorporate that into our systems," he said.

One way autonomous vehicles will influence city life is in the taxi business. So-called robo-taxis are being put forward as a reachable goal for self-driving cars.

"Initially, bringing in autonomous taxis will make congestion worse," said Heuner. "Autonomous people movers will change that."

He moved on to look at some of the fundamental problems that needed to be solved, and the first being how an autonomous vehicle deals with pedestrians.

"The sensors are the eyes of the system," he said. "The car needs them to find out what other objects are. They have to look at other vehicles and pedestrians and what they are doing. Humans do this naturally, and use the information to decide what to do."

Objects close together cause particular problems, which is why a fusion of different sensor technologies is needed.

Pedestrians on the pavement also cannot be ignored. The sensors have to analyse them and determine the risk from their movement that they may be about to step out into the road. This means the system needs to decide not only what an object is doing but predict what it is going to do.



Helge Neuner: "The sensors are the eyes of the system."

Part of the answer is to use deep neural networks to help build up an understanding of what happens on the roads.

"Information that the neural network does not recognise can be used for training the system," said Heuner.

Resilience is another key factor.

"To make a system robust, you need redundant systems," he said.

Overall though, he said, autonomous vehicles would be safer because a human driver could have problems in any situation but autonomous vehicles would only have problems in certain situations.

Baidu hopes for Apollo take off

Chinese internet giant Baidu is practising its ABC as it prepares for autonomous driving, according to Yang Long, who is general manager of the company's autonomous driving division.

He said the firm's strategy was based around A for artificial intelligence, B for big data and C for the cloud. Part of this is Apollo, the firm's open platform for autonomous driving.

"We took the name from the Apollo missions by Nasa," admitted Long.

At the heart of Apollo is Baidu Brain, an aggregation of Baidu's AI technologies, the first version of which was released in 2016 and version 3.0 last year.

Apollo takes this further combining hardware, software and the cloud and the company has put together a range of big-name partners to help. These include chip makers such as Intel, Renesas, NXP and Nvidia, tier ones such as Bosch and Continental, and OEMs including Ford and Honda.

"Establishing an ecosystem is important," said Long.

Apollo started in 2017 and has grown to more than 120 partners and more than 220,000 lines of code. There are nine vehicle types using Apollo in China.

Bus maker KingLong is using Apollo for its Apollong bus capable of level-four autonomous driving. The aim is for mass production of this to start this year. In autonomous mode, it will have a top speed of 20km/hr and is already being used in a park in Beijing.



Yang Long

First time protection



A first time exhibitor at Automotive World was Chinese circuit protection component maker SetSafe and such was its success it is already planning to be back next year with a bigger stand.

"We have got to know lots of people here," said Krystal Jing-Shi (pictured), international sales manager for SetSafe. "There are lots of engineers coming to our stand."

She said the company already had customers in Japan including big names such as Panasonic and Toshiba.

"We want to connect with new customers," she said. "Surge protection is very important. Problems in circuits can cause fires."

The company's main launch at the show was a TCO thermal link for electric vehicles offering temperature fuse protection.



Takashi Yoshizawa: "EVs and autonomous driving have a good affinity,"

Nissan hopes for better lives

Wanting to make people's lives better and more fulfilled is undoubtedly praiseworthy , but an odd goal for a major speech by a car maker. But that was exactly how Takashi Yoshizawa, Nissan Motor VP, opened his talk.

"We want to provide value for our customers with the products we develop," he said, falling more into the expected pattern, before addressing what he described as four major negative impacts from the automotive industry on society.

These issues are energy consumption, global warming, congestion and traffic accidents.

"Nissan should take a role is addressing these," he said. "We have two objectives – zero emissions and zero fatalities."

Electrification, he said, would help address energy and global warming while vehicle intelligence can help tackle congestion and traffic accidents.

"More than ninety per cent of car accidents are caused by drivers," he said, "so the first step is driver assistance. Over the past few years we have been working on autonomous driver technologies. We want to support the drivers."

Such technologies include lane departure prevention, blind spot intervention, back-up collision avoidance, distance control assist, forward emergency braking and around view monitor with moving object detection.

"We want to protect the drivers from danger," he said. "We want to advance these technologies and make improvements step by step."

This he said meant working on the four core fields of sensing, cognition, decision and actuation. Sensing reflects the role of human eyes.

"We use multiple sensing technologies and fuse them to give a 360˚ view," he said.

Cognition replaces the role of the brain in understanding what is around. Decision making again replaces a brain role. And the fourth is movement.

"This is where automotive manufacturers have their strength," said Yoshizawa. "These four technologies will lead to automated driving."

Machines, he said, had a hundred times the capability of a human brain and could already exceed human capabilities.

But a necessary step was validating the profile of the roads.

"This information is important," he said. "We are actually driving all the roads to confirm the information. We want to minimise the driving distance for this but keep the accuracy of the information. Simulation technology on its own is not sufficient. You need to combine simulation technology with actual driving. We need mechanisms for this."

High-definition maps though are not sufficient as they need to be overlaid with dynamic maps.

He said Nissan had started to develop autonomous technology on expressways as there were no pedestrians and they were well regulated.

"But we also need to apply automated driving technology to city driving," he said. "We have to deal with intersections, parking, traffic lights, pedestrians. Pedestrians don't just use crossings, they jay walk."

He also said electric vehicles would be key.

"Electric vehicles and autonomous driving have a good affinity," he said. "It is easier to apply autonomous technology on electric vehicles."

He said his vision for a future society involved no traffic congestion and no traffic accidents.

"I don't know when we will achieve this but to do so we need to develop autonomous driving in city scenarios," he said.

ZF takes steps to level four

ZF believes the latest version of its ProAI mobility supercomputer will be a major step for achieving level-four autonomous driving.

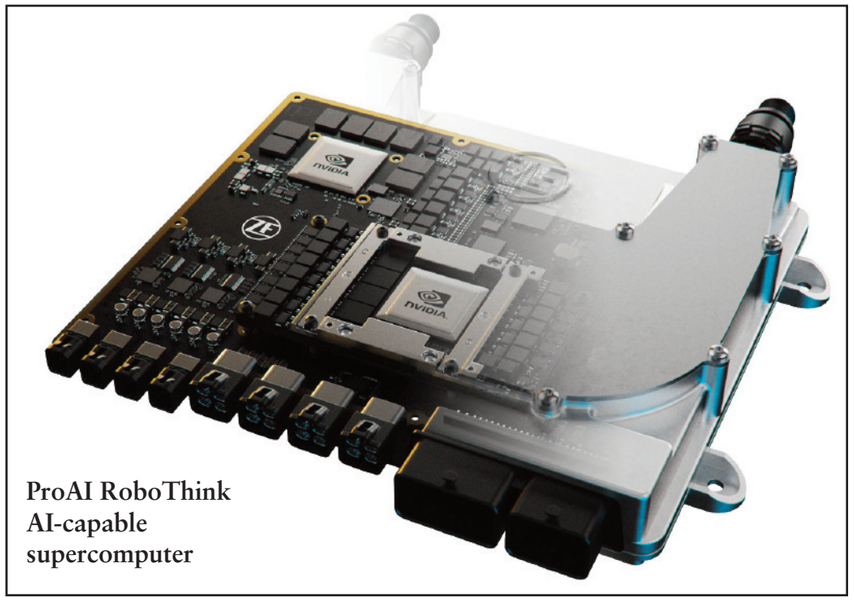
"We have already reached levels one and two," said Qi Ping, director of ZF's engineering centre. "In the next few years, we expect to reach level 2.5 and level three. And we expect to see the cost of electric vehicles reaching parity with internal combustion vehicles by 2025."

ZF, he said, was working in four major action fields – vehicle motion control, automated driving, electric mobility and integrated vehicle safety.

For automated driving, the perception is for self-driving cars to be equivalent to those driven by humans, and for that deep learning and AI were necessary. This is where the company's ProAI range comes in.



Qi Ping: "The computer will take control."



ProAI RoboThink AI-capable supercomputer

The fourth generation model made its debut at this year's Consumer Electronics Show in Las Vegas.

The ProAI RoboThink is claimed to be the most powerful AI-capable supercomputer in the mobility industry. This automotive grade system, combined with ZF's sensor suite, allows real-time analysis of and reaction to virtually any kind of complex traffic situations, making autonomous mobility-as-a-service possible.

Fully networked systems based on the ZF Cloud link the vehicle to the IoT, as well as to applications such as payment systems or ride-hailing services.

"The computer will take over the response in vehicles," said Ping. "The main controller is the human brain but in the future the computer will take control."

The controller uses Nvidia Xavier processors and has a performance up to 150Tops. This means with four units linked together, the performance reaches 600Tops. This level of computing power is designed to be capable of networking the stream of internal and external sensor data with V2X communications and cloud-based data input in real time, providing a platform to help safely operate a level-four autonomous vehicle in virtually any kind of public traffic.

The device is being studied in a test vehicle with cameras, radar and lidar installed.. The company is also working on its E.Go.Mover, a small bus that will be capable of level three to four driving in the next two to three years. However, Ping said development would be needed in lidar technology to achieve this.

"Lidar is very expensive," he said. "This is a handicap. This means we can't reach level four for our vehicles for the next three to four years. We expect this to change as there are a number of companies working on this."

Autonomous driving needs more from radar

Radar technology is well placed to meet the needs of autonomous driving but will still need to improve. This was the view of Continental vice president Norbert Hammerschmidt.

Radar is robust in different weather conditions. It can be used in fog. It can measure the speed of moving objects.

"But what we see today is not enough," he said. "Autonomous driving requires more. We have to improve object classification."

Long-range radar in the 76 to 77GHz is being used for automatic cruise control and emergency brake assist applications. In the future, this will move to 76 to 81GHz radar.

"This is not a question of if but when it will be done worldwide," he said. "With the higher frequencies, you can have a better resolution."

He said there would also be a change from SiGe MMIC technology to RF cmos. It has better scalability.

"Radar sensing is going in the direction of imaging radar to give a clear picture around the car," he said. "Our fifth generation sensor will go to 300m compared with 150 to 200m today."

For autonomous driving, it was essential to detect objects on the road at a far enough distance ahead to give time to react.

"You also have to measure the height of the object," he said. "How big is it? Can you ride over it? Is there space to drive round it? Will I have to brake? If you are driving towards a gate, can you go under it or will you have to stop?"

Road boundaries also need to be detected, but what if they are covered by snow?



Norbert Hammerschmidt

"We have to look at this for next generation products," he said. "The sensors have to deal with adverse weather conditions, and radar is in a good position for this."

The sensors also have to provide 360° awareness because if the car needs to change lane to avoid an object, it needs to be sure the adjacent lane is clear.

To validate the sensors means testing them in different conditions and different countries.

"The billions of kilometres needed for testing autonomous driving technology could not be done by real driving," he said. "You need simulation."

In summary, he said that radar would be a key technology for sensor fusion in the future.

"It is a must," he said. "There is no way round it. We are in a difficult time, a challenging time, but also an exciting time."

IR could have prevented Uber death

The accident where a self-driving Uber car hit a woman pushing a bicycle would not have happened with infra-red technology as she would have been detected earlier, said Katz Hanazaki, senior business development manager at Flir Systems in Japan.



Katz Hanazaki

He believes thermal sensing could play an important role in autonomous driving because of its ability to detect humans and animals in total darkness.

"Infra-red can see in total darkness and through smoke," he said.

He said it was the best technology to identify a pedestrian from a safe distance in day and night.

"I am certain it will be used in the future for autonomous driving," he said. "The disadvantage is it can be blinded by some materials."

He said though that it did not have the weaknesses of RF cmos such as bright sunlight, headlights, fog, smoke and darkness, nor the weaknesses of lidar such as heavy rain and snow.

The technology is already being used on the Cadillac for night vision, and the equipment is becoming smaller.

Suzuki brings adas to kei-cars

While adas is becoming more popular on high-end vehicles, Masahiro Ikuma, general manager at Suzuki Motor, looked at the work that was being done to bring this technology to kei-cars. This is a Japanese category of vehicles for the smallest highway-legal passenger cars and vans.

A kei-car must be less than 3.4m long, 1.4m wide and 2m high with an engine capacity of 660cc or less.

"Kei-car is a unique category," said Ikuma. "It can drive at 100km/hr even though the size is small. About forty per cent of our vehicles are in the kei-car category."

He also looked at data that showed that while the total number of accidents was decreasing it was still increasing for those over 75 years old.

"Most of these are caused by mistakes in operations such as touching the accelerator rather than the brake," he said. "For these drivers, adas is a necessary system."

Suzuki splits its safety technology into three categories – basic, active and passive.

Basic is for improving driving, such as having larger windows to improve visibility and switches that are easier to operate. Passive safety is concerned with body design so that it can absorb and reduce damage from impacts and active safety covers adas type technologies.

Basic even covers improving driving posture.

"We want to reduce fatigue as this can influence performance," said Ikuma. "That is why we pay attention to the layout in the car."

The HMI should also be positioned in such a way that it does not break the driver's concentration.

"The driver should be able to get the information without changing posture," said Ikuma. "We try to standardise the layout across our cars."

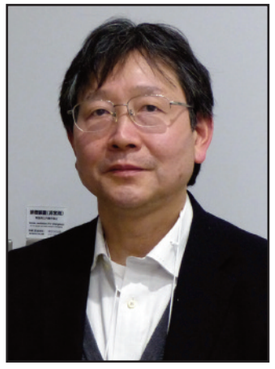
For active safety, Suzuki has what it calls its Safety Support range of adas technologies that it has been implementing since 2013 and these include false-start control for stopping the vehicle if the accelerator is accidentally pressed instead of the brake.



Masahiro Ikuma

"We are going to continue work on adas," said Ikuma. "We want our customers to feel safer when they are driving our cars. Manufacturers have to feel excited about the technology otherwise the customers won't feel excited."

How to realise high-performance lidar



Nobu Matsumoto: "Semiconductor devices can have a big impact on the performance of lidar."

Semiconductor devices will play a big role in realising high-performance lidar technology, according to Nobu Matsumoto, chief specialist at Toshiba.

"Semiconductors can make lidar better," he said. "They can have a big impact on the performance of lidar."

No single sensor can satisfy all the requirements of autonomous driving and lidar will be used alongside ultrasonic, radar and camera sensors. And lidar itself has advantages and disadvantages, he said.

The demands on lidar include long range, high resolution, high accuracy, reliability, small size and low price.

"There is no single lidar that can satisfy all these requirements," he said.

The first battle lidar faces is wavelength with systems at 900 and 1500nm. At the moment, the lower wavelength systems are winning because they are low cost, easy to integrate and available.

The downside is that they cannot have the power turned too high because of the safety risks to the eyesight of pedestrians.

The higher wavelength does not have the same safety concerns but is much higher cost. Matsumoto though believes it could overtake the 900nm wavelength products in the future.

Battery makers adapt to changing EV market

Battery makers are having to adapt to the changing market shares of different types of electric vehicles, according to Munehisa Ikoma, CTO of Panasonic's energy business.

"We are expanding our production capacity," he said. "For automotive, there are some special requirements and these are different for PHEVs and BEVs. There are different energy requirements and they need different numbers of cells."



Munehisa Ikoma: "We will try for the best mix."

The market, he said, had been expanding quite rapidly, which meant an enormous amount of batteries that have to be monitored for quality and be reliable for long periods.

"We have to be aware of the cost too," he said. "We also have to achieve emission requirements and have recycle schemes."

By 2020, he said that current Li-ion batteries would need to go beyond what they could do now.

"We need more innovations as we will hit the technical limits of Li-ion," he said. "We will need to expand the performance of Li-ion."

He predicted that by 2025 the market shares of HEV, PHEV and BEV would be roughly equal whereas today HEV has a clear majority.

"Until now, we have developed mainly for HEVs," he said.

For automotive, the company has cylindrical and rectangular batteries. The cylindrical ones focus on high energy density.

"We want to double energy density so that cell numbers can be reduced to half," he said. "It can also mean doubling the range with the same number of cells. Double the density and we can improve the performance of the vehicle."

For rectangular batteries, Panasonic aims to improve density by fifty per cent for BEVs. For PHEVs, it wants to improve output density and energy density. The company is also working with other materials such as liquid cobalt oxide and solid battery technologies.

"We will try to find the best mix of different types of batteries," said Ikoma. "We want to realise a sustainable world for the future. We want to contribute to the electrification of society going forwards."

Fruits of Avnet, Xilinx and Oki partnership

Xilinx demonstrated the advantages of working together with Japanese companies with the example of a board co-developed with Oki and Avnet. This data aggregation preprocessing and distribution (DAPD) platform was on display at last year's show as something that was in development.

"Now we are showing what we can do with it," said Dan Isaacs, a director at Xilinx.

Called Ultra Z AD, the all-programmable autonomous driving platform allows near and long range sensor fusion and is already in the hands of tier-one suppliers and OEMs in Japan.

It is possible to process information about 800m ahead and connect multiple high-speed interfaces with a high-definition multi-camera of 8Mpixel or more.



Dan Isaacs: "We are showing what we can do with it."

Key to the board is the DFX dynamic function exchange feature that allows the use of the same device for mutually exclusive functions.

DFX lets system developers include mutually exclusive functions during operation run time in a single device. Due to device resource limitations, these functions cannot be used together. These resource limitations are addressed using partial reconfiguration where the functions are activated through DFX.

Multiple functions such as forward camera view, rear camera view, biometrics and other mutually exclusive functions can effectively be offered in a single device through a load on demand event trigger.

Combined, these functions would require more resources than a single device could provide.

Over-the-air updates allow software and hardware to be upgraded.

Honda tackles top three issues

Electrifying society will involve tackling three of the major issues faced today, believes Kiyoshi Shimizu, chief engineer at Honda's automobile R&D centre.

These are pollution through emissions, global warming and sustainable energy to respond to the depletion of fossil fuels.

"The automotive industry has to adjust to these issues," said Shimizu.

To respond to global warming, the industry will see reductions in the use of diesel and petrol with the goal being zero emission vehicles.



Kiyoshi Shimizu: "We are trying to enhance the joy of driving."

Fossil fuels account for half the emission in the UK, for example, but in Japan it is as high eighty per cent, whereas in Canada it is only twenty per cent and negligible in Sweden.

"We want CO_2 emissions to be reduced to a third of what they were in 2011," he said. "With HEVs, we can't achieve that target. We need to increase electrical energy and hydrogen energy. One technology can't solve all the problems so we are working on different types."

This meant that while it was trying to improve the efficiency of hybrid cars it was also working to increase the number of full electric vehicles.

"By 2030, two thirds of our sales will be electric vehicles," he said. "But thirty per cent will still have internal combustion engines, so we need to improve their efficiency. We are trying to achieve carbon-free, fuel efficient driving and enhance the joy of driving."

C'ESt la vie

A round-up of some of the top automotive announcements at last month's Consumer Electronics Show in Las Vegas

Harman technology gives voice to backseat drivers



Harman aims to improve the noise environment inside cars

Samsung-subsidiary Harman has developed technology to make it easier for drivers to hear what passengers are saying, and vice versa.

The Premium Communication modular offering aims to elevate the in-vehicle communications environment. Using microphone, voice processing and noise cancelling technologies, it enables clear, frustration-free conversations for all occupants within a vehicle, with each other, and with digital voice assistants and external callers.

"With the rise in the regular use of voice-enabled devices coupled with consumers' always-on connected lifestyle, communicating clearly on the go, particularly in your car, is more important than ever before," said Michael Mauser, president of lifestyle audio for Harman. "As a result, in-vehicle communication is evolving to be a critical component of the overall passenger experience."

Built on Audioworx, Harman's proprietary, open-framework development platform, Premium Communication components are modular and scalable across vehicle segments. Together, these technologies address the challenges of the evolving vehicle interior and help OEMs capitalise on integrations with voice assistants, while fulfilling consumer demand for elevated communications.

In-car communications (ICC) combine microphones, voice processing and in-vehicle audio signal processing to create an environment for conversation within the car cabin, enhancing the sounds people want to hear, and reducing those they don't.

An always-on adaptive feature, ICC automatically level-sets according to music volume or road noise for clear, two-way conversations among passengers on any drive – front to back and back to front. Drivers can communicate directly with passengers in the back seats without needing to turn around or take their eyes off the road. Alternatively, second and third row passengers can now communicate easily with the first row, eliminating the need for them to raise their voice or strain forward in their seats, allowing all occupants to converse easily with one another.

ClearChat combines beam-forming microphones, echo cancellation and noise reduction algorithms to remove unwanted cabin noise, including air conditioning, road noise or rear seat passengers, for listeners on the receiving end of a call. Beam-forming is a signal processing technique that employs direct signals at particular angles to ensure selectivity. As a result, sonic clutter is reduced and voice clarity is improved for stress-free communications with personal voice assistants and call recipients.

Personal communications zones give every occupant the freedom to interact simultaneously with their voice assistant of choice or have a phone call with confidence that call recipients won't hear the music or entertainment from others in the vehicle.

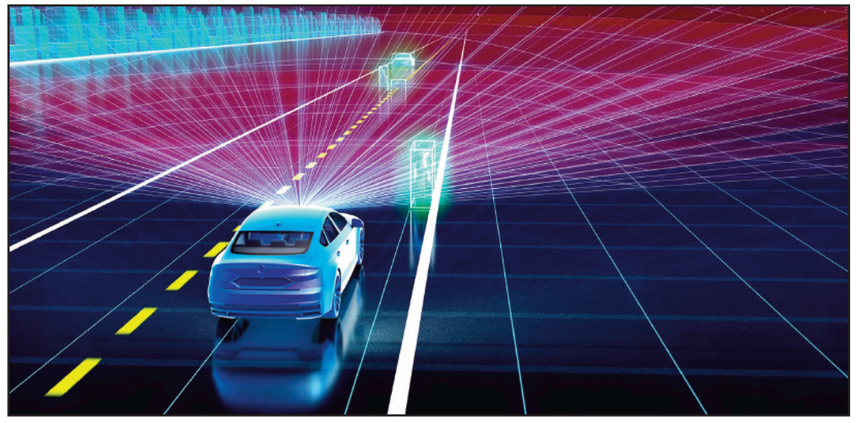
Sensors provide position without GPS

TDK's sensors can enhance the absolute position of a vehicle in GNSS- and GPS-denied environments, such as tunnels, parking garages, and urban canyons.

A vehicle's navigation system can use the output of the six-axis automotive-qualified IAM-20680HP or IAM-20680 to improve estimates of the position, direction, and speed of a vehicle when the satellite signal is deteriorated or non-existent as well as to improve the quality of the position estimation when the satellite signal is strong.

The devices measure up to 16g acceleration and up to 2000 degrees per second.

Velodyne advances lidar technology



Velodyne Vella adas builds on the directional view Velarray sensor

Velodyne Lidar unveiled the VelaDome, a compact embeddable lidar that provides a 180 by 180° image for near-object avoidance. The company also introduced Vella, software that establishes its directional view Velarray lidar sensor as integral for adas.

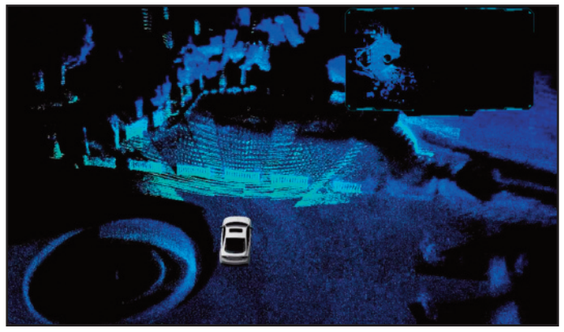
"With these new products, Velodyne's robust portfolio meets the entire range of lidar needs for autonomy and driver assistance," said Anand Gopalan, chief technology officer at Velodyne Lidar. "Over the last 15 years, Velodyne has continued to add intelligence to our sensors, enabling a variety of lidar sensing capabilities that allow our customers to detect more objects and offer cars a more detailed view of their surroundings. Now we will take it even further and our new software, which was developed in close collaboration with our lidar hardware experts, will enable a seamlessly integrated adas powered by our lidars."

The adas product targets functionalities such as lane keeping assist, automatic emergency braking and adaptive cruise control.

The VelaDome's hemispherical field of view and high-density image suits pedestrian, cyclist and blind-spot detection. The sensor has mounting and styling options.

RoboSense upgrades solid-state lidar

RoboSense demonstrated an upgraded version of its mems solid-state lidar, an automotive grade solid-state lidar designed for the mass production of autonomous vehicles.



The opto-mechanical lidar provides an increased horizontal field of view

The RS-Lidar-M1 provides vehicle intelligence awareness to support level-five automated driving. Based on 905nm lidar with a detection distance to 200m, the upgraded optical system and signal processing technology brings a final output point cloud effect that can clearly recognise even small objects, such as railings and fences.

The opto-mechanical lidar provides an increased horizontal field of view by nearly 100% compared with the previous generation, reaching a 120° field of view, so that only a few are needed to cover the 360° field of view.

In addition, with five RS-Lidar-M1s, there is no blind zone around the car with dual lidar sensing redundancy provided in front of the car for a L5 level of automatic driving. Target production cost is $200 each.

"The RoboSense RS-Lidar-M1 lidar system is a giant leap forward for driverless technology," said Mark Qiu, co-founder of RoboSense. "We are committed to developing high-performance automotive-grade lidar at a low cost."



Byton unveiled the cockpit design at CES

Byton unveils cockpit design of M-Byte SUV

Electric vehicle firm Byton revealed more details about its first production model, the M-Byte SUV. Positioned as the next generation smart device, it is designed for the future of autonomous driving when the automobile will become a mobile digital lounge.

"Byton's M-Byte represents the transformation of the traditional car into a next-generation smart device for every user," said Carsten Breitfeld, CEO of Byton. "We achieve this through the combination our state-of-the-art EV platform and our proprietary Byton Life digital ecosystem."

The shared experience display (SED) is said to be the world's largest in-car display for a production automobile. It displays vehicle and driving information and offers various content options in an intuitive way.

The position of the display has been developed and tested so it does not affect the driver's line-of-sight and can automatically adjust brightness according to changes in ambient lighting to avoid further distraction. In addition, the SED will meet automotive safety standards as well as crash standards in all target markets.

The user-interface and user experience hardware will feature shared and private screen space to capture and display a wide array of digital content – navigation, music, videos, photos, files, contacts and more – intuitively and safely to users in any seat.

The SED is a 122cm wide curved display with three areas for content. In full screen mode, the user can interact via both an 18cm driver tablet and a 20cm touch pad. The SED is not a touch device itself.

The driver tablet will be at the centre of the steering wheel just above the airbag. The touch pad has been added between the driver and the front passenger seats.

Rear passengers have access to independent rear-seat entertainment screens that also share content with the SED.

The front seats can be rotated inwards 12 degrees, to create a space that is more convenient for passengers in the car to interact and communicate with each other when not in motion.

In North America and Europe, Byton has been working with Amazon Alexa to develop voice control. Software developers from around the world have been invited to join the ecosystem.

"We have made solid progress in the construction of our Nanjing plant and prototype vehicle testing," said Daniel Kirchert, president of Byton. "This is a vital year for Byton and our global team is sparing no efforts to achieve our goal of volume production."

The production version is slated to debut in mid-2019, with mass-production starting at the end of the year. To achieve this, vehicle testing under real-world conditions continues to achieve the safety and quality standards of China, USA and Europe.

Eyeris expands in-vehicle understanding

Eyeris Technologies announced the availability of its expanded EyerisNet portfolio with in-vehicle scene understanding AI and interior image segmentation software to understand accurately the interior cabin space.

The software was demonstrated on a Tesla Model S vehicle.

The vision AI algorithms use multiple automotive-grade 2D RGB -IR image sensors to provide real-time analytics on the edge, powered by its proprietary AI chip.

Interior image segmentation provides a pixel map where every pixel in the vehicle interior is associated with a class label such as human, object or surface, along with corresponding regions and contours for scene understanding accuracy.

Human behaviour AI provides body tracking, action and activity recognition, face analytics, and emotion recognition for all occupants. Object localisation provides detection, classification, size and position of objects.

And surface classification provides identification and position of all in-cabin surfaces such as footwells, door panels and centre console.

"We continue to pioneer new technology capabilities to enhance safety, comfort and convenience in autonomous and highly-automated vehicles with our in-vehicle scene understanding AI," said Modar Alaoui, CEO of Eyeris. "We are providing the capability to deliver a safer and more personalised experience for both privately-owned and shared vehicles."

Eyeris also introduced its proprietary AI chip, scalable hardware designed to inference the EyerisNet suite of deep neural networks from multiple 2D cameras, for real-time edge computing. The asic is AEC-Q100 qualified and consumes less than 7W.

This car was made for walking



Those steps up to the house a bit too much? Well Hyundai may have the answer with its walking car. The concept vehicle is designed for assisting first responders in reaching difficult areas or, as shown, helping those with mobility problems.

"When a tsunami or earthquake hits, current rescue vehicles can only deliver first responders to the edge of the debris field," said John Suh, vice president at Hyundai. "They have to go the rest of the way by foot. People living with disabilities worldwide that don't have access to a ramp could hail an autonomous Hyundai Elevate that could walk up to their front door, level itself, and allow their wheelchair to roll right in."

The concept is based on a modular EV platform with the capability to switch out different bodies for specific situations. The robotic leg architecture has five degrees of freedom plus wheel hub propulsion motors and is enabled by electric actuator technology. The legs also fold up into a stowed drive-mode, where power to the joints is cut, and the use of an integrated passive suspension system increases battery efficiency. This lets it drive at highway speeds just like any other vehicle.


AIMotive prototypes

AI-powered self-driving full-stack software

Autonomous technology service provider AIMotive announced its latest AI-powered self-driving full-stack software.

AIDrive2's modular design could open the door to a range of implementations reducing the time to market of automated driving products.

Automotive OEMs, tier-ones and robo-taxi companies will have the ability to integrate only selected modules or rely on AIDrive2 to deploy full automated driving.

Compatible with different sensor types and hardware platforms, its flexibility allows various collaborations.

The software stack offers a platform for adas functionalities and L4 autonomy.

"AIMotive has always supported industry collaboration and standardisation," said Laszlo Kishonti, AIMotive CEO. "These will be vital in securing consumer trust in autonomous driving technologies.

"By creating AIDrive2 AIMotive hopes to provide an easily accessible platform to support our partners in achieving their autonomous goals."

The software stack handles all tasks associated with self-driving from perception to control. It relies on AI in perception and motion planning to ensure a higher degree of safety in operation. The AI is augmented with classical, verifiable planning algorithms.

AIDrive uses high- and low-level sensor fusion for robust model space creation.

AIMotive is currently working on the advancement of autonomous vehicle technologies with partners such as Groupe PSA, Samsung and SAIC. AIDrive2 will be available for licensing this quarter.

ConnectedTravel partners Honda on infotainment

ConnectedTravel collaborated with Honda to develop Dream Drive to offer drivers and passengers convenient services and entertainment options, while reducing the potential for driver distraction.

"We are excited to be the first to launch such a cutting edge mobile in-vehicle infotainment system with the help of our partner ConnectedTravel," said John Moon, managing director for strategic partnerships at Honda Innovations. "Each industry leader partnering with us on the debut of Honda Dream Drive has been carefully selected to ensure the highest in-vehicle value to our customers."

The driver experience offers a proprietary voice controlled user interface into a range of search, reservation, ordering and purchasing services integrated with Honda's in-vehicle payment technology. Drivers can safely find and pay for goods and services such as fuel, food, coffee, movie tickets and parking.

For passengers, Dream Drive offers an immersive entertainment, education, information and retail platform. Passengers can choose from a variety of experiences built for the vehicle and curated for their trip. Experiences include a selection of mixed reality games that are integrated with vehicle telematics and interact with original comics, travel applications tuned to explore destinations along the route, all while engaging in the rewards experience directly from the passenger's mobile device.

Valeo and Autotalks demo V2X telematics

Valeo and Autotalks displayed V2X capabilities integrated in a telematics platform.

V2X technology can increase safety by extending the perception of the car for better anticipation of the potential road dangers. By enabling constant information exchange between vehicles and with the infrastructure, V2X is a key technology for cooperative driving.

The live demonstration showed a Valeo telematics platform capable of switching between DSRC and C-V2X for global deployments. The platform includes a cellular NAD (network access device), multi-core application processor and a commercial module with Autotalks second-generation Secton-Pluton chipset capable of both DSRC and C-V2X direct communications (PC5 protocol).


Excited: Hagai Zyss

"We are excited to have our chipset inside Valeo's telematics platform, after a quick and straightforward integration with the NAD and the platform's software," said Hagai Zyss, CEO of Autotalks. "Autotalks is proud to collaborate with Valeo on a truly secure mass-market global V2X system."

Autotalks' deployment-ready V2X chipset supports DSRC based on 802.11p ITS-G5 standards and C-V2X based on 3GPP specifications. The chipset allows users to toggle between DSRC and C-V2X communications, a capability that was shown in the live demonstration.

The chipset isolates V2X from the cellular NAD, thus providing domain separation and security, scalability and potential cost-optimisations for telematics control unit deployments. The separation of V2X from in-vehicle infotainment ensures that the safety related purpose of the V2X system is not compromised.

Furthermore, V2X isolation combined with Autotalks' cyber security enables a secure platform.

"The objective of our collaboration with Autotalks is to propose to our customers a worldwide solution based on a single hardware platform and a single V2X software stack that can be configured for DSRC ITS-G5 or C-V2X (PC5) and switch from one mode to the other," said Laurent Zimmermann, Valeo VP. "This future-proof V2X solution, combined with the adas portfolio of Valeo, will be a solid foundation towards the path of the autonomous car and safer transportation."

Thundercomm accelerates integrated cockpit development

Thundercomm Technology introduced the Turbo X Auto for intelligent in-vehicle cockpit compute systems.

Working with Thundersoft, Rightware and Qualcomm, Thundercomm aims to deliver integrated and scalable products for car makers and tier-ones.

Designed to be a base software platform, Turbo X Auto can be used to aid in accelerating the development and deployment of features and technologies into vehicles, reducing development time and cost when deploying integrated cockpit products.

Optimised for use with the Qualcomm Snapdragon automotive cockpit platforms, it features Thundersoft's intelligent industrial middleware and operating system, and Rightware's Kanzi family of automotive user interface tools.

This offering includes chipset optimised components designed and implemented specifically for Snapdragon, as well as middleware, customised algorithms required by mainstream car manufactures, and a series of reference implementations ready for validation and demonstration.

Designed to support software rich integrated cockpits engineered to meet automotive industry standards, the AI-based Snapdragon platforms are engineered with immersive graphics, multimedia, computer vision and AI capabilities. They also provide scalable architecture with differentiated experiences, leveraging the same software architecture and framework allowing consumers to enjoy a harmonised user experience independent of the vehicle tier while leveraging the same software framework.

Visteon's seamless interface between vehicle and driver

Visteon demonstrated the integration between its SmartCore cockpit domain controller and scalable DriveCore autonomous driving controller, which combine to create a seamless HMI between the driver and the vehicle. This interface manages the experience of drivers and passengers as the vehicle seamlessly takes control from the driver or gives it back.

High-resolution digital displays that are not just flat and rectangular are critical for the all-digital cockpits of the future. As displays get larger, the flat and rectangular-shaped display does not allow for the best viewing experience, or for the industrial design of the interior.

Visteon showed an array of digital displays based on LCD and OLED technologies, including some with curved and non-rectangular shapes. The company also demonstrated its VX display with integrated haptic feedback, proximity sensing and knob-on-glass features.

"The shift towards electric cars and improved automated driving technology is an opportunity to rethink the cockpit in terms of how drivers and passengers interact with the vehicle and their surroundings," said Sachin Lawande, Visteon CEO. "As vehicles become more automated, there is a need for fresh approaches to the human-machine interface in the cockpit to ensure control can shift safely and seamlessly between the driver and the vehicle, and to keep occupants informed, engaged and entertained. In the era of increased automated driving, the cockpit will become a smart, learning, mobile assistant."



Visteon showed digital displays based on LCD and OLED technologies

Machine learning has emerged as a key technology for solving problems – such as voice and image recognition – that have proven to be very difficult for conventional programming techniques. Visteon demonstrated an in-vehicle conversational smart assistant using machine learning for voice recognition. The smart assistant is designed to use natural language processing for on-board or off-board commands in cars without always needing cloud connectivity.

In addition, Visteon demonstrated driver monitoring that also uses machine learning technology. This provides head-pose detection, gaze detection and identification capabilities that are key for enhanced safety.

The company also showed a V2X module that works with either DSRC or cellular networks. This gives car makers the flexibility to offer support for either wireless technology, depending on the needs of the market.

Valens reveals architecture vision

Valens, the developer of HDbaseT technology for in-vehicle connectivity, unveiled its vision for smart vehicle architecture addressing telematics, infotainment and adas.

Valens Automotive has worked with Aptiv, Mitsubishi Electric, Denso, Qualcomm, Brose, Tektronics, ST Microelectronics, Western Digital, TSN and Nvidia.

Demos at the show included 5G, WiGig and wifi connectivity over an HDbaseT Automotive multi-gigabit data link and fail-safe ring topology for critical applications, guaranteeing redundancy, with remote shared memory.

Valens showed the company's upcoming 16G phy for high-speed video links.

HDbaseT Automotive can replace the thick wire harness with a single unshielded twisted pair link for easier and more robust connectivity.

Denso and Valens showed how HDbaseT redundantly interconnects different area control units and each to a centralised computer unit, guaranteeing error-free data transmission.

BMW unveils vision of future mobility

BMW presented its vision of intelligent connectivity, highlighting the potential for future individual mobility. The focal point of the company's CES showcase was the Vision iNext, which looks ahead to the future of driving pleasure, and the BMW intelligent personal assistant, which, as an on-board expert, constitutes the central element for interaction between the driver, vehicle and digital world.

The Vision iNext formed the optical highlight of the stand, which also showed the My Favourite Space interior design principle with harmonious, natural surfaces and technology kept discreetly out of sight.

A mixed-reality installation gave a virtual impression of the future driving experience promised by the Vision iNext, which combines design with autonomous driving, connectivity, electrification and services. It showed what cars would look like when they no longer have to be driven, but still can be.

In the exhibition outdoor areas, BMW Motorrad presented a test and research self-riding motorcycle. The BMW R 1200 GS can start, accelerate, perform cornering manoeuvres, slow down and come to a stop, all by itself. Development of this test vehicle will provide insights into riding dynamics, which can then be used to help the rider recognise dangerous situations and master difficult driving manoeuvres.

A model based on the Vision iNext will enter production in 2021. Automated, emission-free and connected, it brings together BMW's strategic innovation areas. With recent developments in autonomous driving and connectivity, it creates experiences and possibilities for making the most of driving time.

The interior creates a mobile environment to enhance quality of life: a space where driver and passengers can relax and choose what they want to do. The intelligent personal assistant is a companion and expert. It is always connected and serves as an intuitive interface to the digital environment using natural language interaction.

Two large opposing doors, with no B-pillar between, make it easy to climb inside. A characteristic is the unusually distinct separation between cockpit and the rear. A spacious continuous seat area gives the rear a laid-back lounge character.

Drivers can choose to drive themselves in Boost mode or be driven in Ease mode. Boost mode uses the electric drive train to deliver a dynamic and virtually silent driving experience with zero emissions. In Ease mode, the vehicle creates space for the driver and passengers to engage in a wide range of activities.

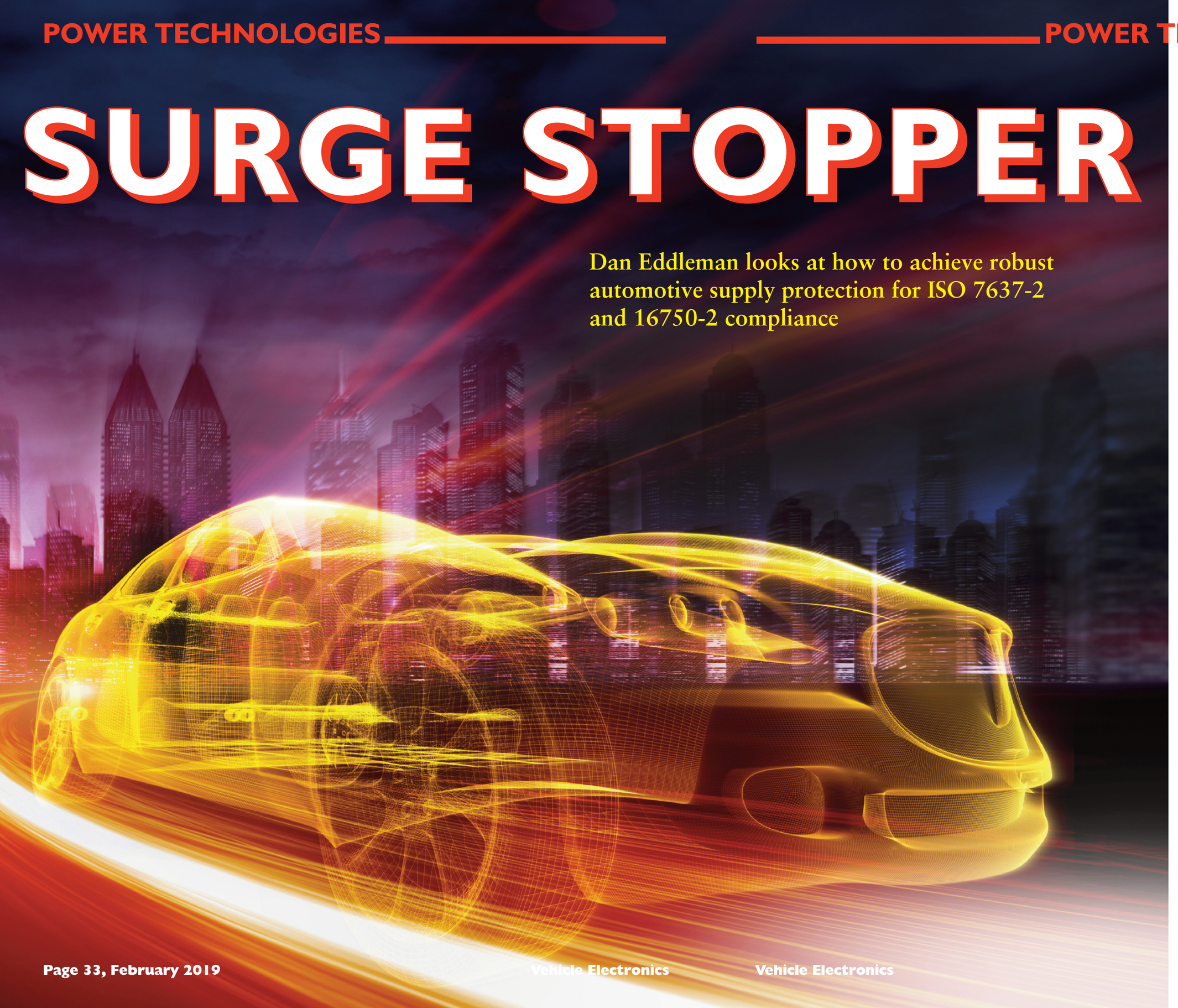
In Boost mode, the steering wheel and displays are angled clearly towards the driver. When switched to Ease mode, the driver's immediate environment changes: the steering wheel retracts and the pedals drop down to create a more open sense of space.



BMW unveiled its Vision iNext concept

POWER TECHNOLOGIES

SURGE STOPPER



Dan Eddleman looks at how to achieve robust automotive supply protection for ISO 7637-2 and 16750-2 compliance

Automotive power supplies produce formidable transients that can readily destroy exposed on-board electronics. Over time, as electronics have proliferated in vehicles, automotive manufacturers have duly noted failures, compiling a rogues' gallery of the responsible power supply transients. Manufacturers have independently created standards and test procedures to prevent sensitive electronics from falling prey to these events. Recently, though, automotive manufacturers have combined efforts with the ISO to develop the ISO 7637-2 and 16750-2 standards, which describe the possible transients and specify test methods to simulate them.

Standards

ISO 7637 is entitled "Road vehicles—Electrical disturbances from conduction and coupling" and is an EMC specification. The second of the three parts of this document, ISO 7637-2 covers electrical transient conduction along supply lines only.

Although ISO 7637 is primarily an EMC specification, prior to 2011 it also included transients related to power supply quality. In 2011, those portions related to power supply quality and not EMC were moved to ISO 16750, "Road vehicles – Environmental conditions and testing for electrical and electronic equipment" with the second of five parts covering electrical loads.

While most manufacturers still maintain their own specifications and requirements rather than

Vehicle Electronics

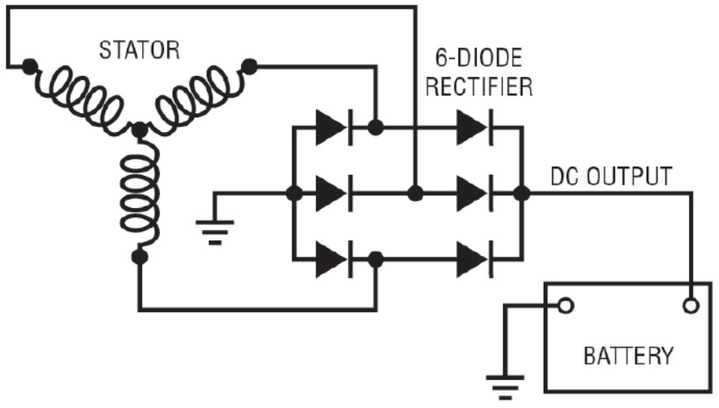


Fig. 1: Standard alternator's three-phase stator windings and six-diode rectifier produce a DC output voltage

adopt ISO 7637-2 and 16750-2 verbatim, there is a trend towards more closely conforming to the ISO standards, with manufacturer specifications following the international standards with minor variations.

ISO 7637-2 and 16750-2 provide specifications for both 12 and 24V systems. For simplicity, this article only describes 12V specifications and presents a circuit for protecting electronics connected to an automotive 12V power supply.

Load dump

Load dump is the most challenging of the power supply transients because of the large amount of energy in the event. It occurs when the alternator is charging a battery, and the battery connection is lost.

Originally, alternators in cars were unclamped and could produce extraordinarily large voltages during load dump, about 100V for 12V systems. Newer alternators are clamped internally to limit the maximum voltage to a lower value during load dump. Because older alternators, and some modern alternators, do not include internal clamps, the load dump specification in ISO 16750-2 is split into test A without centralised load dump suppression and test B with centralised load dump suppression.

Fig. 1 shows a schematic of an alternator's three-phase stator windings and the six-diode rectifier that converts the stator's AC output to the DC that charges the battery. When the battery connection is lost, the resulting current flow is as shown in Fig. 2.

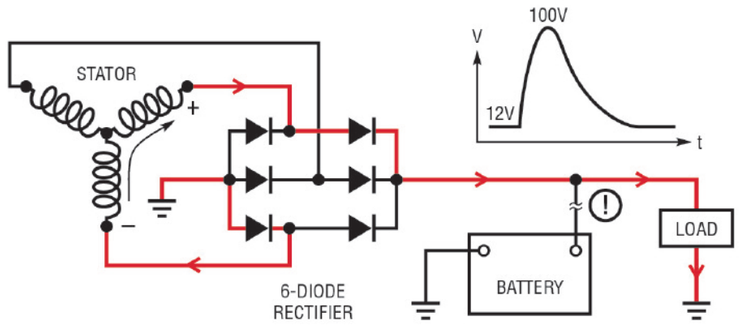


Fig. 2: Unclamped load dump: If the battery connection is lost during charging, the alternator's output voltage can surge to 100V

Without the battery to absorb the stator's current, the output voltage surges to the very high voltages seen during unclamped load dump, as shown in Fig. 3 from the ISO 16750-2 specification. This corresponds to the unclamped alternator scenario in test A without centralised load dump suppression.

Newer alternators use avalanche diodes that have well specified reverse breakdown voltages, which limit the maximum voltage during load dump. Fig. 4 shows current flow during a load dump fault in a clamped alternator that uses avalanche rated diodes in the six-diode rectifier.

When a clamped alternator is mandated by the automotive manufacturer, test B applies. Fig. 5 shows the clamped waveform from test B in ISO 16750-2. Although ISO 16750-2 specifies a 35V maximum voltage for this clamped scenario, be aware that many manufacturers deviate from ISO 16750-2 by providing their own maximum voltage specification.

Also, be aware that when load dump was part of ISO 7637-2, only one pulse was specified, but

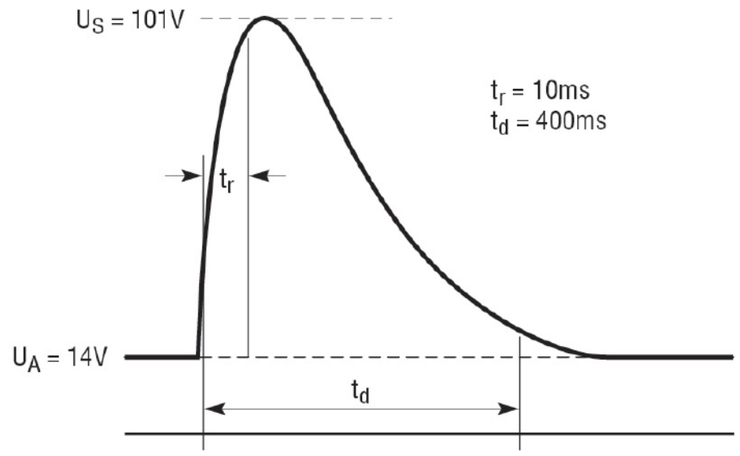


Fig. 3: Unclamped load dump pulse shape as described in ISO 16750-2 specification test A

when the load dump specification moved to ISO 16750-2 in 2011, the minimum test requirements increased to include multiple pulses with a one minute interval between pulses.

TVS protection problems

The internal resistance, Ri, of the alternator in both test A and B is specified to be between 0.5 and 4Ω in ISO 16750-2. This limits the maximum energy that is delivered to protection circuits.

Nevertheless, one fact is frequently overlooked by those implementing protection from the ISO 16750-2 load dump transient: the internal resistance, Ri, does not appear in series with the 35V clamped voltage. Ri actually appears before the avalanche diode, as shown in Fig. 6.

If the onboard electronics are locally protected by a shunt device such as a TVS diode with a breakdown voltage less than 35V, the TVS may be forced to absorb the alternator's energy. In this scenario, the internal clamps in the alternator are of little benefit. The entire load dump energy is delivered to the TVS in the onboard electronics.

Sometimes a series resistor is placed in front of the electronics and the TVS diode, but unfortunately this introduces a voltage drop and extra power dissipation in the resistor even during normal operation.

Active protection

A better method is to use a series active protection device, such as a low quiescent current surge stopper. The block diagram of such a device is shown in Fig. 7. A complete automotive protection circuit is shown in Fig. 8.

By its very nature, a surge stopper protects the downstream electronics from load dump as well as the other conditions in ISO 16750-2 and 7637-2 without relying on the internal resistance of the alternator. The surge stopper in Fig. 8 provides uninterrupted power while operating from a clamped alternator. Furthermore, if it is subjected to load dump from an unclamped alternator, it will not be damaged.

In the unclamped scenario, it may shut off to protect itself and then automatically reapply power to the load after a cool-down period. It is important to note that power is only shut off in the presence of multiple simultaneous faults: an improper unclamped alternator is installed and the battery connection is lost during charging.

Operation

The design in Fig. 8 protects downstream electronics from ISO 16750-2 and 7637-2 transients while providing up to 4A of

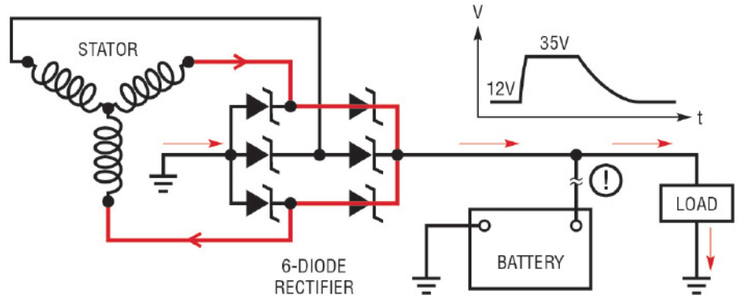


Fig. 4: Clamped load dump: An internally clamped alternator has diodes with well-specified reverse breakdown voltages that limit the output voltage to 35V during load dump

output current. At the same time, it protects the upstream system from overcurrent events caused by conditions such as short-circuit faults in the downstream electronics. As it does this, it consumes a miserly 35μA of quiescent current, an important consideration in modern automobiles featuring countless battery-draining loads while the vehicle is not running.

This protection is based on a low supply current surge stopper, limiting the output voltage to 22.7V from input voltages as high as 100V at the input, sufficient protection against an ISO-16750-2 load dump as well as ISO 7637-2 pulses 1, 2a, 2b, 3a and 3b. It also prevents current flow during reverse battery conditions, and provides continuous power during the ISO 16750-2 superimposed alternating voltage test at severity level one where the peak-to-peak AC voltage is 1V. It may temporarily shut off power in the presence of larger AC voltages.

Continuous power is provided to the load when the input voltage drops as low as 4V to satisfy the minimum supply voltage requirements of ISO 16750-2.

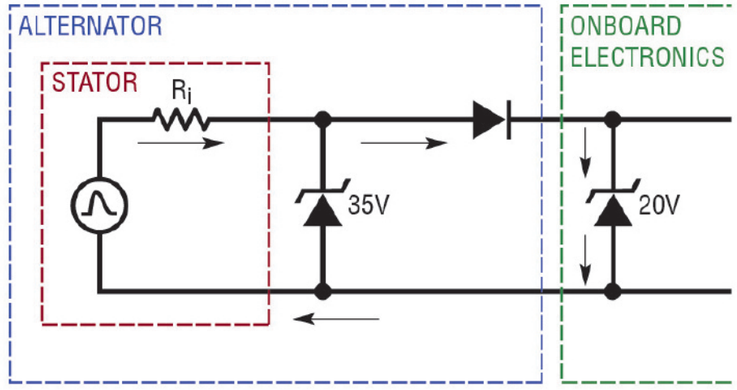


Fig. 6: If the on-board electronics are protected by TVS diodes that break down at a lower voltage than the alternator's clamped voltage, the TVS diodes will be forced to absorb all of the alternator's energy

The mosfets in this circuit are protected by limiting the time spent in high power dissipation conditions, such as when the input voltage surges high during load dump or when the output is shorted to ground. If a fault exceeds the conditions specified in ISO 16750-2 and 7637-2, mosfet M2 shuts off to protect the circuit, reapplying power after an appropriate delay.

For example, a sustained 100V input voltage, or a downstream short-circuit fault, causes the surge stopper to self-protect by limiting the current in M2 and then completely shutting off if the fault persists. This method has a distinct advantage over shunt-type protection, which must dissipate continuous power, blowing fuses in the best case, lighting fires in the worst.

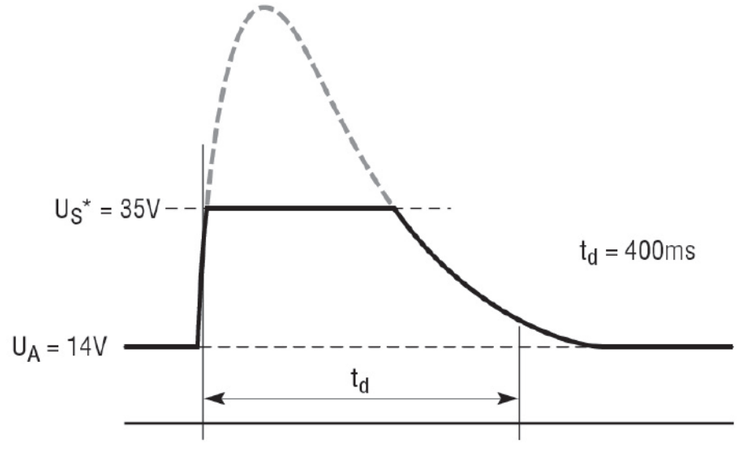


Fig. 5: Clamped alternator load dump pulse shape

Overvoltage protection

To understand the operation of the circuit in Fig. 8, consider a simplified description of the surge stopper. During normal operation, the internal charge pump drives the gate pin to enhance M2. The voltage at gate is clamped to a maximum of 35V above ground (when the SEL = 0V), thereby limiting the output voltage at M2's source to less than 35V.

The circuit in Fig. 8 further improves on that voltage limit by adding a 22V avalanche diode D3, in combination with R6, R7, R8 and Q2 to regulate the output voltage to a maximum of the avalanche diode voltage, 22V, plus the base-emitter voltage of Q2, roughly 0.7V. When the output voltage exceeds 22V + 0.7V = 22.7V, Q2 weakly pulls down on M2's gate to regulate M2's source and the output voltage at 22.7V.

Reverse protection

Mosfet M1, in conjunction with D1, D2, R1, R3, R4 and Q1, protects the circuit from reverse voltage conditions. When the input falls below ground, Q1 pulls M1's gate down to the negative input voltage, keeping the mosfet off. This prevents reverse current flow when the battery is connected backwards and protects the output from the negative input voltages.

D2 and R3 allow the internal charge pump to enhance M1 during normal operation when the input is positive so M1 is effectively a simple pass-through device.

SOA limit

When the input voltage is high, the output voltage of this circuit is limited to a safe level by controlling mosfet M2. This results in significant power dissipation as voltage is dropped across M2 while current is delivered to the load at the output.

If the input is subjected to a sustained overvoltage condition, or an overcurrent fault condition occurs in the on-board electronics at the circuit's output, M2 is protected by shutting off after a duration configured by the timer network made up of R13, R14, R15, C4, C5, C6 and C14. The output current at the TMR pin is proportional to the voltage across mosfet M2 while M2 is in current limit.

Effectively, the TMR current is proportional to the power dissipated in M2. The resistor-capacitor network at the TMR pin is similar to an electrical model of the mosfet's transient thermal impedance. This serves to limit the maximum temperature rise of the mosfet to keep it within its rated safe operating area.

Because allowable mosfet SOA current falls off at high drain-to-source voltages, the 20V avalanche diode D6, in conjunction with R9, R11 and Q3, provides extra current into the timer network when the in-to-out voltage exceeds 20V plus Q3's base-emitter voltage. The 4.7V avalanche diode D7 works with Q4, R12 and C3 to prevent this extra current from pulling the TMR pin above its maximum rated voltage of 5V.

This SOA tracking circuit allows the output to remain safely powered when the input rises to a high voltage. But, if a sustained high power fault condition lasts too long, the circuit self-protects by shutting off M2.

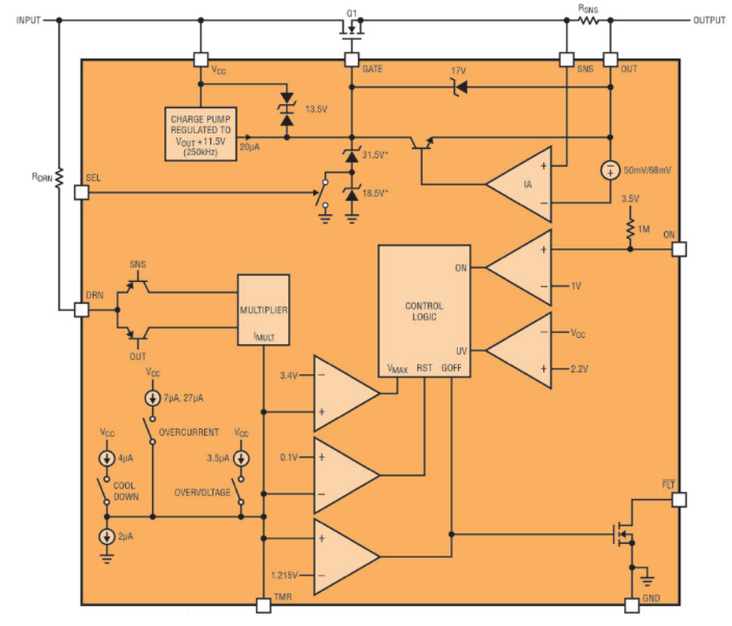


Fig. 7: Block diagram of surge stopper

Thermal protection

The resistor-capacitor network on the surge stopper's TMR pin protects against events that are faster than about one second. For slower events, the case temperature of M2 is limited by the circuit connected to the surge stopper's on pin.

The thermistor, RPTC, is a small surface mount 0402-size component with a resistance of 4.7k at 115°C. Above 115°C, its resistance rises exponentially with temperature. To prevent the timer network from falsely integrating offsets in the power multiplier, the surge stopper does not generate timer current at the TMR pin until M2's drain-to-source voltage

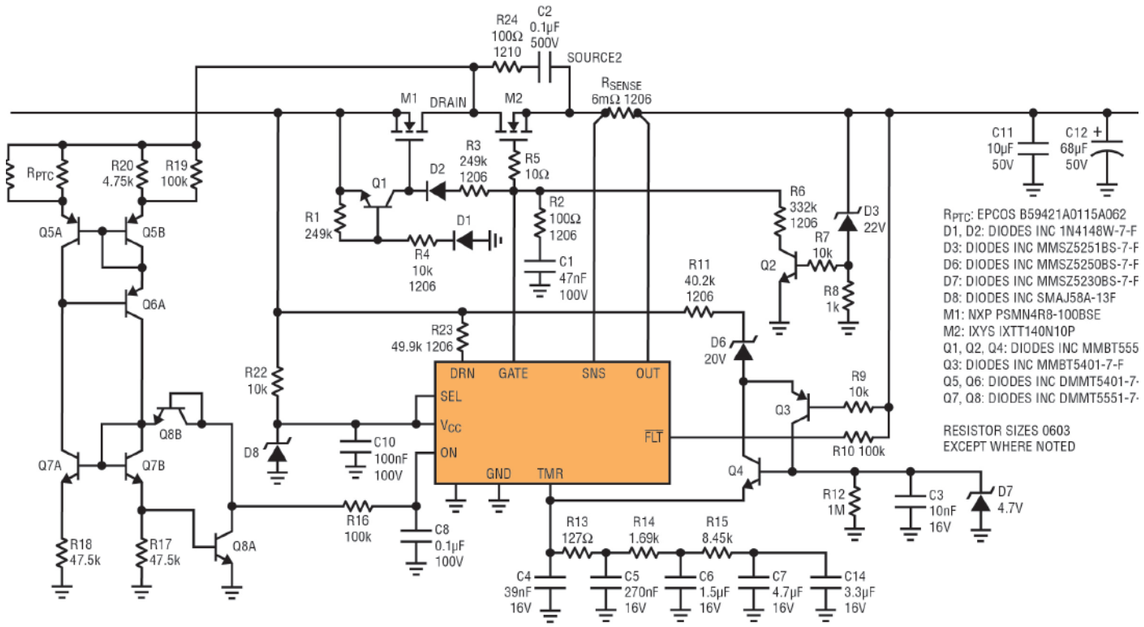


Fig. 8: Surge stopper-based circuit protects downstream electronics from ISO 16750-2 and 7637-2 transients while providing up to 4A of output current

reaches 0.7V.

With 4A and 0.7V, the mosfet could dissipate 0.7V • 4A = 2.8W continuously without the TMR network detecting the mosfet's temperature rise. The PTC resistor, RPTC, in conjunction with resistors R17–R21 and transistors Q5A, Q5B, Q6A, Q7A and Q7B, shuts down the circuit if mosfet M2's case temperature exceeds 115˚C.

Do not be dismayed by the number of components in the thermal protection circuit. The overall design is relatively easy to implement and consists of small components that consume little board area. It is a self-biased circuit that is balanced when RPTC equals R20's 4.75kΩ value.

When the temperature of RPTC, which is placed in close proximity to M2, exceeds 115˚C, its resistance grows and causes more current to flow through Q5B than Q5A. Because that results in more current through R17 than R18, Q8A's base voltage rises and Q8A's collector pulls the on pin of the surge stopper low, turning off M2. At lower temperatures, Q5A's current is greater than Q5B's, and Q8A remains off, allowing the on pin's internal pull-up to keep the on pin high. Note that the on pin current is used as the start-up current of this self-biased circuit through the diode-connected device Q8B.

Conclusion

The ISO 16750-2 and 7637-2 specifications describe the challenging electrical transients that can occur in automotive systems. A low quiescent current surge stopper can be used to protect the on-board electronics from these transients, including both the clamped and unclamped load dump pulses.

The circuit presented in this article provides uninterrupted operation when faced with load dump pulses from a modern, clamped alternator. When faced with more extreme unclamped load dump pulses, it shuts off to protect the downstream electronics. The result is for ISO 16750-2 and 7637-2 compliance for electronics that draw up to 4A of supply current.

Dan Eddleman is senior applications engineer for mixed signal products at Analog Devices

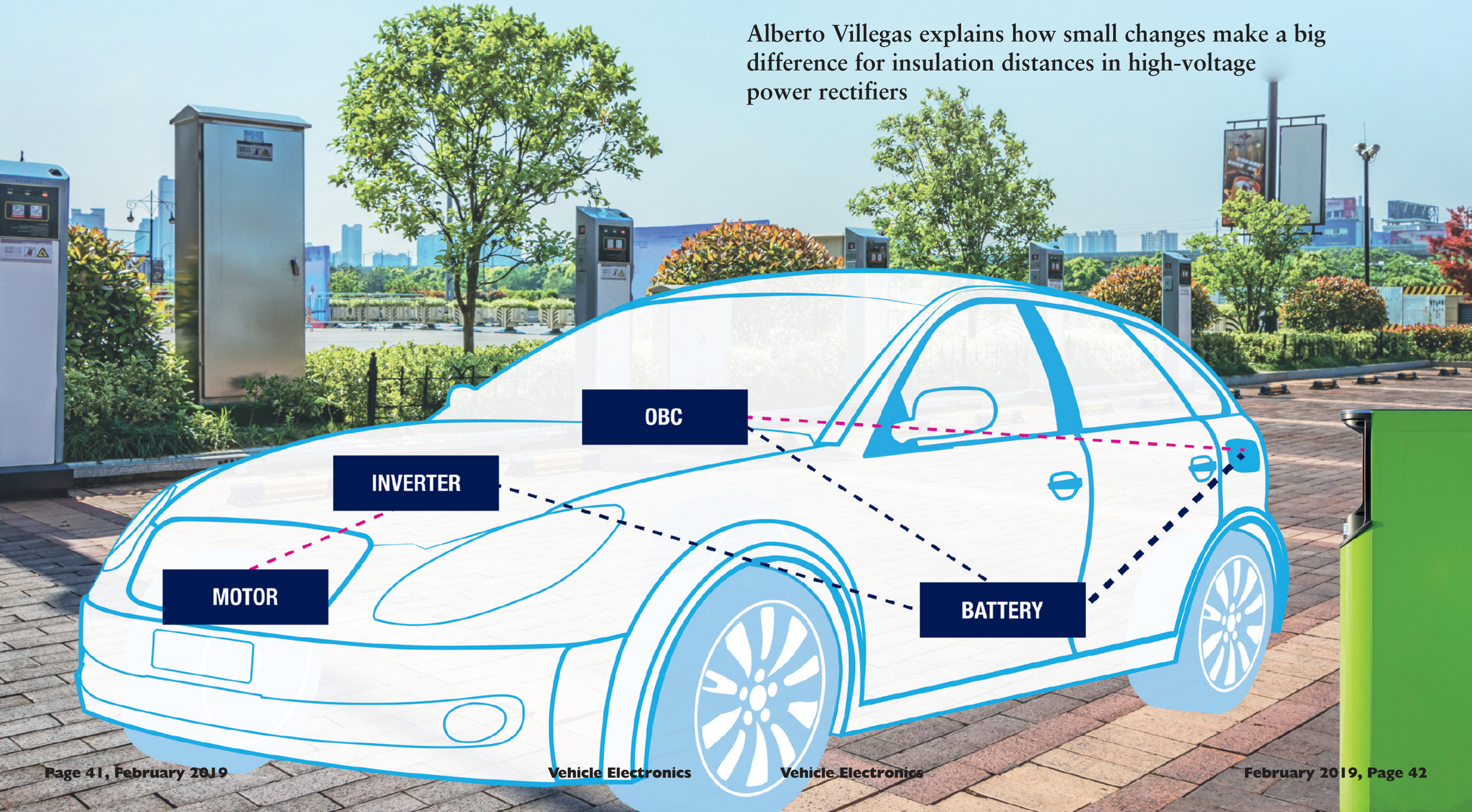




POWER TECHNOLOGIES

Small change, big gain

Alberto Villegas explains how small changes make a big difference for insulation distances in high-voltage power rectifiers



Vehicle Electronics

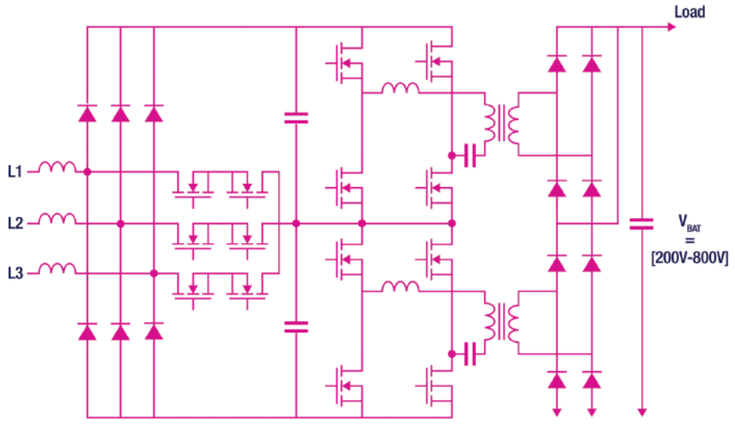


Fig. 1: Example of 22kW three-phase OBC

Due to climate change, car makers are under increasing pressure to reduce vehicle CO_2 emissions. Car electrification through mild hybrid, plug-in hybrid and pure electric technology helps them achieve this.

The replacement of internal combustion engines by an electric motor leads to a radical change of the cars architecture.

In addition to the electric motor, the architecture of an electric vehicle (EV) includes a traction inverter, which controls the electric motor speed and consequently the wheels' speed. A high-voltage traction battery pack and a DC-DC converter generate the low voltage needed to power most electronics systems in the car, usually supplied by a 12V battery. A power electronics converter manages all these systems. Last, the majority of EVs carry an on-board battery charger (OBC).

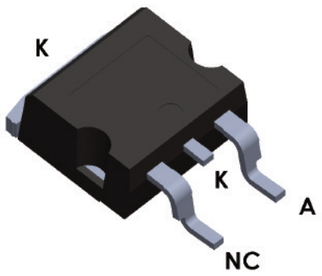


Fig. 2: Regular version of power rectifier available in D2Pak

The OBC input is the main grid – usually 220V AC or 110V AC – which it converts into DC voltage and the current required to charge the traction battery pack. The battery pack is typically 400 to 450V, and the emerging trend is to move to 800V.

Due to these high voltages, for safety reasons, international standards define insulation distances between the terminals of the high-voltage components – active and passive components and connectors – to be present on the OBC. The higher the voltage, the longer the safety distances required.

Whatever the OBC's output power – from 3 to 22kW – they include an important number of active components, such as power transistors and power rectifiers.

Fig. 1 shows an example of a 22kW three-phase OBC.

New look

Market trends and designers' needs for meeting safety requirements steer manufacturers to take a new look at power rectifiers and the standard D2Pak packages used for high voltage.

Fig. 2 shows the regular version of a power rectifier available in D2Pak. The left pin (top view) can be NC (not connected internally) or connected to the anode, and the right pin is connected to the anode. The metallic backside or heatsink is connected to the cathode, as well as the central cut pin.

In this case, the insulation distance is determined by the minimum gap between the central pin (cathode) and the anode's pin. Typically, the distance is about 1.7mm.

Increasing this distance significantly changes the equation. As shown in Fig. 3, the pin-out of this version was modified: the left pin (top view) is not connected internally, while the other two pins are connected to the chip's top side, the anode.

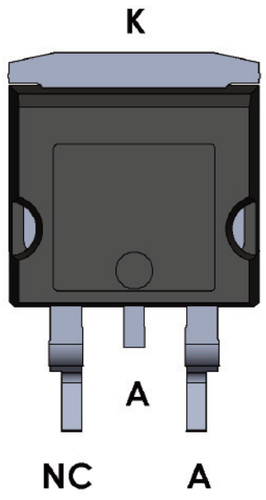


Fig. 3: The left pin (top view) is not connected internally, while the other two pins are connected to the chip's top side, the anode

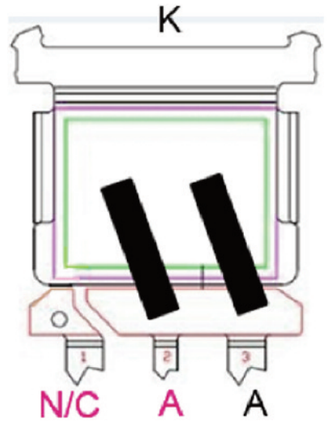


Fig. 4: The backside, as in the regular version, is always the cathode terminal

The backside, as in the regular version, is always the cathode terminal, as shown in Fig. 4.

Here, the insulation distance to take in consideration is between the back metallisation (slug or cathode terminal) and the anode pins, with a minimum of 5.38mm.

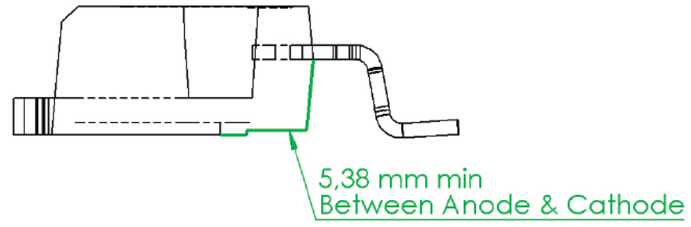


Fig. 5: Internal modification of insulation using the typical mechanical outline dimensions of D2Pak

Fig. 5 shows the internal modification of the insulation using the typical mechanical outline dimensions of the standard D2Pak, to make it easy to use in new designs. However, to take full advantage of this breakthrough, designers should pay attention to the PCB layout.

As an example, Fig. 6 shows two different footprint layouts: a regular one for the standard PCB, and a possible footprint compatible with the insulation distance offered by the new design.

Conclusion

In the area of power rectifiers, small changes can provide big advantages. Enlarging the insulation distances between the anode and the cathode of a diode fulfils the majority of safety recommendations in high-voltage applications, such as on-board chargers and other power electronics applications used in electric and hybrid cars.

Alberto Villegas is marketing manager for ST Microelectronics

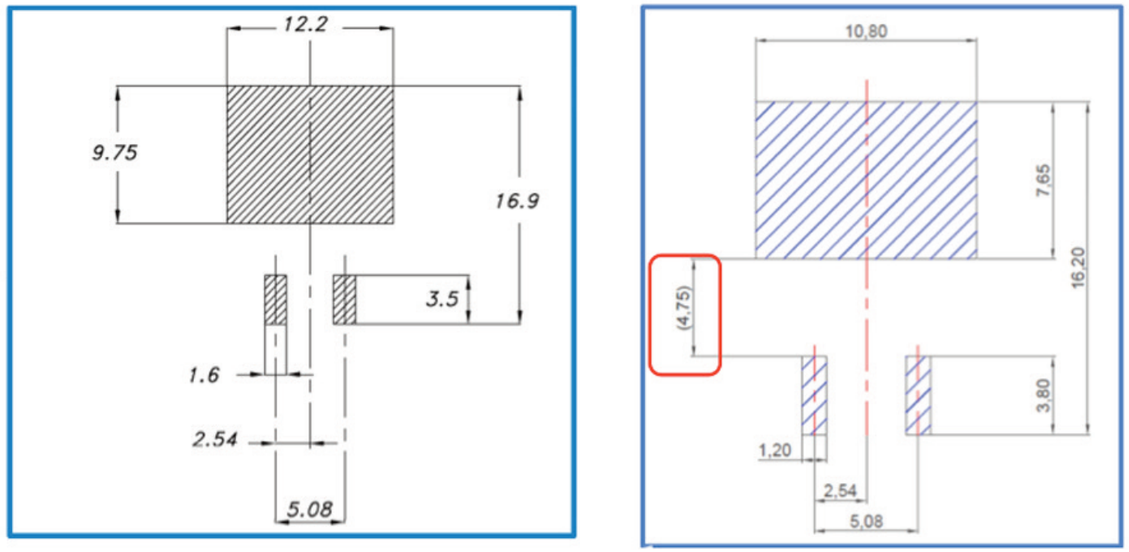
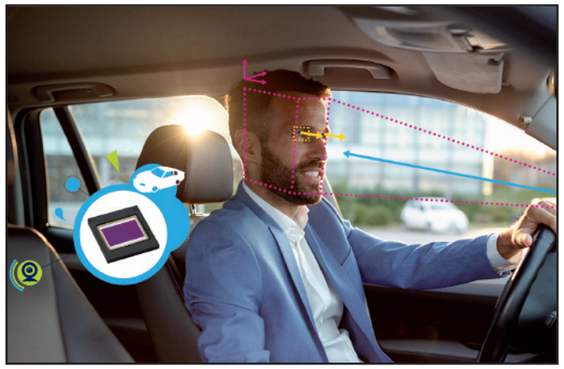


Fig. 6: Standard D2Pak footprint (left) and high-voltage version

Image sensors monitor drivers

Two automotive global shutter image sensors from ST Microelectronics are for driver monitoring.

The VG5661 1.6Mpixel and VG5761 2.3Mpixel sensors capture the scene as illuminated from the camera, eliminating unpredictable external effects such as sunlight or street lighting. Their image quality sharpens the responses of driver-monitoring systems, especially under near-infrared illumination close to 940nm, and makes possible features such as assessing driver attention, passenger comfort or child behaviour.



They embed global shutter technology that reduces the illumination power consumption, even in high dynamic range mode.

The sensors are sampling, and STM is working with customers to facilitate adoption in driver-assistance systems.

Unlike a rolling shutter that continuously reads data directly from pixels one row at a time, a global shutter captures the data at all pixels simultaneously.

They use two memory cells while keeping a pixel size of 3.2μm, resulting in compact sensors, and higher resolution that capture sharp, crisp images in challenging conditions. Two memory zones allow double-image storage, enabling linear high dynamic range up to 98dB or background removal without lag effects and with no need for additional processing by the host system.

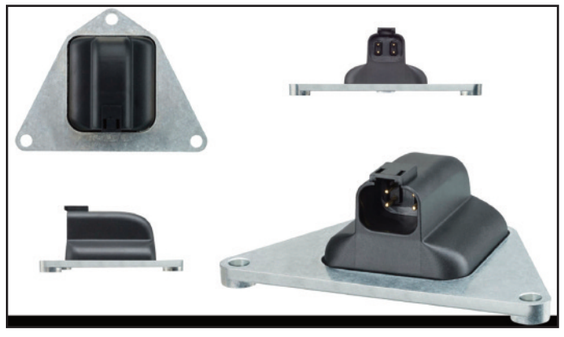
This offloads the host processor and reduces instances of correction artefacts. In addition, high dynamic range and high MTF (modulation transfer function) at near-infrared wavelengths reduces interference from natural light sources.

They come in standard BGA packages, or as bare die for direct integration in automotive OEM systems produced in high volumes.

They are qualified to AEC-Q100 grade two and include safety-integrity features as required for an Asil-B camera system in accordance with ISO 26262.

Dual-axis tilt sensor filters out vibration

A dual-axis, vibration-tolerant tilt sensor from Curtiss-Wright is suitable for pitch and roll detection for on- and off-highway industrial vehicles, including mobile elevating work platforms.



The VTS2021 uses IMU technology and software algorithms to filter out disturbances caused by vibration and vehicle motion. This provides output stability without the measurement delays usually associated with heavily damped, traditional sensing methods.

Each measurement axis has two sensing elements that are constantly compared to ensure correct operation. If an error is detected, its condition is communicated to the host electronics to assume a safe operating situation.

Each output signal is calibrated to account for thermal drift, ensuring accuracy over the operating temperature range.

It operates from a 6 to 48V DC supply for use on 12 and 24V DC vehicle systems. The SAE J1939 Can bus output comes with a choice of baud and frame rates.

Outputs are thermally compensated over the -40 to +85˚C operating range.

The IP67 rating with mated connector provides outdoor protection.



Controller suits in-vehicle HUDs

A display controller for in-vehicle head-up displays (HUDs) has been introduced by Socionext alongside a software development kit.

The SC1711 includes a Seeris 2D graphics engine, high-speed Apix 2 serial interface and safety functions, making it suitable for in-vehicle display systems.

HUDs are attracting a lot of attention as they require less movement in the line of sight to get information, reducing driver fatigue and thus improving safety.

The functionality and performance have been optimised for medium resolution displays, which are used for HUDs, and integrated into a 20 by 20mm package.

The heat tolerance of the package meets the requirement of dashboard devices in a harsh temperature environment.

The device can detect display system errors for stable output using a signature unit, which monitors the integrity of display outputs, and a watchdog function. When a screen freezes due to a damaged cable, the device immediately switches the display output to notify the driver.

It integrates all necessary features to meet the safety standards in automotive applications.

Image sensor aids driver monitoring

A 1Mpixel global shutter image sensor from Omnivision is for in-cabin camera modules in passenger vehicles, where driver state monitoring (DSM) and passenger-monitoring cameras need to be small and unobtrusive, while complying with safety regulations.

Semi-autonomous vehicles use DSM to track the driver's eye gaze and allow the vehicle to take control when the driver becomes drowsy or distracted.

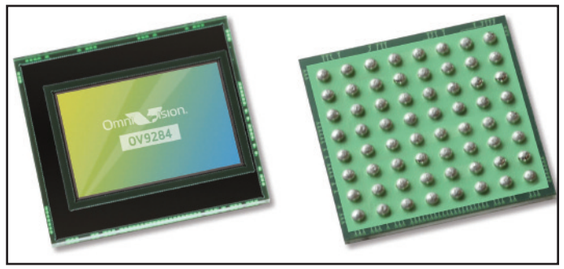
DSM is available in high-end cars but, over the next few years, the feature will migrate into mainstream vehicles.

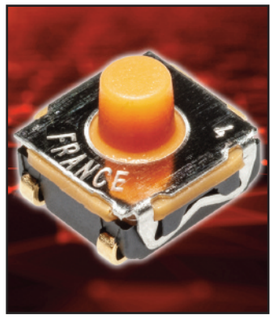
Upcoming mandates will require that all vehicles sold in the EU come equipped with DSM, beginning with 2022 models.

The OV9284 is claimed to have the industry's best near-infra-red quantum efficiency in a driver-monitoring image sensor, with 12% at 940nm.

The sensor consumes 90mW of power at 60frame/s. Additionally, the global shutter sensor with Omnipixel 3-GS technology provides 1280 x 800 resolution at video speeds of up to 120frame/s.

The automotive chip-scale package measures 5237 by 4463μm. It has a 27-degree chief ray angle with a low z height requirement.





Dual-circuit tactile switch is IP67 sealed

A dual-circuit technology tact switch has been introduced by C&K.

The KSC-DCT has SPDT NC-NO dual-circuit functionality that provides two outputs from a single input.

Housed in a 6.2 by 6.2 by 2.9mm PCB-mount package, the silicone 70SH actuator included in the package extends the height to 5.2mm above the PCB surface to ease operation and integration through pre and post travel.

Rated for 300,000 operations, the switch requires an operating force of 4.75N and provides a nominal travel distance of 0.85mm.

IP67 sealed, the switch operates from -40 to +85˚C for use in automotive applications.

Ethernet bridge suits telematics

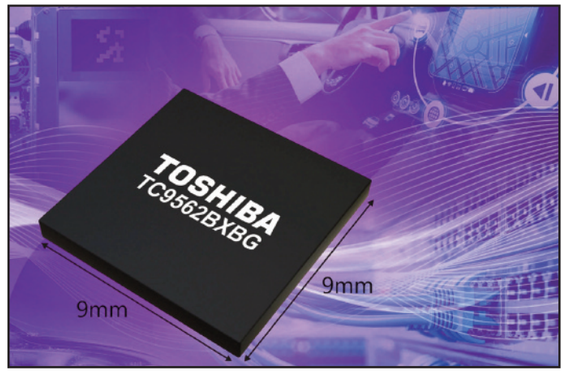
The latest member of Toshiba's automotive network bridge IC product line is the TC9562 that provides Ethernet capability for telematics and infotainment systems.

The IC delivers Ethernet bridging capability up to 1Gbit/s bandwidth. It supports the TSN time-sensitive networking protocol for various industrial and commercial applications.

Real-time processing and reliable data transmission are critical to support telematics, infotainment, driver assistance and various sensor data to enable a connected vehicle. Standards, including Ethernet AVB and TSN, are becoming adopted in automotive and industrial.

The device supports Ethernet AVB specification, specifically IEEE 802.1 AS and IEEE 802.1 Qav, as well as TSN standards IEEE 802.1Qbv, IEEE 802.1Qbu and IEEE 802.3br. The IC also supports a broad range of interfaces including PCI Express 2.0 and 1.0, I²S/TDM, RGMII, RMII, MII and an option for SGMII for expanded interfaces to various IVI SoCs.

The TC9562 series will be automotive qualified and packaged in a P-LFBGA120 9 by 9mm package. Sample shipments will start this month and volume production in October 2019.



Network interface for V2X communications

A network interface from Vector is for V2X communications.

The VN4610 network interface is for IEEE-802.11p and Can-FD applications. As an interface to the Canoe.Car2x test tool, the interface can advance 802.11p-based ECUs to production readiness.

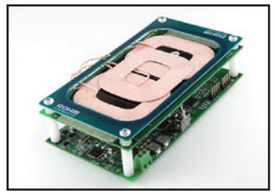


The VN4610 has a USB interface for accessing IEEE-802.11p and Can-FD networks. Users benefit from the ease of receiving and sending IEEE-802.11p messages in implementing their Car2x and V2X apps.

The received IEEE-802.11p messages are transferred to the application time-synchronous to the Can-FD messages. The built-in GNSS receiver provides the GNSS time and the current GNSS position.

It satisfies technical hardware requirements for safely testing DSRC applications over IEEE-802.11p radio channels. It routes all received messages from the two radio channels, unfiltered, to a test tool for analysis.

Messages that would be rejected by an ECU due to timing, geo information or Car2x or V2X protocol errors can be analysed. In addition, latency measurements can be performed because the time stamps of messages are synchronised to the bus channels.



Wireless charger

An automotive wireless charging device from Rohm has integrated near-field communications (NFC). This combines its AEC-Q100 qualified wireless power transmission control IC (BD57121MUF-M) with STM's ST25R3914 NFC reader IC and STM8A 8bit microcontroller.

In addition to being compliant to WPC's Qi standard supporting EPP (extend power profile) that enables the charger to supply up to 15W of power, the multi-coil design enables a wide charging area that provides spatial freedom in vehicle applications; 2.7x greater charging range versus single coil options.

This means users do not need to worry much about exactly aligning their smartphones.

The company plans on releasing a sample reference board to let users configure a wireless charger for automotive use compatible with EPP when combined with its Qi-certified receiver board.

Light sensor provides four slave address options

An integrated automotive grade proximity and ambient light sensor from Vishay has four different slave address options.

Featuring Filtron technology, the VCNL 4030X01 combines photo detectors for proximity and ambient light, a signal conditioning IC, a 16bit ADC, and a high power IRed in a 4 by 2.36 by 0.75mm surface-mount package.

The AEC-Q101 qualified sensor has an interrupt function and supports the I²C bus communication interface for automotive applications.

The device can provide proximity sensing for touch-screen locking in smartphones and tablets to save power; presence detection for display activation in notebooks, automobiles, and consumer and industrial devices; ambient light sensing for dimming control in displays, keypads and rear-view mirrors; and collision avoidance in toys and robots.

All the circuitry needed for these applications is included in one package to save PCB space, while its four slave address options provide design flexibility in applications requiring more than one sensor.

A programmable interrupt function allows high and low thresholds to be set to reduce the overall power consumption within an application. The function can be programmed to trigger both the ambient light and proximity sensor.

Filtron technology enables ambient light spectral sensitivity close to that of the human eye while offering background light cancellation capabilities.

A built-in ambient light photodiode provides detection from 0.004 lx to 4.2 klx, allowing the device to operate in applications with dark or high transparency lens designs.



The sensor has an accuracy of ±10%, fluorescent light flicker immunity and temperature compensation from -40 to +105˚C. Intelligent cancellation eliminates cross-talk, while a smart persistence scheme ensures fast response time and accuracy when an object is detected.

The device's sensitivity allows for object detection distances up to 300mm. The emitter wavelength peaks at 940nm and has no visible red tail.

Supply voltage range is 2.5 to 3.6V and I²C bus voltage from 1.8 to 5V.

Offered in a lead (Pb)-free eight-pin QFN package, the sensor is RoHS-compliant, halogen-free and Vishay Green.

Wifi and Bluetooth combos for development

Cypress has announced wifi and Bluetooth combo chipsets and supporting software to serve as application development platforms that let multiple users connect and seamlessly stream unique content to as many as ten mobile devices simultaneously.



The infotainment platforms include a Wi-Fi 6 (802.11ax) and Bluetooth combo that uses the firm's RSDB real simultaneous dual band architecture, which enables two unique data streams to run at full throughput simultaneously by integrating two complete wifi subsystems into one chip.

Cypress has also added two Wi-Fi 5 (802.11ac) and Bluetooth combos, providing car makers and system suppliers with a scalable platform to address a wide range of vehicles with a uniform software architecture that reduces development and integration costs.

Data logger helps validate radar sensors

The DP²4R gigabit data logger from Embedded Brains collects raw radar signals between the sensor and pre-processing. The stored signals can then be fed back via the same interface.

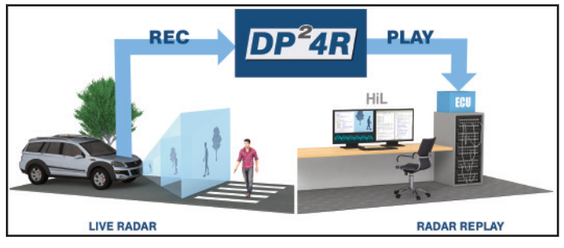
This lets real traffic situations be replicated repeatedly in the laboratory and optimise the processing chain of radar signals. Testing and validation of radar signal processing can be moved from the road to the laboratory. This saves time and allows data processing reliability to be documented.

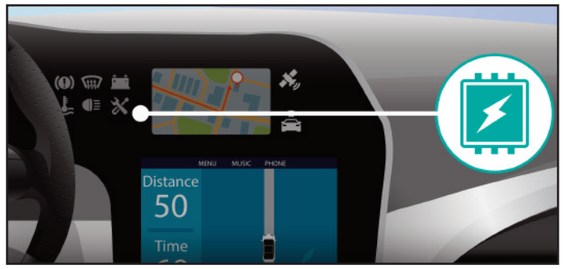
For developing and validating autonomous vehicle management, real traffic scenes are usually simulated and tested in the lab. Since pre-processing is carried out directly in the sensor front end with modern radar sensors, this can result in a gap in coverage during testing and validation of object detection. In addition, the optimisation of algorithms for testing in real traffic is complex and seldom reliable.

The approach of the data logger is to read raw data by a data head directly coupled to the radar sensor, store it and later feed it back in the laboratory. This requires a data rate of more than 300Mbit/s per sensor, which is why these data cannot be transferred via the system bus. For practical aspects of data analysis, apart from raw sensor data, other context-specific data such as pictures from a camera and GPS position data can be recorded with synchronous precision.

The head unit is based on a standard unit that is tailored to each sensor to enable safe and interference-free signal scanning as well as re-injection of the raw data. The sampled information is transmitted together with a time stamp via an internal interface to the central unit. The central unit consists of a car PC with a special insert card.

Up to four head units with a cable length of 7m can be connected to it.





Buck converters and controllers solve space and power problems

Small power-management ICs from Maxim can help automotive designers meet space and power challenges in automotive applications.

These buck converters and multiphase buck controllers help designers balance low power consumption with efficiency and EMI mitigation.

With a package size of 3.5 by 3.75mm, the buck converters' flip-chip quad -flat no-leads (FCQFN) packaging reduces high-frequency switch node ringing and eliminates bond wires to lower mosfet switch on-resistance and increase efficiency.

The pin-compatible Max 20004, 20006 and 20008 parts are for 4, 6 and 8A, respectively. All have spread-spectrum modulation, high switching frequency, forced pulse-width modulation and skip-mode operation.

The 40V tolerant synchronous buck converters with integrated high-side and low-side mosfets have switch resistances of 38 and 18mΩ.

Features include 25μA quiescent current, operating input voltages from 3.5 to 36V and 93 per cent peak efficiency. All are available in a 17-pin side-wettable QFN package that reduces high-frequency switch node and improves efficiency.

The Max 20098 220kHz to 2.2MHz synchronous buck controller is for applications with mid- to high-power requirements operating with input voltages from 3.5 to 36V; 42V tolerant. Quiescent current is 3.5μA in skip mode at 3.3V output along with a 1μA typical shutdown current. It comes in a 3 by 3mm side-wettable QFN package.

The Max 20034 220kHz to 2.2MHz dual synchronous buck controller for high-voltage applications operates with inputs from 3.5 to 36V; 42V tolerant, where one regulator will operate as a fixed 5 or 3.3V output and the other output is adjustable between 1 and 10V.

Modular gateway PC for Din rail mounting

The MC50M is a modular Din rail box PC from MEN Mikro for embedded applications in transportation.

The computer platform is based on Intel's Atom E3900 CPU series. This makes the PC suitable for functions such as security gateway, predictive maintenance, CCTV and ticketing systems, or as a diagnostic server.

It can be used as a stand-alone product or with a range of pre-fabricated extension modules, providing additional features and short delivery times. Extension modules can provide application-specific functions such as wireless communications – LTE Advanced, wlan, GNSS – MVB, Can bus or other IOs.



A removable storage shuttle supports integrating one or two 6.35cm Sata hard disks or SSDs.

The wide range PSU allows isolated power supply from 24 to 110V DC nominal and extends the entire system to EN 50155 compliance. Operating range is -55 to +70°C.

The board management controller improves reliability and reduces downtime. The trusted platform module supports security and encryption features. With the ignition switch for remote start-up and shutdown control, the platform provides additional energy saving features.

The aluminium housing with cooling fins ensures conductive cooling and fanless operation. There are no moving parts, so it can be operated maintenance-free. The long-term availability of 15 years from product launch reduces life cycle management by making the PC available for at least this period.

MEN's Din rail concept is for flexible configuration of module combinations and is suitable for embedded IoT applications in various markets. The CPU modules can be flexibly combined with various expansion modules and power supplies.

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