VEHICLE electronics

The monthly magazine for automotive electronics engineers

Analog Devices buys Maxim for $21bn

Analog Devices (ADI) is buying Maxim Integrated for $21bn.

Maxim's strength in automotive and data centres with ADI's strength across the broad industrial, communications and digital healthcare markets are said to be complementary.

ADI is known in the automotive world for its power products and the A²B audio infotainment platforms. In automotive, Maxim specialises in video and high-speed serial data links.

The combined company is estimated to be worth more than $68bn.

The transaction was unanimously approved by the boards of both companies and is due to be completed by summer 2021.

"ADI and Maxim share a passion for solving our customers' most complex problems," said Vincent Roche, CEO of ADI. "Maxim is a respected signal processing and power management franchise with a proven technology portfolio and impressive history of empowering design innovation."

Upon closing, two Maxim directors will join ADI's board, including Maxim president and CEO Tunç Doluca.

"I am excited for this next chapter as we continue to push the boundaries of what's possible, together with ADI," said Doluca. "Both companies have strong engineering and technology know-how and innovative cultures."

Roche said Maxim had a leading position in automotive connectivity.

"Within automotive connectivity, our solid position in audio infotainment, like our A²B technology, complements Maxim's leadership in video and safety serial link technology," he said. "Together, our automotive capabilities will power, connect and enhance the overall driving experience."

Combining technologies will let the combined company serve more than 125,000 customers and capture a larger share of a $60bn addressable market. Together, they will have more than 10,000 engineers and about $1.5bn in annual R&D investment.



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NXP extends Imagination Ethernet licence

NXP has extended its licence for Imagination's EPP Ethernet packet processor IP for use in S32 vehicle network processors.

The NXP processors safely and securely address problems of routing and processing the rapidly growing high-speed data in vehicle networks. The EPP IP accelerates the routing of Ethernet packets while processor cores focus on providing new vehicle services with cloud connectivity.

The vehicle network processors combine ISO 26262 Asil D functional safety, hardware security, real-time and application processing, and vehicle network acceleration for service-oriented gateways, domain controllers and safety co-processors.

Brian Carlson, global marketing director at NXP, said: "Our collaboration with Imagination leveraging NXP automotive and networking expertise resulted in the EPP IP offering flexibility and programmability to address demanding, new vehicle Ethernet networking requirements driven by the automotive industry transformation to electrified and autonomous connected vehicles."

Imagination's multi-gigabit EPP IP provides a flexible core that supports smart routers and multiple switches, or a combined switch and router configuration. It uses a hardware and software framework, combined with hardware accelerators and a high-speed flexible DMA fabric, to provide a complete and optimised product that can scale up to 16 ports and 12 million packets per second.

"Our EPP technology has been designed to be automotive grade, with safety mechanisms integral to the IP and is silicon-proven," said Jaime Broome, senior director at Imagination Technologies. "In line with our safety strategy, it is compliant to the demands and requirements of ISO 26262, showcasing our focus on the future of automotive."

The EPP IP has multiple Gigabit Ethernet ports, helping car makers begin developing vehicle architectures that are future-proofed for throughput and latency requirements.

Lotus plans technology centre

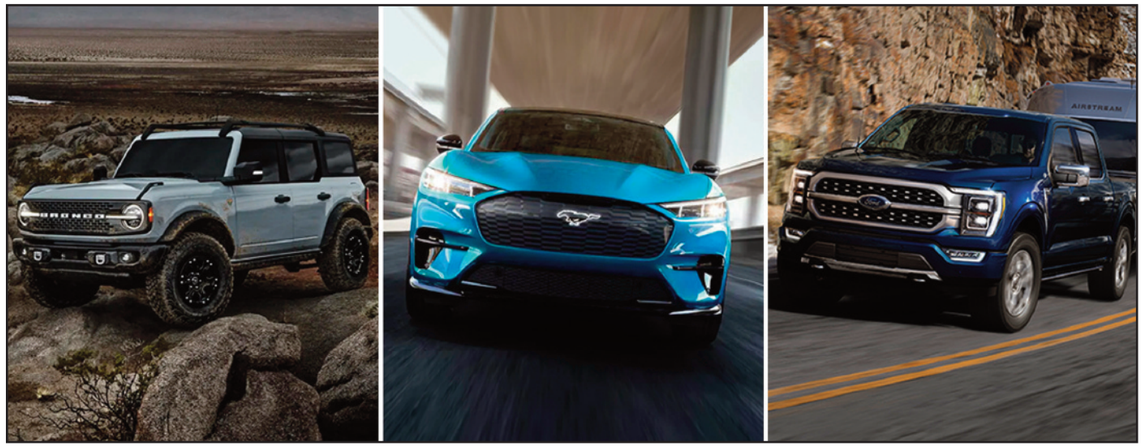


Lotus Cars plans to build an advanced technology centre on the University of Warwick's Wellesbourne Campus in the UK. Lotus Engineering – the consultancy division of Group Lotus – will also base its HQ at the site.

The facility represents a partnership between Lotus and Warwick Manufacturing Group (WMG) at the university. An initial 130 engineers will move in, with capacity for more jobs. These will complement the 500 engineers at the home of Lotus Cars in Hethel, Norfolk.

WMG specialises in collaboration between academic research, teaching, training and industry. The facility will consist of offices, workshops and laboratories with space for expansion.

"This is a big step forward for Lotus and our engineering consultancy," said Matt Windle, executive director of engineering at Lotus Cars. "The new space, facilities and job opportunities at Wellesbourne will be in great demand as we rapidly build our portfolio of external projects."



Mobileye technology will be used across a range of Ford vehicles

Ford commits to Mobileye for driver assistance

Intel subsidiary Mobileye is helping Ford develop driver-assistance systems across its global product line.

As chosen supplier of vision-sensing technology for Ford adas, Mobileye will provide its EyeQ family of devices with vision-processing software to support levels one and two driver-assistance in Ford vehicles.

"It is a privilege to extend and expand our long-standing collaboration with a company that is so committed to safety on behalf of its global customer base," said Amnon Shashua, CEO of Mobileye. "We look forward to working closely together to bring these functionalities to market in the full Ford product line."

Together, Ford and Mobileye aim to provide better camera-based detection capabilities for adas, including improved forward-collision warning; vehicle, pedestrian and cyclist detection; and lane-keeping features.

The EyeQ sensing technology will support Ford Co-Pilot360 adas features such as lane-keeping, auto high-beam headlamps, pre-collision assist with automatic emergency braking, and adaptive cruise control with stop-and-go and lane-centring.

Ford will display Mobileye's logo in its Sync adas communication displays.

"Providing people with extra confidence while driving is invaluable, and it's exactly what our available Ford Co-Pilot360 features are designed to do," said Lisa Drake, vice president at Ford Motor. "By customising Mobileye's excellent software and sensing technology, Ford's great driver-assist features will continue to evolve and provide customers with confidence on the road throughout the life of their vehicles."

As part of the agreement, new production vehicles will use EyeQ computer chips and software to support features under Co-Pilot360. Used to help identify what the windshield camera in a vehicle can see – including lane markings, traffic signs, pedestrians and other vehicles – Mobileye's technology will support adas features in the Mustang Mach-E and F-150.

While Ford and Mobileye have worked together for years, this is the first time Ford has committed to the company's technology for the entire lifecycle of its next-generation vehicles. Both parties will work with designated Ford tier-one providers to supply the technology for vehicle integration.

Additionally, Ford is evaluating the use of Roadbook in its vehicles.

Roadbook uses anonymised, crowd-sourced data from vehicle cameras to build a high-definition map that can be accessed by vehicles and leveraged by driver-assist technology, including hands-free driving features such as active drive assist.

The EyeQ family supports complex and computationally intense vision processing while maintaining low power consumption even when on the windshield.

Building on the capabilities of its predecessors, EyeQ4 can process multiple sensors and other inputs required for driver-assist features.

Convex consortium completes C-V2X trials

Audi, Ericsson, Qualcomm, Swarco Traffic Systems and the University of Kaiserslautern have completed their C-V2X trial.

Initiated in December 2016, the trial used a test bed and field tests based on 3GPP C-V2X direct and network-based technologies for connected vehicles and intelligent transportation systems.

The tests provided evidence of the complementary nature of short-range direct and cellular wide-range communication with C-V2X and received results demonstrating the reliability and performance of V2X technology.

The organisations formed the Connected V2X of Tomorrow (Convex) consortium and have completed and analysed end-to-end implementation and performance testing in realistic driving conditions.

Convex, co-funded by the German government, tested and demonstrated several use cases for C-V2X, including V2V and V2I direct communication operating in the 5.9GHz frequencies, as well as V2N wide area communication.

For these tests, Audi vehicles and Swarco's intelligent road infrastructure were equipped with C-V2X technology based on the Qualcomm 9150 C-V2X platform.

Convex investigated the reliability, range and performance of C-V2X direct communication using 5.9GHz between vehicles and with infrastructure at varying speeds. Testing delivered 100 per cent reliable reception of safety messages in line-of-sight conditions up to 1.2km, with the distance limited by the length of the test roads. The test was conducted with relative vehicle speeds between two vehicles travelling in opposite directions at up to 430km/h. These tests were conducted at two locations on the German A9 and A6 motorways.

Tests were also conducted in urban conditions with completely blind intersections and showed at least 140m range with safety messages delivered at 100 per cent reliability for the V2V communication.



Siemens acquires Avatar and debuts Extreme version of AFS

Siemens is to acquire Californian place-and-route IC design software developer Avatar Integrated Systems and plans to add its technology to its subsidiary Mentor's Xcelerator suite of software.

Mentor, meanwhile, is targeting the automotive market among others with it Analog FastSpice (AFS) Extreme technology for nanometre-scale verification of large, post-layout analogue designs.

Avatar will be integrated with existing Mentor products, specifically the Calibre, Tessent and Catapult platforms.

At 7nm and below, detailed routing must be considered during placement. Avatar pioneered a detailed-route-centric architecture built bottom-up on a unified in-memory data model, designed to let all engines access full design data and attributes at any time. This empowers each engine – placement, routing, timing, optimisation, clock tree synthesis and so on – to invoke dynamically other engines incrementally.

AFS Extreme is the latest version of AFS, first introduced in 2006. Users of the original can access this one at no extra cost.



Greg Curtis: "Designers can increase simulation performance."

The Extreme version is for long post-layout transient simulations and provides performance improvements focused on the core Spice matrix solver.

"It solves everything in a single matrix," said Greg Curtis, senior product manager at Mentor. "Designers can increase simulation performance while meeting user-defined accuracy."

The product targets analogue and mixed-signal use in automotive, communications, computing and IoT. Automotive applications include adas, lidar, V2V communications and braking.

"We are looking at all the parts that will be transmitting an analogue signal that will be used in digital processes leading to a specific action being taken," said Curtis.

It can handle analogue designs containing high levels of parasitic complexity and contact resistance, both of which grow more problematic as process geometries shrink.

"There can be a three times increase in resistance," said Curtis. "Device noise is becoming a first order effect. Consumers are delaying smartphone replacement so there is a need for more long-term reliability, and we see that already in automotive."

Initial benchmarks show a tenfold simulation performance boost over previous AFS offering.

This version, available in October, provides rapid circuit verification for nanometre analogue, RF, mixed-signal, memory and custom digital circuits. Foundry certified to 5nm, the platform is said to deliver nanometre-scale Spice accuracy twice as fast as parallel Spice simulators.

This complements the Mentor Symphony mixed-signal platform, which uses the AFS circuit simulator and provides mixed-signal verification with standard HDL simulators. Symphony supports verification of complex, nanometre-scale mixed-signal ICs with debugging and configuration support.

"This release addresses analogue verification requirements and lets you remove the post-layout simulation bottleneck," said Curtis.

GaN Systems reduces size of BrightLoop converters

GaN Systems and BrightLoop Converters are jointly developing AC-DC and DC-DC converters for electric motorsport and aerospace applications.

Leveraging GaN Systems' 650V GaN transistors, BrightLoop is producing converters said to be smaller, lighter and more efficient than currently available.

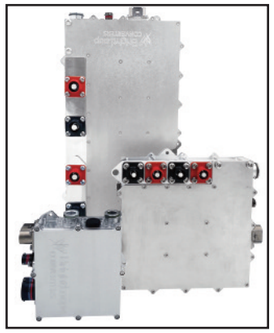
BrightLoop's most recent 1.9, 4.8 and 9.6kW DC-DC converters for hybrid and electric racing incorporate GaN Systems transistors and are around half the size and weight of the company's first DC-DC converter developed without GaN.

"We are excited to partner with GaN Systems as a recognised leader in the GaN power semiconductor marketplace," said Florent Liffran, CEO of BrightLoop Converters. "The industries which we service require high reliability and performance and GaN is an important piece in helping us achieve that. GaN Systems offers one of the best lines of 650V GaN transistors and, coupled with its unique packaging, allows unprecedented integration."

The converters are used in many of the Formula E teams and the winning DS Techeetah team from 2019. The converter's function is to power all the low-voltage electronics including pumps, lighting and radio.

Recently, BrightLoop was announced as the sole supplier of DC-DC converters for electric touring car racing (ETCR) cars. ETCR is the world's first electric touring car championship, due to begin this autumn.

"Teaming up with a leader like BrightLoop to demonstrate GaN Systems' products in these very demanding applications proves the value and ruggedness of our GaN in high reliability power applications," said Jim Witham, CEO of GaN Systems.



GaN Systems transistors make BrightLoop converters smaller and lighter

Goodix touch in Hyundai Sonata

Goodix's automotive touch controller is integrated into a 31.2cm infotainment touch screen to deliver a smart cabin experience for the Hyundai Sonata launched in China last month.

It lets car users precisely control the infotainment system with gestures such as tap, slide and multi-finger touch. The response time of a touch input is less than 13ms on average, offering touch sensitivity and accuracy similar to those for mobile phones.

The signal-to-noise ratio ensures its water resistance performance and reliability under extreme conditions.

The technology supports displays up to 33.8cm with aspect ratios of 4:3, 8:3, 16:9, 16:10 and 16:14. Car makers can customise touch gestures and up to ten capacitive touch keys.

Through IC design, package and testing, it meets AEC-Q100 grade two and IATF 16949. Its EMC performance in the automotive in-cabin environment complies with EMI Cispr 25 class five.

Adas HiL radar collaboration

Konrad Technologies, Rohde & Schwarz and National Instruments are collaborating on adas hardware-in-the-loop (HiL) radar simulation.

To enable more reliable and capable radar object simulation for automotive radar HiL use, the three are working on an approach for over-the-air simulation. Konrad will combine radar test technologies from Rohde & Schwarz and NI for radar sensor simulation in adas HiL applications.

It will use the Rohde & Schwarz antenna array as a frontend to the NI vehicle radar test system for radar object simulation in an HiL test setup.

The primary goal is to expand the capabilities of the Konrad radar HiL tester to enable higher precision and reliability for more sophisticated tests that involve multiple objects moving across the field of view.

"The novel approach supersedes the traditional setup with mechanical moving parts to simulate moving radar objects," said Christian Evers, VP at Rohde & Schwarz.

Google, Qualcomm and OpenSynergy work together on reference platform

A year-long collaboration between Google, Qualcomm and OpenSynergy has created a reference platform with a virtualised Android Automotive OS instance running on top of OpenSynergy's Coqos hypervisor SDK and Qualcomm's Snapdragon SA8155 automotive SoC.

Google has announced collaborations with several vehicle makers to power in-vehicle infotainment (IVI) systems with Android Automotive OS, Google's open-source Android platform.

The automotive sector is moving towards consolidating increasingly complex and heterogeneous hardware subsystems such as the instrument cluster, infotainment and head-up display onto a single SoC with mixed safety-critical and non-critical requirements.

This enables tighter software integration between the subsystems, and allows for cost and weight savings. Hence, Google is working on virtualisation of Android Automotive OS by leveraging and extending Virtio, an established virtualisation standard maintained by the Oasis consortium, of which Google is a member.

Virtualisation allows multiple guest operating systems with mixed-criticality requirements to share the same hardware or host managed by host hypervisor software. Android Automotive OS will be supported as a guest virtual machine on automotive hypervisors.

Last year, Google, OpenSynergy and Qualcomm decided to collaborate on the implementation of this reference platform. The goal, which is planned to be released soon, is to show how Android Automotive OS can be safely and securely integrated on a SoC using an open-standards based virtual platform.

"Embracing Virtio was a major milestone for our automotive-grade Coqos hypervisor SDK," said Regis Adjamah, CEO of OpenSynergy. "It is good news for all our customers currently in the process of upgrading their IVI programmes. We are complementing our lean, os- agnostic, type-one hypervisor with the open-standard device sharing technology Virtio. We believe the time has come for the automotive industry to abandon proprietary to embrace open standards and compete on the quality of their implementation."

Autotalks chipsets aid dual-mode V2X trials

Applied Information is carrying out dual-mode C-V2X and DSRC V2X deployment in which Autotalks dual-mode chipsets are installed in emergency vehicles and on roadside units (RSUs) such as traffic lights.



Yuval Lachman

The technology is being used on roads in Georgia, Texas and Hawaii.

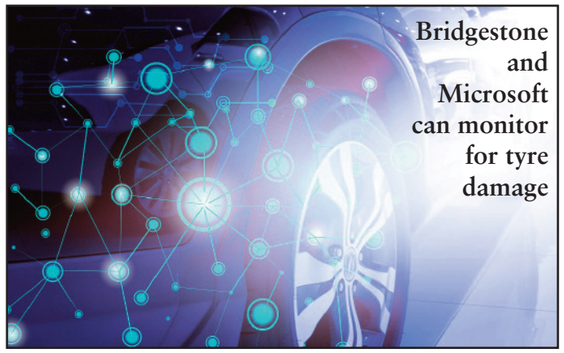
Applied Information has developed a dual-mode and dual-active RSU to communicate with vehicles equipped with V2X on board units.

The main use-cases are for emergency vehicles' traffic signal pre-emption, transit buses for traffic signal priority and vehicles involved in roadside work zones.

"Our work with Applied Information is another proof that the auto industry is determined not to wait until the US regulator will decide which V2X technology to deploy," said Yuval Lachman, vice president at Autotalks. "Whether C-V2X or DSRC is selected, there is a move to deploy agnostic technologies such as the one we are offering with AI, and begin saving lives today."

The chipset supports DSRC based on 802.11p and ITS-G5 standards and C-V2X based on 3GPP releases 14 and 15 specifications with embedded V2X cyber-security functionality. Users can toggle between DSRC and C-V2X communications.

The traffic signal pre-emption function in Alpharetta, Georgia, the first site of the RSU deployment, transfers the normal operation of the traffic control signal to a mode of operation that gives the right of way to emergency vehicles such as ambulances and fire-fighting vehicles, while all other traffic is brought safely to a halt.



Bridgestone and Microsoft can monitor for tyre damage

Bridgestone and Microsoft partner to protect tyres

Tyre maker Bridgestone is collaborating with Microsoft to develop a monitoring system for detecting tyre damage in real time.

Tyre problems contribute to nearly a third of all car accidents caused by technical failure and take four main forms – inadequate pressure, fatigue, irregular wear, and damage from kerbs, potholes or items on the road.

Tyre pressure monitoring systems are mandatory in many countries and help motorists avoid low-pressure problems. Regular service and replacing tyres in time will guard against wear and fatigue.

The problem is tyre damage, which often cannot be detected without close, manual inspection, and which can potentially occur at any time.

The monitoring system developed by Bridgestone and Microsoft checks for damage in real time. It uses Microsoft's MCVP connected vehicle platform's cloud framework with sensor data from hardware already installed; algorithms detect events affecting the tyre surface and carcass.

The driver can then be immediately notified of the hazard and act to remedy the situation.

It not only detects when damage has occurred, but also where, which can be used to alert the agencies responsible for road repairs.

MCVP is a cloud-connected platform on top of which can be built in-vehicle infotainment, navigation, autonomous driving, telematics and prediction services, as well as over-the-air updates.

Cohda and U-Blox collaborate on V2X

U-Blox and Cohda Wireless have produced a V2X system for the cooperative intelligent transport market. Cohda's V2X software stack will support the U-Blox UBX-P3 V2X chip for connectivity based on DSRC/802.11p standards.

Cohda Wireless and U-Blox have a long-standing relationship and share a common vision of using wireless technology to reduce the number of road accidents and fatalities.

The UBX-P3 chip, which enables wireless V2V and V2I communications, has been enhanced with Cohda's hardware-agnostic software, providing 360° awareness and detecting hidden threats beyond anything a driver or on-board sensors can see.

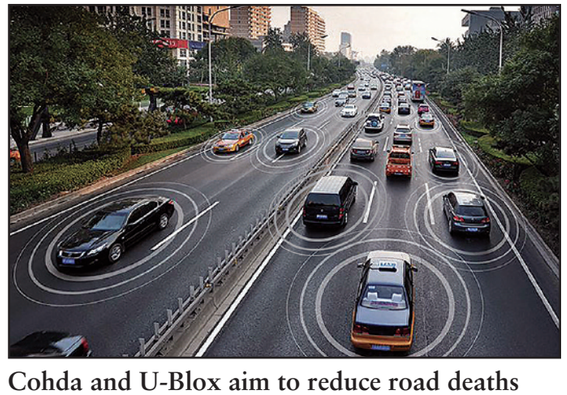
Cohda Wireless chief engineer Fabien Cure said the partnership offered the market a V2X system that would interest tier-one suppliers, OEMs and road authority suppliers.

"To progress vehicle safety, OEMs need to produce vehicles that have embedded V2X wireless communications as standard," said Cure. "Likewise, cities around the world are preparing for wide scale cooperative intelligent transport systems."

Cohda says it is the only supplier to have its V2X software in production vehicles, namely from GM and Volkswagen.

Herbert Blaser, senior director at U-Blox, added: "Porting Cohda's V2X software stack onto our high-performance UBX-P3 chip enables a swift integration into automotive platforms."

Cohda's software is in more than 60 per cent of all V2X field trials in the world in compliance with FCC and Etsi standards.



Cohda and U-Blox aim to reduce road deaths

Bosch pools software and electronics in one division

Bosch is combining its software and electronics expertise in one division with 17,000 employees.

From the start of 2021, existing and new customers will receive electronics systems and the requisite software from a single source.

The cross-domain computing division will have more than 40 locations in over 20 countries.

The market for software-intensive electronic systems is expected to grow by some 15 per cent annually between now and 2030.

"Only a company with wide-ranging electronics and software expertise will be in a position to shape the future of mobility," said Stefan Hartung, board member at Bosch.

The move towards more sophisticated electronics and software is seeing an increase in the complexity of automotive engineering. The new division's goal will be to reduce this complexity through cross-domain software and electronics. It will aim to get new vehicle functions on the road significantly faster.

Bosch has assigned software, electrical and electronics engineers from the areas of driver assistance, automated driving, car multimedia, powertrain and body electronics to the unit.

"Bosch is an automotive electronics pioneer," said Hartung. "Moreover, for quite some time now, it has also been a software company. And in the future as well, our new division is predestined to make further progress in the digitalisation of vehicles."

Bosch has an annual expenditure of €3bn on software expertise.

"Software will play a crucial part in determining a vehicle's features and feel in the future," said Harald Kroeger, Bosch board member. "It will help make cars ever more intelligent, and provide drivers with a tangible benefit."

However, traditional software engineering in individual, discrete units is increasingly coming up against its limits.

"Supplying software from a single source is our response to the enormous challenge of making cars ever more digitalised," Kroeger said.



Bosch is combining software and electronics expertise into one division

He will be responsible for the division, which will develop the software on which the vehicle computers and control units are based and the software for vehicle functions from park-assist and lane-keeping support to music streaming.

In addition to cross-domain software development, Bosch is devoting effort to future-proofing vehicles' electrical and electronic architecture. This is why the company is also making the division responsible for developing vehicle computers, control units and sensors.

"The core task will be to make the complexity of electronic systems controllable," Kroeger said. "In addition, the systems will have to be as reliable as possible."

In this respect, Bosch is focusing on vehicle computers as the technical basis for the digitalisation of modern vehicles. With more functions in every part of the vehicle, these computers combine the tasks of individual control units.

"Today's premium vehicles feature more than 100 individual control units, and even compact vehicles have between 30 and 50," Kroeger said. "Such powerful computers will allow us to significantly reduce these numbers."

Continental picks Renesas SoC for HPC

Continental has adopted Renesas' R-Car M3 SoC for its body high-performance computer (HPC), an automotive computing platform that provides central control of vehicle systems and has secure gateway functionality to enable cloud service connectivity.



Continental uses Renesas SoC in vehicle computer

The R-Car M3 supports over-the-air software updates with security and functional safety, making it possible to control automotive software updates centrally. The SoC also contributes to the realisation of an electrical and electronic architecture concept that helps improve vehicle performance, safety and reliability while reducing vehicle weight.

"Thanks to the new server architecture, vehicles will be kept up to date easier and faster than today," said Johann Hiebl, head of connected car networking at Continental. "We are making the vehicle an integral part of the internet of everything, contributing to the higher functionality and comfort in the vehicle. The first generation of Continental's body high-performance computer using the high-performance R-Car SoC is already going into production at a global vehicle manufacturer."

Whether used for personal use, as taxis, or for mobility services such as for the distribution of goods, modern vehicles must be capable of quickly updating software in the field to operate efficiently and safely. Performing software updates individually on the dozens of ECUs in a typical vehicle is difficult.

The current shift towards an electrical and electronic architecture that uses a central vehicle computer to implement centralised software updates aims to address this.

"Renesas focuses on achieving an optimal balance between performance and power efficiency for our automotive customers, with a view towards device adoption in high-volume vehicles," said Shingo Yamamoto, executive vice president at Renesas. "I am delighted that Continental has recognised our commitment and adopted the R-Car M3 for use in their body HPC."

Voxx acquires Directed for $11m

Automotive and consumer technology maker Voxx has acquired the aftermarket vehicle remote start and security systems and connected car businesses of Directed Electronics for $11m.

Directed has been Voxx's primary competitor in the North America remote security business for years and, to a lesser extent, in the connected car telematics segment.

Within the remote security business, Directed has eight brands – Viper, Autostart, AstroStart, Automate, Avital, Clifford, Directed and Python. Analogue and digital products include security, remote start and combined systems directly hardwired into vehicles, as well as systems with data bus interface modules.

Within the connected car business, products are sold under the Viper and Directed brands. It also includes Directed's vehicle control platform, which provides subscription-based revenue and the potential to expand into enterprise and fleet B2B markets.

"This is a natural fit for both companies, with far reaching synergies and opportunities to leverage platforms and talent to improve the customer offering, learn from each other and enhance value," said Pat Lavelle, president of Voxx. "The engineering talent we are adding is exceptional and we already see areas for crossover."

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JLR predictive touch reduces spread of Covid-19

Contactless touchscreen technology developed by Jaguar Land Rover and the University of Cambridge could help reduce the spread of bacteria and viruses such as Covid-19.

The patented technology offers dual benefit of keeping drivers' eyes on the road and reducing the spread of viruses.

The predictive touch system uses artificial intelligence and sensors to control infotainment systems without needing to touch the screen. Lab tests and on-road trials show the time and effort needed to use a touchscreen can be halved.

AI and sensors predict a user's target on the touchscreen – whether satellite navigation, temperature controls or entertainment settings – without touching a button.

Uneven or poor road surfaces can cause vibrations that make it difficult to select the correct button. This means drivers take their attention away from the road, increasing the risk of an accident.

The technology uses AI to determine the item the user intends to select early in the pointing task, speeding up the interaction. A gesture tracker uses vision-based or RF sensors to combine contextual information such as user profile, interface design and environmental conditions with data available from other sensors, such as an eye-gaze tracker, to infer the user's intent in real time.



The technology can predict user actions

"Predictive touch technology eliminates the need to touch an interactive display and could therefore reduce the risk of spreading bacteria or viruses on surfaces," said Lee Skrypchuk, technical specialist at Jaguar Land Rover. "The technology also offers us the chance to make vehicles safer by reducing the cognitive load on drivers and increasing the amount of time they can spend focused on the road ahead."

This software-based product for contactless interactions has reached high technology readiness levels and can be seamlessly integrated into existing touchscreens and interactive displays, so long as the correct sensory data are available to support the machine-learning algorithm.

"Touchscreens and other interactive displays are something most people use multiple times per day, but they can be difficult to use while in motion, whether that's driving a car or changing the music on your phone while you're running," said Simon Godsill, a professor at Cambridge University.

Danfoss and Infineon sign multi-year deal

To meet the long-term demand for power semiconductors for electric cars, Danfoss and Infineon Technologies have signed a multi-year volume agreement.

Infineon will supply chipsets of IGBTs and diodes to the Danfoss Silicon Power business. The chips are mainly used in power modules for inverters that control the motors in electric vehicles.

"The market for electro-mobility is picking up noticeably, and the supply industry is getting ready for this," said Claus Petersen, senior vice president at Danfoss. "For us as a manufacturer of power modules for electric drivetrains, a long-term secure supply of semiconductors is extremely important. With this agreement we can accommodate the high growth expectations of our customers."

Infineon produces the IGBTs and diodes for Danfoss at its plants in Dresden, Germany, and Villach, Austria. Danfoss manufactures its power modules in Flensburg, Germany, and Utica, New York.

"With electro-mobility, the semiconductor content per car will increase to almost double that of conventional cars," said Peter Schiefer, president of Infineon's automotive division. "Power semiconductors represent by far the largest part of this additional content. The expansion of our manufacturing capacities, for example in Villach, Austria, enables us to establish a long-term cooperation with customers like Danfoss. A reliable and resilient supply chain is crucial for the rapid success of the mobility revolution."



Virtual pavilion provides an online display of Taiwanese products

VIRTUAL WORLD

Taiwan has reacted to the lockdown by running virtual press conferences. Steve Rogerson reports

This has not been a good start to the year for anyone, including Taiwan, which saw its big flag ship automotive electronics show – Autotronics, part of the giant Taipei Ampa autoparts event – cancelled in April due to the Covid-19 pandemic. At the time of writing, the organiser Taitra was still hoping for the event to go ahead in October.

Taitra is the country's external trade development organisation and it is determined to give some of the companies that missed their chance in April an opportunity to promote their wares in front of the world's press and industrial buyers.

The first initiative in this was an online virtual press conference in which four companies that have won Taiwan Excellence awards could strut their stuff.

"Several intuitive smart transportation apps are in Taiwan, including electric vehicle and electric scooter charging stations," said Walter Yeh, president and CEO of Taitra. "Smart products from Taiwan are globally recognised for their quality. These companies can help build smart cities in the post-pandemic era."

The centrepiece of the initiative was a virtual pavilion that is available on the Taiwan Excellence web site. This features 27 brands with 55 products. Visitors can click on the products for more information and 360° views of them all. Those interested in knowing more can submit contact information and be put in touch with the company.

"Taiwan has more to offer the world," said Guann-Jyh Lee, deputy director general of Bureau of Foreign Trade at Taiwan's Ministry of Economic Affairs. "The Covid-19 pandemic has led to a suspension of global economic activities so we are promoting our products through these virtual pavilions."

He said that over the next five years the Taiwanese government along with the public and private sector would invest more than US$200bn in transportation infrastructure. This will include smart traffic data analysis technology, upgrades to traditional transportation, and improving mobility services to the elderly and remote population.

There would also, he said, be innovations in autonomous vehicles and smart motorcycle technology.

First up out of the four selected companies was Everfocus Electronics, a company that has been around for 25 years and invests more than 35% of its profits into research focussing on artificial intelligence and IoT development including products for monitoring driver behaviour and for helping the driver. The company's AiO software runs on x86 and Arm platforms for use in network video recorders (NVRs). It can also be used for pedestrian and vehicle detection.

"This helps drivers identify blind spots and potential accident situations," said Paul Lee, marketing deputy manager at Everfocus. "If a vehicle moves into the warning zone, the driver can quickly take action to prevent accidents."

The company's AI can also be used at train stations for people counting, especially during special events such as New Year's Eve celebrations. This can help with crowd control and alert authorities if it detects people loitering.

The firm's main product in the pavilion is the eIVP5600, a mobile in-vehicle NVR powered by an Intel seventh generation processor.

Next up was electric vehicle charging company Noodoe, which sees itself as part of the mission to accelerate the world to zero carbon emissions.

Calvin Lu, Noodoe's vice president of sales, predicted that over the next five years 350 new electric vehicle models would enter the market. In ten years, there will be 130 million EVs on the road. The expected CAGR of EVs is 21 per cent between now and 2030, which will see EVs take



Walter Yeh: "Taiwan's smart products are globally recognised."

26 per cent of automobile car sales in Europe, 21 per cent in Japan and 29 per cent in North America.

The problem was keeping all these vehicles charged.

"There are not enough electric vehicle charging stations around the world," he said.

When it comes to charging, he said the EV market was fragmented. Many emerging EV charging businesses need to develop in-house technologies or source and integrate network software and charging equipment. Either way, this is costly and will take time to bring to market. Noodoe aims to solve that problem.

"We can produce everything to enter the EV charging market," he said. "We are an enabler that produces the essential components for the EV charging infrastructure."

The company's cloud-based operating platform acts as a central brain that runs the EV charging network, including round-the-clock service delivery, peak-hour price adjustment, transaction billing, payment processing, bank transfers, infrastructure diagnostics and intelligent energy management.

For drivers, this means they can just scan a code on their smartphone to pay.

"There is no need for special codes or to open an account," said Lu. "You can pay with credit card or Apple or Google Pay. It is simple, fast and easy."

A smart parking meter system was on show from Acer ITS. This lets drivers receive real-time information on the availability of roadside parking spots and use the app to navigate to the available spaces.

Each meter has two cameras that cover two parking spaces and detects whether or not they are occupied, and it will recognise vehicle licence plates, even if they are skewed to the direction of the camera.

"It will automatically charge the fee to avoid unnecessary fines," said Terry Chang, director of smart roadside parking at Acer ITS. "There are multiple payment



Guann-Jyh Lee: "Taiwan has more to offer the world."



Jas Hsu: "We are targeting the USA and Europe."

options, and it supports in-app credit-card payments."

She described the system as accurate, efficient and sustainable.

"It helps reduce traffic congestion and there will be less emissions from cars searching for parking paces," she said. "Parking operators benefit from enhanced management efficiency and a higher turnover rate of the parking space. And it can assist with urban planning and transportation policies."



Terry Chang: "It helps reduce traffic congestion."

The system has been installed in Taipei, Tainan and the Kaoshing Software Parks.

The final company was electronics parts supplier Hua-Jie, a maker of switches, acoustic components and sensor products. It was established in 1989, has six factories and employs 900 people.

Its Taiwanese Excellence award winner was the ATS6C quiet switch to help reduce in-vehicle noise. This is achieved by using silicone as the button catalyst. It has a life cycle of more than a million operations and is primarily used in steering wheel buttons.

"These products are used in steering and infotainment systems," said Jas Hsu, marketing coordinator for Hua-Jie. "We are targeting the USA and Europe. We are looking not just at the big automotive manufacturers



Paul Lee: "This helps drivers identify blind spots."



Calvin Lu: "There are not enough EV charging stations."

because most of our components are used by subcontractors."

Isuzu and Honda have finished testing the product and are ready for batched trial production.

The company also showed its latest product, the ADT08 automotive bilateral instant changeover switch with a stable contact conduction function and IP67 waterproof rating.

• The Taiwan Excellence award scheme is a joint effort set up by the Bureau of Foreign Trade and Taitra back in 1992 and is regarded as the highest accolade for Taiwanese products.

V2X

CONNECTING EVERYTHING

Ulrich Möhlmann and Dietmar Schnepp discuss V2X as a complete system in connected vehicles

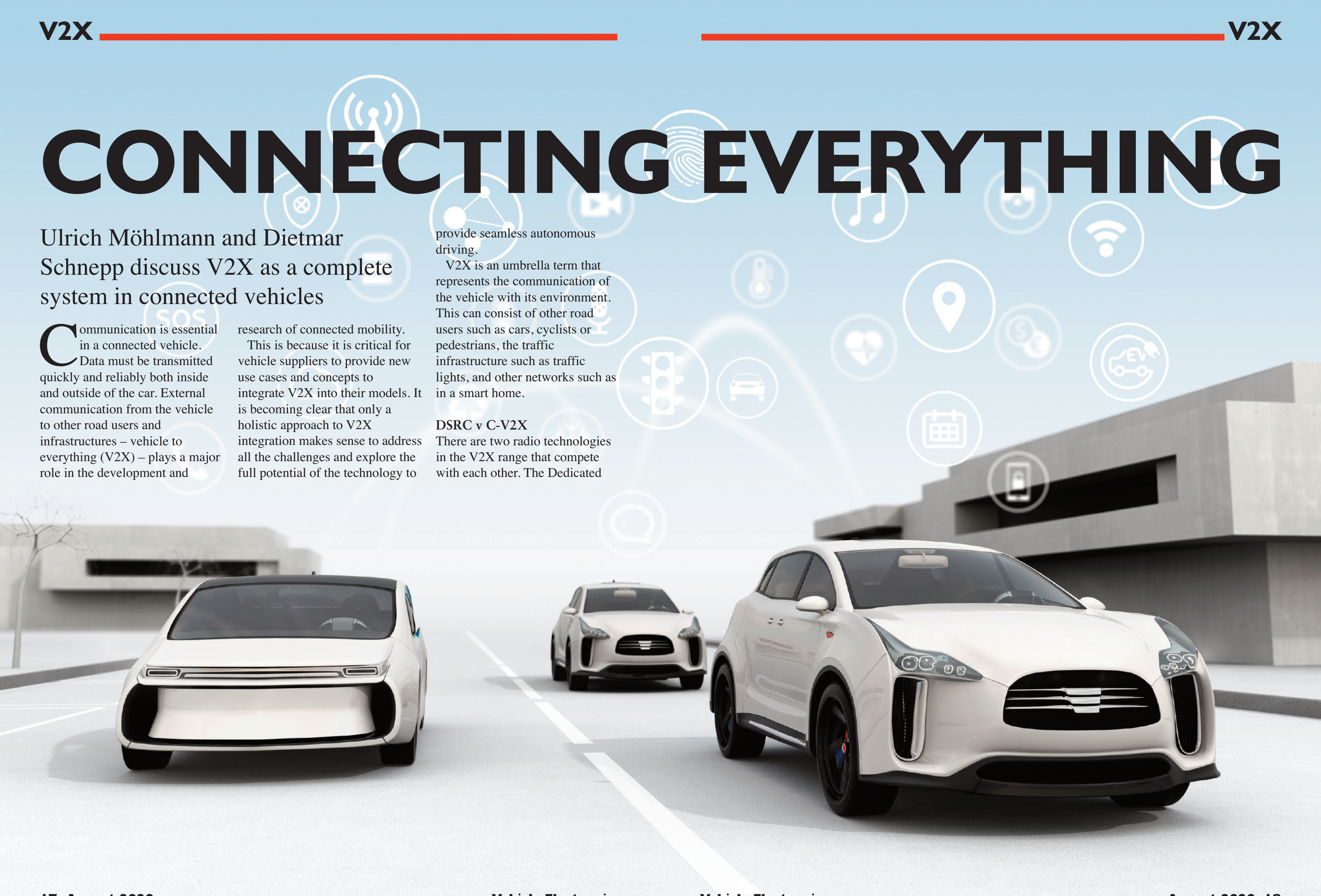
Communication is essential in a connected vehicle. Data must be transmitted quickly and reliably both inside and outside of the car. External communication from the vehicle to other road users and infrastructures – vehicle to everything (V2X) – plays a major role in the development and research of connected mobility.

This is because it is critical for vehicle suppliers to provide new use cases and concepts to integrate V2X into their models. It is becoming clear that only a holistic approach to V2X integration makes sense to address all the challenges and explore the full potential of the technology to provide seamless autonomous driving.

V2X is an umbrella term that represents the communication of the vehicle with its environment. This can consist of other road users such as cars, cyclists or pedestrians, the traffic infrastructure such as traffic lights, and other networks such as in a smart home.

DSRC v C-V2X

There are two radio technologies in the V2X range that compete with each other. The Dedicated



Vehicle Electronics

Short-Range Communication (DSRC) in the USA and ITS-G5 in Europe, which are based on an 802.11p wifi standard, and cellular V2X (C-V2X) based on 4G and 5G cellular standards.

Neither the legislator nor the car manufacturers have yet to agree which of these two V2X technologies will be preferred and declared the standard. DSRC or ITS-G5 is the more proven technology, as it has been available for some time and several long-term test series have already been carried out. C-V2X is considered to be more future-proof since it also enables use cases that will only become relevant in the coming years.

In addition, C-V2X as a mobile telephony-based technology offers the advantage of being an integral part of the telematics unit. DSRC or ITS-G5, on the other hand, would be a system that could only be used for car-to-car or car-to-infrastructure communication and would therefore have to be integrated as an add-on module, which in turn would increase system costs for OEMs.

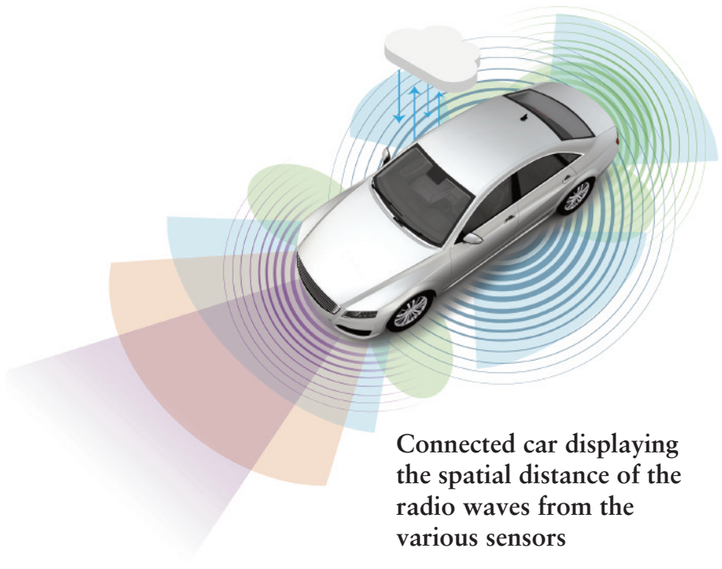
Use cases

V2X is primarily intended to increase road safety. The technology is designed to expand the senses of the vehicle and as a result provides the driver with information that could not be otherwise predicted or even captured by camera or lidar.

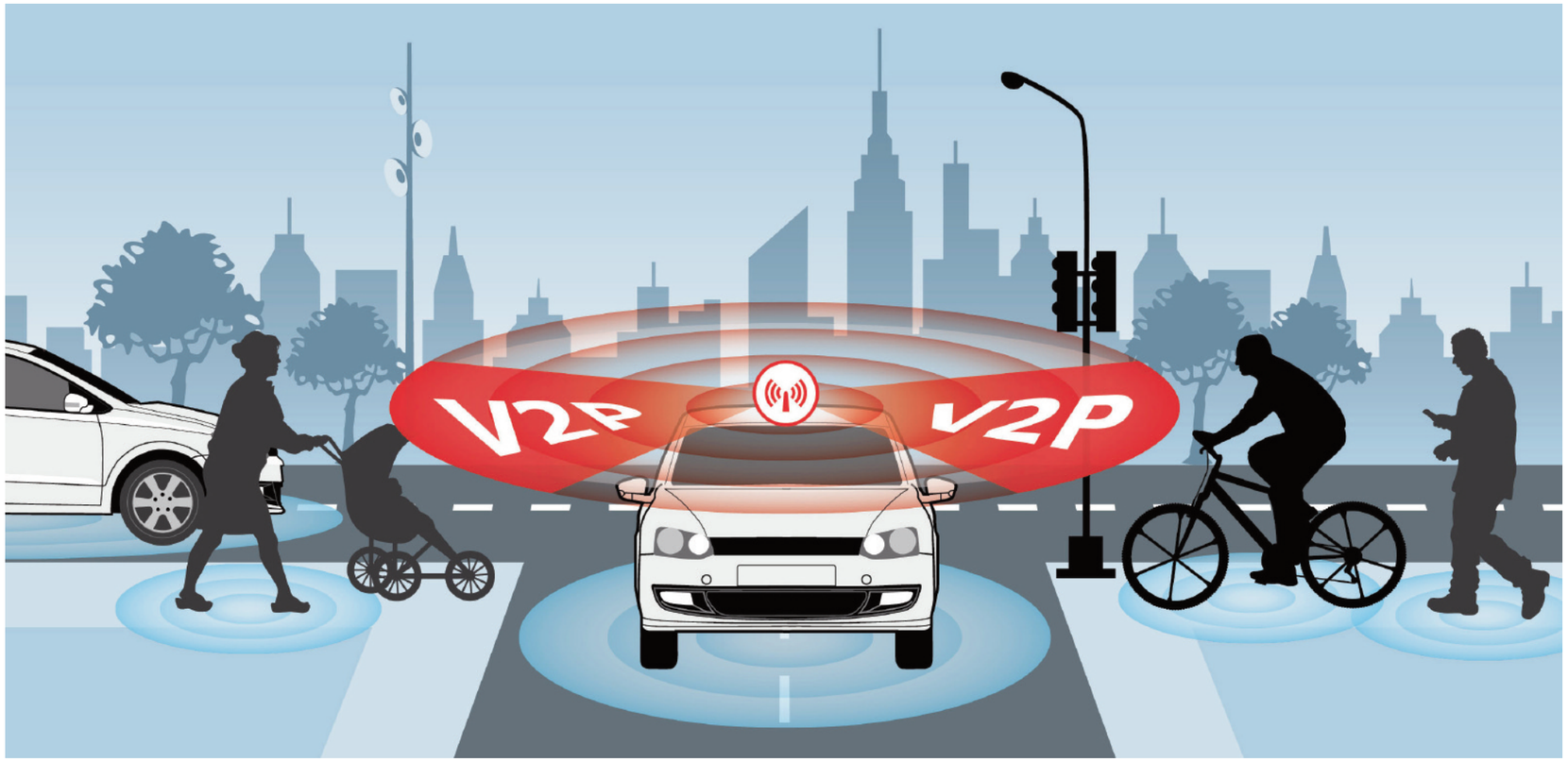
This already applies to current use cases, in which drivers are warned of dangerous situations, but even more so to future applications.

In addition to safety, V2X should also contribute long term to improving the efficiency of traffic flow. For example, allowing vehicles to communicate with traffic lights and influence their switching could have a positive effect on environmentally relevant aspects such as reduced pollutant emissions.

In general, a distinction is made between day-one and advanced use cases for V2X application examples. Day-one use cases are those that have been tested over a long period of time and some of them are already rolled out. They are warnings to the driver about dangerous situations that might not be perceived or that are misjudged without external help.



Connected car displaying the spatial distance of the radio waves from the various sensors



V2P (vehicle to pedestrian) displaying 360° coverage to see surroundings and demonstrate increased safety

Examples of this are the messages that an emergency vehicle is approaching, a broken-down vehicle is on the road ahead or a vehicle in front is applying emergency braking.

Blind spot messages alert when a pedestrian or cyclist is approaching or to provide assistance when turning to inform the driver about oncoming vehicles and their speed. These are already on the market.

Advanced use cases are those that usually involve direct intervention in the vehicle that go beyond the pure warning function. The incoming signals are then processed in driver assistance systems or semi-autonomous driving systems.

Examples include sensor data sharing to implement swarm intelligence or so-called see-through where vehicles driving behind other vehicles that obstruct their view are fed the front vehicle's data.

Implementation

There are two major challenges in implementing V2X. First, the specification of the cyber-security requirements that ensures data security is not yet complete. The transmission must be tightly secured so no false information from the outside enters the network.

In addition, the connections must be established and able to react reliably, quickly and safely, even in high-density traffic scenarios, such as traffic jams.

A second critical challenge is the unclear legal situation as to which technology should be used in which region. This lack of specifications creates uncertainty in the market.

For manufacturers there are several scenarios, each of which carries a certain risk. One scenario is to wait, risking the chance of being left behind technologically. Another is for the vehicle manufacturers to decide to implement a particular technology and risk selecting the wrong one.

The final option is to implement both V2X technologies, but then incur increased costs.

The challenge that poses the biggest risk for manufacturers is the uncertain timetable for when technology regulations will be in place. It is critical that the technology regulation gap is resolved to ensure the market is aligned with the industry.

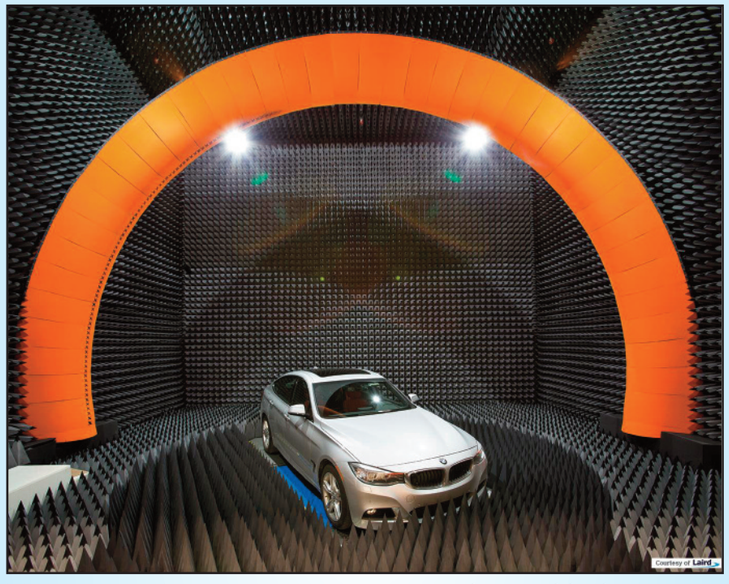
All these problems are expected to be solved in the near future.

The key point is for vehicle manufacturers to start the integration of V2X technology into their vehicle's overall system.

Integration

Initial tests have shown that it makes sense for vehicle manufacturers to consider the integration of the V2X module not in isolation but in the context of the overall system. Therefore, it is not enough to consider only the integration of the V2X module, whether cellular or DSRC, vehicle manufacturers must consider the associated system consisting of V2X modem, V2X antennas, distribution of antennas in the vehicle, and the resulting aspects such as compensation for antenna losses.

Indoor anechoic chamber



To ensure optimum antenna coverage and to enable data transmission at a 360° angle around the vehicle, the antenna power is measured in an anechoic chamber. This anechoic chamber is designed to measure antennas, either stand-alone or integrated into subsystems, and is intended for measuring antennas on complete vehicles.

The arch equipped for antenna tests with measuring probes is built into the space and is shielded from external radio waves to ensure maximum measurement repeatability.

Thanks to a high-precision control system, measurements can be performed on the fly.

The test system can test vehicle systems with integrated or connected antennas and its configuration can be adapted to specific needs and requirements and therefore to different types of vehicles.

If they ignore this, V2X may not have the desired functionality because individual components are not compatible. For example, antenna power loss without compensation may cause the overall system to function less effectively. Therefore, the V2X overall system must be completely adapted to the vehicle and optimised to the specific model series to guarantee performance.

So, why is it important to consider not only the installation of the V2X module, but also its effect and interaction with the overall system?

One purpose of the module is to improve communication with other vehicles and the infrastructure. This requires antennas, whose interaction with the V2X module is in turn relevant for the communication performance. This is because the antenna requires a 360° panoramic view around the vehicle without blind spots so consistently superior performance can be achieved in receiving and transmitting data.

Usually the primary antenna is connected to the TCU (telematics control unit) and positioned in the roof area of the vehicle. By testing in an antenna test chamber – anechoic chamber, see box – it can now be examined to see whether 360° coverage is achieved. If this is not the case, an additional antenna is required, which is usually installed as a front antenna in the area of the windscreen or in the bumper, thus increasing coverage.

These blind spots for example through a panoramic glass roof can reduce the range by more than half in the direction of travel. This may mean the functional requirements can no longer be met. However, the front antenna must be connected to the TCU by cable, which in turn leads to losses of up to 18dB through the cable connection.

These losses can be compensated for with the aid of a compensator, something car manufacturers must consider at the design stage.

When planning V2X integration, car manufacturers must take all these points into account and, when choosing their suppliers and partners, they must ensure they also consider the overall system of the vehicle.

Approaches

When it comes to the actual integration of V2X, there are several approaches that manufacturers can take. One it to install V2X as part of the telematics unit. Another is to isolate V2X and implement it stand-alone in a separate control unit.

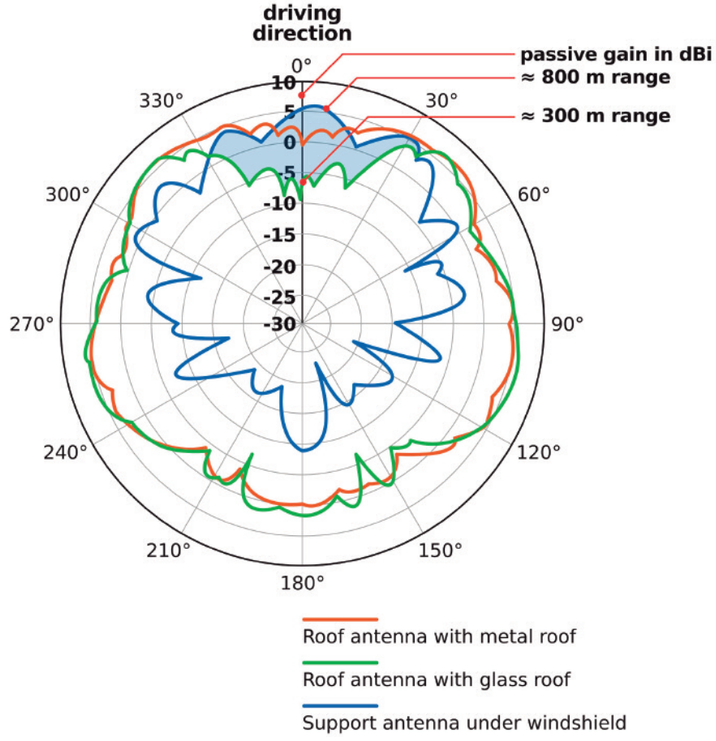
Which the vehicle manufacturer chooses heavily depends on several factors and perhaps the most important is the regional or global range of the V2X. The option might only be introduced in certain vehicle models or regions versus being implemented on a global level.

The stand-alone option allows the manufacturer to integrate V2X regionally, but not globally. On the other hand, if it is rolled out comprehensively in all vehicle models worldwide, it is expected there will be a cost benefit if the V2X is integrated into the telematics unit.

Functional safety beyond warning alerts is another important aspect that raises concern for future use cases. When sensor information is used for assistance systems or autonomous driving, there are different demands on functional safety than with warning systems. In situations where the V2X is used to assist autonomous activity, it may make sense to separate the V2X module and the telematics unit to ensure functional safety and redundancy.

Another approach to V2X integration is to use a combination that supports both C-V2X and DSRC. This offers vehicle manufacturers more flexibility for all markets at all times, but results in higher costs.

The core criterion for decision making is therefore which the car manufacturer wants to implement, how it fits into the vehicle architecture and the overall system, and which use cases the vehicle maker wants to cover in the future with V2X applications.



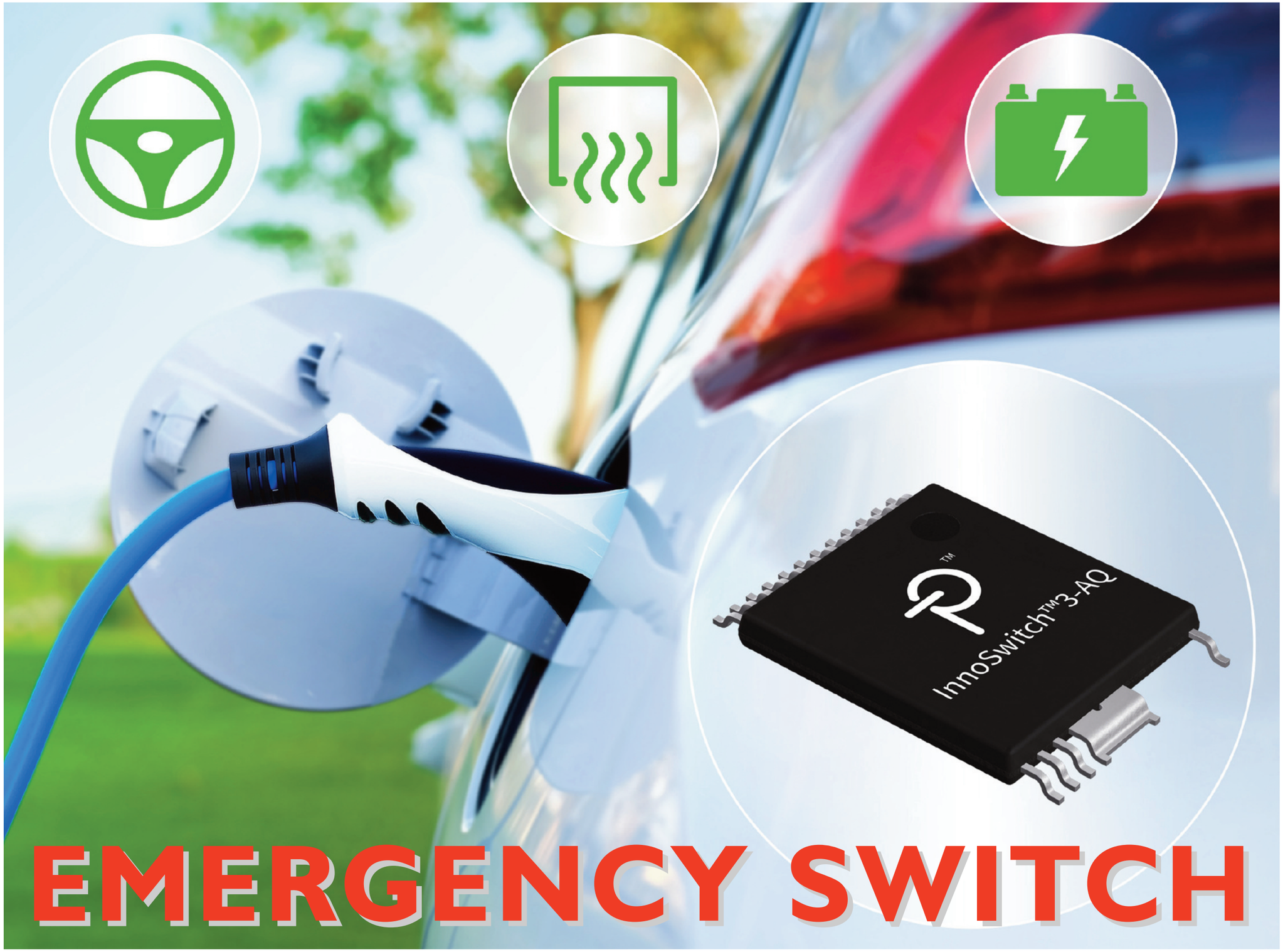
Measurement of antenna performance and various conditions



Ulrich Möhlmann is senior director of advanced engineering and Dietmar Schnepp is product director for vehicle communication devices, both at Molex



POWER TECHNOLOGIES



EMERGENCY SWITCH

Steve Rogerson talks with Edward Ong from Power Integrations about the company's latest automotive products

The trend towards electric and plug-in hybrid electric vehicles (PHEVs) has created a serious boost for the power semiconductor industry, and one company that is starting to take full advantage of this is California-based Power Integrations.

The firm has been around since the late 1980s and has been growing organically but has more recently entered the acquisition market with its purchase in 2012 of Swiss IGBT provider CT-Concept for $116m and the UK's Cambridge Semiconductor in 2015 for $23m. In 2017, it opened an R&D and production support centre in Malaysia.

A significant technology achievement took place last year with the introduction of its Innoswitch 3 range using gallium nitride (GaN) transistors. This was expanded in July this year with the launch of the InnoSwitch 3-AQ, an AEC-Q100 qualified flyback switcher for EV and PHEV applications such as for traction inverters, on-board chargers, energy management DC-DC bus converters and battery management systems.

"There are lots of applications where power supplies are

needed," said Edward Ong, the firm's product marketing manager. "With this product, we are focussing on the traction inverter. It takes its input from the high-voltage bus and drives the motor for the vehicle to move."

Automotive applications have to conform to the ISO 26262 functional safety standard. This means if there is a vehicle failure, the vehicle has to fail in a safe way.

"That is the core of the standard," said Ong. "For the traction inverter, this means there is an emerging need for emergency or back-up power supplies. Companies are already designing these."

Switcher ICs meet AEC-Q100



Buck and flyback switcher ICs from Power Integrations are for us in 400V DC electric vehicles.

The AEC-Q100-qualified version of its LinkSwitch-TN2 switcher IC is for buck or non-isolated flyback applications. With an integrated 750V mosfet, the IC provides power for EV subsystems connected to the high-voltage bus, including HVAC, climate control, battery management, battery heater, DC-DC converter and on-board charger systems.

The surface-mount device requires no heatsink, needs few external components and occupies a small PCB footprint.

The 7W (flyback), 360mA (buck) switch has an input range of 60 to 550V DC, supporting the 400V DC bus commonly seen in electric vehicles. The power supply IC provides regulation of better than ±5% across line voltage, load, temperature and component tolerances.

It can reduce the requirement for the conventional 12V distributed rail, saving assembly and material cost. Samples are available now

This power supply provides power to steer and slow down the vehicle safely if there is an auxiliary battery failure. Though the high-voltage bus is providing 400V for cars or 800V for commercial vehicles, the EVs still use a 12V battery to power the gate drivers of the IGBT modules.

"If there is a failure in this battery in that it dies, malfunctions or becomes disconnected, that can cause a hazard meaning the car is no longer safe," said Ong. "To mitigate that, the emergency power supply gets its input from the high-voltage bus. However, the condition of this big voltage could be quite varied. It could be already discharged to a low voltage or as high as 550V for a 400V system."

This means the emergency power supply has to operate from as low as 30V all the way up to 550V DC. This will provide power so the driver can park the car safely.

"A challenge with these supplies is that designers prefer not to use optoisolator circuits because they can degrade with time and are therefore not reliable," said Ong. "If you don't have an optoisolator, it can be a challenge to come up with good regulation with a wide input voltage. That is where our technology comes in."

The InnoSwitch3-AQ uses the company's high-speed FluxLink coupling to achieve ±3% accuracy for combined line and load regulation while eliminating both dedicated isolated transformer sense-windings and optocouplers. The technology maintains output voltage regulation even under the transient stress test.

"FluxLink eliminates the need for an optoisolator," said Ong. "It enables tight regulation even if the input is changing from 30 to 550V."

The device has an integrated 750V mosfet and is fine for 400V applications. However, for 800V commercial vehicles, it can be used with an optional StackFet device to reduce stress on the primary switch and spread the thermal load between devices.

"This means with the same part you can scale up to 800V use," said Ong.

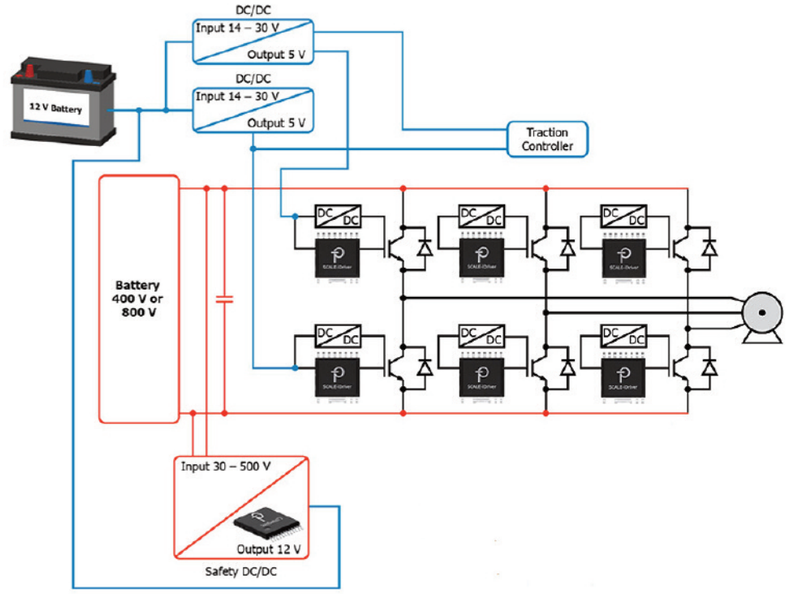
To deal with both these situation, the company has two reference boards – the DER-840Q for 30 to 550V DC input with 12V DC output and the DER-859Q with the StackFet to support up to 925V DC.

"With both these, the output can still be regulated," said Ong. "The efficiency is high across the input range. It is quite amazing."

An on-chip synchronous



Edward Ong: "There is an emerging need for emergency or back-up power supplies."



How the Innoswitch 3-AQ (bottom) fits into an automotive emergency power supply circuit

rectifier controller delivers above 90% efficiency at the nominal 400V DC input voltage. Optimised designs can achieve less than 10mW no-load energy usage across the input voltage range.

The ICs are packaged in a surface-mount InSop with 11mm primary to secondary creepage, which exceeds the requirements for high altitude – more than 5000m – isolation.

"The InnoSwitch3-AQ represents the highest level of integration for a flyback controller, resulting in automotive power supplies with the lowest component count and smallest PCB area," said Ong. "The high efficiency of the device across a wide load range means it easily meets the automotive industry's demanding thermal requirements. FluxLink technology enables accurate performance and is highly reliable."

The company's wafer fab and assembly sites are IATF 16949 certified. The company uses fabrication facilities in Germany, Japan and the USA and assembly sites in China and south-east Asia.

The Innoswitch 3-AQ was the company's second automotive product launch in July. The first was an AEC-Q100-qualified version of its Linkswitch-TN2 switcher IC (see box).

"Our automotive switcher ICs reduce size while increasing the reliability and robustness of automotive subsystems," said Ong. "By supplying auxiliary systems directly from the high-voltage bus with a LinkSwitch-TN2 power supply, automotive engineers can reduce the requirement for the conventional 12V distributed rail, saving assembly and material cost."

LIGHT CHARGE



Bart De Cock, Serge Peeters and Jeroen Büscher ask if the automotive battery management market is ready for standardisation

A typical lithium-ion battery pack in an electric- or plug-in hybrid electrical vehicle (PHEV) will comprise a series string of about 100 battery elements, that is cells or cells in parallel. The Li-ion cells require detailed voltage and temperature monitoring by a battery management system (BMS).

Thermal management is a key requirement during charging and discharging using Li-ion batteries, as their temperature needs to be kept within the operational window. Li-ion batteries need to be warm to work, but generate heat when in use, so the BMS has to heat and cool the batteries, or at least monitor their temperature.

Today, nearly every OEM, tier-one battery system supplier and silicon vendor will have its own BMS. As the number of PHEVs and EVs is expected to grow steadily in the coming years, any variability in the BMS hardware supply-chain will become problematic.

Increasing volumes and changing technical and economic parameters could impose a change of BMS silicon supplier. However, because silicon vendors do not offer compatible hardware, selecting another chip for the BMS means the tier-ones and OEMs face a long redevelopment and requalification cycle, with large investments and risks related to validation and qualification.

It will be a challenge to align silicon vendors when it comes to the detailed operation inside the chip because each vendor's development team brings its own IP. Fortunately, full alignment is not required, as long as all provide similar data through registers, for example, to the host controller.

For tier-ones and OEMs, it makes sense to have access to ICs from different vendors that behave similarly with respect to the main functions, using a standard system interface. This would extend to include the topological approach adopted to meeting functional safety requirements, as in ISO 26262.

By examining the advantages and disadvantages of the various BMS topologies, it is apparent that the differences mainly relate to questions such as: should this be a modular BMS, that is one IC monitors a series string of multiple battery elements, or a cell-level BMS where one IC monitors a single battery element; should it use a wired or wireless network; and is a microcontroller or state machine involved.

While each of the available topologies deserves the right to exist, it would accelerate market adoption if there were silicon standards available that addressed each of these points and more.

Standardisation

Predicting the growth rate of the numbers of Li-ion battery cells fitted in passenger cars is close to impossible; what is known is that the trend is upwards. This is mainly because batteries improve the well-to-wheel efficiency of cars. The fuel consumption of small cars can be improved by up to 25% by adding a 48V system, while larger cars based on a PHEV system can achieve during short daily commutes fuel efficiencies comparable with a full EV.

Although a full electrical powertrain offers a lot of advantages, for many car owners moving to a full EV is not practical or financially viable. However, soon surplus electricity coming from a growing number of renewable energy plants will provide the basis for the production of e-fuels, formed through the combination of hydrogen, generated through the electrolysis of water using green electricity, and captured CO_2.

The resulting e-fuels will be compatible with the current fuel distribution supply chain and applicable to existing internal combustion engine technologies. This will likely further propel the adoption of hybridisation, as the combination of electric and carbon-neutral drive trains is likely to appeal to consumers and governments.

Topologies

A BMS usually consists of one or a number of cell voltage measurement (CVM) slaves that are connected through a BMS-internal communication network with a BMS master. The CVM slaves can be organised per cell, per stack of cells mounted in series, per set of parallel cells, or any combination of these. The term "modular BMS" is applicable if the CVM monitors a stack of series cells, while the term "cell-level BMS" refers to a topology where the CVM is connected to a single cell or a number of parallel cells.

Modular BMS

The maximum voltage the CVM ICs need to monitor in a modular BMS is defined by the cell technology and the number of cells connected in series. While the total voltage may be much higher, it is advantageous to limit the maximum voltage of each

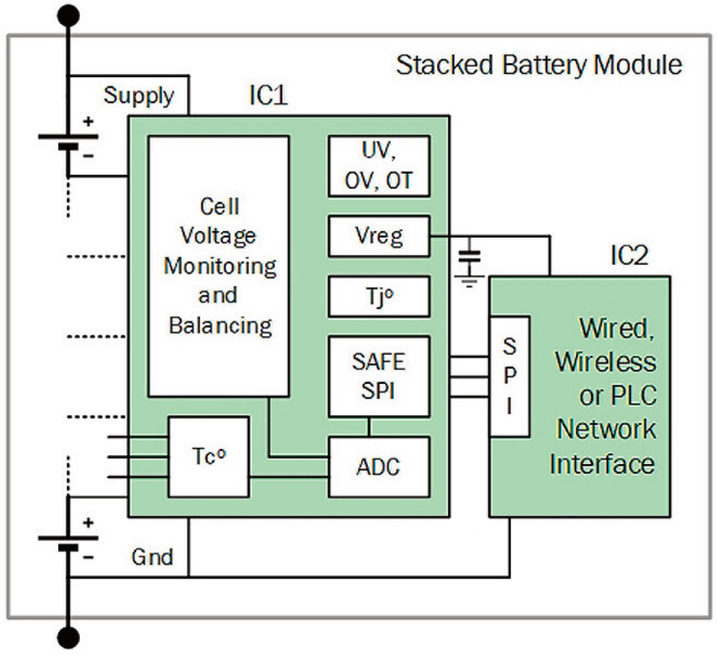


Fig. 1: Module-level BMS topology

module to 60V or below, as it requires less complex production and servicing procedures. It is also advantageous to design modules using multiple cells, as this lowers the cost per cell while reducing the number of modules in a system.

This means that, depending on the type, size, shape and maximum voltage of the cells, and the most practical volume and weight of a module, the CVM IC could be monitoring between six and 24 cells in series. This highlights a weakness of the modular approach; it is a tedious task to employ wired connections between each cell and the PCB of a module. It is also hard to automate this work. A second disadvantage is the need for specific mechanical and thermal design and qualification efforts, which leads to large cost-adders, particularly if the production volumes are relatively small.

One advantage, however, is that the car manufacturer or tier-one can design one module type for different pack-designs to be used in multiple car models, which would help reach cost-efficient volumes. The modules are low-voltage subsystems and, once assembled and tested, a large portion of their development and manufacturing cost could be recouped when the battery pack is disassembled, assuming the modules have been developed to be used without hardware changes in a second life application.

The relatively high variability in the numbers of cells per module does not necessarily present a big challenge for the internal

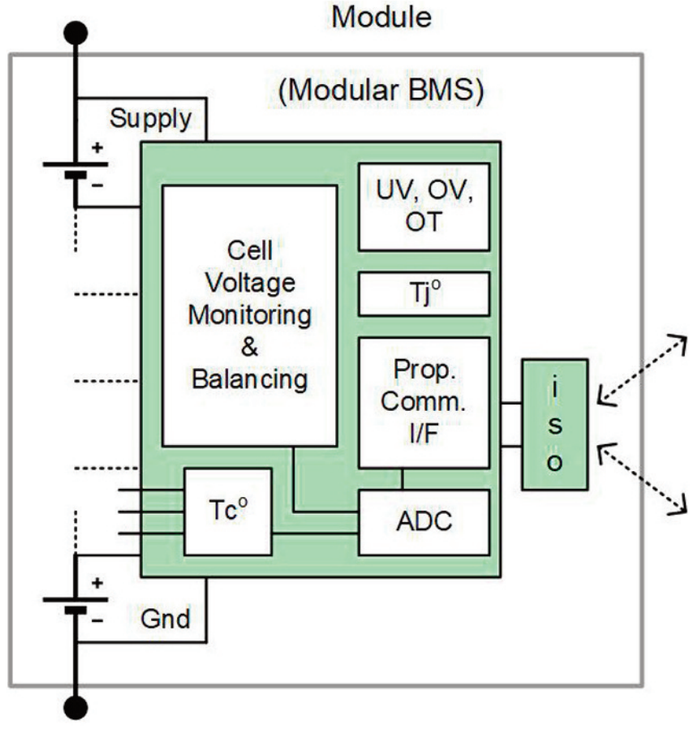


Fig. 2: Module with single CVM IC and proprietary isolated communication interface

architecture of the CVM ICs. The actual silicon area dedicated to interfacing with a battery cell can be relatively small.

It is estimated that IC manufacturers could address six to 24 cells in series repackaging two different silicon dies. The cost-effective balancing components are mounted together with the CVM IC on a standard PCB and the module does not even need to contain a microcontroller.

Furthermore, communication interfaces would only be required per module, as would the high accuracy voltage reference and the large low-ohmic transistors to switch-out individual modules, so in general the cost of electronics per cell can be kept low. A smart module with an embedded microcontroller and features such as data pre-processing, EIS (electrochemical impedance spectroscopy) or wireless connections would result in only a moderate cost increase per cell.

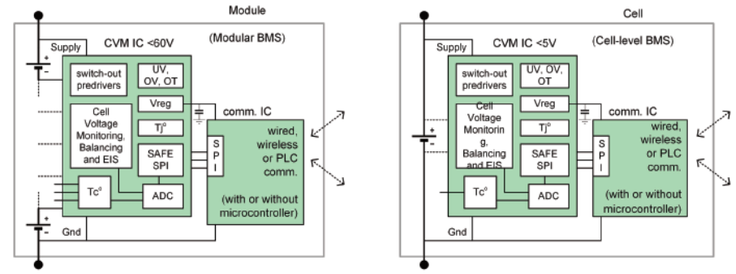


Fig. 3: First step of a two-step approach: synergy between modular BMS and cell-level BMS

Cell-level BMS

A cell-level BMS has the advantage that the CVM IC is in direct contact with the cell, making accurate temperature observations and EIS easier, and even pressure measurements could be possible.

A 5V compatible silicon process is sufficient to build the CVM, enabling higher integration and improved processing capabilities, such as adding digital signal processing or a microcontroller, very close to the cell chemistry.

A dedicated supply chain is needed because battery cell manufacturers should evolve towards mechatronic and electronic subsystem manufacturing, where a compact electronic circuit is embedded inside or attached to the battery cells. It is noteworthy that OEMs invest increasingly in Li-ion cell manufacturing facilities, potentially keeping all options open for embedding electronic customisations in the future.

A further advantage of a cell-level BMS is the complete absence of CVM modules and all costs related to them. A potential disadvantage is the elevated cost of electronics, not only for acquiring, processing and communicating data, but also to manage cell temperatures due to the dissipation from cell balancing.

The cost of the electronics per battery pack deteriorates further if the application requires cell types such as lithium titanate oxide (LTO), where about twice as many cells are required in series to develop the same system voltage as compared with more common Li-ion battery chemistries.

Finally, a wireless communication node per cell requires careful design to avoid interference between nodes, while a wired isolated communication interface on each cell would mean a mountain of isolation components.

Nevertheless, this topology could offer the OEM enough features and system benefits to offset the relatively higher cost of electronics per cell.

Second life

A circular economy is crucial in meeting the goals of the Paris Climate Agreement. However, when looking at re-using automotive batteries for stationary applications, there are many uncertainties and a lot of work still needs to be done.

An important aspect is the requirements for re-use of battery subsystems need to be taken into account from the start of the battery system development; for example, it is more viable to re-use modules or cells from a cell-level BMS than the entire automotive pack.

Due to safety concerns, residential energy storage is typically limited to 60V or below, which is largely compatible with automotive modules. Another aspect is that automotive battery cells repurposed for a second life

application should come with some assurance of life expectancy. This can be ensured through local EIS with SoH (state of health) estimation and an eeprom integrated in the battery subsystem to store historic cell usage data.

It is not clear yet if a microcontroller in the cell or in the module is needed for this, as long as the first and second life BMSs have access to this feature and memory. Therefore, irrespective of whether a modular or a cell-level BMS is chosen, the second life BMS should be able to make use of the original application's data and communication interface.

If the cell or module contains a microcontroller with OEM-specific software, it should be possible to remove, disable or replace this software completely. A second life (re)manufactured application is then created by loading software and dedicated IP with new added value onto the flexible hardware platform.

It is clear that second life considerations will shape the requirements when addressing any possible standardisation of the battery management chipsets.

Taking steps

Looking at the different CVM ICs and their BMS-internal communication interfaces available on the market, it is apparent that most communication interfaces are currently proprietary and protected by patents, see Fig. 2.

Although individual CVM products can be cost-optimised, selecting a CVM chip from another manufacturer means also changing the communication interface, resulting in a long development cycle with large investments and risks during validation and qualification. At the same time, the single CVM ICs for modular BMS architectures are constantly under review because requirements are changing.

Through an evolutionary process, industry members are trying to maintain as much of the architecture as possible, adding only those features that are required. However, new features are becoming very diverse, imposing large silicon changes such as the addition of a wireless interface, pre-drivers to control switch-out FETs, the introduction of EIS functions, or the addition of a microcontroller to provide extra pre-processing or greater flexibility in the module.

This level of change brings an opportunity to re-think the CVM IC approach completely and to look for more standardisation between CVM ICs, avoiding the pitfalls from the past.

From the earlier discussion about choosing a modular or cell-level BMS, it is clear that the ICs used in a modular BMS are completely different from those used in a cell-level BMS. However, taking a two-step approach through separating cell monitoring functions from communication functions, there seems to be some room for standardisation when it comes to the CVM interface, see Fig. 3.

By way of example, industry members could define a quasi-standard SPI interface between the CVM IC and the communication IC, with an agreed minimum subset of commands and defined locations for the various data, such as: voltage and temperature readings; balancing commands; undervoltage and overvoltage thresholds; functional safety approach; and size of cyclic redundancy check. This common protocol would decouple the cell voltage monitoring function from the communication interface and allow OEMs and suppliers to choose the most appropriate two-chip design approach for the application.

Most wireless and PLC (power line communication) options are naturally software-defined applications based on embedded microcontrollers with flash memories. While this complies very well with the drive towards

BMS	Communication Interface	
	Wired	Wireless
Modular	Highly Fragmented State-Machine Based Proprietary (No Standards)	In Development Microcontroller Based Standardization Possible
Cell Based	In Development Standardization Possible	In Development Microcontroller Based Standardization Possible

Table 1: Comparison between modular BMS and cell-level BMS



higher levels of integration, these IC technologies are often focused on consumer products targeting the IoT and, as such, not compliant with the mixed signal automotive processes used for CVM ICs (less than 60V) in a modular BMS.

The best architecture is therefore a two-chip approach, hosting CVM and communication functions in two separate integrated devices. A second stage towards higher integration could be to assemble these devices in the same package. Wired communication interfaces may still require additional transceiver infrastructure depending on the isolation technology chosen.

Ethernet and Can, for instance, have protocols that can also be integrated with the microcontroller in a dedicated or standard communication chip.

Of course, it is still possible to integrate the CVM functions with the communication functions in a single device, especially for the cell-level BMS. However, because of different OEM requirements and potential changes in the coming years – both for CVM and communication functions – it seems prudent to isolate the issues first and resolve them by developing a two-chip approach while standardising the interfaces; the cells and module-level PCBs are typically large enough to host a two-chip design.

There is no immediate need or desire particularly in relation to cost to integrate proprietary products that may have a limited lifespan. But once industry-wide, re-usable standards for BMS internal communication both for wired and wireless communications have been developed and a compatible supplier base has emerged, then the development risks will be mitigated enough to encourage manufacturers to consolidate CVM and communication functions into a single device.

Conclusion

Changing BMS requirements are pushing CVM IC suppliers into heavy development efforts. At the same time, a lack of standard interfaces makes it very difficult for OEMs and battery system manufacturers to change CVM IC supplier.

Different OEMs will always have different needs so modular- and cell-based BMSs will co-exist, wired or wireless and with or without microcontrollers.

Efficiency of investments will improve if second life requirements are taken into the equation and if a few standard BMS-internal interfaces are selected. To increase the mobility of potential products and to enable emerging standards, a two-step approach is proposed with the creation of an industry-wide standard SPI-like interface between separate CVM and communication functions as the first step.

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LEAST RESISTANCE

Simone Bruckner explains how to choose a resistor for automotive applications

The electric car boom is upon us. However, the technology behind the movement must continue to be refined to perfect its use in commercial vehicles, and this includes what manufacturers must consider when choosing power resistors for electric vehicles.

Most electric passenger and commercial vehicles would use regenerative braking, which recuperates energy lost through braking and returns it to the battery to increase the range. However, when the battery is full, the vehicle must rely on its mechanical friction braking system to slow the vehicle or to bring it to a standstill.

Instead, it would be more beneficial to use a resistor to discharge the excess energy.

Not only would the resistor be useful in the event of an electrical fault, it would also reduce servicing costs due to reduced wear on the friction braking system.

The energy dissipated during dynamic braking into the resistor can also be used to heat the cabin or trailer, reducing the requirement for electrical heating, which places an extra load on the battery.

Application

The first step for automotive manufacturers looking to purchase a resistor is to analyse its potential purpose.

If it is to be used for both discharging excess energy produced during dynamic braking and heating the cabin, a liquid-cooled resistor is probably best. Discharged energy is transferred as heat to the liquid coolant, which can then be circulated to the vehicle's heating system.

This is an effective use of energy that would otherwise simply be lost. It also reduces the need for an electrical heating system that uses the battery's energy, which in turn drastically reduces the vehicle's range.

Based on an average estimation of the braking power needed for a car, a liquid-cooled resistor used for both applications will require a power rating of between seven and ten kilowatts. Larger vehicles such as lorries or vans will require a higher rating.

Pressure

In addition to ensuring a sufficient power rating, a vehicle manufacturer purchasing a liquid-cooled resistor must take pressure drop into account.

Within the resistor, liquid flows between the inlet and outlet to remove excess heat. Often this flow will be through channels that may have additional obstacles inside. This causes the pressure of the pumped fluid to drop between the inlet and outlet and, if the pressure becomes too low, the flow will not be sustained.

A trade-off exists between efficient cooling, which allows a resistor to have a higher power rating and pressure drop. Resistors with a higher power rating will also experience higher power drop.



Liquid-cooled modular resistor

For larger vehicles, which require the highest power rating, it may be possible to use an additional auxiliary pump. However, smaller vehicles are often limited in space and the pressure drop experienced by a resistor with a higher power rating might be unacceptable. Liquid-cooled modular resistors are available with a 25kW rating.

Design

The design of the vehicle and placement of resistor could also dictate the available choices. A resistor rated to IP56 can be safely subjected to harsh environmental conditions. Therefore, it is safe to be mounted outside or even underneath the vehicle.

Another consideration is the level of maintenance required by an additional component. Extra maintenance can deter potential consumers, particularly those interested in purchasing several vehicles as a fleet.

Servicing the resistor's coolant can be as simple as avoiding contamination and ensuring the reservoir is filled, exactly the same as a traditional internal combustion vehicle. In fact, such resistors have been successfully tested with 20 and 50 per cent glycol, the most common coolant for combustion engines.

Manufacturers who are looking to use new technologies in their electric vehicles must ensure they make the right choices about power rating, pressure drop and resistor size.



Simone Bruckner is managing director of Cressall Resistors

ON THE ROAD

CONNECTED CAT

A look at the technology inside the Jaguar all-electric I-Pace SUV



Vehicle Electronics



The Jaguar I-Pace is smarter and better connected

Jaguar's all-electric I-Pace SUV has a new infotainment system, three-phase AC charging and more driver-focused technology. The Pivi Pro infotainment is said to be as quick and easy to use as a smartphone, with self-learning navigation that can show where the nearest available charge station is, how much it will cost and how long it will take to charge.

Connectivity has been improved with dual-modem embedded SIM and a 4G data plan, wireless device charging, embedded Spotify, and Bluetooth for two phones at the same time.

Driver assistance technology includes an optional ClearSight rear-view digital mirror and standard-fit 3D surround cameras.

Software-over-the-air capability means infotainment, battery management and charging systems can be updated remotely.

Since its debut, the I-Pace has won more than 80 global awards, including the 2019 World Car of the Year, World Car Design of the Year and World Green Car.

With two Jaguar-designed electric motors at each axle, producing a combined performance of 400PS and 696Nm, aluminium construction and a low centre of gravity, the vehicle can balance its all-wheel drive performance with real-world range and day-to-day usability.

Technology

This is the first Jaguar to feature the Pivi Pro infotainment system. As intuitive to use as a smartphone, Pivi Pro is fast and responsive with enhanced EV navigation that can show if nearby charging stations are available or in use, what they cost, and how long it will take to charge.

The car comes with an 11kW on-board charger as standard, giving drivers access to three-phase electricity supplies to enjoy faster charging: when connected to an 11kW wall box, 53km of range per hour can be achieved, while a full charge from empty takes 8.6 hours – suitable for overnight charging at home.

Those using 7kW wall boxes benefit from competitive charging capability – up to 35km of charge per hour, with a full charge taking 12.75 hours. When charging on the go, a 50kW charger will add up to 63km in 15 minutes, while a 100kW charger will add up to 125km over the same period.

Cabin air ionisation features PM2.5 filtration to capture ultrafine airborne particles and allergens. It can even filter its cabin air before a journey begins.

"When we developed the I-Pace, we wanted it to be the world's most desirable electric vehicle and to show what happens when Jaguar goes electric," said Alan Volkaerts, vehicle line director at Jaguar. "I think we've achieved those ambitious goals, and now we've made it even better with a new infotainment system, three-phase charging and technology that benefits driver and passengers alike."

Connected

The infotainment system is a highlight. The 31cm high-definition virtual instrument cluster, 25 and 13cm upper and lower touchscreens, and multi-function, haptic rotary controllers are matched to crisp, clean, contemporary graphics for an intuitive user experience.

Inspired by smartphones, Pivi Pro is easy to use, while its processor and fast start-up ensure the system is ready to go by the time the user is in the driving seat. Supported by a built-in back-up battery, navigation initialisation takes just a few seconds.

The flat menu structure makes navigating the system easier with the features and functions used regularly accessible via the home screen with a click. The redesigned navigation system reduces the number of steps required to set a destination by half and users can pan and zoom in and out of the map with a pinch of the fingers, just as with a smartphone.

An optional wireless device charging pad can be beneath the floating centre console. Wireless charging also includes signal boosting, ensuring the phone's signal remains stronger for longer. A smartphone pack with Apple CarPlay is standard, as is Bluetooth technology, which can pair two phones simultaneously. The pack also includes Android Auto as standard.

The car comes with a dual modem embedded SIM (eSIM) and 4G data plan, which enables music streaming via Spotify, Deezer or Tunin and map, weather, calendar and traffic updates simultaneously.

The navigation uses self-learning algorithms to optimise routing, voice guidance knows to remain quiet when travelling through known areas, and maps will be updated using software-over-the-air functionality.

"The Pivi Pro infotainment system makes it easy to use public



App shows navigation and charging details

charging networks," said Stephen Boulter, vehicle engineering manager at Jaguar. "As well as showing where charging stations are, it can also tell you if they're available, what they cost to use, and an estimate of charging time. We know that most customers charge their I-Pace at home but we wanted to make charging on the go just as simple, and our new infotainment system makes that possible."

Simplifying the process still further is Pivi Pro's ability to add charging stations automatically to the route, if needed.

The system will select the optimum chargers to reduce total journey time. On long drives, Pivi Pro can also show the predicted charge level on arrival at each waypoint.



The infotainment system is a major highlight

Driver assistance

Digital technology assists drivers and road users. Visibility is enhanced with a 3D surround camera system as standard, which provides a 360° digital plan view of the surrounding area and potential hazards, visible through the central touchscreen.

Inside the cabin, the ClearSight rear view mirror improves vision and convenience by ensuring the driver always has an unobstructed view of the road behind, even with three people in the rear seat or with the 656-litre luggage compartment loaded to the roof.

There is a wide-angle, rear-facing camera linked to a high-resolution screen within the frameless glass mirror. A small toggle switch on the mirror allows the driver to switch seamlessly between the view from the standard mirror and the camera feed.

Integrated within the roof-mounted antenna module, the high-definition camera works in all conditions, including low ambient light, while a protective lip and hydrophobic coating help repel water and ensure the camera lens remains as clean as possible.

Inside, there is the option of a Meridian 3D surround sound system with Trifield technology. The system has two additional speakers in the cabin headliner, meaning the 16 speaker and one subwoofer arrangement can deliver an exceptional experience for all occupants.



Charging on the go has been simplified

Going electric

With a range of up to 470km from its 90kWh battery, those with an average daily commute would only need to charge their car once a week.

A range calculation tool makes it easier to see how factors such as vehicle speed, ambient temperature and climate control settings can influence the real-world expected range.

Jaguar has developed the iGuide app making it simple to find and understand the key features and controls. It also doubles as a mobile owner's manual, answering questions about charging.

There is also the round-the-clock I-Assistance service; at the touch of a button, owners can be connected directly to an expert to answer any queries about the vehicle.

Every home charging point from Jaguar's recommended partners comes smart enabled, meaning users can activate and deactivate charging progress from a smart phone.

When charging in public places, the charging cable locks into place as soon as the car is locked, and cannot be disconnected until the vehicle is unlocked.

An eco mode helps preserve range by reducing energy depletion and encouraging a more efficient driving style. It also makes subtle changes to cabin temperature, air recirculation and to a number of the car's other features. These changes can be overridden by normal operation of each feature or via the menu settings.

Software-over-the-air functionality means infotainment, battery management and charging can be updated remotely.

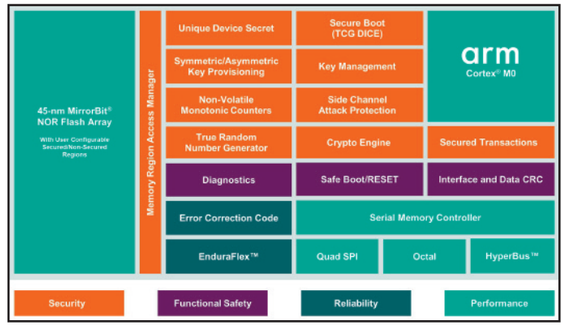
The car was awarded the maximum five-star Euro NCap rating.

Security and safety combined in NOR flash

Following the acquisition of Cypress Semiconductor, Infineon Technologies has added Semper Secure to its Semper NOR flash memory platform.

This combines security and functional safety in a single NOR flash device to deliver the security, safety and reliability required for connected automotive, industrial and communications systems.

Having a secured flash is important when the NOR flash is placed outside of a processor, making it vulnerable to various attacks.



This product serves as a hardware root-of-trust to provide end-to-end protection.

Additionally, the Semper development kit enables easy integration to accelerate time-to-market and reduce cost of ownership.

The family includes AEC-Q100 qualified devices with a temperature range of -40 to +125˚C. They support 1.8 and 3.0V operating ranges and come in densities of 128, 256 and 512Mbit.

The flash is designed and compliant to ISO 26262 and is Asil B compliant and ready to be used in systems up to Asil D.

The implemented EnduraFlex architecture simplifies system design by enabling optimisation for high endurance or long data retention partitions.

The devices are offered with quad SPI, Octal SPI and HyperBus interfaces. The Octal and HyperBus interface devices are compliant with the Jedec expanded SPI (xSPI) for high-speed x8 serial NOR flash and have a read bandwidth up to 400Mbyte/s.

The 256Mbit devices are sampling now with volume production expected during the second quarter of 2021.

Static analysis

The static code analysis tool C-Stat in IAR Embedded Workbench now has extended coverage for the Misra C coding standard through complete support for Misra C: 2012 amendment one.

The tool performs code analysis to find potential issues. The analysis provides code alignment with standards such as Misra C: 2012, C++: 2008 and C: 2004, and detects defects, bugs and security vulnerabilities as defined by the CWE common weakness enumeration and Cert C.

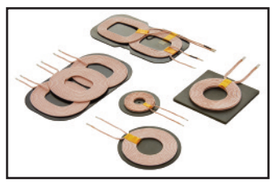
The Misra C: 2012, amendment one adds 14 rules with a focus on security concerns highlighted by the ISO C secure guidelines. Several of these rules address issues pertaining to the use of untrustworthy data, a well-known security vulnerability in many embedded applications.

Integrated with the Embedded Workbench IDE, C-Stat enables static analysis in a straightforward way and as a natural part of a developer's workflow. This helps developers ensure their code is safe and of high quality at an early stage

Wireless coils

Wireless charging transmission coils from Bel subsidiary Signal Transformer come in single and multiple windings for smart car applications.

They use pin-cooling technology and pin tolerance control to ±1.0mm after the tin immersion process. There are two core shapes – square-rectangular (Q) or circular (C) – and have Qi standard compliance and customisable size and shape characteristics, with a low profile and high mechanical intensity.



Inductance tolerance is ±5% for J and ±10% for K with inductance of 6R3 for 6.3μH, and an operating temperature of -40 to +125˚C for automotive applications.

They comply with environmental requirements, including RoHS, Reach, Prop 65 and Conflict Minerals.

The series uses inductive coupling to transfer signals, data and power from one source to another.

Multi-finger weather-proof touch

Touch controllers from Microchip provide multi-finger thick glove and weather-proof operation.

The company has extended its MaxTouch portfolio with the MXT-288UD-AM and the MXT144UD-AM for vehicles, motorcycles, ebikes and car-sharing services.

Secondary touch surfaces can be placed in both the interior of cars and exterior of a motor vehicle, such as handlebars, doors, electronic mirrors, control knobs, steering wheel, between seats or in an armrest.

With the 7 by 7mm automotive grade VQFN56 package, tier one suppliers can reduce board space by 75% and lower costs.

The wait-for-touch mode consumes less than 50μA, remaining responsive for the user, even if the display switches off to save power or to avoid disturbing the driver at night. The system will wake by a touch event anywhere on the touch surface.

In addition, the devices enable detection and tracking of multi-finger thick gloves through various overlay materials and thicknesses, such as leather, wood or uneven surfaces, even in the presence of moisture.

Normally the dielectric constant of these overlay materials would limit the detection of the touch, however these devices can detect and track multi fingers with a high signal-to-noise ratio and through a proprietary differential mutual acquisition scheme.

For example, in car sharing applications, this touch functionality helps users access a car from the outside by tracking touch coordinates on an exterior display in any environment, including rain, snow or extreme heat. Motorcycles and other motorbike vehicles also benefit from such weather-proof designs.

Then firmware is developed to Automotive Spice processes and is AEC-Q100 qualified.

Software tools include MaxTouch Studio and a MaxTouch analyser. For the MXT288UD, the hardware includes an evaluation kit with a PCB and a 12.7cm capacitive touch panel, while the MXT144UD's evaluation kit includes a PCB and a 7.4cm capacitive touch pad. For both, a bridge PCB is included with a USB connection for interfacing to a computer when running MaxTouch Studio.



Sealant protects vehicle connectors

A light- and humidity-curing sealant for connectors in vehicle control units or sensors is available from Delo.

The Dualbond GE4918 provides pin-sealing properties to increase connector life and allow efficient production.

Connectors need to be reliably sealed to protect electronics from humidity, media and corrosion. Automotive suppliers generally use silver-coated connector pins since they are more cost-efficient than gold and more reliable than copper. Silver is given an additional passivation layer to protect it from tarnish and abrasion. This coating is usually based on mercaptan and can be difficult to bond, until now.



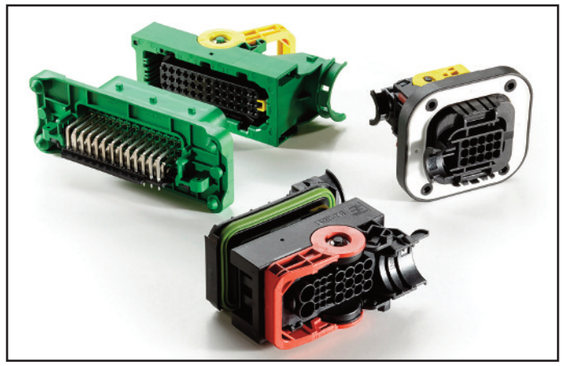
The sealant has been optimised for sealing these types of pins. It not only adheres to the mercaptan coating, but also to the typical connector housing materials PA and PBT.

Since this sealant is flexible in the cured state, it compensates for the different thermal expansions of metal pins and plastic housings.

Temperature resistance is up to +150˚C, and it can keep connectors tight after thermal shock tests from -40 to +150˚C.

The sealant can be fixed in 10 to 20s with the help of high-intensity UV light. In shadowed areas, a second curing allows the adhesive to cure under air humidity.

Connectors handle harsh environments



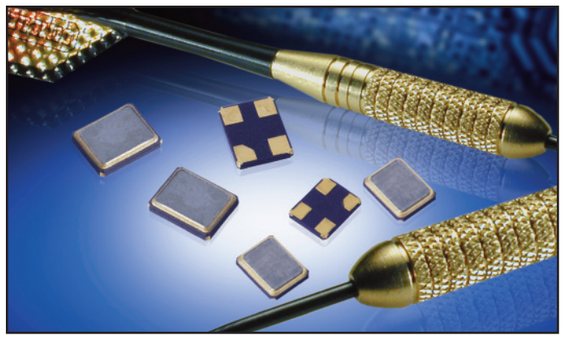
TE Connectivity has expanded its Leavyseal range of connectors for electrical systems in vehicles within the transportation, construction, mining, marine and agricultural industries.

These need protection from harsh environments such as vibration, moisture, salt, dust and dirt. To address this, the connectors and accessories can withstand harsh environments and help vehicles operate safer, cleaner and smarter.

Variants are made of flame-retardant UL94 V-0 material. An integrated secondary locking feature secures contact alignment. Temperature range is -40 to +140˚C. IP protection is IP67, or IP69K with cover.

The lever lock enables strong, sealed mating and there are in-line, flange and PCB mount options as well as arrangements from 15 to 120 positions and mixed terminal sizes in one housing.

The lever design and four colour codes with mechanical keying allows for flexible usage and provides proper mating and ease of assembly. Accessories include back shells, adapters and interface protection covers.



Crystal oscillators

Surface-mount low-phase-noise crystal oscillators from Euroquartz are for automotive applications.

Operating temperature is from -40 to +125˚C for the XOY oscillators that have a phase noise performance of -155dBc/Hz at 10kHz and -160dBc at 100kHz offset.

Integrated phase jitter is 150fs typical (12kHz to 20MHz) and frequencies available are from 1.25 to 50MHz.

They are housed in a 3.2 by 2.5mm surface mount package with supply voltages of 1.8, 2.5 and 3.3V ±10% available.

Specifications include 15pF LV-cmos load, rise time of 10ns maximum, start-up time of 5ms maximum and tri-state function as standard.

Current consumption is 2.0 to 6.0mA depending on supply voltage and frequency. Ageing is ±2ppm maximum for the first year. Solder profile is up to +260˚C.

Four channels each for Can-FD and Lin

HMS Networks has extended its Ixxat PC-interface portfolio with the multi-channel interface Can-IB 640 and PCIe unit that offers four channels each for Can-FD or Can and Lin connectivity for automotive test applications.

This interface makes network connectivity and integration more straightforward and cost-efficient.

For more connectivity, several cards can be operated in parallel.

The active PC-interface has an on-board microcontroller that can read, timestamp and filter large amounts of data in real time. The network connection is done via two D-sub 9 connectors, which are galvanically isolated to protect the interface card and the connected PC.

There are driver packages for Windows and Linux, including SocketCan. The drivers ease application development since all cards can be interfaced from the application in the same way.



Discretes come in flat no-lead packages

Automotive-qualified discretes from Nexperia come in AOI-compatible DFN (discrete flat no leads) packages.

The AEC-Q101 devices include switching, Schottky, Zener and protection diodes, bipolar junction transistors (BJTs), n- and p-channel mosfets, resistor-equipped transistors and LED drivers.

They range from the small form factor DFN-1006BD-2 (1 by 0.6 by 0.5mm) up to DFN-2020D-3 (2 by 2 by 0.65mm), including the recently released DFN-1110D-3 and DFN-1412D-3 styles.

DFN devices can measure down to 0.6mm² offering a PCB space saving of up to 90% compared with sot-23 devices.

The thermal performance ($R_{th(j-sp)}$) allows an equal or better P_{tot} on the smaller DFN footprint. The DFN package technology supports a T_j capability of up to +175˚C.



Because automated optical inspection is vital for some applications, the DFN package has side-wettable flanks (SWFs) so visible solder joints can be inspected post soldering. An additional benefit of DFN packages with SWFs comes from the mechanical robustness of the bond to the PCB. SWFs improve shear forces and board bending capabilities.

Cores certified to Asil B and D

The CryptoManager RT-640 and RT-645 root-of-trust cores from Rambus have been certified Asil B and D ready, respectively.

These automotive-grade secure co-processor IPs safeguard SoCs in V2X communications, adas, ECU platform management, infotainment and other critical vehicle systems.

Easily integrated into chips serving the automotive market, the cores provide security features such as secure boot, secure firmware updates, secure debug, authentication, attestation, device personalisation, key and data provisioning, secure feature and configuration management, cryptographic acceleration, and secure key and data storage.

In addition, they provide design integrity and reliability.

They can operate as full or medium hardware security modules for Evita e-safety vehicle intrusion protected applications.

Asil certification was provided by SGS-TÜV Saar.

The cores are available for licensing. They come with a secure application SDK to speed development and deployment.

Shunts take on Hall sensors

Reinforced isolated high-power shunt modules have been introduced by Riedon to take on Hall sensors in industrial and automotive installations.

The SSA Smart Shunt current sensing modules combines conventional passive shunt resistors with those associated with more expensive and bulky closed-loop Hall Effect current sensors.

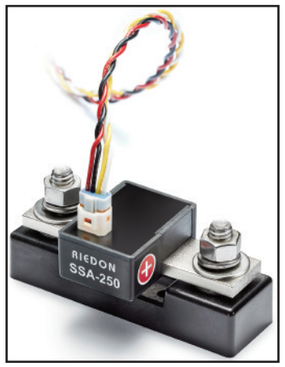
Each has a built-in precision amplifier and provides reinforced electrical isolation up to 1.5kV DC.

Sensing accuracy and linearity are both ±0.1% over the current range, with less susceptibility to temperature drift. The need for routine calibration can thus be negated.

Response time is less than 1.5μs.

With an amplified analogue output and integrated protection, they can be placed on the high or low side of a circuit. Temperature range is -40 to +125˚C.

The company plans to offer a digital output as well, through I²C, RS232, Modbus and Can.



Bi-supply simplifies powertrain testing

A bidirectional power supply from MDL Technologies is said to simplify electric vehicle powertrain testing.

The Chroma 62000D bidirectional DC power supplies are for high current testing of electric vehicle powertrain components. They provide two-quadrant operation with programmable DC output and regenerative DC loading in one unit.

High power components that can be tested include bidirectional onboard chargers, bidirectional DC converters and DC-AC motor drivers; they can also do power conversion simulation tests of batteries in both directions.

Compliant with LV123 and LV148 standards for EV component testing, the units have a fast cross-quadrant bandwidth that produces a transient response time of 1.5ms or less.

Various voltage and current combinations are available in constant power mode; constant current and constant voltage modes are also available.

Maximum power is from 6 to 18kW, with a power density of 18kW within a 3U rack height. Output current ratings are up to ±540A, with voltage ratings up to 1800V DC.

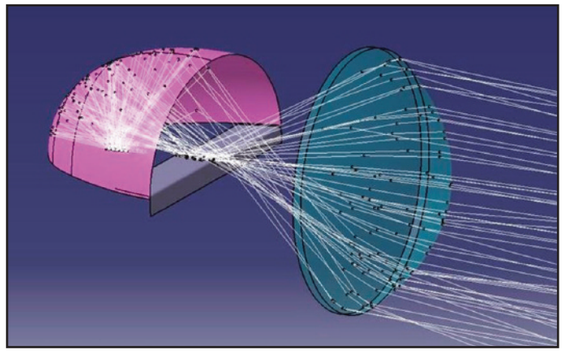
When more power is needed, master-slave capability enables up to ten units to operate in parallel to deliver up to 180kW.

Icons on the touch screen make it easier to carry out voltage and current settings and measurements, as well as programme auto sequence control settings and preview output waveforms.

There are 100 programmable user settings available in the units' list mode.

Control interface options include USB, lan, Can bus and GPIB as well as analogue APG.





Tool makes light design photorealistic

The latest release of Synopsys' LucidShape CAA v5 software product provides design and visualisation workflow for automotive lighting design within the Catia v5 environment.

Two added modules for design and visualise help designers conceptualise and design automotive lighting products and generate physics-based photorealistic images that accurately depict how headlights, tail lights and signal lights will look in real life.

Catia design tables show simulations of multiple model configurations and improve design-for-manufacturing capabilities for automotive light guides. Designers can achieve first-time-right designs with integrated optical and mechanical modelling and fully parametric features.

Geometry creation tools give users the freedom to focus on overall design objectives rather than the implementation details of complex optics. Tools such as MacroFocal design help designers conceptualise and design freeform reflectors and lenses that meet photometric and aesthetic requirements.

Photorealistic visualisation is used in the creative process to evaluate the aesthetics of a lighting design, and in the engineering process to evaluate optical feasibility based on uniformity, brightness and manufacturability. Features such as the environment light source and human eye vision image tool augment the realism in a scene and enable designers to evaluate virtually how the human eye will perceive a headlight, tail light or signal light.

Users can construct and simulate design variations quickly.

Node provides 3D contactless sensing

An AEC-Q100 automotive-grade monolithic sensor from Melexis uses the Hall Effect to provide contactless sensing in three dimensions.

The MLX90395 Triaxis magnetometer node dual-die version provides redundancy for scenarios such as gear lever position sensing.

The functionality is defined through the system processor rather than hardwired into the device itself.

There are I²C and SPI interfaces for integration into an automotive or industrial control environment.

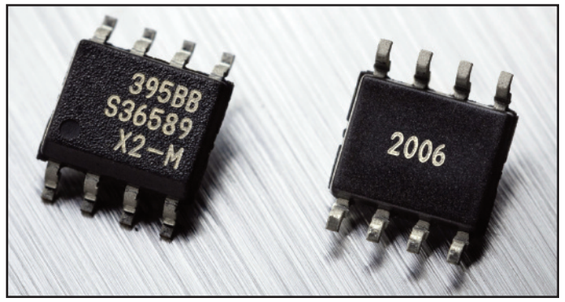
Both medium-field (50mT) and high-field (120mT) versions are available in three package options – soic-8, tssop-16 dual-die for redundancy and QFN-16 with wettable flanks.

All packages are qualified to AEC-Q100 covering the temperature range -40 to +125˚C and are RoHS compliant.

The selectable digital output provides 16bit resolution for x, y and z magnetic field measurements, enabling the host processor, DSP, microcontroller or digital signal controller to decode the absolute position of any magnet as it passes the sensor.

The Triaxis technology reduces power consumption, with an idle current of 1.4μA, standby current of 2.4μA and supply current of 4mA or less.

Along with magnetic field sensors to measure three fields (Bx, By and Bz), it integrates a temperature sensor and supply voltage monitor. The sensor has three state machines and operates in one of three modes – single measurement, burst mode and wake-up on change mode.



Engineers can select which magnetic field is measured and the frequency of measurement, to fine-tune the sensor's energy efficiency as well as the filtering and sampling time to optimise noise versus bandwidth.

Operational modes can be defined and selected at runtime through the I²C or SPI interfaces, allowing multiple sensors to form part of a sensor cluster, controlled by a single microcontroller.

The bus protocol is also selectable, running at up to 10MHz for SPI and 1MHz for I²C.

Each sensor is given a unique 48bit ID number during the manufacturing process and contains additional free space to store user traceability information.

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