VEHICLE electronics

The monthly magazine for automotive electronics engineers

FCA turns to Samsung and Google for connectivity

Fiat Chrysler will use Samsung subsidiary Harman and Google technologies to deliver an ecosystem that will enhance the connected life of its vehicle owners globally.



Fiat Chrysler wants to improve the connected experience

Off-board, the system will promptly and securely manage in-vehicle and additional data using an architecture based on the Harman Ignite cloud-based platform. The system will predict maintenance needs, locate fuel and charging stations, show traffic prompts and restaurant offers, and provide live customer-care assistance at the push of the button.

Vehicles will also receive over-the-air (OTA) software updates.

The platform will offer owners 4G network connectivity and support the evolution to 5G, is homologated for all regions and will integrate with any service provider around the world. The off-board system also has the capability to interact with future smart cities infrastructure as well as household devices via Samsung's Smart Things platform.

Dealers, fleet operators and service providers will benefit from features delivered through cloud-based connectivity.

On-board, the system will be powered by Android offering an app-based environment that provides fresh content via OTA updates and wireless integration with the user's mobile devices.

For FCA electric vehicles, applications such as remote battery management, smart EV trip navigator and vehicle-to-grid services will be available. It will also support the FCA Mobility Services portfolio, including features such as pay by the kilometre options, usage-based vehicle insurance, short-, medium- and long-term vehicle rental, and peer-to-peer car sharing, such as the U-Go system recently launched by Leasys in Europe.

The key components of the system will start to rollout during the second half of 2019, and all new FCA vehicles will be connected by 2022.

Issue 65
May 2019

IN THIS ISSUE

3: ZF adas uses AI

5: VW automated tests in Hamburg

8: Autosar updates Adaptive platform

9: Nidec buys Omron business

12: Audi, Ericsson and Qualcomm C-V2X trials

13: Autotronics in Taipei report

21: News from Traffex event

25: Sensors creating congested spectrum

31: C-V2X enhances adas sensors

33: Creating safer automotive displays

37: Product news

42: Contact details

T-Systems and Argus combine on security

Deutsche Telekom's T-Systems and Continental subsidiary Argus Cyber Security are working together on cyber defence for cars, they announced at last month's Hannover Messe.

T-Systems is planning a security operations centre specialising in vehicles.

Israeli automotive cyber security specialist Argus has an information and event management system for cars as well as in-vehicle products. Car makers and fleet operators use it to identify anomalies for connected vehicles. Attacks from the internet are increasing rapidly.

"We are currently seeing a new peak of 32 million daily attacks on our systems," said T-Systems CEO Adel Al-Saleh. "Attackers don't stop in front of our cars either. The connected vehicle needs a digital bodyguard and real-time cyber defence."

Werner Koestler, head of strategy at Continental, added: "We are bringing together the largest IT service provider in the automotive industry in Germany with Argus. This will enable OEMs and fleet operators to realise their vision of safe and secure mobility."

And Yoni Heilbronn, chief marketing officer of Argus Cyber Security, said: "Argus' focus has always been on averting attacks on the automotive industry and anticipating future threats. Together with T-Systems, we will offer customers an advanced and robust automotive security operations centre. To do this, we link, fuse and analyse multiple data sources. This enables automakers to respond immediately to threats."

Visteon cluster displays 3D on 208



The first fully digital cluster displaying holographic objects can be seen on the latest Peugeot 208 as part of its 3D i-Cockpit. Partnering with Groupe PSA to develop the 3D Blade concept, Visteon's digital cluster displays reflections to create the impressions of 3D graphics.

The cluster is composed of a high-definition 26cm background TFT and a 17.8cm foreground TFT projected on a semi-reflective blade. The display creates a 3D projection of approximately 15mm between the front and rear images.

"With distracted driving continuing to pose a challenge, presenting critical information to the driver in intuitive ways will be the key to successful, next-generation human-machine interaction development," said Loick Griselain, vice president at Visteon.

The cluster's projection offers styling teams the flexibility to create depth with rotating menus and shadow effects and including priority information such as speed and alerts. The display also allows animations to pass dynamically from the foreground to the background in adas modes or as 3D animations in a number of configurable colours and skins.

ZF adas uses AI for automated driving

The ZF CoPilot is an adas that uses artificial intelligence (AI) and is equipped with a sensor set so vehicles can perform various automated driving functions, especially on freeways.

It can be operated with voice commands and is designed to recognise traffic conditions, sense vehicle handling and monitor the driver, helping pre-empt hazardous situations through active control intervention.

Powered by the ZF ProAI central computer and the Nvidia Drive platform, it is designed for volume production and will be available from 2021.

Three months after ZF and Nvidia announced that ZF ProAI as the first system to run the Nvidia Drive software, CoPilot debuted at the recent Shanghai International Automobile Industry Exhibition.

It is a level two-plus system leading to enhanced safety and driving comfort opportunities in passenger cars.

"The ZF CoPilot is equipped with artificial intelligence, a 360° sensor set, the powerful ZF ProAI central computer and Nvidia's Drive platform, thus offering driving and safety functions that surpass the performance of a regular level-two system for semi-automated driving," said Torsten Gollewski, head of autonomous mobility at ZF. "This enables us to achieve an improved quality in semi-automated driving."

The demonstration vehicle, presented for the first time at last month's Auto Shanghai, shows the functional scope and relative comfort and safety benefits for drivers. The vehicle can perform specific driving manoeuvres autonomously, for example entering and leaving highways under the appropriate conditions.

For more relaxed highway driving, it combines cruise control with active steering assistance and lane keeping assist. And it can proactively change lanes, pass and merge. The system continuously analyses vehicle surroundings, recognising pedestrians, oncoming traffic and intersections.

Equipped with sensors and functions that monitor the driver, it can trigger warnings in the event of potentially dangerous situations such as the driver becoming distracted or showing signs of drowsiness.

The sensor set in the demonstration vehicle consists of a front radar, four corner radars and eight cameras. Two cameras are directed forwards and one backwards, two are integrated into each side mirror, and one monitors the driver.

To evaluate the massive amount of data collected in real time, the ProAI Gen2 central computer has Nvidia's Xavier processor at its core. It can integrate and control the pre-trained algorithms for driver assistance.

"We are convinced that an extended level-two system like the ZF CoPilot is very attractive for manufacturers," said Gollewski. "Due to its wide range of functions, it offers consumers significant added value in terms of safety and driving comfort, and at a competitive price."



ZF CoPilot demonstration vehicle

ANALOG DEVICES

ELECTRIFY BATTERY FORMATION AND TEST PRODUCTION

PRODUCE ELECTRIC VEHICLE BATTERIES WITH AMAZING EFFICIENCY.

Don't let EV production get bogged down by a slow and costly battery formation and test phase. With new power products, integrated, high-precision solutions and production-ready reference designs from ADI, you can produce batteries up to 50% more cost-effectively. And you can bring test equipment to market up to 80% faster. Now that's how to electrify the automotive market.

#batterytest

SCALE UP BATTERY MANUFACTURING WITH ADI
analog.com/batterytest

VW tests automated vehicles on city streets of Hamburg



Volkswagen test drive in Hamburg

Volkswagen is testing automated vehicles in urban traffic in Hamburg. This is the first time the car maker has tested automated driving to level four in real driving conditions in a major German city.

Five e-Golfs, equipped with laser scanners, cameras, ultrasonic sensors and radars, are driving on a 3km section of the digital test bed for automated and connected driving in the city.

The results of the test drives will be continuously evaluated taking into account all data protection rules.

"The tests centre on technical possibilities as well as urban infrastructure requirements," said Axel Heinrich, head of group research at Volkswagen. "To make driving even safer and more comfortable in future, vehicles not only have to become autonomous and more intelligent, cities must also provide a digital ecosystem that enables vehicles to communicate with traffic lights and traffic management systems as well as with one another."

A 9km digital test bed for automated and connected driving is being constructed in Hamburg, with completion scheduled for 2020. The city is upgrading traffic lights with components for vehicle-to-infrastructure (V2I) communications.

"Two and a half years from now, Hamburg will be hosting the World Congress for Intelligent Transport Systems," said Michael Westhagemann, Hamburg's senator for economics, transport and innovation. "Automated driving will play a key role. We will establish Hamburg as a model city for intelligent mobility and be presenting numerous innovative mobility projects to a global audience in 2021."

The configured e-Golf has eleven laser scanners, seven radars and 14 cameras. Up to 5Gbyte of data are communicated per minute during the regular test drives, each of which lasts several hours.

For safety reasons, test drivers will be seated behind the steering wheel during all test drives in Hamburg to monitor driving functions and intervene in an emergency.

TE to acquire Kissling

TE Connectivity is to acquire the Kissling Group, a provider of high-power relays and ruggedised switches used in commercial vehicles, transportation, industrial, military and aviation industries.

This will let TE expand its portfolio of specialty relays and switches to support the needs of industrial and commercial transportation customers – lorry, bus, construction and other specialised vehicle manufacturers facing evolving high voltage and power management requirements.

"Kissling has an established reputation as an innovation leader in building mission-critical hardware with products that have a solid performance track record in the commercial vehicle, transportation and industrial markets," said Aaron Stucki, senior vice president at TE. "Their specialty relays and ruggedised switches and expertise in electronics for smart relays and power distribution, combined with TE's broad portfolio, global footprint and close customer partnerships, will allow us to strengthen our support for customers in markets around the world."

Headquartered in Wildberg, Germany, Kissling is a privately owned company that has about 450 employees at sites in Germany, Switzerland, Slovakia, Spain and the USA. TE and Kissling will continue to operate independently until the acquisition closes, after which Kissling and the Kissling brand will become part of TE's industrial and commercial transportation business.

The transaction is expected to close at the end of May.

Neusoft picks QT for cockpit foundation

Neusoft, an IT-enabled service provider from China, has selected QT's software development framework as a foundation for its automotive digital instrument clusters for OEM digital cockpits.

Displays in digital instrument clusters must address several design and technical requirements so the driver can use them safely. OEMs must provide responsive graphics and reliable performance for their displays, but they must also meet functional safety standards with rapid design-to-development production cycles.

"The contradiction between a better HMI experience and shorter time to market and lower costs is a significant challenge, especially considering OEMs are paying more attention to the digital experience than ever before," said Lingjun Meng, vice president for Neusoft. "We have been paying close attention to QT's technology and found that QT has made significant progress in the automotive industry in recent years, especially in the arena of functional safety."

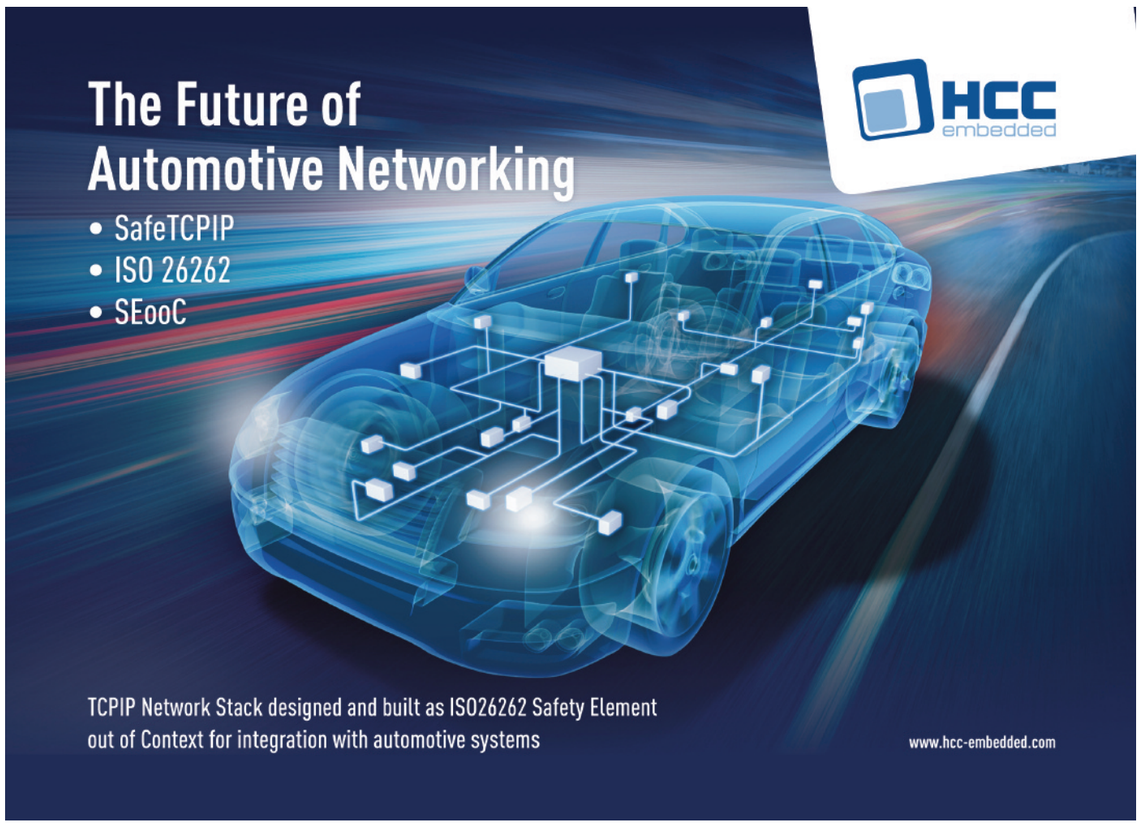
Due to the availability of its source code, QT's technology provides more control over the entire development process.

It is flexible, as it lets users write code once and run it on any platform. Neusoft gains access to QT's global community of development experts and practitioners, as well as its professional support services.

"We are delighted to see Neusoft selecting QT as the primary digital instrument cluster technology for China's automotive market," said Juhapekka Niemi, executive vice president for QT.

In addition to providing a cross-platform development framework, the framework also features a safe renderer, which lets Neusoft render the safety-critical information in functional safety applications.

Founded in 1991, Neusoft employs more than 4000 automotive engineers around the world. Its infotainment software serves 80% of the top 30 global car brands.



Toyota looks to skies for HD map data

Toyota's automated driving software development company Tri-Ad is working with Maxar Technologies and NTT Data on a proof of concept to build automated high-definition (HD) maps for autonomous vehicles using high-resolution satellite imagery.

This is part of a move towards advancing Tri-Ad's open software platform concept known as Amp, for automated mapping platform.

Autonomous vehicles use several real-time sensors to ensure safe driving and these sensors need to be cross-referenced with an HD map.

According to Tri-Ad analysis, HD maps cover less than one per cent of the global road network, and there is a need to increase the coverage of urban areas and local roads before autonomous vehicles can become a mainstream mobility technology.

An HD map created from accurate satellite imagery allows the driving software to compare multiple data sources and signal the car to take action if needed to stay safe.

"Recent advances in electronics and aerospace engineering are leading to higher resolutions and more frequent updates of global imagery from space-based assets," said Mandali Khalesi, vice president at Tri-Ad. "Additionally, machine learning is helping automate the discovery and integration of semantic relationships between road elements within image data."

In this proof of concept, the three companies will work together to process satellite imagery into vehicle-friendly HD maps. Leveraging Maxar's cloud-based GBDX geospatial big data platform, imagery from Maxar's optical satellite image library will be fed into NTT Data's algorithms using artificial intelligence to extract information needed to generate the detailed road network.

"High-definition maps are an essential element for the navigation and safety of autonomous vehicles, and Maxar is proud to provide the data and analytics platform that make HD maps possible," said Paul Granito, Maxar's vice president.



Satellite images can provide basis for HD maps

Tri-Ad will make HD maps available for delivery from the cloud into Toyota test vehicles. The group is focusing first on creating an automated HD map for a predefined area of the Tokyo metropolitan region, opening up the future possibility of supporting automated mobility on all roads.

"We will use NTT Data's AI and enhanced image-processing expertise to expand the coverage of high-definition maps on a fast, scalable and cost-effective basis," said Katsuichi Sonoda, vice president of NTT Data. "We hope to map worldwide road networks from space using our enhanced image-processing expertise."

Synopsys and STM speed development

Synopsys and ST Microelectronics are establishing a programme to speed development of automotive electronic systems and software.

The programme focuses on Synopsys Virtualizer development kits for the STM Stellar family of multicore MCUs, helping companies accelerate the development of electronic systems by enabling the move from physical to virtual testing.

The first kit with support for the Stellar family is available. Using a kit lets automotive tier-ones develop software and test patterns 18 months ahead of the first Stellar samples. Within a few days of receiving the samples, the developed software was executing on the sample hardware.

"New domain controllers that support data-enabled services require new tools to start software development early and accelerate system testing by moving from a physical to a virtual environment," said Fabio Marchiò, VP at STM.

Autosar updates Adaptive platform

The latest release R19-03 of the Autosar Adaptive platform and R1.5.1 of the Autosar Foundation stabilises existing features and improves the open system architecture.

R19-03 focuses on stabilising the existing features from release R18-10. Besides several improvements from a quality perspective, some features have undergone design and architectural changes to prepare for future extensions.

These include state management, diagnostics, identity and access management, network management, timesync, use of ara::core types and exception-less API, and cryptography.

R1.5.1 has been revised to support the R19-03 Adaptive platform changes. Additionally, the following specifications were updated: end-to-end protocol specification including configuration of maximum data lengths for end-to-end profiles; requirements on end-to-end; specification of health monitoring; and time synchronisation protocol specification.

"For Autosar, the stabilisation of releases is an important step to continuously improve the quality of the last features and to be prepared for next features," said Günter Reichart, recently appointed Autosar spokesperson. "After completion of this important work, we are now focusing intensively on new features in our working groups. The next release is planned for November 2019 and we are looking forward to present further new functionalities for the Autosar Classic and Adaptive platforms."

Reichart replaced as spokesperson Thomas Scharnhorst, who held the role since 2017.

As the initiator of the Autosar concept, Reichart was involved in the foundation of the development partnership.

He worked for BMW from 1987 to 2008, where he was responsible for vehicle research and electronics in series development.

RobosSense partnerships focus on lidar

At the Shanghai Auto Show, RoboSense announced it had teamed up with Horizon Robotics, Cainiao Network, Sensible 4 and Auto X to launch a smart sensor system for four key smart transportation vehicle applications – autonomous passenger cars, low-speed autonomous vehicles, high-speed robotaxis, and V2I.

The system combines lidar hardware, AI point cloud algorithms, and an IC design for a one-stop strategy that collects and interprets environment information, distinguishing itself from traditional lower resolution lidar.

Also at the show, RoboSense announced two lidar products that are integral to the system: the RS-Bpearl is a super wide angle blind-spot lidar; and the RS-Ruby is a super high-resolution lidar. In addition, RoboSense also unveiled its final mass production-ready design of its RS-Lidar-M1 automotive grade solid-state lidar smart sensor system with embedded perception algorithms, which will be mass produced in 2021. RoboSense has teamed with Alibaba's Cainiao Network to produce the system for unmanned low-speed vehicles with the RS-Bpearl lidar.



RoboSense has teamed up with Cainiao Network

R&S C-V2X approval

Rohde & Schwarz has achieved approval for its cellular vehicle-to-everything (C-V2X) protocol conformance testing package, fulfilling the specification defined by the Global Certification Forum (GCF).

The approval is based on tests executed using the CMW500 wideband radio communications tester and SMBV100A vector signal generator.

The GCF is an industry-recognised organisation trusted by cellular network providers to certify the conformance of cellular handsets. Such approval ensures handsets operate as specified with the wide range of base station hardware installed by network operators.

Lear acquires Xevo for $320m

Lear, a Michigan specialist in automotive seating and electrical-electronic systems, is to buy Seattle-based Xevo, an automotive software supplier for cloud, car and mobile devices, for $320m.

Xevo's Journeyware suite combines a user-friendly interface with a cloud-based framework that allows drivers to interact seamlessly with in-car content and mobile applications using real-time data. Xevo Market, an automotive commerce and services platform, connects consumers with popular food, fuel, parking, hotel and retail brands through in-vehicle touchscreens and OEM-branded mobile applications.

"The acquisition of Xevo broadens Lear's connectivity portfolio, bringing together Xevo's leading ecommerce vehicle platform technology with Lear's expertise in electronic systems," said John Absmeier, Lear's chief technology officer. "Xevo's user interface establishes a connected marketplace for consumers in their vehicles, unlocking previously unrealised value from vehicle data and opening up new revenue streams."

Xevo's technology is available in more than 25 million vehicles located primarily in the USA, with opportunity for expansion not only in North America, but also in Asia and Europe.

"Automakers have embraced the potential of Xevo's ecommerce platform, as well as the deeply customisable driver experiences made possible by Xevo's artificial intelligence technology," said Dan Gittleman, Xevo's chief executive officer. "Today, with Lear's reach, we can scale Xevo's innovative technology and business model to a global customer base."

Lear will acquire all the outstanding shares of Xevo for $320m. The transaction, which is subject to regulatory approvals and other customary closing conditions and adjustments, is expected to close in the second quarter of 2019.

Lear intends to fund the transaction through debt financing.

"With the acquisition of Xevo, Lear advances its leadership position in the global trends reshaping the automotive industry," said Ray Scott, Lear's chief executive officer. "This transaction is consistent with our stated capital allocation strategy. It allows us to enhance our capabilities in software, services and data analytics and strengthen our market position in connectivity. Xevo's world-class team will bring an invaluable pool of experience and expertise to our organisation, and I am delighted to welcome them to the Lear family."

Nidec to buy Omron automotive electronics business

Japanese electric motor maker Nidec is to acquire Omron's automotive electronics business for around ¥100bn.

Nidec is pushing the automotive motor market as it is expected to grow rapidly in coming years. The company is particularly focusing on module products with electric power steering motors, electric brake motors and electronic control units (ECUs) due to the trends towards electrification and autonomous driving, as well as EV traction motor systems, for which significant market growth is expected.

The company anticipates that the electrification trend will accelerate further in response to the global environmental and energy related problems and will continue to engage in research and development with Elesys, an ECU manufacturer which joined the Nidec group in 2014, to create more electrification products going forward.

Omron Automotive Electronics engages in research and development, manufacturing, and sales of automotive electronics products as a subsidiary of the Omron Group, which has strengths in control equipment, systems and electronic components based on its sensing and control technologies.

In particular, Omron Automotive Electronics has produced many high-quality control products for body control system, ECUs for motor control systems, power control systems, and other areas to address the market's electrification needs.

The company will combine Nidec's motors, pumps and gears with Omron's ECUs and other electronics products.

Furthermore, Elesys and Omron have a complementary relationship in the area of adas.



Horiba's vehicle resilience technology centre

Horiba Mira sets up vehicle resilience centre

Horiba Mira has established a vehicle resilience technology centre at its UK headquarters in Nuneaton. It provides a combined approach to automotive cyber security, functional safety and electromagnetic resilience.

The £1.5m of capital expenditure is complemented by investment into capability development.

The centre has been developed in response to the emergence of increasingly electrified, connected and automated vehicles. As well as opening up opportunities, these trends also bring challenges for vehicle electronics; such levels of complexity are increasingly difficult to manage, requiring a more integrated approach.

Connectivity test capabilities include real-world performance metrics for wired and wireless communications.

The centre includes modelling and simulation capabilities and is supported by more than 14 test facilities for physical testing.

Ranging from workshops and screened laboratories for static and dynamic vehicle testing, and system analysis and attack laboratories, through to a city circuit, these facilities allow the safe assessment of resilience for vehicle electronic systems.

"By combining automotive cyber security, electromagnetic resilience and functional safety for the first time, Horiba Mira will deliver advanced engineering in line with the increasing complexity of electrified, connected and automated vehicles, to address the growing and evolving risks to vehicle safety, security and functionality," said Graeme Stewart, chief technical officer at Horiba Mira.

Molex partners Accenture and AWS on Automotive Ethernet

Molex is expanding its autonomous and connected vehicle capabilities by working with Accenture and Amazon Web Services (AWS) to bring edge computing and voice assistant capabilities to its Automotive Ethernet platform.

These digital enhancements can provide autonomous vehicle performance and communications functionality for automotive OEMs.

"AWS and Accenture's contribution can profoundly help our customers innovate faster, drive down costs and build some of the most advanced vehicles in the automotive industry," said Joseph Stenger, product manager at Molex. "We look forward to working together in the development of industry-leading technology that helps automotive OEMs design for the cars of tomorrow."

The Ethernet-based connectivity platform has a multi-zone architecture across hardware, software and interconnect cabling, with the flexibility to incorporate legacy automotive protocols and scalability for upgrades.

It uses AWS IoT Greengrass machine learning to enhance capabilities such as diagnostics, security and end-user experience. The automotive-grade gateways act as central hubs, providing secure and reliable interconnects and processing data across the vehicle network to functional domains such as adas or autonomous driving.

The collaboration with Accenture and AWS addresses the growing requirements for safe and secure software-enabled features in autonomous vehicles. Together they are expanding Molex's custom gateway to include on-board diagnostics with edge analytics that can grow and evolve in functionality, compute power and performance, such as predictive maintenance, meeting safety requirements and maintaining network integrity, all of which can be accessed by users through Amazon Alexa.

"Accenture is excited to work with Molex to change the future of human mobility through new network and infrastructure capabilities for autonomous vehicles," said Mark Pintar, MD of Accenture's technology consulting practice. "Our collaboration delivers an engaging customer experience that can adapt to meet the changing needs of users."

Magnachip and Melfas partner on OLEDs

Magnachip Semiconductor is collaborating with Melfas, a provider of touch controller ICs and touchscreen and touch key modules based on capacitive touch sensing, to develop OLED display capabilities for the automotive sector.

OLED technology is deployed primarily in TVs, smartphones and watches. The two companies are working initially for consumer electronics and then for OLED displays in automotive.

Over the past ten years, Magnachip has shipped more than 400 million OLED DDICs, and developed a portfolio of patents related to the design and manufacturing of OLED display drivers.

Melfas has shipped over a billion controller ICs since 2005. Further, it recently launched an OLED touch controller IC and has supplied the same in large quantities to major handset makers.

"Automotive display is an attractive market segment, and this partnership with Melfas will provide opportunities to develop feature-rich and cost-effective products," said YJ Kim, Magnachip CEO.



Scary: Most motorists are fearful of driverless cars

Motorists horrified by driverless cars

More than half of UK drivers say the idea of driverless cars horrifies them, according to a survey by motor retail web site Buyacar.co.uk.

The figures show motorists are more fearful and sceptical about computer-controlled driving than just two years ago.

The retailer has tracked consumer attitudes to the concept of autonomous vehicles since April 2017. In February, the UK Department for Transport announced it wanted driverless cars to start being introduced in 2021.

Two years ago 46% of drivers said the idea of giving up control of their car "horrifies me" but that figure has risen to 56%.

At the same time, the already small percentage of 11% for whom driverless cars were an exciting development has almost halved to just six per cent.

In 2017 almost one in five motorists thought they definitely or probably would own a driverless car one day. That has slumped to 13%. And in a sign of hardening attitudes the number of people declaring they definitely will not own a driverless car at any point is up from 38% to 42%.

Over the past two years fear of not being in control has risen from 55% to 62%. Concerns over poor quality road markings leading to confusion for visual recognition systems are also on the increase, up from 24% to 29% of motorists mentioning it as a factor.

But overall, 44% of drivers now say they just don't trust the idea of a driverless car, compared with 34% in April 2017.

The fear of cyber attacks affecting the behaviour or security of the car has increased from 23% of motorists to 28%.

"There seems to be a gap emerging between the enthusiasm of transport policy planners towards autonomous vehicles and the willingness of today's motorists to accept them," said Buyacar managing director Austin Collins. "Despite the constant flow of headlines about driverless cars arriving in a few years, our analysis of the views of motorists shows enthusiasm waning and fears growing. If driver concerns about their introduction continue, it's possible to imagine it becoming a problem for transport policy makers or even a political issue."

Audi, Ericsson and Qualcomm in cross-border C-V2X trials

Audi, Ericsson, Swarco Traffic Systems, the University of Kaiserslautern and Qualcomm have implelmented a cross-border demonstration of cellular V2X (C-V2X) direct communications.

The companies, which formed the Connected Vehicle to Everything of Tomorrow (Convex) consortium in 2016 to carry out the first announced C-V2X trial based upon the 3GPP Release 14, participated in the cross-border digital testbed Project Day.

This was held last month in Schengen, Luxembourg, at the trilateral testbed hosted by France's Ministry for the Ecological & Inclusive Transition, German Federal Ministry of Transport & Digital Infrastructure (BMVI), Luxembourg Ministry of Mobility & Public Works, and Luxembourg Ministry of the Economy.

Convax, co-funded by BMVI, showcased the reliability, range and performance of C-V2X direct communications between vehicles and with infrastructure, across the three European borders.

Audi vehicles and Swarco's intelligent road infrastructure were equipped with C-V2X technology using the Qualcomm 9150 C-V2X platform. Throughout the event, the platform showed vehicle-to-vehicle and vehicle-to-infrastructure safety use cases, demonstrating the maturity and potential of C-V2X technology and the ability to operate without the need for a sim subscription via PC5.

This potentially addresses problems faced with roaming and network subscriptions.

The use cases included roadworks warnings, in-vehicle information and slow or stationary vehicle warnings.

Swarco provided connected and cooperative traffic management on established channels. In Schengen through the Convex project, Swarco provided C-V2X technology-based communications between real infrastructure components and vehicles on public roads in Europe.

"Digitisation and cross-industry collaboration have always been key to shaping the connected and autonomous vehicles of tomorrow," said Jens Kötz from Audi.

C-V2X is designed to allow vehicles to exchange information with other vehicles, infrastructure and pedestrian devices, and supports automotive safety, automated driving and traffic efficiency. Technology and products are commercially available.

The cross border demonstration follows the cooperation and integration of the technology among the participating companies throughout 2018 and thus far in 2019 around Europe, China, Japan, Korea, Australia and the USA.

The 9150 platform is commercially available and is helping automotive suppliers progress with C-V2X this year along roadways and into vehicles. Further, Qualcomm has also integrated C-V2X into the Snapdragon automotive 4G and 5G platforms, designed to ensure that connected vehicles natively support C-V2X from 2021.

"This demonstration serves as another proof point that we are on our way to reaching our vision for smart transportation, one which supports an increased safety-consciousness and more efficient driving experience," said Enrico Salvatori, senior vice president at Qualcomm.

Bridgestone completes TomTom Telematics takeover

Tyre maker Bridgestone has completed its acquisition of TomTom Telematics for €910m.

First announced in January, the acquisition has passed regulatory stages and had approval from TomTom shareholders.

The acquisition builds on work at Bridgestone to strengthen its digital capabilities. Telematics fits Bridgestone strategically and gives it a reinforced footprint in mobility that makes fleet operations more efficient.

"With demand for fleet-based mobility growing year on year, fleet managers need more than ever before a reliable and innovative partner to help them maximise their effectiveness and efficiency through increased productivity and minimised total cost of ownership," said Paolo Ferrari, CEO of Bridgestone in Emea. "Together, Bridgestone and TomTom Telematics have the tools, insights and experience to fulfil those demands."

AUTOTRONICS TAIPEI

INNOVATION ISLAND

Steve Rogerson reports from last month's Autotronics show in Taipei



Live demonstration of driverless shuttle

The show saw a live demonstration of a driverless shuttle complete with willing volunteers to step out in front of it as it moved along a predetermined route.

The shuttle's sensors detected them every time and nobody was taken to hospital.

The shuttle has already been in action in tests in Taipei and Kaohsiung in the south of the island and is a collaboration between local company 7Starlake, French mobility company Easy Mile, Intel, NEC, NexCobot and iPass.

The bus has been in real life service in Taiwan for nearly two years and at its heart is a military standard rugged computer made by 7Starlake subsidiary Perfectron. This SR200 computer is powered by an Intel Core Haswell i7-4700EQ processor with Nvidia's GT730M graphics card. This was developed in partnership with Thales and Schneider Electric.

"The driverless shuttle is not just a vehicle but a movable IoT platform for a smart city," said Martin Ting, president of 7Starlake. "It can connect not only V2V and V2I data but other IoT to build a virtual smart corridor by picking up residents as part of mobility-as-a-service."

Working with the National Taiwan University of Science & Technology, 7Starlake has developed the Likey app that can be used for making reservations on the shuttle and matching idle vehicles with riders in rural areas.

"The bus can work with an app and you can tell it when you get up or want to be picked up from work," said Ting. "In the future, there will be more smart platforms."

Built-in 2D and 3D cameras at bus stops and inside the vehicle help in data collection and analysis using AI technology.

Dailywell switches to automotive

Dailywell Electronics is hoping to find automotive users for its recently developed piezo and capacitive switches that are already finding applications in the industrial market.

"We have not got automotive customers yet for the new switches, just industrial ones," said Emily Chuang, Dailywell's marketing sales representative. "We are now looking for automotive users."

She said the switches could be used for car ignition or audio controls.

The TC capacitive and TZ piezo switches are rated from 5 to 24V and have an operating life of at least fifty million cycles. Contact resistance is 1Ω maximum and they have an IP68 ingress protection rating.

Coming soon is the HJB series of joysticks and the HRT series of Hall effect rotary switches.

The joysticks are rated at 5V DC and have an operating life of at least five million cycles. Maximum supply current is 23mA and maximum overload voltage is 20V DC.

The Hall switches operate from a 5V supply and have a four degree resolution. Power consumption is up to 12mA and output voltage tolerance is three per cent maximum.

All ranges work from -20 to +65˚C.

The 21-year-old company has a factory in China and offices in China and Taiwan. Nearly two thirds of its output is for export, mainly to Europe and the USA.



Emily Chuang: "We are now looking for automotive users."

Mobileye targets fleet operators



Though Intel subsidiary Mobileye has no office in Taiwan, just a local distributor, the company was at the show to target local fleet operators.

"We want to sell our adas products to the fleet market to increase the safety of drivers," said Andy Mo (pictured), sales manager at the company's China office. "We are looking for fleet customers."

The company was showing how three cameras on a vehicle such as a city bus could cover all the blind spots and give warnings to drivers. And it was happy for other companies to take the credit.

"If you want to have your own branding on our adas products, we can do that," said Mo.

When two is better than four

Two is better than four, believes TC Chi, project manager at E-Lead Electronic. He was talking about the firm's 79GHz radar system that uses just two radars and can be used to replace systems with four ultrasonic sensors for detecting objects behind the vehicle.

As well as being cheaper, it is also easier to install, he said.

But four is the optimum number for cameras on its 360˚ surround vision system that it supplies to Ford and Toyota.

"This is for OEMs, because it needs to be mounted perfectly in the car and designed for the car," said Chi. "It is not suitable for the aftermarket."

The company is also making head-up displays (HUDs) to project information onto the windshield for, among others, Volkswagen and Geely in China.

For the future, the company is designing an augmented reality HUD that could be used as part of an autonomous driving system, but Chi admitted there were technical hurdles to overcome.

The system is working to a degree and was on display at the show, and Chi demonstrated how it could spot and highlight pedestrians and overlay direction information onto the road ahead.

"However, if you look at the image carefully, you sometimes get a double image," said Chi. "The other problem is that if you wear sunglasses you will not see the image. It also needs very precise GPS that is not available in most countries except Germany."

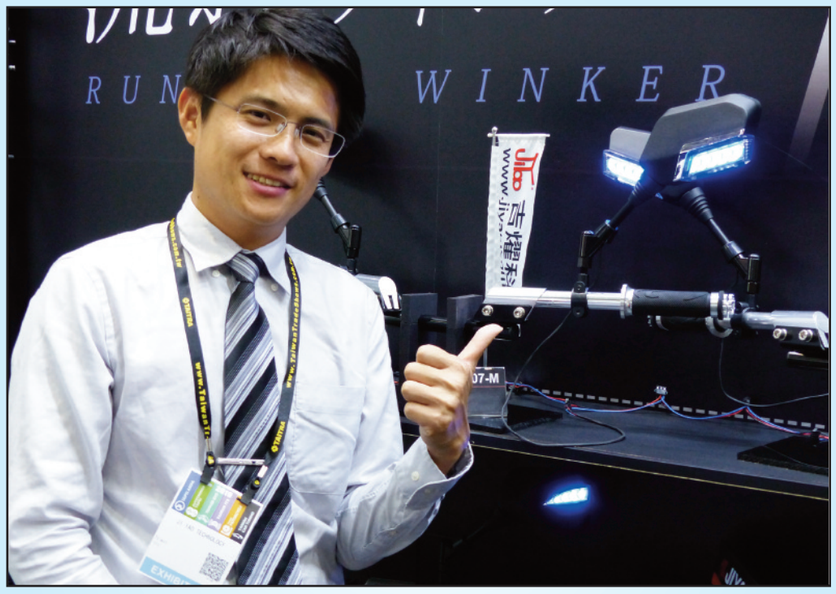
He is confident, though, that these problems can be overcome and reckons that within ten years it will be a part of autonomous vehicles.

"Now, it is still in development," he said. "We are working with several European car makers. They have given us some of their specifications, but it is not easy to make so we are continuing development."



TC Chi

Clever winkers



In just three years, Ji Yao Technology has seen its rear-view mirror with running LED winker sales grow to about ten per cent of the company's business.

"Three years ago, we started doing them," said the company's Jack Huang (pictured). "They have been growing at about thirty per cent per year."

Designed purely for the aftermarket, the products are designed and made by the company with LEDs brought in from Everlight and electronics components from various suppliers.

Taiwan to challenge Infineon on IGBTs

Infineon is running scared of Taiwan challenging its position in IGBT technology, according to Winner Yu, chairman of the Autotronics Collaborative Alliance, part of Teema, the Taiwan Electrical & Electronic Manufacturers' Association.

Infineon is the market leader for discrete IGBTs by some distance, but Yu believes Taiwanese company Actron Technology will next year be in a position to challenge that by matching or bettering Infineon on quality and beating the German company on price.

"Infineon is very scared that Taiwan can do it," said Yu. "It will be good quality and the price will be good."

Actron Technology was established in 1998 and specialises in automotive diodes, alternators, regulators and anti-lock braking systems. It is a supplier to the top six car makers.

Yu predicts that as early as next year Actron will be supplying IGBT technology to major tier-one automotive suppliers.

"We will then be challenging Infineon," he said. "There is just the one company – Actron Technology – at the moment but there will be more in the future."



Winner Yu: "Infineon is very scared that Taiwan can do it."

Making the dashcam connection

A PCB manufacturing company formed in the 1970s by former Intel engineers has grown into a major player in the dashcam market both for aftermarket and direct sales to OEMs.

Mitac Digital Technology claims to have the most complete line for high-end and low-end dashcams with its MiVue range. And it is adapting to modern adas trends with cameras that can be part of lane-departure warning and forward collision detection systems.

The company mainly sells to Russia, China, Japan, UK and the Middle East. It counts among its car-making customers the likes of Volkswagen, Mazda and Ford.

"We are qualified worldwide for Ford," said Tony (TC) Lin, Mitac director. "We also have them installed on BMW motorbikes, front and back."



Tony Lin

Some of the products use GPS with dead reckoning for in-tunnel positioning, and have a gyro fitted to detect not just collisions but on what part of the vehicle the collision happened.

"It collects useful data for the insurance companies," said Lin. "It can show hard braking or fast cornering, so they know about driver behaviour and can adapt the insurance accordingly. You can build a profile of the driver over time."

The company makes all the cameras for cars, including facial recognition cameras to identify authorised drivers.

"Anything for automotive cameras, we do," said Lin.

The company has three factories in China with R&D centres in China, Russia, Taiwan and the USA. It employs around 7000 people.

As well as dashcams, it also makes tablets, wearables and medical devices.

Virtual reality testing for autonomous vehicles

A Japanese company that was founded more than three decades ago writing software for civil engineering is now using virtual reality to create driving simulations that could be a major step in developing autonomous vehicles.

Forum 8 Software Technology dates back to 1987 and fifteen years ago started looking at 3D virtual reality simulation software.

"We have now moved into testing car components for autonomous driving," said the company's Zhena He, "though sixty per cent of what we do is still in civil engineering. But civil engineering also involved traffic simulations so that was the path to vehicle simulations."

For example, the Central Police University in Taiwan uses the simulation software for driver training.

"They use it for training students in traffic safety," said He.

The company imports open-source data on road networks and so on and then defines its own events, such as people crossing the road.



Zhena He: "They use it for training students in traffic safety."

One of the big users in Japan is Hitachi for designing its autonomous construction machines.

"This has led to real vehicles doing construction work," said He.

It can also be used for simulating traffic accidents so emergency services can learn how to deal with a situation. One demonstration at the show saw a car crashing in a tunnel and looking at how other drivers could escape if there were flames and smoke as a result.

The company has also designed an electric power steering simulator for Denso.

"This uses simulated steering loading and virtual reality data to provide streets and highway models," said He. "Normal and abnormal motions are reported."

Show stats

Taipei Ampa combines six shows organised by Taitra, Taiwan's external trade development council. Taipei Ampa is the automotive parts show and acts as the umbrella for Autotronics Taipei for automotive electronics, Taiwan ITS for intelligent transport systems, Taiwan EVS for electric vehicles, Taiwan Motorcycle and Taiwan Car Tuning.

For the first time, the whole event this year was held at the recently expanded exhibition complex in Nangang rather than being on two sites.

The six shows were home to 1340 exhibitors across 3750 stands and were expected to attract more than 7000 international visitors. Just 171 of the exhibitors were from overseas. It is the second largest automotive parts show in Asia behind Automechanika Shanghai.

Wieson ready for 5G

Wieson Automotive is ready for the arrival of 5G with a 5G sharkfin antenna that fits on the top of a vehicle and is available for OEMs.

"We are experts in antennas," said Tony Chang, director of Wiseon's marketing department. "These are smart antennas because we are also experts at connecting things."

The company was established in 1998 and entered the automotive market five years later. It started automotive antenna development in 2007 and before long was supplying the likes of Delphi and Hella.

These days, it employs around 3000 people with four factories in China and offices in France, Germany, Korea and the USA.

As well as antennas, it was showing its Adas XEye that uses Mobileye technology and can alert the driver of potentially dangerous situations.

Functions on the device include forward collision warning, pedestrian collision warning, lane departure warning, and headway monitoring and warning.

Using a single camera mounted on the front windshield, it is suitable for passenger cars, commercial vehicles, buses, lorries and heavy vehicles.

The company also makes GNSS modules with 1cm accuracy.



Tony Chang: "We are experts in antennas."





BEYOND THE CAR

Steve Rogerson reports from last month's Traffex transportation event in Birmingham, UK

For connected and autonomous vehicles (CAVs) to become a reality there needs to be serious developments not just in the vehicles themselves but in the infrastructure that surrounds them.

Autonomous cars cannot work in isolation. They need high definition maps, they need information about traffic conditions and road works, they need to communicate with the centres that control the traffic lights so they are part of an optimised traffic flow through cities, they need to talk with other vehicles.

"CAVs are no longer just vehicles," said Brian Wong, transport director for legal firm Burges Salmon, speaking at last month's Traffex transportation event in Birmingham. "They will have to be connected in the future. Technology is not the biggest obstacle. There are infrastructure issues be addressed. Intelligent infrastructure is needed to make CAVs operate successfully."

For example, he looked at delivery vehicles – the infamous white vans – and pointed out they were becoming a major problem in cities as more goods were ordered online.

"Amazon and the like are looking at electrifying them and automating them as a way out," said Wong.



Brian Wong: "The UK dipped its toe in very early."

Legal hurdles

However, his main focus was on the legal ramifications of autonomous vehicles. He said: "What happens if there is an autonomous vehicle collision? What happens when the vehicle hands back control to the driver? We have to look at all of this. The legal framework is important."

He praised the UK for being proactive in the way it prepared the legal groundwork for autonomous vehicles.

In 2015, the UK government issued a code of practice for autonomous vehicles. This was updated earlier this year.

"The UK dipped its toe in very early," said Wong. "In the USA they are still struggling to get a code of practice up and running."

The UK also brought in its first act on autonomous vehicle insurance last year covering levels four and five autonomy. This means companies can test self-driving vehicles on British roads as long as they are roadworthy, there is a safety driver and they have insurance.

"And the government is revising its code to allow in the future for the safety driver to be taken out," he said. "They are putting in place the structure for these vehicles to be tested and used."

However, there is still a bit of a muddle for level three where the driver has to be ready to take back control. In insurance terms, this is classed as high-level assistance so if there is an accident it will be seen as a driver incident rather than a machine incident.

The UK government is also aware that its public transport regulations are creaking.

"The problems they have had with Uber are nothing compared with what they will have with automated public transport," said Wong. "The UK regulation system will be completely revised and overhauled by 2021."

And he said the current uncertainty over Brexit should not damage that vision even if it led to a change of government.

"Government strategy has been done on a cross-party basis," he said. "If the government changes, I can't see any of this policy changing."

Wong also stressed how important it was to have the public on board.

"If everything works well but the public do not want to ride in them, it will have all been for nought," he said. "Public acceptance is essential."



John Pickworth: "We can use data to nudge people."

Connected corridor

One of the projects in the UK helping with this is the connected corridor in south-east England covering the A2 and M2 roads. This is being partly financed through a European Commission project. Kapsch provided the roadside units.

"The use cases we are testing include road works warnings, green light optimal speed advice and in-vehicle signage," said Barbara Hollinger, business development manager at Kapsch. "We are handling traffic jam incident management and weather conditions and getting this information to the cars directly. In the future, there will also be autonomous cars and they will bring new challenges."

The cars will have various sensors to know what is around them, and these will be connected to the infrastructure. Like Wong, she stressed its importance.

"There will be no autonomous vehicles without them being connected because that is what makes the whole thing work," she said.

A challenge, she said, would be mixed road traffic where autonomous and regular vehicles were on the same stretch of road.

"With fifty per cent of the cars being autonomous, traffic efficiency does not increase but actually decreases," she said. "We will only see real improvements with a lot more autonomous vehicles. There needs to be a very flexible traffic management system to solve the problems of mixed road use."

And she said once this moved from highways into cities, the problems became more complex as the safety of other road users had to be taken into account.

"We are working on improving intersection handling as these are prone to accidents for vehicles and other road users," said Hollinger.

Move to 5G

A big help with the infrastructure problem will be the move of mobile communications from the current 3G and 4G to 5G with its much higher data rates.

"As we move from 3G to 4G to 5G, it will allow us to have much more connectivity," said Jeff Lake, senior manager at Altran. "5G will hopefully give us a smooth flow of data that will help enable autonomous vehicles. By 2020, 5G connectivity will be enabled for the mass market."

He said the amount of data that would be needed for just one autonomous vehicle would be 4000Gbyte per day.

"They need to be constantly aware of their environment, hence the amount of data they need," he said. "The amount of data is vast and the data are flowing in all directions all the time."



Barbara Hollinger: "There needs to be very flexible traffic management."

Before the move to full autonomy, drivers will need to interpret these data and often at speed. Thus, Lake stressed the importance of a clear and simple human-machine interface (HMI).

"HMIs can be too complex," he said. "One of the major requirements is they reduce the workload for the user. Drivers need to get the information by only taking their eyes of the road for half a second to a second."

Information from a linked infrastructure includes how long till the next red light, recommended speed to hit that light when it turns green, if a lane is to be closed up ahead and so on.



Jeff Lake: "5G will allow us to have much more connectivity."

Trusting data

Road users also need to trust the data. At the moment, the volume of data is quite small and the way people use it is relatively cautious, according to John Pickworth, intelligent transport director at 4Way.

"In cities and towns, there is a rich bed of data," he said. "But in the car, we are relatively poor in the amount of data we have."

Pre-journey, road users go on line to plan the route. During the journey, they mostly rely on out-of-date satnav data and road signs. Post journey, there is very little done in the way of analysis.

"And almost all the decision making is in the hands of the user," he said. "We decide whether to drive or go by train. We decide whether to turn left or right. But the data are not trusted."

He said by 2025 there would be a shift is the way data were used and by 2045 the use of data would be hugely improved.

"The data will come direct to the vehicle," he said. "A lot of information will bypass the user and decisions will be made for you. The trust relationship will change."

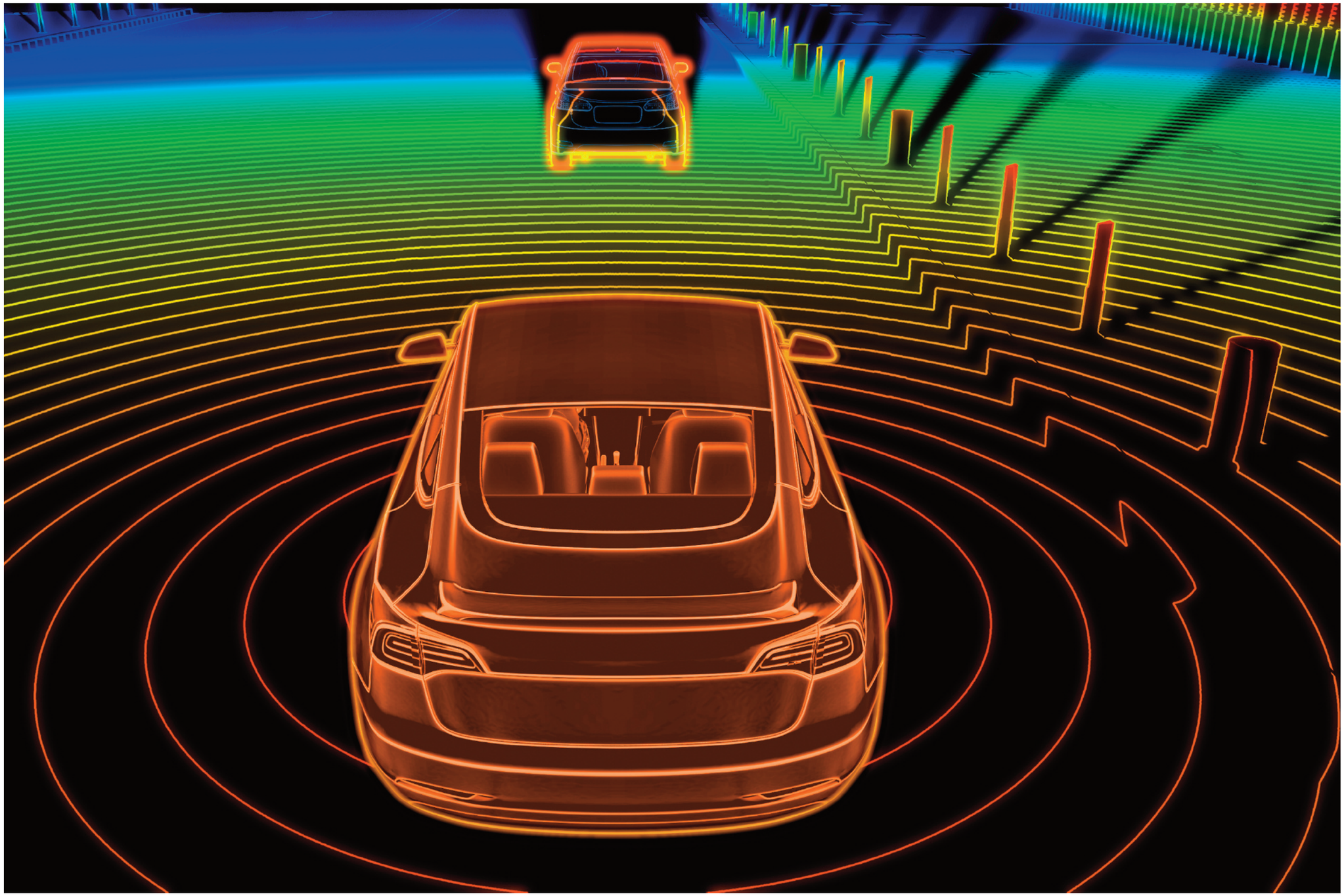
But he said changes are starting to be made today.

"We can use data to nudge people in the way they travel to improve network problems," he said. "We have to look at building trust in the data. If someone gets bad information, they will probably not use that source again. If it comes from an app, they will delete the app."

Conclusion

The move towards autonomous vehicles is gaining momentum but there is still a lot of work to do, not just with the cars themselves but with the infrastructure and communications networks around them. Legal mazes need to be negotiated. More trials are needed. But as seen from this and many other conferences, the industry is focussing on the problems and chipping away at the solutions. So far, so good.

SENSORS



URBAN BATTLEFIELD

Sefa Tanis discusses how the increasing numbers of automotive radar sensors are creating a congested radio spectrum

As automotive radars become more widespread, the heavily occupied RF spectrum will resemble an electronic battlefield in an urban environment. Radar will face a combination of unintentional or intentional jamming attacks, and designers must implement counter-jamming techniques such as the ones used in electronic warfare (EW).

An automotive radar could typically experience a denial or deceptive jamming attack. Denial jamming blinds the victim radar. This technique reduces the signal-to-noise ratio and, as a result, the probability of target detection is degraded.

On the other hand, deceptive jamming makes victim radar think there are false targets. The victim radar loses the ability to track real targets and hence the victim's vehicle behaviour is severely influenced.

These jamming attacks could originate from mutual interference between automotive radars or happen deliberately by simply pointing a strong continuous wave (CW) signal into the victim radar using inexpensive hardware.

While current jamming avoidance techniques might be

adequate for today, with the proliferation of radar sensors, a resilient type of mitigation techniques will need to be used by itself or with the avoidance approaches. Resilient techniques include time frequency domain signal processing or complex radar waveforms.

Radar waveforms

The radar waveform is one of the critical system parameters that determine the sensor performance in the presence of jammers. Automotive radars in today's 77GHz band mainly use FMCW type waveforms. In FMCW radar, a CW signal is linearly swept or chirped in frequency across an RF band. Fig. 1 shows an example FMCW chirp sequence (CS) waveform.

The frequency difference (fB, beat frequency) is proportional to the distance R to the target and can be determined by the following relation:

$$f_B = \frac{2}{c}\frac{f_{sweep}}{T_{chirp}}R$$

Impacts of jamming

Jamming occurs in a dense RF environment when FMCW radar sensors are operating in the same portion of the frequency band. A typical oncoming automobile jamming example is shown in Fig. 2.

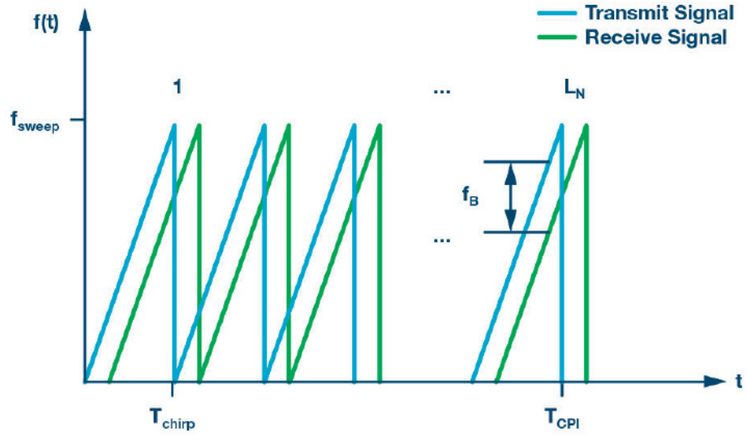


Fig. 1: FMCW CS example

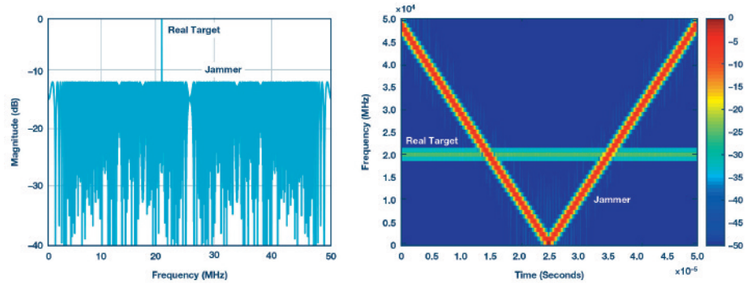


Fig. 3: FFT and STFT domain representation of radar echo IF waveform

Denial jamming

An arbitrary FMCW type strong jamming signal that falls into the receiver bandwidth raises the noise floor of the victim radar. This denial jamming may cause small targets – that is, small radar cross section – to disappear due to the poor SNR.

A denial attack could also purposefully be carried out by simply beaming a strong CW signal into the victim FMCW radar. The impact in the victim radar would be similar to an FMCW jamming case, see Fig. 4.

Deceptive jamming

If the jamming signal sweep is synchronised but delayed with the victim radar, then the impact would be deceptive false target generation at a fixed range. Such techniques are common with EW jammers.

An oncoming automobile radar of a similar type will act as an unintentional jammer. However, the probability of time alignment between victim and jamming radar would be very small.

A jammer delay offset that is less than the maximum range delay of the victim radar could look like a real target. For example, a 200m maximum range would require sweep alignment of less than 1.3μs. However, such a deceptive attack could be carried out intentionally using sophisticated EW-like equipment mounted on the oncoming automobile platform.

More generally, deceptive jamming is based on retransmitting the victim radar's signal with a systematic change in delay and frequency. This can be either non-coherent, in which case the jammer is called a transponder, or coherent, when it's a repeater. Repeaters receive, alter and retransmit one or more jamming signals, whereas transponders transmit a predetermined signal when a desired victim signal is detected by the jammer.

A sophisticated repeater-based attack would typically require a digital RF memory (DRFM). A DRFM is capable of carrying out coordinated range delay and Doppler gate pull off attacks. So, the false target range and Doppler properties are maintained to deceive the victim radar.

Mitigation techniques

Basic radar jamming mitigation techniques mostly rely on the avoidance approach. The objective is to reduce the probability of overlap in space, time and frequency such as:

- **Spatial:** Use of narrow and electronically scanned beam can reduce jamming risk. A typical field of view for long-range automotive cruise control radar is ±8°. Nonetheless, a strong jammer could still be effective through the antenna side lobes.
- **Temporal:** Randomise FMCW chirp slope parameters to avoid periodic jamming.
- **Spectral:** Randomise FMCW chirp start and stop frequencies to reduce the probability of overlap and jamming.

The basic methods of randomisation would avoid accidental synchronisation with other radars, but might not be as useful in dense RF environments. The growing number of radar sensors will require more sophisticated resilience techniques to mitigate the jamming.

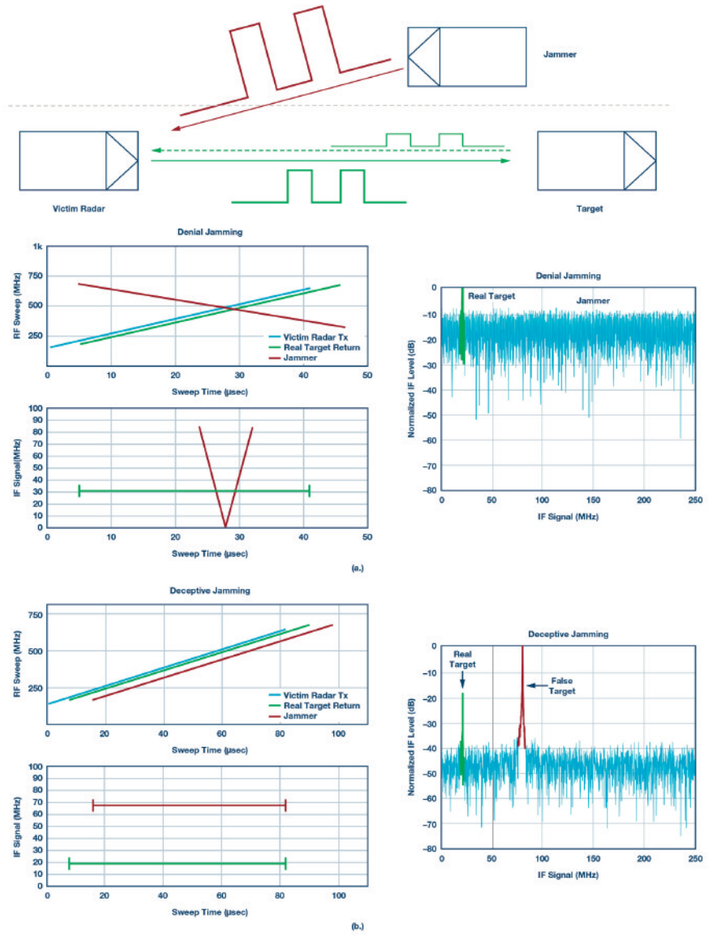


Fig. 2: Examples of a) FMCW denial jamming and b) FMCW deceptive jamming

Detect and repair

An alternative method of avoidance could be used to repair the received waveform using signal processing algorithms. Time frequency domain techniques could be effective against the denial type of jamming attacks.

In the oncoming automobile FMCW jamming scenario, the jammer sweeps all frequency bins for a very short duration of time. This fast time varying signal manifests itself as a raised noise floor in regular FFT domain. Time frequency domain signal processing technique transfers the signal to another domain where it is easier to filter out the jamming in comparison to FFT domain, see Fig. 3.

For time varying signals, a short time Fourier transform (STFT) provides more information than a regular FFT. STFT-based

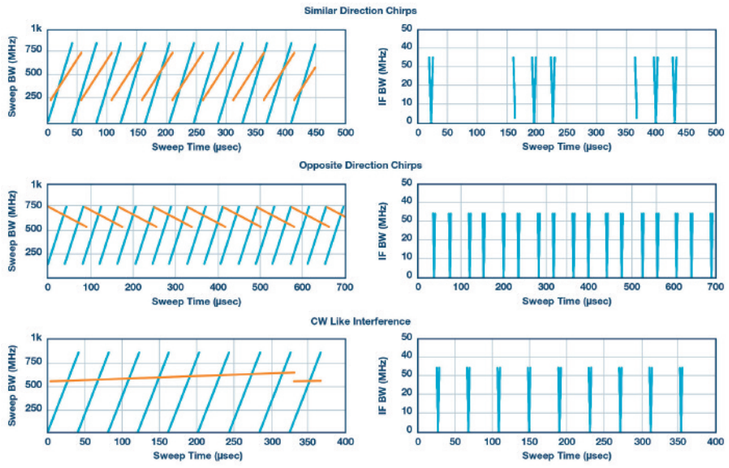


Fig. 4: STFT domain, left: FMCW radar and jammer, right: IF domain

techniques could be used for narrow-band jamming excision. The STFT essentially moves a window through the signal and takes the FFT of the windowed region.

The signal is filtered in the frequency domain to remove the jammer components before being transformed back to the time domain. Fig. 4 shows a typical FMCW jamming scenario of overlapping RF chirp sequences along with resulting IF beat signal in the STFT domain.

The plots on the right of Fig. 4 show the IF domain that is the end result of the mixing of radar (blue) and jamming (orange) signal. A horizontal line would indicate a target, whereas V shaped vertical lines indicate the presence of a jamming signal.

Similar or opposite direction jamming FMCW, or even a CW-like slow chirp, have similar impacts in the IF signal. In all of these jamming scenarios, the fast moving V shaped IF signal raises the noise floor in the regular FFT domain, as shown in Fig. 3.

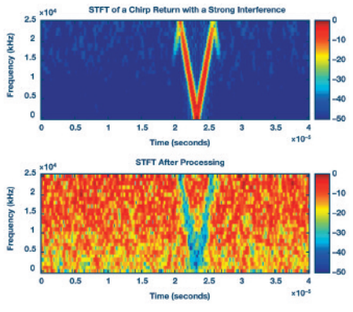


Fig. 5: Amplitude-based masking in the STFT domain

An amplitude-based masking could be used to filter out the jamming signal in the STFT domain. This assumes, of course, that the victim radar front end and quantisation have enough dynamic range to process the stronger jammer signal and the small intended target linearly at the same time, see Fig. 5.

The top image of Fig. 5 depicts a strong jammer, while the bottom shows an STFT after processing. Multiple real targets are not visible in the presence of a strong jammer, as in the top. The V shaped jammer in the lower plot is excised and the low SNR targets would now be discernable when transferred back to the time domain.

The STFT-based jamming mitigation technique could be used in denial jamming scenarios against strong jammers. For deceptive jamming attacks, an STFT alone cannot authenticate whether the return signal is real or false.

Encrypted RF

The elementary countermeasure to reduce the impact of deceptive jamming from repeater attacks is the use of low probability of intercept (LPI) radar waveforms. The objective of an LPI radar is to escape detection by spreading the radiated energy over a wide spectrum of frequencies, usually via quasi-random sweep, modulation or hopping sequences. FMCW is a type of LPI waveform. If phase coding or encryption is introduced into the frequency chirp, it is possible to reduce further the chances of a DRFM intercepting the automotive radar signal.

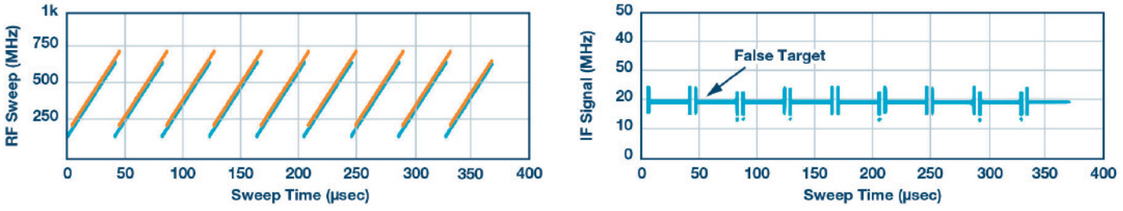


Fig. 6: Jamming due to identical radars with frequency offset and delay

An encrypted RF signature unique to each radar sensor could authenticate the return signal. Fig. 6 shows a use case where two identical radars – one of which is mounted on a different automobile – with frequency offset and delay between them generate a false target in the victim radar. The jamming radar is time aligned – same chirp slope and a short offset – with the victim radar.

Phase coded FMCW radars could offer high jamming robustness in this use case. The use of orthogonal codes could also make mimo radar operation possible by enabling multiple simultaneous transmit waveforms.

The requirements of coding are:

- **Code length:** The goal is to achieve minimal range sidelobe levels with short sequences. A PRN sequence length of 1024 results in a peak side lobe level (PSLL) of about 30dB (10log1024). Transmit codes together with the receive filter weights could be optimised to improve the PSLL at the expense of SNR.
- **Good cross-correlation properties:** Cross-correlation coefficients of the members of a set should be zero to achieve a good separation between sensors.
- **Doppler resistance:** Phase coded radar performance could suffer from the Doppler shift. Binary codes are Doppler intolerant. Polyphase codes degrade less rapidly than binary codes.
- **Available number of different codes:** A large family size is better to assign a unique code to each radar sensor.

Fig. 7 illustrates the radar echo with no phase coding. The jamming signal shows itself as a false target. When the transmitter FMCW waveform is phase coded with a PRN sequence, the jamming signal could be suppressed, as shown in Fig. 8.

The dynamic range is compromised with this method. However, the radar signal processor could use phase coded FMCW for a few chirps to flag a false target and then switch back to normal operation.

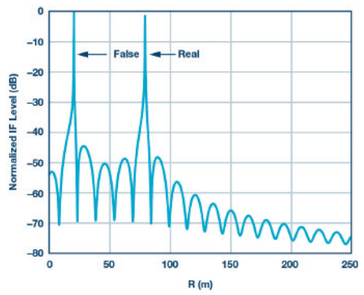


Fig. 7: Radar return without phase coding false and real targets

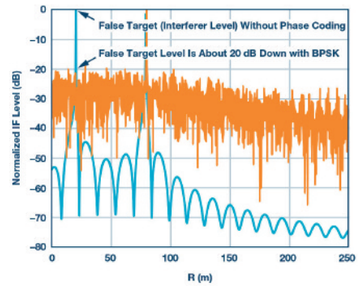


Fig. 8: Radar return with and without phase coding

Conclusion

Jamming in congested automobile radar sensor environments can be mitigated using advance signal processing algorithms and complex waveform generation techniques. STFT-based signal processing techniques could be used against denial type of attacks. Phase coded FMCW provides an additional layer of resistance to both non-coherent and coherent deceptive attacks by means of processing gain and interception avoidance.

The jamming mitigation principles for automotive radars are also applicable to other radar sensor environments, for example robotics, road tolling, GPS and UAV landing or collision avoidance systems.

Currently, automotive radar sensors are operating in non-cooperative mode without communicating with each other. Although a cooperative mode would require industry-wide harmonisation, the arbitration between radar sensors could help resolve the interference issue.

A future radar concept including the sensor cooperation would be the fusion of communications nodes and radar sensors. Future radars with complex waveforms offer the possibility to include information in the radar signal as well. The same hardware could be used for radar and communications simultaneously.

Sefa Tanis is a senior RF systems engineer at Analog Devices



SENSORS



Continental says its hybrid V2X-platform makes driving safer

Tawhid Khan looks at how C-V2X is seen as an enhanced adas sensor for cost effective and efficient driving

A key reason for cellular vehicle-to-everything (C-V2X) development is to meet automotive industry demand for autonomous driving technologies. In this context, C-V2X point-to-point communications are viewed as a wider radio communication sensor, complementing camera, radar, lidar and other traditional adas sensing technologies.

Furthermore, C-V2X is becoming a critical requirement to predict potential upcoming dangers and reduce driver reaction time in hazardous conditions.

At Mobile World Congress in Barcelona in February, Qualcomm demonstrated C-V2X use cases to illustrate a cost effectiveness and energy efficiency of driving with C-V2X advanced sensing, compared with dedicated short-range communication (DSRC) V2X. However, even with these benefits of C-V2X, technical specialists from Qualcomm expect 25 per cent of vehicles will be equipped with C-V2X by 2023, leaving 75 per cent with DSRC V2X or no V2X at all.

Mixed communication in V2X will continue for at least five years. In this context, the hybrid V2X from Continental can solve near- to medium-term connected car problems. This integrates 4G and 5G network access, as well as DSRC and C-V2X, for direct V2X communications.

It allows vehicle manufacturers to overcome the challenge of mixed communications issues when deploying V2X. It is important to note that C-V2X has strong support in China, South Korea and North America. Support is also growing in Europe, as well as among vehicle manufacturers.

And 5G connectivity will quickly gain market share in the automotive market in 2023, and it is forecast to be the leading technology in 2027. China and the USA will be the early adopters of these technologies. The combination of these communication technologies will certainly increase connected car features available to consumers.

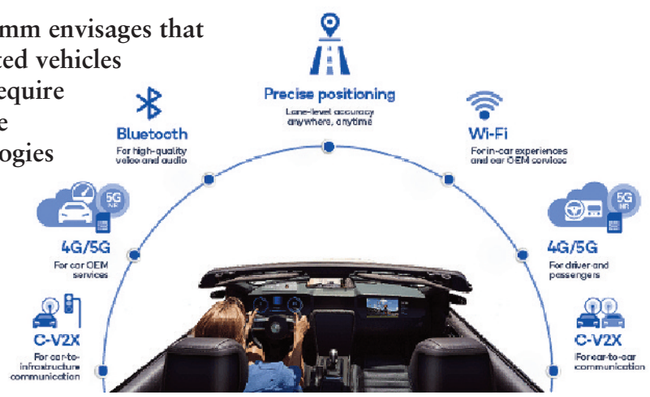
Monetisation

C-V2X is designed to make travel safer, while allowing lower future infrastructure costs and coverage for priority services. As such, governments around the world have mutual interests in this technology. A key challenge is how to monetise the C-V2X communication process. One idea put forward by Ericsson is a dual-sim telematic ECU in the vehicle, with private-public cellular communications access. The telematics must be equipped with C-V2X functions.

To meet the private-public communications, the answer needs to cater for two communication channels; primary and secondary. The order of channel usage can be debated; however, one method is that the primary channel can be used for car manufacturer's LTE and 5G telematics applications. The secondary communication channel is a secured point-to-point cellular V2X public communication, which can be funded by federal state and local governments. Ericsson argues that this method will improve digital network coverage from mobile network operators, which is a key demand from certain governments.

Tawhid Khan is consulting director for IHS Markit

Qualcomm envisages that connected vehicles could require multiple technologies



Vehicle Electronics

DISPLAYS



DIM VIEW

Szukang Hsien explains how local dimming creates safer automotive displays

Inside a typical car today, there can be up to 13 screens. As automotive OEMs move towards level-five fully autonomous vehicles, an even larger array of high-resolution screens will become the norm.

Designing automotive displays requires careful management of voltages, mitigation of electromagnetic interference, a high contrast ratio, and adherence to functional safety standards.

Early digital instrument panels from the 1970s and 1980s displayed fairly basic information by today's standards: speedometer reading, outdoor temperature, fuel level. These displays also faced a lot of criticism – they were expensive to repair and, unlike their analogue counterparts, they couldn't provide a sense of continuous acceleration. And they were were hard to see in bright light.

By the 1990s, many vehicle manufacturers returned to traditional analogue gauges. A decade later, however, manufacturers began incorporating digital speedometers into hybrid vehicles.

Today, Tesla provides a glimpse of where the industry seems to be headed: a large centre information display (CID) delivers not only a variety of infotainment functions, but its touchscreen also provides driver control functions and a large instrument cluster display in front of the driver. Also, Byton, for its smart electric vehicles, offers one long 124.5cm display that covers the whole dashboard.

Automotive displays can be found in many sections of today's cars: the instrument cluster (1), the CID (1-2), front passenger area (1), smart back mirror (1), side-mirror replacement (2), heads-up display, or HUD (1), steering wheel (1), rear-seat mount on the head support (2), and rear-seat control (1-2).

Over the next several years, in-vehicle screens of greater than 86cm will become commonplace, as will resolutions of 4K and, eventually, 8K. As these displays become more and more important, especially as part of adas, digital instrument clusters or HUDs, their image content must maintain certain functional safety requirements.

Dimming

Many TVs and smartphones now boast crystal-clear displays courtesy of organic light-emitting diode (OLED) technology. However, OLED is not yet automotive qualified. Also, the pricing for large OLED displays is very high. This is where local dimming comes in.

Local dimming provides a very high contrast ratio to make colours more crisp and vivid and to turn black into a true black. Compared with OLED, local dimming has demonstrated lower cost levels and higher reliability in automotive applications.

The local dimming LED is placed on the back of the display instead of on the edge, then certain regions of a display can be turned off while not in use. Thus, local dimming technology can also help lower power consumption, which becomes much more important for larger displays.

In addition, when driving at night, eyes can be bothered or even fatigued by the instrument cluster's grey light. Display locations that can benefit from local dimming include the instrument cluster, CID, front passenger area and side-mirror replacement display.

Walking through the design of typical application circuitry for local dimming (Fig. 1), the input would come from the battery through a DC-DC, either a buck or a buck-boost converter and controller, depending on the current. The LED strings would all be connected together to the DC-DC.

To optimise efficiency and thermal performance, the feedback pins would be connected together. The IC must be able to support daisy chaining and SPI and a fault pin must be in place to communicate with the microcontroller.

Functional safety

ISO 26262 provides an international standard for safety-critical components in automotive systems. It encompasses a series

	Asil B	Asil C	Asil D
Single-point fault metric	≥90%	≥97%	≥99%
Latent-point fault metric	≥60%	≥80%	≥90%

Table 1: Common Asil metrics, measuring robustness to a single point and residual faults, as well as robustness to latent faults

of steps to manage functional safety throughout the entire product development process, covering the hardware, software and system levels.

The automotive safety integrity level (Asil), which classifies the inherent safety risk in an automotive system, is a key part of complying with ISO 26262. See Table 1 for an outline of common Asil metrics.

Rather than focusing on the technologies used in a system, Asil is centred on the potential for harm to the driver and other road users. There are four Asil levels, each determined by severity (of injuries), exposure (probability) and controllability. Asil D requires the most safety-critical process and testing.

Electric power steering, engine management, braking, side-view cameras (mirror replacements) and airbag deployment are examples of automotive systems that typically would require Asil D compliance.

Automotive displays, such as the instrument cluster, HUD and side-mirror replacement, generally fall in the realm of Asil B.

Two examples of instrument cluster display blocks that should meet functional safety standards are the TFT bias for power management and the LED backlighting driver. The TFT bias typically consists of AVDD and NAVDD voltages for the TFT source driver, VGon and VGoff voltages for the TFT gate driver and, in some cases, Vcom voltage for the LCD backplane. I²C and a fault pin are used to communicate with the host microcontroller unit (MCU).

An Asil B-compliant TFT bias block would have these components:

- I²C (data signal and the clock signal) and the fault pin for performing setting adjustments and diagnostics on each rail;
- Undervoltage and overvoltage on each rail;
- Internal resistors with fixed or adjustable voltage through I²C; since external resistors mean more points of failure, many designers avoid them;
- Redundant reference; and
- Open enable to provide additional redundancy; when the enable is open, then the chip will look at another pin to determine whether it is on or off.

As for the LED backlighting driver, in this block, the input typically connects directly to the car battery, which has voltage protection when the output is short. Based on the number of LEDs per string, the output can either be a boost or single-ended primary-inductor converter (sepic). I²C and a fault pin are needed to communicate with the MCU. An Asil B-compliant LED backlighting driver would look like this:

- SPI or I²C with fault pin communicating with the microcontroller for setting adjustments and diagnostics on each rail;
- Open-short LED per string

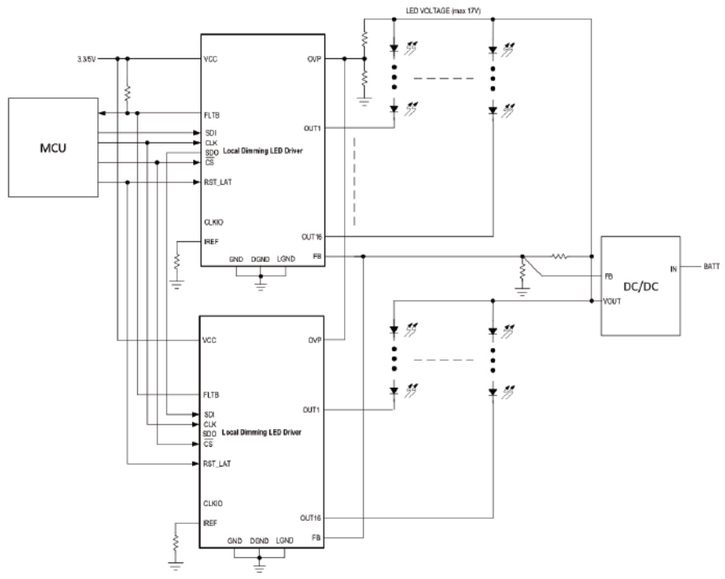


Fig. 1: Typical local dimming LED driver application circuitry



Byton provides one long 124.5cm display that covers the whole dashboard

diagnostics; and
- Redundant reference.

Fault scenarios

With the TFT bias, there are three common fault scenarios to be aware of: Vcom voltage goes out of range; VGon voltage is overvoltage; and fail-safe operation with open enable pin.

An Asil B-compliant TFT bias block would mitigate these faults. In the first two situations with Vcom and VGon voltages, the fault pin alerts the microcontroller of the scenario and the microcontroller then reads the register to validate the situation, using I²C to adjust the voltages accordingly.

In the fail-safe operation scenario, when the enable pin is open while FEN is still high, the output voltages will fall back to the default settings. The microcontroller can adjust the voltage via I²C.

LED drivers also come with some common fault scenarios, which can be mitigated if the LED driver is Asil B compliant.

When string one has LED open, the fault pin alerts the microcontroller, and the microcontroller reads the I²C register to know which LED string has an open. The MCU will show the error or other important message on the display. Also, the MCU has the option to increase the current or PWM duty on other strings.

If string two has an LED short, as with the previous scenario, the fault pin will alert the MCU, and the MCU will read the I²C register to know which LED string has the short. To save power, the LED driver will shut down the string with the short. The MCU will show the error or other important message on the display. Also, the MCU has the option to increase the current or PWM duty on other strings.

If the boost output voltage is too low or too high, the fault pin again alerts the MCU, and the MCU reads the I²C register to know that the boost voltage is low. The MCU has the option to turn off the DC-DC and the LED driver.

Summary

Automotive displays warn drivers to brake if they have not yet depressed the pedal, tell them if they're veering into the next lane, indicate where the blind spots are, and much more. As important vehicle safety components, these displays must meet stringent standards and reliably deliver clarity in all types of driving conditions. The combination of functional safety compliance and local dimming in automotive-grade ICs can help designers deliver high-performing displays that facilitate a safer driving experience.

Szukang Hsien is executive business manager for Maxim Integrated's automotive business unit

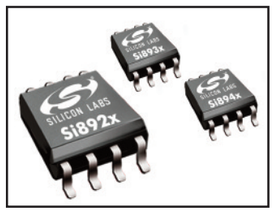


Isolated amps control current and voltage

Isolated analogue amplifiers, voltage sensors and delta-sigma modulator (DSM) devices from Silicon Labs can provide flexible voltage, current, output and package options for electric vehicle battery management and charging systems.

The isolation technology can keep controllers safe across wide temperature variations with 1414V working voltage and 13kV bipolar surge.

The Si892x isolated analogue amplifier is for shunt-current sensing.



The Si8931/2 isolated analogue amplifiers are for general-purpose voltage sensing. The Si8935/6/7 isolated DSM devices are for voltage sensing. And the Si8941/6/7 isolated DSM devices are for shunt-current sensing.

The 75kV/μs immunity to fast transients ensures reliable and accurate current readings. The family also supports a fail-safe indication to the host controller if the high-side supply voltage is not detected.

The devices provide typical offset error as low as ±40μV and ±0.1% gain error.

Typical offset drift is down to ±0.15μV/°C and typical gain drift as low as 6ppm/°C.

Typical signal-to-noise ratio is up to 90dB. A low-power mode automatically reduces current draw on one side of the isolation barrier to approximately 1mA whenever voltage is removed from the other side, enabling a controller to manage power with a field-effect transistor.

The current or voltage-optimised devices have single-ended, differential or DSM output with ±62.5mV, ±250mV or 2.5V input ranges.

A stretched wide-body soic-8 package supports 5kV rms isolation and 9mm creepage and clearance. A narrow-body soic-8 supports 2.5kV rms isolation.

SM gate drive transformers

The HA42A and HA86A gate drive transformers from TT Electronics have a miniature surface mount design for battery management system applications.

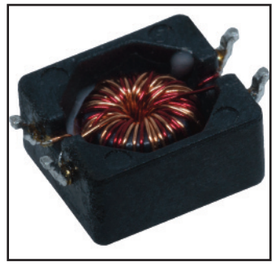
They can be used in space-constrained scenarios to deliver controlling pulses while isolating the mosfet and the controlling drive circuit.

Mechanically robust with lower leakage inductance, they can reduce turn-on and turn-off delay time to improve performance.

The HA86A has higher current capability and lower temperature rise performance.

Made of a toroid core ferrite material, the HA42A and HA86A have roll-off inductance characteristics that maintain efficiency without affecting temperature.

They are AEC-Q200 certification and RoHS compliant.





LED drivers deliver 250mA

Nexperia has extended its constant current LED driver family with eight AEC-Q101 qualified devices to drive low- and medium-power LEDs up to 250mA.

The 16V NCR32xx and 40V NCR42xx series are available in two package styles, the sot-457 (SC-74) and sot-223 (SC-73), a slightly-larger option that delivers a higher-power capability of up to 1250mW.

The LED drivers have an accurate, stabilised output current of 10mA without an external resistor; if an external resistor is used then the output current is adjustable up to 250mA. Voltage overhead is down to 1.4V. For extra ruggedness, the junction temperature of the drivers is +150°C.

They suit constant current source and automotive applications including interior and exterior lighting such as for door handles, dashboards, number plates, indicators and rear lights.

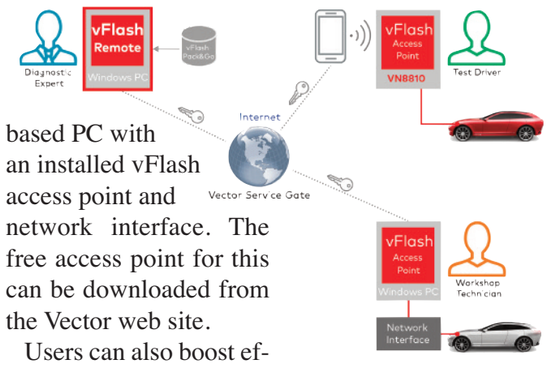
Tool flashes ECUs from distance

The vFlash Remote tool completes Vector's remote diagnostics offering that consists of the Indigo Remote diagnostic tester and the Remote D-PDU API.

The vFlash Remote gives diagnostic users the option of flashing ECUs remotely, independent of location. Users benefit from flexibility and reliability, especially on vehicle test drives and offshore production plants.

The tool makes it easier to re-programme ECUs remotely, independent of location and without much organisational effort or cost.

To set up the communications infrastructure, the user uses it as the flash tool and connects to an access point on the vehicle remotely over the internet. In turn, two possible pathways are available for the remote interface: either simply via the intelligent VN8810 diagnostic device that already integrates the vFlash access point or via a Windows-based PC with an installed vFlash access point and network interface. The free access point for this can be downloaded from the Vector web site.



Users can also boost efficiency and reduce costs by reusing existing flash packs for remote applications that have already been created with vFlash.

Focal points include the security and reliability of the flashing procedure. The remote connection between vFlash Remote and the access point is always encrypted. This ensures that flash data cannot be seen or manipulated by third parties.

Furthermore, the transfer of flash data to the access point is decoupled from ECU reprogramming. Reprogramming is not started until the data to be flashed have been fully transferred to the access point and passed a plausibility check.

The user gets added transparency from continuous display of progress information during the flash procedure, qualified status feedback after completion and optional generation of a report for documentation purposes.

It works with flash templates that implement the flash specifications of the automotive OEMs. More than 130 templates are available for over 70 OEMs.

Sensor IC improves safety

An automotive grade current sensor IC from Allegro Microsystems can improve safety and efficiency in EV chargers.

The ACS71240 AEC-Q100 qualified, monolithic Hall effect current sensor ICs have an output signal immunity to stray magnetic fields created by adjacent motors or current carrying wires. Signal accuracy is better than ±1.5% typical. And there is output signal immunity to noisy supply voltage rails. Typical response time is 1.5μs.

The fault output provides a way to detect short-circuit events to prevent damage to mosfets or IGBTs in inverter, motor and other switching power electronics.

The device comes in two form factor packages, each providing different levels of galvanic isolation. The 3 by 3mm, wettable flank QFN package can be used on voltage rails up to 120V DC and enables solder joint inspection required in zero PPM automotive applications. The soic-8 package is UL certified to 2.4kV RMS of isolation and has a working voltage of 420V DC or 297V RMS.

They can replace shunt resistors, op-amps, current transformers and voltage isolators in applications that require small form factor, monolithic sensors.



Linear LED controller with dimming feature

An automotive-compliant linear LED controller from Diodes has an operating voltage of 4.5 to 60V.

The AL5816Q supplies an output drive current of 15mA to control LED lights through an external bipolar junction transistor, delivering a constant current of a few milliamps up to 1.5A, or higher LED current if a mosfet is used.

This ability to optimise the external transistor makes the device suitable for many automotive



LED lighting applications, such as rear light clusters, interior illumination, instrument panels and licence plate lighting.

The combination of a high-input voltage and high-output drive current, coupled with a high-voltage PWM dimming feature, means car makers can reduce cost for a wide range of applications.

The five-pin sot-25 package requires few external components and does not need a separate switching inductor.

The feedback pin operates at 200mV so the device can control the LED drive current precisely while reducing the drop-out voltage and the LED system power dissipation.

The high-output drive current means it can drive a single LED, an LED chain or multiple LED channels. The PWM dimming input accepts a signal operating at up to 50kHz.

Protection features include input under-voltage lock-out and over-temperature shutdown.

Oscilloscope tackles Automotive Ethernet tests

A mixed-signal oscilloscope from Teledyne LeCroy has a 39cm display, bandwidths from 500MHz to 4GHz, and sample rates up to 40GS/s. Resolution is up to 11bit.



The WaveRunner 9000 is said to have the industry's deepest toolbox and the most complete collection of serial data debug and validation offerings, making it suitable for embedded, automotive, and EMC and EMI test applications.

Various test, debug and validation tools make it suited to testing embedded computing systems. Serial data triggering and decode packages provide flexible serial triggering with an intuitive colour-coded decode overlay.

Measure-graph and eye-diagram test packages enable extraction of decoded data and subsequent waveform data plots, performing bus-timing measurements and creating eye diagrams for testing against standard or custom masks.

These tools cover all aspects of Automotive Ethernet validation and debug, including 1000-baseT1 and 100baseT1 compliance tests.

It can provide improved resolution with bandwidth trade-offs by filtering, and each channel can be filtered independently. The filtered result shows the improvement in the number of effective bits at a given bandwidth.

For EMC and EMI compatibility applications, it accurately characterises EMC test signals with a 40GS/s sampling rate and 1% gain accuracy.

The spectral analysis mode pins down high harmonic peaks across a wide EMC band using an interactive peaks and markers table.

A dedicated EMC pulse parameter measurement package lets the user tailor measurements to specific EMC and ESD standards.



ESD protection to 1kV

Compact AEC-Q200 compliant power inductors from Murata provide up to 1kV ESD protection for automotive applications.

The additions to the DFE series of power inductors have been developed for use within in-vehicle applications such as adas, infotainment and powertrain components.

The DFE2HCAH measures 2.5 by 2.0 by 1.2mm and provides 1kV protection, and the DFE2MCAH measures 2.0 by 1.6 by 1.2mm and is rated at 500V ESD protection.

Both are fabricated using metal alloy material and accommodate the automotive operating range from -40 to +150˚C.

Inductance values are from 0.33 to 2.2μH with a value-dependent maximum current rating of 5.8A.

Four channel IC for camera modules

With automotive camera modules becoming smaller, designers can use Maxim's Max 20049 power management IC that integrates four power supplies.

There are options to support various output voltages, while also providing fault mitigation by flagging faults and shifts in output voltages.

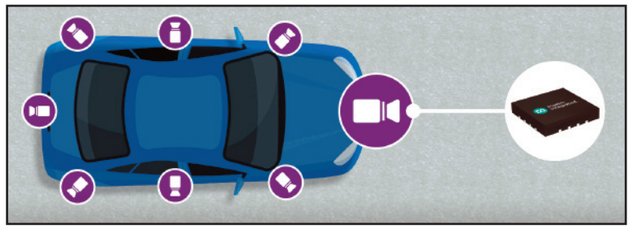
The four-channel device has a PCB footprint of 38mm^2. The four outputs – dual bucks and dual LDOs – come in a 3 by 3mm QFN package.

Protection includes over-voltage protection, under-voltage lockout, external power good signal and cycle-by-cycle current limit. System efficiency at full load is 74 per cent.

The dual buck converters and low-noise LDO support a voltage input from 4 to 17V, enabling power-over-coax, typically from 8 to 10V. There is also an option of using one of the buck converters as an intermediate supply for generating typical sensor plus serialiser rails.

It optimises thermal performance and reduces coax inrush current at start-up. Flexible sequencing and fixed output voltages support various image sensors. It flags faults and shifts in output voltages to ensure cameras are working as intended.

Spread spectrum and 2.2MHz switching frequency mitigates electromagnetic interference to meet Cispr low-noise specifications.



Sensor checks cabin

An automotive 2MP image sensor from Omnivision is for cabin and occupant monitoring.

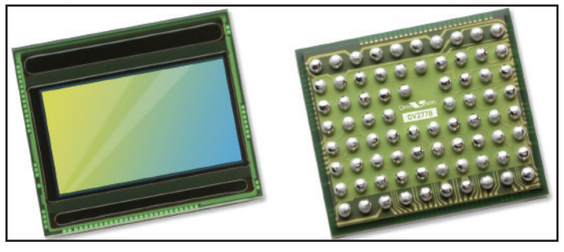
The OV2778 RGB-IR sensor suits interior applications such as detecting packages and unattended children, as well as video-conferencing. It comes in a 6.5 by 5.7mm CSP and can be used with adas.

Built on 2.8μm Omni-BSI-2 Deep Well pixel technology, it delivers a 16bit linear output from a single exposure. With the second exposure, the dynamic range increases to 120dB, which reduces motion artefacts.

There is an integrated RGB-IR, 4x4 pattern colour filter and external frame synchronisation capability for varying lighting conditions.

The sensor is AEC-Q100 grade two certified.

Samples are available , along with a plug-and-play reference design that can be connected to any vehicle for development.



SiC mosfets and diodes power EVs

Microchip has announced the production release of silicon carbide (SiC) products for high-voltage power electronics in electric vehicles and other high-power applications.

The 700V SiC mosfets and 700 and 1200V SiC Schottky barrier diodes (SBDs) join its existing portfolio of SiC power modules. The more than 35 discrete products that have been added are available in volume, supported by development services, tools and reference designs.

The family of SiC die, discretes and power modules are offered across a range of voltage, current and package types.

The SiC mosfets and SBDs are said to offer more efficient switching at higher frequencies and pass ruggedness tests at levels considered critical for long-term reliability.



They are suited to the growing number of EV systems including external charging stations, onboard chargers, DC-DC converters, and powertrain and traction control.

The portfolio is supported by SiC Spice models, SiC driver board reference designs and a power factor correction Vienna reference design.

Inductor works up to 155˚C

An expansion to Vishay Intertechnology's automotive grade IHLP low-profile, high current inductors is a device in the 2020 case size. The Dale IHLP-2020BZ-5A combines a temperature to +155˚C with a profile of 2mm for under-the-bonnet applications.

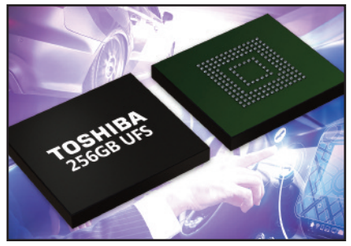


The AEC-Q200 qualified device is for energy storage in DC-DC converters up to 2MHz. It provides attenuation of noise in high current filtering applications up to the SRF of the inductor.

The device is for filtering and DC-DC conversion in engine and transmission control units, diesel injection drivers, and entertainment and navigation systems, in addition to noise suppression for motors, windshield wipers, power mirrors and seats, HID and LED lighting, and heating and ventilation blowers.

Typical DCR is from 7.3 to 181.0mΩ and inductance from 0.47 to 10.0μH. Rated current is to 13.43A and it handles high transient current spikes without saturation.

Packaged in a 100% Pb-free shielded, composite construction that reduces buzz, the inductor has resistance to thermal shock, moisture and mechanical shock. It is RoHS-compliant, halogen-free and Vishay Green.



Embedded memories

Toshiba has begun sampling automotive UFS Jedec 2.1 embedded memories that support a temperature from -40 to +105˚C and meet AEC-Q100 grade-two requirements. The line consists of four capacities – 32, 64, 128 and 256Gbyte.

The embedded NAND flash memory devices integrate BiCS 3D flash memory and a controller in a 153-ball FPGA package. They include a HS-G3 interface and operate from a supply of 3.3V (memory core) and 1.8V (interface).

Added functions include refresh, thermal control and extended diagnosis, which suit automotive requirements. The refresh function can be used to refresh data stored in UFS, and helps extend the data's lifespan.

The thermal control function protects the device from overheating in high-temperature environment. The extended diagnosis function helps users understand the device's status.

Hall effect sensors support Sent protocol

TDK has expanded its Micronas linear Hall effect sensor portfolio with the programmable Hal 1890 supporting the latest Sent protocol according to SAE J2716 Rev 4.

The device comes with digital output signal supervision and is as small, robust and cost-effective as the existing Hal 188x variants.

For measuring angles of up to 90˚ or linear displacements of a few millimetres in harsh environments, it can be used as a gear position detection sensor in dual-clutch automatic transmission or as a steering torque sensor for industrial or recreational vehicles.

The sensor supports Sent data frame formats H.2 and H.4 as well as error signal transmission on fast and slow channels. Several programmable output signal clamping levels extend the error signalling capabilities to indicate various fault conditions, such as under and overvoltage, under and overflow of the signal path, and overcurrent.

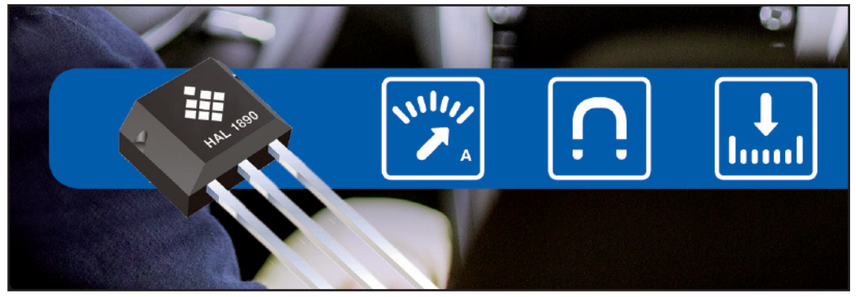
The signal path enables flexibility via external programming: characteristics, such as magnetic-field range, sensitivity, offset and temperature coefficients, are programmable in non-volatile memory.

A one-pin programming interface enables simultaneous programming of several sensors via their output pins.

The device generates an accurate and customised output from a magnetic input signal and provides 10bit output resolution supporting a maximum bandwidth of 5kHz.

It is qualified according to AEC-Q100 and is housed in a standard three-pin TO92-UA package, lead free with matte tin lead frame plating. It comes with two pin configurations: an in-line version with 1.27mm pin-to-pin spacing or a spread-pin version with 2.54mm pin-to-pin spacing, which is more suitable for welding.

Samples are available. Production is planned for the second half of 2019.



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

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

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

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

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

© 2019 Vehicle Electronics
ISSN 2055-1177

Vehicle Electronics is available to readers worldwide. It will be published twelve times a year in a digital-only format. The magazine complies with GDPR. All rights reserved. No part of Vehicle Electronics may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying or recording on any information storage system, without the written consent of the publisher. The publisher cannot be held responsible for loss or damage to unsolicited press releases or photographs. Views of contributors and advertisers do not necessarily refelect the policy of Vehicle Electronics or those of the publisher.