VEHICLE electronics

The monthly magazine for automotive electronics engineers

NXP and Foxconn MoU to develop smart vehicles

NXP Semiconductors has signed a memorandum of understanding (MoU) with Hon Hai Technology Group (Foxconn) to develop platforms for smart connected vehicles.

Foxconn is the world's largest electronics manufacturer and will use NXP's portfolio of automotive technologies and its expertise in safety and security to enable architectural innovation and platforms for electrification, connectivity and safe automated driving.

The collaboration builds on the company's initial digital cockpit partnership, based on the NXP i.MX applications processors and NXP's software-defined radio platform.

The primary focus of the expanded collaboration is aimed at Foxconn's efforts in electrical vehicle (EV) platforms, leveraging NXP's expertise and electrification portfolio, from NXP S32 processors to analogue front-end, drivers, networking and power products.

Another innovation priority is connectivity using the latest NXP S32 domain and zonal controller family for gateways and vehicle networking control, while advancing secure car access with ultra-wideband (UWB) and Bluetooth Low Energy (BLE).

A third pillar is safe automated driving augmented by NXP's radar technology.

NXP will also offer hardware and software support and leverage the expertise of its third-party ecosystem in the areas of electrification, connectivity and automation.

"Foxconn sees the disruptive challenges and the potential for innovation in today's automotive industry," said Young Liu, chairman of Foxconn.

Kurt Sievers, CEO of NXP Semiconductors, added: "We are proud to join forces with Foxconn to support its ambitious leap into automotive."

• NXP wins Embedded World award, p19.



From the left: NXP CEO Kurt Sievers, Elton Tsang, senior sales director of NXP Taiwan, Jerry Hsiao, CPO of Foxconn, and Young Liu, chairman of Foxconn

Issue 104
August 2022

IN THIS ISSUE

2: VW and STM co-develop SoC

3: BMW deploys Monolith AI

4: Hailo works with Renesas on adas

5: Baidu removes steering wheel

7: SoftBank and May cooperation

9: Microchip boosts Panasonic's knob

10: Hyundai checks driver vital signs

13: Embedded World show report

21: How to enable DSRC and 5G V2X

27: EVs can help balance the grid

29: Reliable flash in high temperatures

35: Product news

40: Contact details

VW and STM co-develop SoC to secure chip supply

Volkswagen's Cariad software unit and ST Microelectronics are co-developing a system-on-chip (SoC) for software-defined vehicles.

They are developing tailored hardware for connectivity, energy management and over-the-air updates making vehicles fully software-defined, secure and future-proof.

The plan is for VW vehicles to be based on the unified and scalable software platform.

At the same time, the parties are moving to agree that semiconductor foundry TSMC will manufacture the SoC wafers for STM. With this move, Cariad aims to secure the chip supply for Volkswagen cars years in advance.

As part of its strategy, Cariad will enter direct relationships with semiconductor suppliers at the tiers two and three levels for Volkswagen for the first time. In the future, Cariad plans to direct tier-one suppliers to use only the SoC co-developed with STM and STM's standard Stellar microcontroller for Cariad's zone architecture.

"We are about to launch a ground-breaking new cooperation model for Volkswagen," said Murat Aksel, Volkswagen's board member."

The SoC aims to complement STM's Stellar microcontroller family by extending its power-efficient real-time capabilities to service-oriented environments.

Cariad CEO Dirk Hilgenberg said: "The use of a single, optimised architecture in all Volkswagen electronic control units will give us an enormous boost for the efficient development of our software platform."

This should see all ECUs running on common basic software.

Marco Monti, president of STM's automotive group, said the details of the cooperation would now be finalised and cast into detailed agreements.

T-Systems invests in automotive



T-Systems is investing in the automotive industry, focusing on four areas – vehicle software and connectivity, digital customer experiences, the digitisation of the company, and secure cloud computing.

To this end, the Deutsche Telekom subsidiary plans to create around 600 jobs worldwide by 2023. Already, 4000 experts are working on the digitisation of the industry. T-Systems is recruiting around 200 employees for its Wolfsburg site alone.

"Electromobility, autonomous driving, networking: in the future, the core competence of car manufacturers will be software," said Christian Hort, responsible for T-Systems' automotive business. "The challenge lies in managing the entire software lifecycle. In my opinion, this is even more complex than the pure electronics delivery cycle. No car manufacturer will manage to map the entire software supply chain on its own and also offer all services related to the car, the customer and production from its own resources."

T-Systems is working on initiatives for more connectivity, automation and resilience in the industry. For example, it is a co-founder of the Catena-X initiative to bring transparency to supply chains and leave data sovereignty with the providers of the data.

BMW deploys Monolith AI for crash tests



BMW uses Monolith AI for vehicle development

BMW is using Monolith's AI software to accelerate the development of its vehicles.

By training Monolith self-learning models with the company's engineering test data, engineers can use AI to solve physics problems and instantly predict the performance of complex systems such as in crash and aerodynamics tests.

BMW's crash test engineering team began working with Monolith in 2019 via the BMW Startup Garage to explore the potential of using AI to predict the force on a passenger's tibia during a crash. Current crash development uses thousands of simulations as well as physical tests to capture performance.

Even with modelling, owing to the complexity of the physics underpinning crash dynamics, results require engineering know-how to calibrate for real world behaviour.

Moreover, physical crash tests can only be conducted in later stages of development when the design is mature enough to create physical prototypes.

Exploring a more efficient option, BMW collaborated with Monolith to see if AI could predict crash performance and, key, earlier in the vehicle development process.

Using Monolith, BMW engineers built self-learning models with existing crash data and were able to predict accurately the force on the tibia for a range of different crash types without doing physical crashes.

Moreover, the accuracy of the self-learning models should continue to improve as more data become available and the platform is further embedded into the engineering workflow.

This approach means engineers can optimise crash performance earlier in the design process and reduce dependence on time-intensive, costly testing while making historical data more valuable.

"When the intractable physics of a complex vehicle system means it can't be truly solved via simulation, AI and self-learning models can fill the gap to instantly understand and predict vehicle performance," said Richard Ahlfeld, CEO of Monolith. "This offers engineers a tremendous new tool to do less testing and more learning from their data by reducing the number of required simulations and physical tests while critically making existing data more valuable."

The platform has been developed with a focus on user experience by automotive experts and data scientists to ensure seamless integration with existing engineering processes. As a result, as soon as the software is implemented, domain experts quickly begin gaining insights and time back, as well as the chance to explore an even wider design space.

BMW is expanding its use of Monolith into more engineering functions across R&D that generate data from crash testing to aerodynamics, motorsports and adas.

Ansys gets Nascar to starting line

Nascar used Ansys simulation technology to ensure the safety of its latest race car in time for the 2022 season with virtual crash tests that accelerated validation time and reduced material costs for physical testing by $1m.

The crash simulations allowed Nascar to overcome pandemic-induced physical testing difficulties and meet its goal to debut the car in February at the Daytona 500 season opener.

By integrating Ansys LS-Dyna into crash testing, Nascar was able to analyse, test and validate multidirectional influences, including nonlinear and linear contact to the entire vehicle, spanning frontal impacts, roof crashes, lateral side impacts, rear impacts and oblique impacts.

These data, compiled by virtual crash simulations, slashed typical validation timing and material costs.

Hailo and Renesas collaborate on adas

AI chip maker Hailo is working with Renesas to deliver energy-efficient processing for adas and automated driving (AD).

The joint offering aims to make adas technology more accessible in cars of all types.

The combination of Hailo-8 processors, designed for heavy neural network (NN) acceleration, with the Renesas R-Car V3H and V4H SoCs can power scalable, efficient and cost-effective adas for zonal and centralised vehicular ECUs.

The results are scalable for a wide range of adas functions from level two-plus up to level-four AD functions requiring high tera-operations per second (Tops), ranging from 60 to over 170Tops for multi-sensor perception and fusion.

"Adas and AD features have proven to be instrumental in minimising accidents and saving lives," said Orr Danon, CEO of Hailo. "However, technological challenges have caused great difficulties for automakers looking to make such advanced functions accessible in anything but higher-end vehicles. Together with Renesas, we are helping democratise adas, so its benefits can be enjoyed by more and more drivers. AI will play a major role in making our roads safer and, with industry leaders like Renesas helping us innovate, we will make driving both safer and more affordable."

Yusuke Kawasaki, director at Renesas, added: "We are confident our collaboration with Hailo, which has expertise in AI technology, will enable our customers to easily extend the performance of the R-Car so that they can flexibly and quickly incorporate adas and AD functionality in various classes of vehicles."

The Renesas R-Car V4H is expected to achieve Asil B and D metrics for the real-time domain, and Hailo-8 supports Asil B.

- Renesas has completed its acquisition of Reality AI, which provides embedded AI and TinyML for non-visual sensing in automotive, industrial and commercial products.



Baidu removes steering wheel from latest AV

Baidu has unveiled its latest fully autonomous vehicle (AV), the Apollo RT6, an all-electric, production-ready model with a detachable steering wheel.

Designed for complex urban environments, the RT6 will be put into operation in China next year on Apollo Go, Baidu's autonomous ride-hailing service.



Removing the steering wheel creates room for other activities

Per unit cost is RMB250,000.

"This massive cost reduction will enable us to deploy tens of thousands of AVs across China," said Robin Li, CEO of Baidu. "We are moving towards a future where taking a robotaxi will be half the cost of taking a taxi today."

The steering wheel-free design unleashes more space to craft unique interiors, allowing for the installation of extra seating, vending machines, desktops or gaming consoles. At 4760mm long with a wheelbase of 2830mm, it delivers comfort with independent rear seating, rear legroom of 1050mm, a purely flat floor and an intelligent interaction system.

The exterior seamlessly integrates sensors on the sunroof alongside interactive lights and intelligent electric sliding doors to enhance the riding experience.

The vehicle uses Baidu's level-four autonomous driving system, powered by automotive-grade dual computing units with a computing power of up to 1200Tops. It has 38 sensors, including eight lidars and twelve cameras, to obtain accurate, long-range detection on all sides.

Real-world data have been gathered by a total test mileage of over 32 million kilometres driven by Baidu's AVs to date.

Zhenyu Li, senior corporate vice president of Baidu, said the autonomous driving capability of the RT6 was equivalent to a skilled driver with 20 years of experience.

This is the first vehicle model built on Xinghe, Baidu's self-developed automotive EE architecture for fully autonomous driving. The vehicle is 100% automotive-grade and has full redundancy throughout hardware and autonomous driving software.

Apollo Go has expanded to ten cities in China since its launch in 2020, including all first-tier cities, and has provided more than a million orders.

Bosch deploys Qt design tools for digital cockpits

Bosch will deploy Qt's unified cross-platform HMI design and development framework to give automakers the tools to create digital cockpits.

The tools provide a turnkey approach for automotive OEMs seeking to develop their HMIs to run, for example, on Autosar architectures.

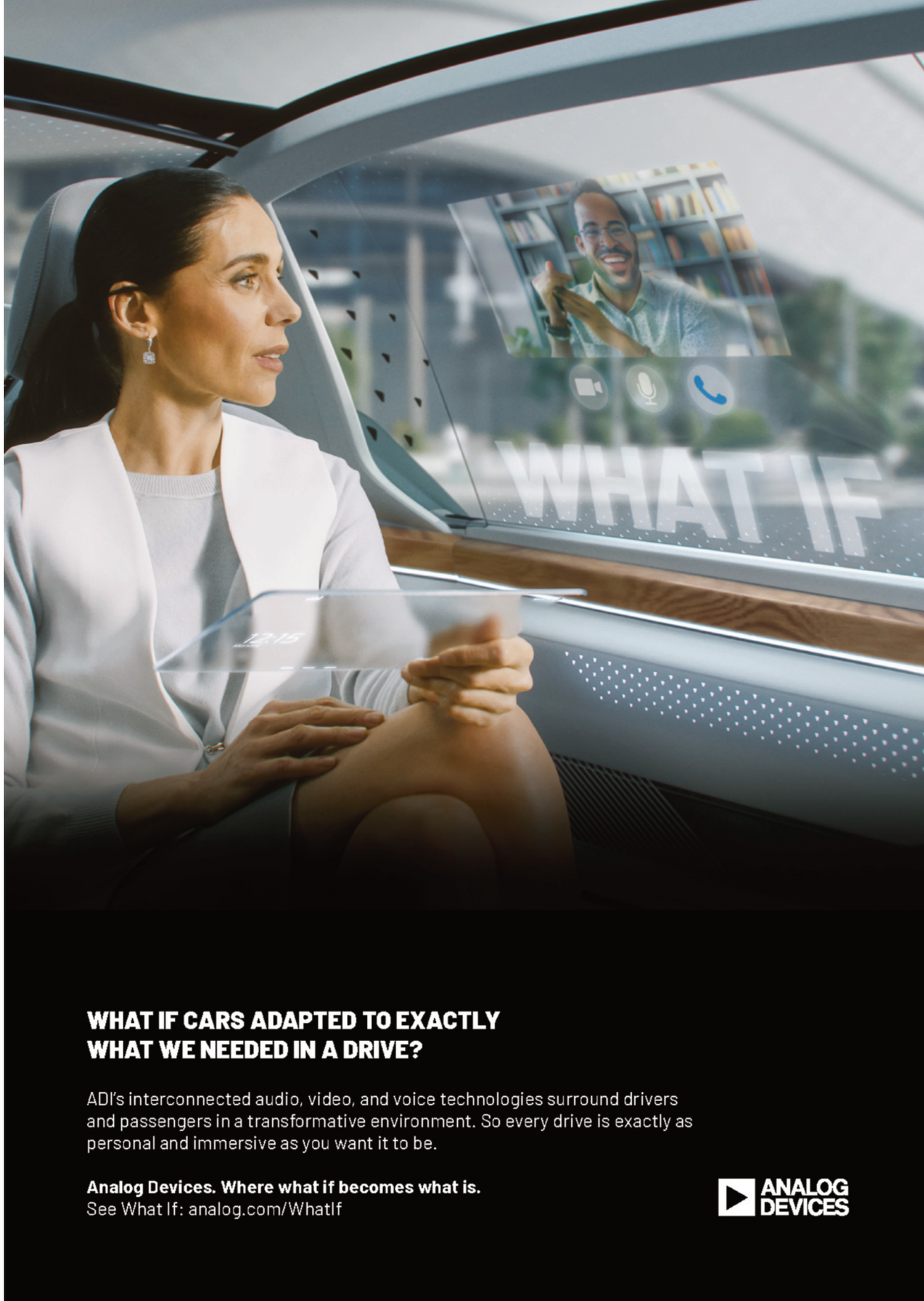
With the latest addition for MCUs, Qt can be deployed to any automotive grade MPUs and MCUs. It can be used across any operating system or software platform environment, including Integrity, QNX Neutrino, Android Automotive and Automotive Grade Linux, as well as Autosar Classic.

The collaboration lets OEMs build out the entire digital cockpit and, for the first time, Qt for MCU enables Qt HMI to be deployed on top of the Autosar Classic platform.

OEMs can increase the efficiency of graphics compute and safety while reducing costs. Development needs can also be scaled up and down when using Qt; software developed with Qt is reusable and scalable source code.

The collaboration eliminates the need to buy additional hardware as all features such as hvac and electric mirrors can be enabled on a single SoC.

"This new approach will enable consumers to have access to the advanced digital cockpit features as demanded by the current state of the industry, bringing memorable experiences to all vehicle users," said Miao Luo, head of automotive at Qt. "The ability to run a hybrid MPU and MCU model means OEMs will be able to squeeze more compute from the hardware, saving cost and increasing the benefits."



SoftBank and May plan 5G autonomous driving in Japan

SoftBank and US autonomous vehicle company May Mobility are cooperating to create an autonomous driving service using SoftBank's 5G network in Japan.

In Japan, autonomous driving is expected to be a type of mobility infrastructure that will alleviate traffic congestion, reduce traffic accidents, and solve social problems in depopulated areas and aging communities with fewer children.

"Autonomous driving is expected to contribute to solving various social issues facing Japan," said Junichi Miyakawa, CEO of SoftBank. "By collaborating with May Mobility, which has advanced autonomous vehicle technology, we expect to accelerate the implementation of autonomous driving in Japan and realise a better society."

The government of Japan is targeting the implementation of uncrewed autonomous driving services in various locations nationwide by 2025.

So far, SoftBank has been working to contribute to solving various social problems Japan faces by researching and developing 5G network technologies for industries and providing mobility-as-a-service (MaaS) in collaboration with companies and local governments.

"This partnership with SoftBank is a golden opportunity for May Mobility to leverage next-generation mobility infrastructure to increase the adoption of MaaS," said Edwin Olson, CEO of May Mobility. "We look forward to sharing our knowledge and experience in expanding autonomous driving in Japan."

May Mobility has provided autonomous vehicle services equipped with its proprietary ADK autonomous driving kit in nine cities in North America and Japan.

Since its founding in 2017, the company has given more than 315,000 autonomy-enabled rides to the public.

Research and development for autonomous driving to levels four and five is in progress.

With these vehicles, it is expected there will be no human drivers in the vehicle but driving conditions must be monitored remotely to ensure the safety of the self-driving vehicles.

This remote monitoring requires a high-capacity and low latency network optimised for autonomous driving to collect real-time peripheral images from the vehicle, vehicle status data, and data from sensors installed on the surrounding roads.

It will transfer those data and images to a remote monitoring centre.

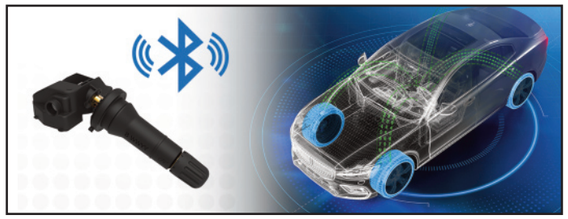
SoftBank aims to realise a network for autonomous driving in Japan by leveraging its expertise in vehicle communications with May Mobility's autonomous vehicle technology.

In addition to the establishment of networks, it is necessary to build management systems for remote monitoring and charging and maintenance locations, as well as developing user applications for vehicle dispatch and payments to implement autonomous driving services.

SoftBank plans to contribute its knowledge regarding information communication technology (ICT) and digital transformation (DX), and will leverage its customer base and the various services of its group company Monet Technologies.



May and SoftBank aim to launch MaaS in Japan



Sensata switches to Bluetooth LE for TPMS

Sensata Technologies has developed a Bluetooth Low Energy (BLE) tyre pressure monitoring system (TPMS) to help vehicle OEMs improve safety and performance.

It replaces the UHF radio with a BLE radio to enable two-way communications.

Interest in BLE TPMS is on the rise as vehicles become more connected, electrified and autonomous. While common in consumer applications such as speakers and headphones, BLE is relatively new in the TPMS space and is enabled by modern vehicle system architectures that can support BLE functionality.

These monitors are available in clamp-in and snap-in configurations, are optimised for long battery life, and deliver the same pressure, temperature and auto-location capabilities as the firm's existing UHF products.

BLE TPMS technology helps improve vehicle safety, performance and the driving experience. The technology can enhance adas and augment remote diagnostics support.

With over-the-air updates, drivers can download tyre-related features and software updates. BLE two-way communication also enables cyber security authentication, not possible with traditional one-way UHF, and adds a layer of protection from being hacked.

A vehicle maker in North America has selected Sensata's technology for its electric vehicles and Sensata will be launching production in the first half of 2023.

"BLE TPMS is the natural evolution of the TPMS Sensata provides today," said Eric Sorret, vice president at Sensata. "This business award with a leading vehicle OEM is an exciting first step towards showing the added value BLE TPMS can bring to both OEMs and consumers. BLE TPMS opens the door to generating new data and insights that can improve vehicle safety, performance and the overall user experience."

Ultrasonics check fuel levels

Sentronics and Horiba have developed an ultrasonic fuel consumption measurement sensor for the automotive industry.

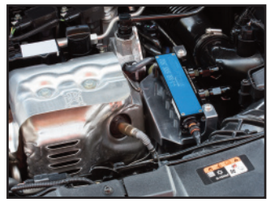
Featuring patented technology in ultrasonic fuel flow sensing, the RealFlow provides under-bonnet installation and real-time measurement of fuel consumption for automotive validation and verification test applications.

With a flow measurement accuracy of ±0.5% over a turndown range of 1000:1, it is suitable for measuring ultra-low fuel flowrates found in high efficiency road car engines.

This on-vehicle technology has been trusted to uphold compliance and monitor fuel usage in competitive motorsport over the past five years and now the low flow variant presents an opportunity for vehicle test houses to unlock its accuracy, reliability and repeatability.

Digital processing techniques are harnessed within the instrument to measure time of flight with levels of precision commonly associated with bulky, expensive laboratory equipment.

With no restrictions on mounting orientation, the sensor is suitable for direct installation in any engine bay for R&D and emissions testing to the RDE and WLTP standards.



The RealFlow is for under-bonnet use

Baselabs adds automated parking

Sensor fusion specialist Baselabs has added dedicated functionality for automated parking to its algorithm for processing high-resolution sensor data.

The firm's Dynamic Grid now detects parking spaces from semantically processed camera data.

Combined with its free space estimation, it lets the vehicle automatically approach parking spaces and park independently.

This functionality matches the integrated detection of dynamic and static objects in the Dynamic Grid. The algorithm runs on automotive CPUs in real time and is implemented according to ISO 26262.

The technology detects and tracks objects of arbitrary shapes without extensive training. It also determines the direction of movement and the velocity of dynamic objects.

Car manufacturers break wireless patent record

Patents for wireless communications technology filed by the top 20 car makers jumped to a record high of 991 in the past year, according to intellectual property law firm Mathys & Squire.

The figure is up from 945 the previous year and up three-fold from 323 patents five years ago.

Mathys & Squire says the automotive industry has begun to generate its own wireless communication patents to avoid possible clashes with the telecoms industry. The telecoms sector is seen as being more litigious than the automotive sector in the protection of its intellectual property.

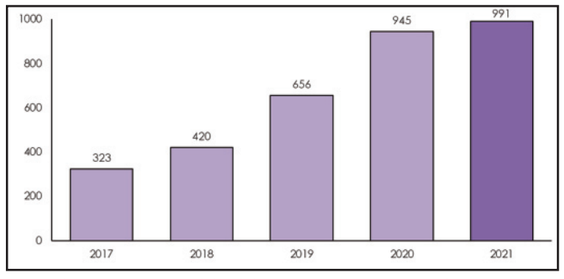
By owning their own driverless car technology, car makers can avoid protracted legal battles with telecoms companies over the licensing of wireless technology owned by telecoms companies.

One example of where the sectors have already clashed is the high-profile dispute between Nokia and Daimler over wireless technology. Nokia had claimed that Daimler should pay licensing fees for its use of its navigation technology. Daimler claimed the supplier of the part which used the technology should pay the licence fee, potentially decreasing the total fees paid to Nokia.

The case was settled with Daimler paying Nokia an undisclosed amount.

Andrew White, partner at Mathys & Squire, said the automotive industry was used to a culture where it could fit parts from suppliers into its vehicles without worrying about being sued by other automakers. The sudden dependence on wireless technology in their autonomous vehicles moves them into a much more unfamiliar legal landscape.

"The automotive industry knows access to wireless communications technology is vital to its future," said White.



Wireless patents filed by top 20 car makers



Magic Knob for automotive cockpit touch panels

Microchip helps Panasonic make updates to its knob

Microchip and Panasonic have co-developed an updated version of the Magic Knob, Panasonic's capacitive rotary encoder containing mechanical rotation and push functionality that can be placed everywhere on a touch area to bridge the gap between touch and mechanical haptics.

As vehicle electrification increases, so does touch panel usage for operating automotive cockpit applications. Screen sizes have also grown, thus being more complicated to be operated only by touch input.

The former Magic Knob required a dedicated unique pattern on the touch sensor, which is no longer necessary. This had been a constructive prerequisite that caused some design and touch handling limitations.

This can be significantly improved by incorporating hybrid input devices allowing an intelligent capacitive and mechanical operation.

The newly developed MPMK (Microchip Panasonic Magic Knob) can be driven with standard touch sensors by using Microchip's MK variant of the MaxTouch touchscreen controllers enabling placement of the knob anywhere on the touch panel.

In addition to the rotating operation, it also comes with a vertical ring push function. Both functions can be customised to create an ideal click feeling sensation.

Being mounted directly on the touch panel, the MPMK enables easier integration of touch panel and hvac operating devices.

This results in the profile being slimmer, and an overall reduction of components. This also applies for non-display application; as long as there is a capacitive sensor behind the respective flat or glass panel, the MPMK can be operated the same way.

Hyundai technology could let car take sick driver to hospital

Hyundai Mobis is developing technology that could let a car automatically take the driver to hospital in a medical emergency.

This is the ultimate goal of an integrated controller that Hyundai has developed that analyses the driver's vital signs, such as posture, heart rate and brainwaves.

Dubbed the Smart Cabin Controller, it consists of four sensors for measuring the vital signs of occupants, a controller to analyse the signs, and software logic.

While there are already controllers that can process certain vital signs in the mobility industry, this is said to be the first time for a dedicated healthcare controller to be developed that can perform an integrated analysis of various vital signs.

The company plans to combine this healthcare technology with mobility.

"Our core competitive edge is the software that has been designed to apply healthcare to mobility and the controller that enables integrated control," said Cheon Jaeseung, head of the R&D division at Hyundai Mobis. "Based on the unique vital signs database we've built up, we will upgrade this technology further to provide more features, including car-sickness prevention, stress management and the blocking of drunk driving."

The controller analyses various vital signs collected from these sensors in real time.

For example, it recommends switching to the autonomous driving mode if the ECG sensor detects a high stress level in the driver, and it opens windows or switches to the outside-circulation mode if the CO_2 level is too high. This technology is expected to further evolve to guide the vehicle to a hospital in case of an emergency, such as a cardiac arrest.

The four sensors are a 3D camera that captures the posture of occupants, an ECG sensor mounted on the steering wheel, an ear-set sensor to measure the brainwaves flowing around ears, and an hvac sensor to measure the temperature, humidity and carbon dioxide level of the cabin.



Cockpit has ECG sensor and driver monitor

Indie opens centre of excellence in Germany

California-based Indie Semiconductor has opened an engineering centre of excellence (CoE) in Dresden, Germany.

The centre is one of a series of European facilities the company is creating or expanding as part of its strategy to deliver local technical support for a rapidly growing base of OEM and tier-one suppliers in the Emea region.

Engineering teams at the Dresden CoE are developing and supporting mixed-signal, semiconductors in products that address vehicle electrification and driver safety and automation applications.

The CoE also provides functional safety design support up to Asil D.

The technologies are enhancing driver and passenger user experience and accelerating mass-market deployment of integrated lidar, radar, computer vision and ultrasound sensors.

With more than 30 employees to date, the Dresden facility has grown rapidly, bringing the total number of engineers in Emea to well over 100.

Indie's Emea design facilities are in Scotland, Israel, Germany and Hungary.

Donald McClymont, CEO of Indie, said: "By expanding our footprint in Germany, the Dresden CoE plays an important part in our strategy to provide high-quality, local resources."

The opening creates career opportunities in engineering and other areas.

Indie recently launched a dual-channel USB power delivery IC that reduces component count, simplifies designs and enhances reliability of in-cabin charging systems for portable devices.

World's Leading Exhibition for Advanced Automotive Technologies

AUTOMOTIVE WORLD

Electronics | EV/HV/FCV Tech | Connected Car | Autonomous Driving Tech
Lightweight Tech | Mechanical Components | MaaS

Held 4 Times a Year

Tokyo Show -September-
Dates: Aug. 31 (Wed) – Sep. 2 (Fri), 2022
Venue: Makuhari Messe, Japan

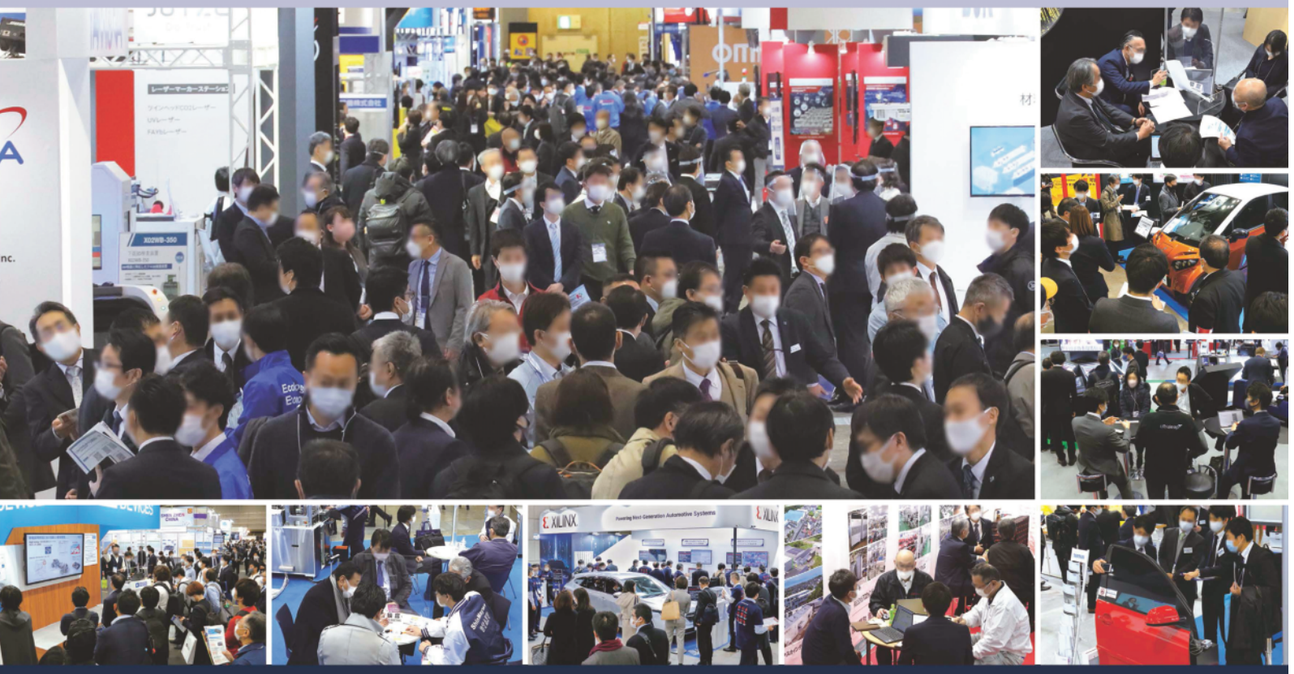
Nagoya Show
Dates: Oct. 26 (Wed) – 28 (Fri), 2022
Venue: Portmesse Nagoya, Japan

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

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

Organised by: RX Japan Ltd. Formerly Reed Exhibitions Japan Ltd.

Exhibit and Meet Automakers & Tier1 Suppliers!



Concurrent Shows (Tokyo edition in January)
NEPCON JAPAN 2023 R&D and Manufacturing
9th WEARABLE EXPO Wearable Device & Technology Expo
2nd SMART LOGISTICS Expo SLE 2023
FACTORY INNOVATION Week 2023

Built by RX In the business of building businesses

Organiser: RX Japan Ltd. (Formerly Reed Exhibitions Japan Ltd.)
AUTOMOTIVE WORLD Show Management
TEL: +81-3-3349-8502
E-mail: car.jp@rxglobal.com

Valeo provides adas control for BMW Neue Klasse

Valeo is to provide the adas domain controller, sensors and software for parking and manoeuvring for BMW's upcoming Neue Klasse ERV platform, due to launch in 2025.

Valeo will develop and produce the adas domain controller capable of managing all data flows from all adas sensors in BMW vehicles based on the Neue Klasse platform.

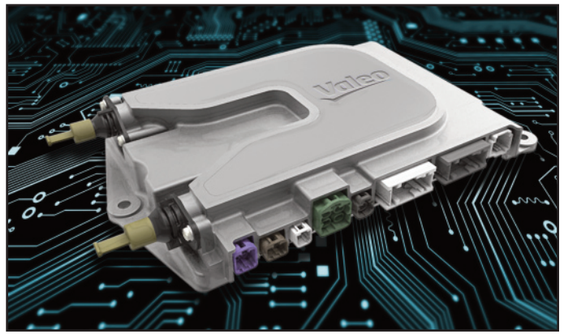
All driving assistance functions will be hosted and processed by the domain controller, which will be powered by Qualcomm Snapdragon SoCs.

The domain controller will host Valeo's software platform for low-speed manoeuvring, as well as software assets from BMW and Qualcomm for driving automation.

The system will be able to obtain real-time mapping and understanding of the car's surroundings, as well as the interior of the vehicle. Features and upgrades will be added throughout the car's lifecycle.

"This collaboration between BMW and Valeo builds on the successful products we have been developing together over the decades," said Nicolai Martin, senior vice president at BMW. "We look forward to shaping the future together with Valeo through this close collaboration in our next generation for manoeuvring and parking."

Marc Vrecko, president of Valeo's driving assistance group, added: "Beyond the opportunities resulting from our integrated software stack, the domain controller itself is an important cornerstone in our strategy for safer and smarter mobility. BMW Neue Klasse will also feature the next generation of Valeo's ultrasonic sensors, the full set of surround view cameras, as well as a new multifunctional interior camera that will contribute to improved safety and create a new level of user experience."



Valeo adas domain controller set for BMW

Adas is increasing in volume and allowing the car to perceive its surroundings with greater precision. Software is increasingly prevalent and essential to managing the car as well as its range of sensors. As a result, processors such as the adas domain controller, can be key to processing the vast amount of data collected and executing instructions.

HiRain picks Arbe chipset for imaging radar

Chinese adas tier-one supplier HiRain Technologies is undertaking OEM and autonomous driving projects with an imaging radar system it developed using Arbe Robotics' perception radar chipset.

HiRain expects to reach mass production of the radar system by 2023.

HiRain developed its 4D imaging radar systems based on Arbe's chipset and technology. Radar systems are crucial sensors in the adas and autonomous perception suite, due to their adaptability in all weather and environmental conditions, as well as their accurate detection of distance and speed.

The radar system uses Arbe's chipset with 48 transmitting and 48 receiving channels, and a dedicated processor, which expands the mimo array to improve the radar's ability to map the environment and sense the surroundings of the vehicle in high resolution.

"China has the largest vehicle market in the world and is leading the way towards an autonomous vehicle future," said Kobi Marenko, CEO of Arbe. "HiRian is one of the most experienced tier-ones in the Chinese automotive industry, and we are honoured it has chosen our chipset. HiRain's transition into mass production and its progress with key OEMs is an important step towards achieving true safety on the roads, driving vehicle autonomy, and providing for the tremendous demand in the region."

HiRain's radar detection distance reaches 350m and achieves a physical resolution of 1° in azimuth and 1.5° in elevation. It provides a dense point cloud, comparable to the imaging of lidar, that can meet the needs of L3 and higher autonomy.

embeddedworld2022
Exhibition&Conference
... it's a smarter world

THE SHOW MUST GO ON

Steve Rogerson reports from June's Embedded World in Nuremberg, Germany

Collaboration needed to overcome skills shortage

The automotive industry is facing a serious shortage of skilled people as the industry moves towards software-defined vehicles.

That was the main message from Matthias Klauda, executive vice president for R&D at Bosch, in his keynote address.

"Mobility is more and more software defined," he said. "This drives the pace of innovation, which is unprecedented. However, there is huge competition for talent. We need smart people."

He said there used to be a large pool of people who wanted to work at the big automotive companies.

"But now it is getting very tight," he said.

He said this meant that companies were needing to find new ways to develop vehicles, and that involved collaboration. There was a need to form teams across OEMs and tiers one and two suppliers.

"We learned with the pandemic how to coordinate with internal teams," he said.

This, he said, now had to be expanded externally.

For example, Bosch collaborates with VW automotive software subsidiary Cariad. More than a thousand engineers across the two companies are working together on automated systems up to level three and they are planning joint development work for level four.

"We need to understand what an automotive system means across all layers so it can be integrated," he said.

Today's vehicles, he said, had very complex domain separation with around one hundred loosely coupled ECUs and a complicated wiring harness. These use traditional power networks and conventional fuses. There is limited cloud connectivity and that mostly for infotainment.

Modern vehicles are different with a consolidation of critical computing platforms. Wiring has been reduced with zonal ECUs that are domain agnostic. The complexity is being handled using techniques learned from the IT industry.

"We are seeing new topologies for the power network," he said. "We need to handle the power network more intelligently. We are using e-fuses. There is connectivity to the back-end. Connections with the cloud are reaching unprecedented levels."



Matthias Klauda: "The car is becoming a living product."

This though is bringing benefits such as an up to a twenty per cent reduction in the weight of the wiring, up to four per cent reduction in electronics costs, nine per cent fewer ECUs, and double the computing power.

There has also been an increase in the amount of third-party software from a broad variety of sources.

For testing, he said there was now fast access to data for real and simulated driving scenarios.

"We can't define all test cases," he said, "so systems are not completely specified. There are corner cases that are not there. So we have to expose these systems to the field and train them, and feed this back into the development."

For adas, he said, this was important as there was no way to predict all uses cases that could be seen in the real world.

A big change, he said, was the way hardware and software had decoupled. This means there can be continuous development of software on the same hardware.

"In the old way, the product was fixed after purchase," said Klauda, "with no changes during the vehicle's lifetime. Now, it is becoming a living product that adapts to the user based on customer demand and data."

In summary, he said the electrical and electronic architecture of vehicles was changing rapidly towards the software-defined car.

"This is one of the most exciting times in automotive history," he said. "We need intensive high-level collaboration. This can involve cultural change."

PI pushes gate driver boards

Power Integrations was pushing its Scale EV family of gate driver boards first covered in the June 2022 issue of *Vehicle Electronics*.

The automotive-qualified IGBT and SiC module drivers are suitable for original, clone and new SiC variants. They target high-power automotive and traction inverters for EVs, hybrids and fuel-cell vehicles including buses and lorries as well as construction, mining and agricultural equipment.

"They work very well with Infineon power modules," said Cristian Ionescu-Catrina, PI's senior product marketing manager. "They are the first automotive-qualified gate driver boards on the market."



Cristian Ionescu-Catrina

A key feature is the telemetry that allows fault reporting to the microcontroller for conditions such as active short-circuit, active discharge of connected DC-link capacitor, overvoltage limitation via active gate control, diagnostic function such as gate monitoring, signal transmission monitoring and on-chip temperature monitoring, and short-circuit and over-current response of less than 1μs for SiC mosfets and less than 3μs for IGBTs.

"We provide not only warnings and faults but data," said Ionescu-Catrina. "The telemetry comes from the main board via an interface board that is connected to a PC that decodes that telemetry data and presents them to the user in a way that is easy to read."

This, he said, was good for debugging and development and speeds the time to market.

The product is sampling now with full production expected towards the end of the year.

ADI takes control of LED lights



Simona Di Domenico: "Very creative."

Analog Devices showed how its Max 25603 can control two separate strings of LED lights with low power loss as it uses just one inductor.

"You get more power losses with multiple inductors," said Simona Di Domenico, an ADI field application engineer. "And PWM dimming makes the waveform sharper so you don't see flickers on the light."

The device uses time sharing to drive all the front lighting lamps form a single IC, and it provides seamless transition between buck, buck-boost and boost modes to drive a wide range of LEDs when operating from the car battery.

"This came out recently and if a customer is interested, they can get it now," said Di Domenico. "We have samples with customers and mass production has started."

The same chip allows different dimming percentages.

Also being shown was the Max 25630 4x24 automotive matric LED driver. This can drive up to 96 LEDs with individual dimming.

"Each chip can control up to 96 LEDs, and you can put up to 16 chips together in a daisy chain meaning up to 1536 LEDs can be controlled," said Di Domenico. "You can change the patterns and display fancy stuff. You can be very creative."



Stephane Di Vito: "The key is unclonable."

Another issue ADI is tackling is car security.

"Cars are becoming more complex with many electronic systems," said Stephane Di Vito, ADI product definer. "It is like an industrial network on wheels. Cyber security has become a concern because cars are connected to the internet."

There is also a huge supply chain so it is becoming harder to stop counterfeit parts, which can also cause security and quality problems.

ADI is getting round this by using authenticators that can be applied to numerous automotive applications using a secret key.

"The key is unclonable," said Di Vito. "It is impossible for an attacker to take the key and put it in another part."

The authentication comes from the ECU. When the ECU boots, it checks the authentication of parts. The car maker can set how it reacts to a false part such as not allowing it to start or reducing functionality.

Micron receives ISO 26262 memory approval

Micron Technology has received ISO 26262 Asil-D certification of memory for its low-power double data rate 5 (LPDDR5) dram, which is based on its first-to-market 1-alpha process node.

With adas applications requiring increasing levels of autonomy and safety, this certification validates that Micron's LPDDR5 meets functional safety standards.

The certification came from Exida, an expert in automotive safety. The LPDDR5 is in mass production in 48 and 96Gbit densities.

Proprietary on-chip safety features include capabilities to detect and alert the system of systematic and random hardware faults so the vehicle can intelligently react .

AMD shows life with Xilinx

The show marked the first time since AMD's takeover of Xilinx was finalised earlier this year that engineers in the embedded sector could see the combined portfolio.

These included demonstrations of forward cameras, surround view, in-cabin monitoring, 4D imaging radar and lidar.

"What is unique about our technology is a small device can be used in all these applications, and they are," said Wayne Lyons, automotive marketing director at AMD. "I am so excited about what cars will be in the future."

One company using an AMD board for a driver-monitoring application is Israeli firm Jungo.

"This is for safety," said Lee Rabin, business development manager at Jungo. "It can send an alert if the driver is drowsy. Our new board is not in cars yet, but by 2024 all car makers in Europe will have to have some form of driver monitoring."

Lyons added: "Jungo was able to get this going in very quick time."

The forward camera demo was based on a product launched earlier this user at the CES in Las Vegas. It uses an Omnivision 8Mpixel imager and was built by Motovis.

"This went from a 1.2Mpixel design to an 8Mpixel design in three months by repurposing the Xilinx device," said Lyons.

AMD field application engineer Kay Migge added: "When you buy a car today, it will be 2Mpixel. With 8Mpixel, you can look further ahead, 200 to 300m away with high resolution."



Wayne Lyons: "I am so excited."

Motovis is a tier-one supplier to Asian car makers.

"They are very prominent in China," said Migge. "With this, you can identify objects earlier. As the technology evolves, things like 8Mpixels will come down in price. Now it is a premium price. And they can do it by reconfiguring the Xilinx device rather than by using a new chip."

AMD uses a technology called dynamic function exchange to let the functionality of the chip be changed. This means hardware can be reused to perform two adas edge functions instead of one.

"So it can do driver monitoring when going down the freeway and at slower speed can be used for surround view," said Lyons. "This is hardware reconfiguration you can do in milliseconds."

Croatian company Xylon through its LogicBricks subsidiary was demonstrating how this technology can be used for driver monitoring and parking assist with surround view.

"You can have two huge functions on one device but not at the same time," said Roko Končurat, FPGA project leader at LogicBricks. "It can take 80ms to change over from surround view to driver monitoring."

The changeover can be triggered in various ways including vehicle speed.

Proofs of concept of the technology are being done now.

Tasking tools develop safe software

Tasking showed tools for developing safe and secure embedded automotive software.

Highlights included SmartCode, a software development environment for the third generation of the Infineon Aurix TC4x microcontroller family.

The TriCore Inspector, part of the firm's safety eco-system, reduces the effort required to maintain safety compliance throughout the project cycle for, for example, ISO 26262.

The VX-Toolset for Arm is a compiler toolchain that now also supports the Infineon Traveo T2G microcontroller family, which is based on Cortex M4 and M7.

NXP lands show award for real-time processors

NXP won the Embedded World award in the hardware category for its S32Z and S32E real-time processors, which were described in the *Vehicle Electronics* July issue.

The award was presented to Brian Carlson, NXP's global marketing director for automotive.

The processors offer the advantages of microcontroller behaviour, but with significantly higher performance, integration and memory expansion. They fill a key processing area between the S32K microcontrollers and S32G vehicle network processors in NXP's S32 automotive platform that provides automakers with the processing power required for vehicle control, domain control, zonal gateways, and safe and secure processing applications.

"We call them real-time processors because they go beyond a traditional microcontroller," said Carlson. "The latest microcontrollers are at 20nm. We are at 16nm."

The company has also announced a roadmap to 5nm. Carlson said NXP had taken the technology and put it on a 5nm test chip at TSMC.



Brian Carlson with the Embedded World award

The existing devices should be in vehicles in early 2024 with 5nm models two to three years later.

"We do isolated applications, so multiple functions on the vehicle can run on one processor," he said. "They do it safely. A fault on one application will not cause a fault on another."

Traditionally, these types of microcontroller have embedded flash, but the latest units have a fast interface that lets the user expand the memory.

"We are seeing memory anxiety as we move to software-defined vehicles," said Carlson. "People are worried they don't have a path forward. These give them up to 2Gbyte extra memory."

Carlson said the chips would work in domain or zonal architectures but said he believed zonal will be the way forward.

"OEMs are moving to a shared infrastructure across all their vehicles," he said. "Our chips provide the base platform for the vehicles."

He said the S32E was ideal for electric vehicles.

"It truly is an EV-on-a-chip approach," he said. "OEMs are using them for different platforms. It is very versatile. It is a new type of processor that lets us move from a hardware-defined world to a software-defined world."

Early support for the devices has come from Green Hills Software to help enable safe and secure mixed-criticality execution and consolidation in zonal and domain vehicle platforms.

"By providing broad production-focused software for NXP's new multicore S32Z and S32E real-time processor families, joint customers can start immediately developing their next-generation vehicle ECUs with the highest performant, most scalable and configurable offerings available," said Dan Mender, vice president at Green Hills Software.

Green Hills also demonstrated an early-access version of an update to its μ-Velosity rtos for vehicle electronics.

Even with the consolidation of functions in zonal and domain controllers, the number of microcontroller cores to support safety and real-time applications is growing. To support these real-time processors, μ-Velosity has been updated with rtos features for new processors, along with optional capabilities that can be tailored to user requirements.



Ian Ferguson: "We are on that journey."

Lynx targets ISO 26262 by year end

Lynx is hoping it will be ready to be certified to ISO 26262 by the end of the year.

The firm already has avionics security and safety qualifications and Ian Ferguson, vice president of marketing, is keen to extend that into automotive.

"We have the certification for avionics and we have to take that knowledge and move it to ISO 26262," he said.

He said this involved extending the number of processors that it supported.

"The ones with avionics are not the same ones with cars," he said. "We are working with NXP but not on the S family. The S32 family at NXP is the first priority. We are on that journey. We will also get to Nvidia."

Lynx is in the process of building up a software stack for automotive.

"We have done some work with Bosch and Etas," he said, "but we need to extend that. We are working with GuardKnox. They are looking at the shift to domain control. That fits the need for virtualisation. They have a good software stack that can run on our hypervisor."

He acknowledged that Blackberry QNX had done a good job building a software stack but ruled out working with the company.

"We need to make something that can compete with QNX," he said. "I do not think a partnership with QNX would work."

He said Lynx was being brought into consideration for cyber security.

"An operating system is one of the vulnerabilities for hackers," he said. "If they can get to the operating system, they can get to the crown jewels. We don't have an underlying operating system; we have a hypervisor. We are much more robust for cyber security."



MIX AND MATCH

Danish Aziz, Chris Bohm and Fionn Hurley show how to enable 5G and DSRC V2X in autonomous driving vehicles



Vehicular communication is an essential enabler for achieving higher levels of automated driving. However, for a long time it remained under investigation among the automotive industry players whether the required wireless access should rely on cellular access technology (C-V2X) or on direct access technology (DSRC).

Future use cases of autonomous driving will require both technologies to be used in coordination or cooperation.

Multi-wireless standard devices employ individual modules for different technologies. Therefore, in the absence of any inter-wireless standard interface, realisation of such a cooperative system appears to be difficult.

However, using a single chip, it is possible to transmit and receive concurrently in multiple bands. Such technology could be leveraged to support automotive manufacturers by providing product differentiation and enhanced control for improved quality of service.

Introduction

C-V2X could complement other wireless access candidates in unlicensed and dedicated frequency spectrum ranges such as DSRC or IEEE 802.11p. For this purpose, it is necessary to link the requirements of the use cases and the need for exploiting the benefits of multiple access technologies.

When it comes to the realisation of a multi-standard V2X device, currently, multiple modules with individual software and firmware implementation could be used. However, this limits the potential of the cooperative and coordinated function of the access technologies. Multichannel, multiband transceiver technology could enable a multiband V2X communication device.

V2X

The automotive world is rapidly innovating to achieve full automation in all possible driving

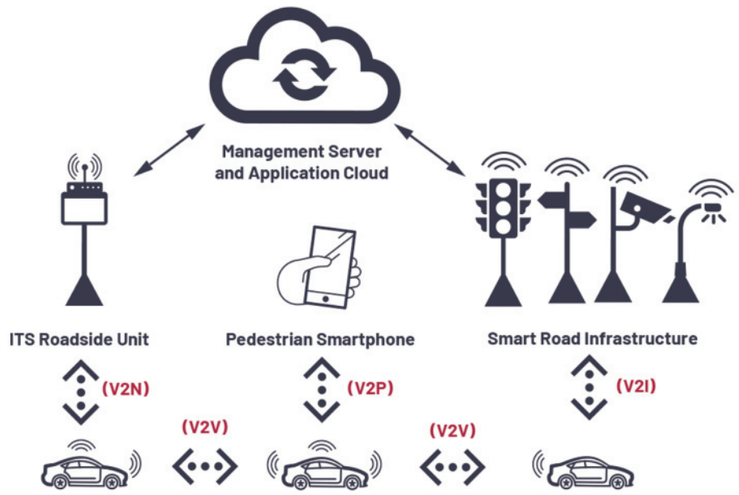


Fig. 1: Entities, infrastructure and interfaces for V2X communication system

scenarios, manoeuvres and situations. It has been established that wireless connectivity will be required as one of the fundamental technologies in enabling not only full automation but also lower levels of automation.

In particular, safety critical applications of self-driving vehicles will heavily rely on wireless connectivity.

It is essential to perform safe manoeuvres with ultimate (99.999%) reliability in the presence of entities that share the driving space or traffic system. Such entities may include other vehicles, persons, transport systems on the road, or a traffic management network. Hence it is essential to equip every vehicle with wireless connectivity for information exchange, cooperation and coordination with other entities in the system.

The foundations of automotive intelligent transportation systems (ITS) have been laid by the governing bodies in Europe, for example Etsi. Similar systems have been developed all over the world, in America and Asia Pacific. ITS has defined and specified communication nodes, architecture, protocols and messages for a diversity of applications and use cases.

New infrastructure is required to enhance the DSRC-based applications in unlicensed or dedicated frequency bands. The infrastructure deployment process is already active in many regions under smart highways and smart cities initiatives.

In the case of C-V2X, the existing cellular infrastructure is used.

Fig. 1 shows the interfaces with which an ITS vehicle can communicate with other vehicles or other entities in the transportation system.

The following is a description of each interface:

- V2V (vehicle-to-vehicle): Initially it was only for broadcast messages, but now vehicles can also perform unicast or multicast messaging. This interface could be used for any information propagation directly from one vehicle to another in the range of communication, for example in emergency braking.
- V2P (vehicle-to-pedestrian): Using this interface, vehicles and roadside users could communicate assuming the smartphone has a V2X application. For example, a vulnerable roadside user could be warned of an approaching vehicle.
- V2N and V2I (vehicle-to-network or -infrastructure): This interface could be used for any information facilitating smart transportation.

Wireless access

Fig. 2 shows the layered architecture for a complete ITS. The top application layer contains the definition of use cases such as emergency brake warning, intersection collision avoidance and traffic light periods.

Other layers provide information and communication support services such as positioning and location

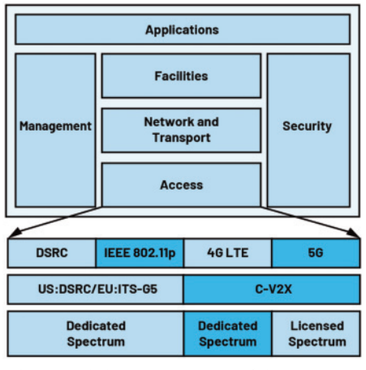


Fig. 2: ITS represented in communication layers format

information, awareness messages, and notifications. Finally, these protocol messages should be transmitted over the air by using a wireless technology.

DSRC was already established in the USA for vehicular communications, and Europe has established IEEE 802.11p-based wireless access for the same purpose. However, these wireless technologies were developed based on the IEEE 802.11x wifi standard for ad hoc communications.

Therefore, their range is limited and they face similar congestion and quality of service (QoS) problems as other wifi-based systems. Moreover, it will require heavy capital investments for the deployment of roadside infrastructure to ensure the coverage of the traffic management servers.

On the other hand, wireless access through public land mobile radio, also known as a cellular communication system, provides a solution to both problems of coverage and QoS. The cellular network is already covering most of the roads, and access controlled by the network has been scheduled to guarantee the QoS by avoiding congestion or call drops.

V2X service is already provisioned in the 4G LTE cellular standard. However, in 4G LTE, the primary target is basic safety use cases. The 5G standard is targeting more safety critical and high reliability use cases.

The term C-V2X is used for the V2X service provided by the mobile network, be it with 4G LTE or 5G. This overall picture of vehicular communication systems allows for the possibility of multiple technologies and standards in not only different regions but also different frequency bands.

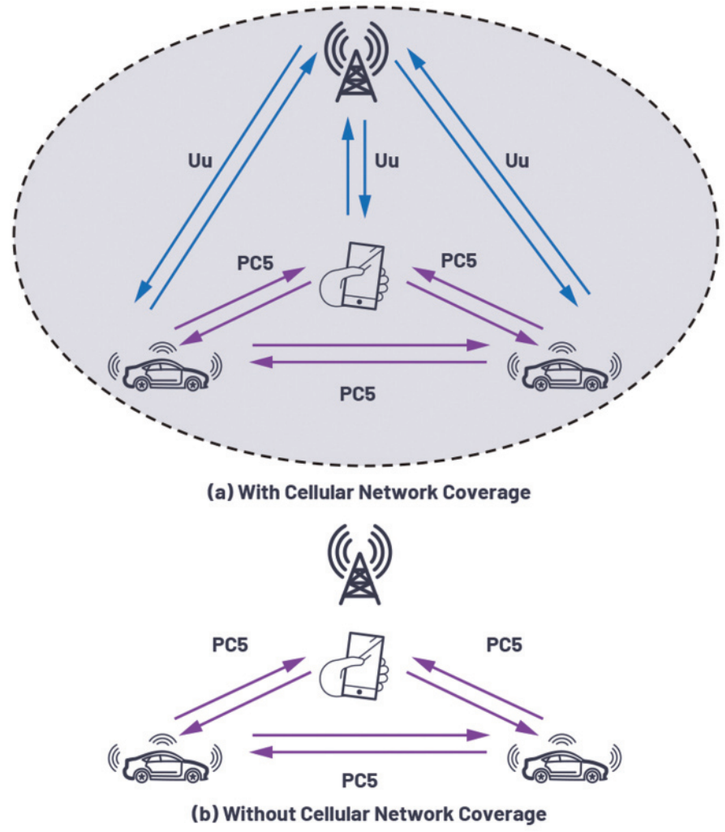


Fig. 3: Usage of cellular frequency resources for V2X communication with or without cellular coverage

The overall picture becomes a little more complicated when different spectrum bands in different regions and for different standards are considered.

C-V2X

Providing 100% cellular network coverage is a very difficult challenge for any mobile network operator. On the other hand, a radio coverage hole could be worse than a street hole for connected and automated driving. Therefore, C-V2X has provisioned enhanced features by which it can also work in the absence of network coverage.

In Fig. 3a, a scenario is shown where vehicles are communicating in the presence of network coverage. There are two options for the vehicles to communicate.

Option one is by using the classical Uu interface – named by 3GPP for the radio link between the end user device and the radio base station – where the cellular network is involved between two communicating V2X nodes.

Option two is by using a new interface known as PC5, which offers direct communication between the V2X nodes. It is also known as sidelink (SL) communication.

The network coverage is absent in Fig. 3b. However, using the PC5 interface, the V2X nodes can still communicate. Under the coverage scenario, the network can use any allocated cellular band.

Spectrum allocation

A dedicated spectrum with a bandwidth of 70MHz has been allocated in Europe for vehicular communications in the 5.9GHz band. The efforts are underway to allocate it globally.

Moreover, harmonisation work is in process to enable the use of ITS-G5 and C-V2X in this band.

In the context of C-V2X, the service could already use multiple cellular bands together with the combination of PC5 and Uu interface.

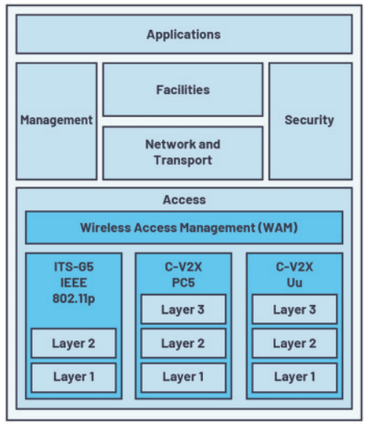


Fig. 4: Realisation of cooperation and coordination among multiple radio technologies in the ITS access layer

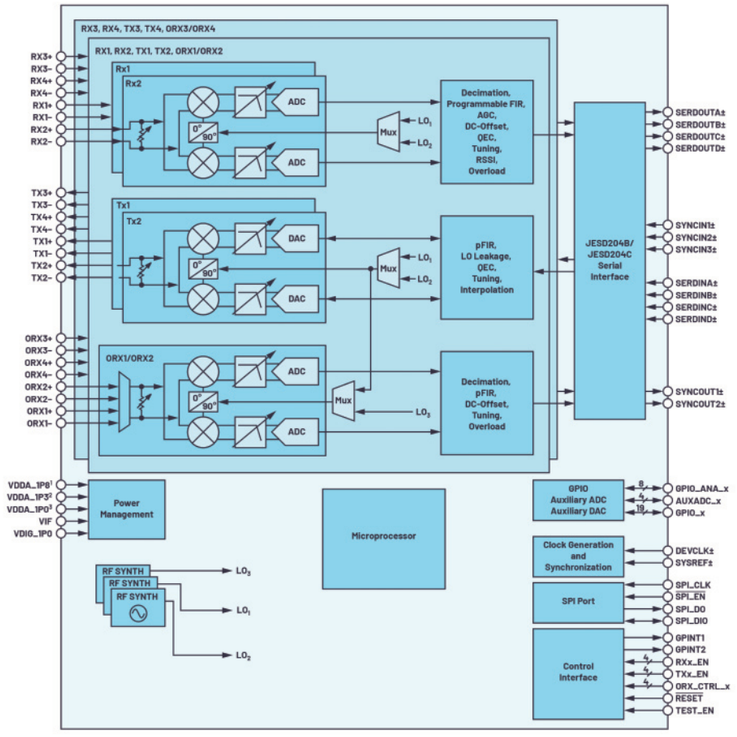


Fig. 5: Block diagram of quad transmitter and quad receiver

The cellular standard is investigating the concurrent operation of dual bands for V2X based on 3GPP specifications.

Dual band

In the presence of multiple radio access technologies (RATs) and the possibility of communication in multiple spectrum bands, automotive OEMs must decide what to adopt. In the USA, the FCC is inclined towards the use of DSRC-based wireless access, whereas the Asia-Pacific region is welcoming the development and deployment of C-V2X. In Europe, the idea is to keep the wireless access technology neutral.

In this regard, some studies have been presented that outline the benefits of ITS-G5 and DSRC over C-V2X. Similar studies argue for the benefit of C-V2X over ITS-G5. Hence, automotive and telecom industry partners are working to develop a situation where V2X service can exploit the benefits offered by wireless access technologies in the licensed as well as unlicensed spectrum.

Fig. 4 is a modified version of Fig. 2 with a new sublayer between the radio access and packet access. This is called wireless access management (WAM).

The function of this sublayer is to ensure the optimised V2X service delivery from the network to the radio level.

Based on use case (latency requirements, QoS and so on), traffic (congestion) and link (radio quality) conditions, it could select different wireless access technologies in coordination for diversity or in cooperation for higher throughput.

For example, if congestion is detected on the ITS-G5 air interface, then the same message could be sent over PC5 using C-V2X. This will provide diversity gain and ensure reliability. In a use case where vehicles are exchanging high density map data, the Uu interface could be used in cooperation with PC5 or ITS-G5 to fulfil the required high throughput.

Cellular systems standardisation bodies are already investigating the concurrent operations of 4G LTE Uu and 5G NR Uu bands with PC5 and ITS-G5 in the 5.9GHz band. Hence, with the concurrent operation of bands and concepts previously explained, the foundations for a dual-band and even dual-RAT V2X system have been laid by the standardisation bodies and the applied industrial research community. Now it is time for the automotive industry to discover the optimum hardware implementations by which they can exploit the benefits of dual-band and dual-RAT V2X concepts.

Future V2X

Present-day wireless devices are already equipped with multiple wireless standards where each standard is implemented using its unique module or piece of hardware. Mostly these modules work from the RF level to the application layer.

Implementing such a dual-band V2X system and providing a coordination and cooperation mechanism is not easy in such architectures, as the manufacturers or vendors of such modules do not provide the degrees of freedom to access the intermediate layers, which is necessary to implement coordination or cooperation among multiple standards.

External standardised interfaces will be required to realise these implementations using available wireless modules.

Hence, a design is needed that will allow the implementation of such a system. The design of radio transmitters and receivers using software-defined radios (SDRs) provide full degrees of freedom in accessing and processing digital data on any stage.

A functional block diagram of a quad transmitter and quad receiver is shown in Fig. 5.

Conclusion

There are two wireless technologies that could complement each other to fulfil the critical requirements of V2X service. These are C-V2X and DSRC, which are operable in licensed and unlicensed bands. There are different options for the realisation of a coordinated and cooperative V2X system.

The technology exists to support dual-band and dual-wireless standards with higher RF performance, lower latency, higher data rate and higher reliability. A V2X communication device using such an RF IC could provide wireless access concurrently to the two V2X technologies in two different radio bands.

Danish Aziz is a staff field applications engineer, Chris Bohm a digital design engineer and Fionn Hurley marketing manager, all with Analog Devices

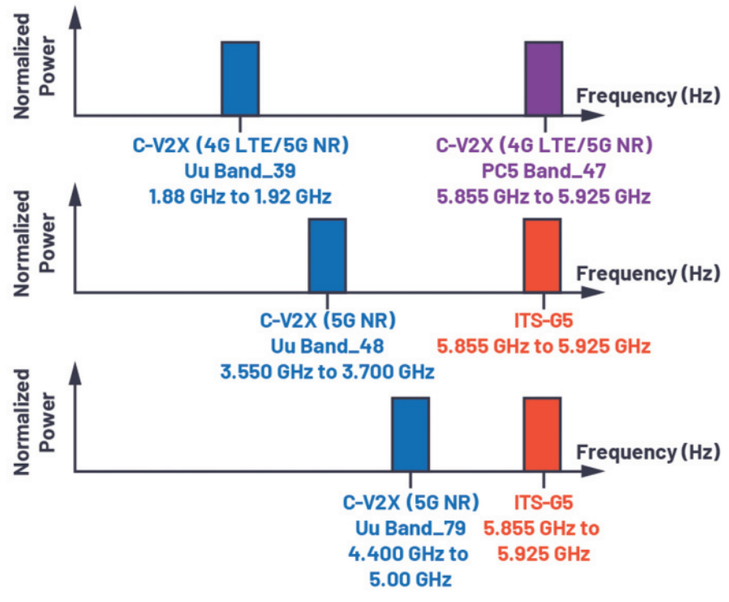


Fig. 6: Quad transmitter and quad receiver combination is capable of concurrent transmission and reception in multiple bands

V2G

FIGHTING VAMPIRES



Steve Hughes explains how manufacturers can prepare EVs to balance the grid when needed

According to Virta, there will be around 140 to 240 million electric vehicles on the road globally by 2030, meaning roughly 240 million batteries on wheels. With concern around power consumption growing, the only sustainable option is one that balances increased charging needs with the ability to feed back into the grid, a vehicle-to-grid (V2G) approach.

No one can deny the growing pressure on the power grid, with more and more homes being built and so-called vampire devices such as TVs and phone chargers being used.

According to the UK government's latest Energy Trends report, final consumption of electrics in 2021 was 285TWh, up 1.8 per cent on 2020.

As the world embraces EVs, there has been criticism of both the lack of robust charging points and the fact that these vehicles will draw power from the grid, exacerbating the issue.

One answer is V2G technology, where energy stored in EV batteries can discharge energy back into the grid during peak demand to ease pressure on the wider network. However, this is still in its infancy and there are several things to consider when developing vehicles and the technology required.

Incoming

With EVs still a relatively new phenomenon, the maximum charging power is currently around 10kW, just enough for home and workplace charging. However, as these vehicles develop and more motorists embrace electric, charging systems must expand and evolve.

While power incoming from the grid is alternating current (AC), most EVs include onboard chargers (OBC) that convert this into the direct current (DC) needed to power the vehicle. Therefore, these draw readily available AC power and can be plugged into any of the billions of outlets installed in every building.

In V2G applications, there's always a risk the vehicle could draw large harmonic currents from the grid, which, unless monitored and controlled, could be injected back into the grid.

Charging several vehicles in the same area and fast charging at high powers can both lead to a considerable increase in harmonics. Consequently, this can damage the vehicles, their various electrical components and the mains supply.

Standard

Regulatory compliance is an important consideration because of the need to meet power factor rules for the grid when the vehicle is plugged in. While electromagnetic interference (EMI) is not a big issue, reducing harmonics is a priority. As the number of mains-connected devices using high frequency switching has grown, the industrial sector has recognised the need to protect against harmonic distortion.

The Engineering Recommendation G5/4 aims to ensure that levels of harmonics in the public electricity supply are not an issue for users and that power quality is maintained. Therefore, design engineers and manufacturers must factor in the need for additional components such as inverters, resistors and chokes, which all facilitate the transfer of electrical power to and from these vehicles.

Quality

There are several components that can provide much-needed protection in V2G applications. For instance, when attached to EVs, EMI filters can protect against the harmful impacts of EMI by suppressing noise transmitted through conduction. Meanwhile, chokes can help relieve the supply network by compensating harmonics reactive power.

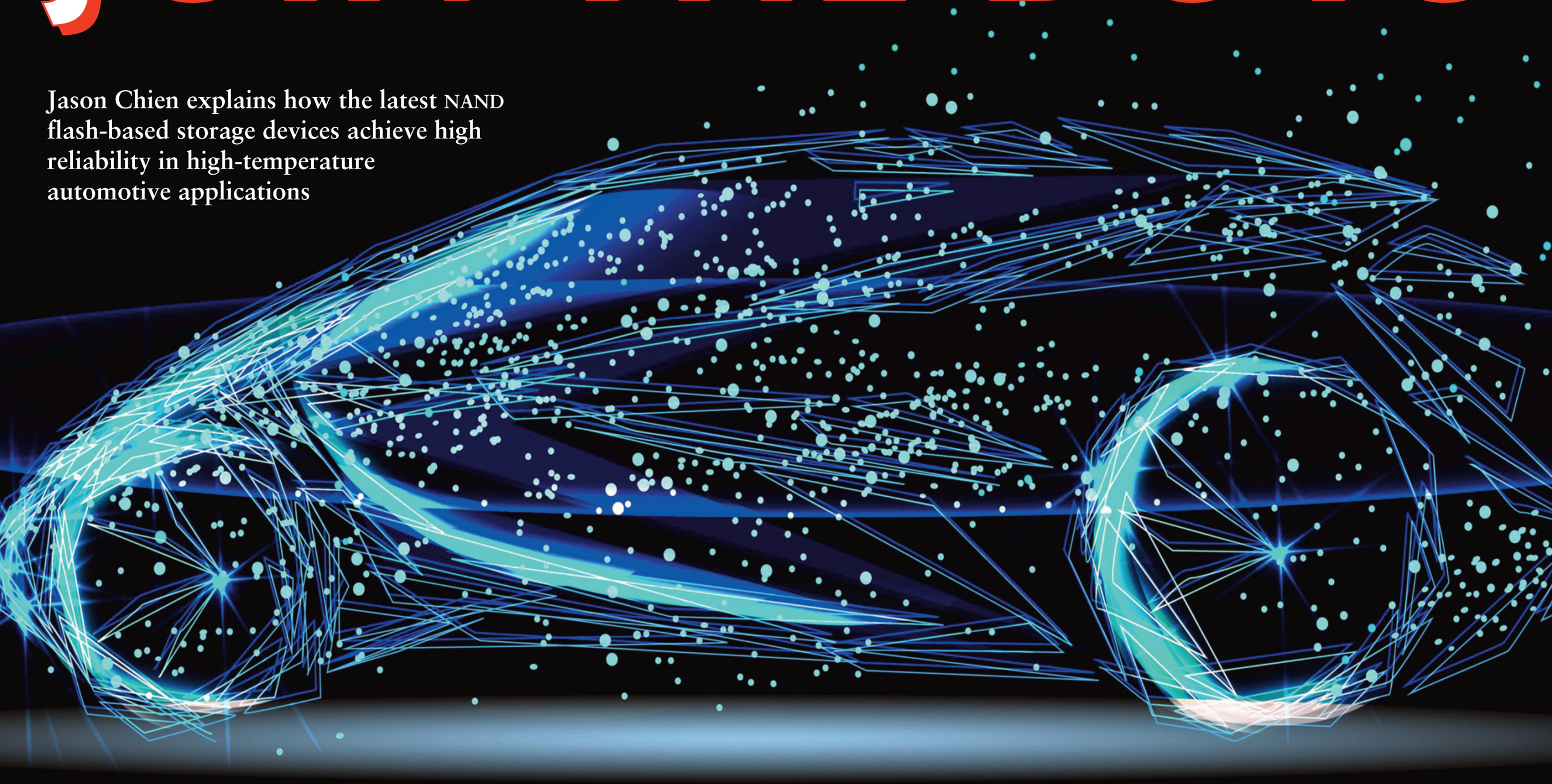


Steve Hughes is managing director of Reo

MEMORY

JOIN THE DOTS

Jason Chien explains how the latest NAND flash-based storage devices achieve high reliability in high-temperature automotive applications



Vehicle Electronics

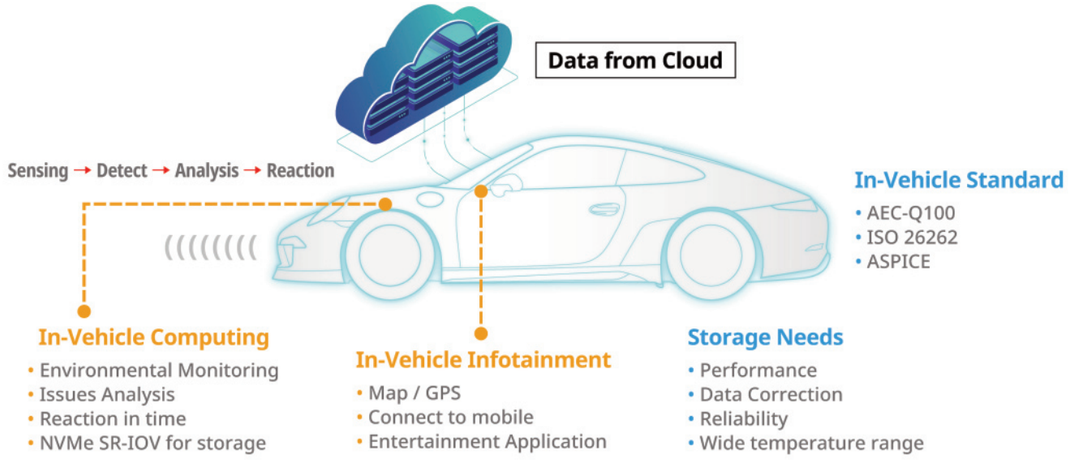


Fig. 1: The car is becoming a data centre on wheels

With the introduction of every generation of passenger vehicle, the automation, safety and navigation systems become more sophisticated. Supported by an array of cameras, radar and lidar ranging systems, sensors, and other detection systems, adas can generate and process huge quantities of digital data.

Infotainment systems, too, are growing in code size as drivers demand superior navigation and information systems, and passengers look for more entertainment options in the front and rear of the cabin.

In functional terms, the car is becoming a data centre on wheels and, like a data centre, it needs high-speed access to a large data storage capacity.

Reliability concerns have led automotive manufacturers to end the use of traditional hard disk drive (HDD) storage devices, which offer a limited lifetime and are prone to mechanical failure.

Instead, automotive designers today prefer to use a mass storage device taht is based on NAND flash memory technology, such as a solid-state disk (SSD), eMMC drive or UFS (universal flash storage) device.

NAND flash has become the preferred technology for mass storage in mobile phones, laptop computers and other consumer devices as well as in SSDs because it offers a valuable combination of high memory density and high performance. This means huge data storage capacity can be provided in a small packaged device, and the user benefits from rapid access to stored data and quick data storage operations.

These characteristics are important as well to automotive manufacturers. But automotive applications impose special requirements that raise important additional questions about manufacturers' choice of NAND storage device:

- **Performance** – in use cases such as driver assistance and navigation, latency is a key figure of merit. Automotive manufacturers require fast read and write speeds and high data throughput.
- **Data integrity** – every read and write operation carries a risk of generating bit errors, which can lead to data loss or corruption. Reliability is a critical factor in the automotive market, and in a storage device, data integrity is an important marker of reliability.
- **Data retention** – unlike a consumer device such as a mobile phone, a vehicle is expected to have an operating lifetime of at least ten years. Automotive manufacturers want to be confident that their chosen NAND storage device will retain data for the life of the vehicle.

In vehicles, the long-term reliability and lifetime of an electronics component such as a mass storage device are crucial criteria. The automotive industry applies strict qualification tests, according to AEC-Q100, to the integrated circuits used in automotive ECUs, with the aim of achieving zero defects over a long lifetime at temperatures of +85°C or higher.

The goal of reducing the component defect rate to zero is important because of the long lifetime of a vehicle, the high number of components in a vehicle, and the huge cost of rectifying a known fault in a fleet of vehicles that are in service, not to mention the reputational damage to a car maker's brand.

To illustrate the point simply, imagine a single ECU consisting of 1000 parts. If the ECU manufacturer tolerated a defect rate as low as 1ppm, this single ECU alone would be responsible for 1000 faults in a fleet of a million vehicles. And, according to a 2019 report form analyst firm IHS Markit, a new luxury vehicle can contain as many as 150 ECUs.

This is why the automotive industry imposes the goal of a zero-defect rate. And its strategy for reaching this goal is to apply a component qualification process, codified in the various AEC-Q10x standards. The criteria for AEC-Q100 qualification, for example, are extremely strict, and verify a component's reliability across a number of test parameters. The main reliability tests are accelerated environmental stress testing, accelerated lifetime simulation testing, packaging and assembly tests, die fabrication testing, electrical verification, defect screening, and package integrity testing.

This qualification process is exhaustive, and has been proved to screen out potentially defective parts effectively. Components that pass the tests and achieve AEC-Q100 qualification have demonstrated a remarkably high level of reliability and integrity in a demanding set of environmental and application conditions.

One of the most difficult elements of AEC-Q100 qualification for NAND flash-based storage products to achieve is to pass the high-temperature and accelerated lifetime simulation tests. Storage systems must maintain reliable operation at continuous temperatures of up to +85°C for AEC-Q100 qualification to grade three, and up to +105°C for grade two.

And the compact, chip-style packages in which the latest products are housed, have more constrained thermal pathways than in the larger enclosure of a typical free-standing SSD used as a computing accessory.

To maintain reliable operation and data integrity in automotive storage devices, various technologies can be applied. An understanding of these technologies will help the automotive system designer evaluate NAND flash-based storage devices with confidence that they are robust and reliable enough for use in vehicles.

Operation

To see how technology can counter the effect of high temperatures on NAND flash cells, it is important to understand the operation of these cells. In flash memory, data bits are represented by stored charge (electrons) in cells.

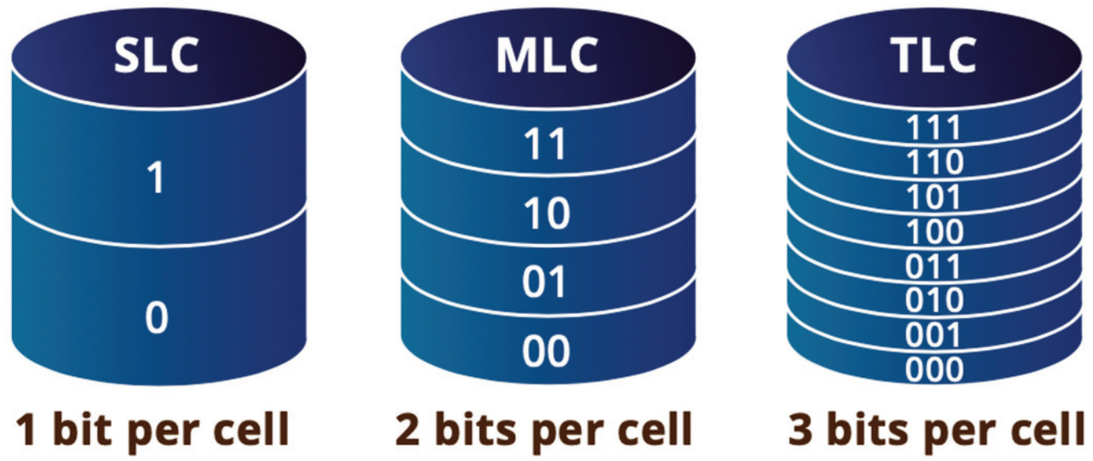


Fig. 2: NAND flash chip makers developed MLC technology that stores two bits per cell and then TLC technology with three bits per cell

When NAND flash technology first came on to the market, memory arrays were made of single-level cell (SLC) elements. In SLC NAND, the cell stores one bit of data – a 1 or 0.

As technology advanced, NAND flash chip manufacturers responded to demand for higher memory density by developing multi-level cell (MLC) technology, which stores two bits per cell, and then triple-level cell (TLC) technology, with three bits per cell, see Fig. 2.

This means the cell volume-per-bit has declined with each new generation of NAND flash. NAND cell size also shrinks as semiconductor fabrication processes advance from older process nodes to the latest sub-10nm nodes.

The high memory density of today's TLC NAND flash devices means a storage device can provide up to 480Gbyte of data capacity in a surface-mount BGA package with a footprint of just 20 by 16mm.

But the small size of TLC cells means they wear out at a faster rate than SLC cells, a factor that the flash controller embedded in a storage device has to take into account.

Every programme-erase (P/E) cycle slightly degrades the oxide layer in the cells on which a P/E operation is performed. Smaller TLC cells have a thinner oxide layer than the larger SLC cells, so they degrade faster, and can on average withstand fewer P/E cycles. Proprietary technology does exist to solve this problem.

NAND flash cells also experience electron leakage over time. If too much charge leaks from a cell, its data can no longer be read out. Data retention – the length of time for which data can be stored in a cell – declines as more P/E cycles are performed. And heat accelerates electron leakage, so data retention also declines faster as temperature rises, as Fig. 3 shows.

So this is the problem for NAND flash-based storage devices for automotive applications such as the infotainment system: in a car's centre console, an infotainment ECU might be required to operate at temperatures as high as +85°C, but data loss is not acceptable for infotainment applications such as mapping and navigation. And the AEC-Q100 standard mandates a defect rate of zero when tested at temperatures up to +85°C for grade-three qualification.

It is a problem that a storage controller and the firmware that it runs can solve.

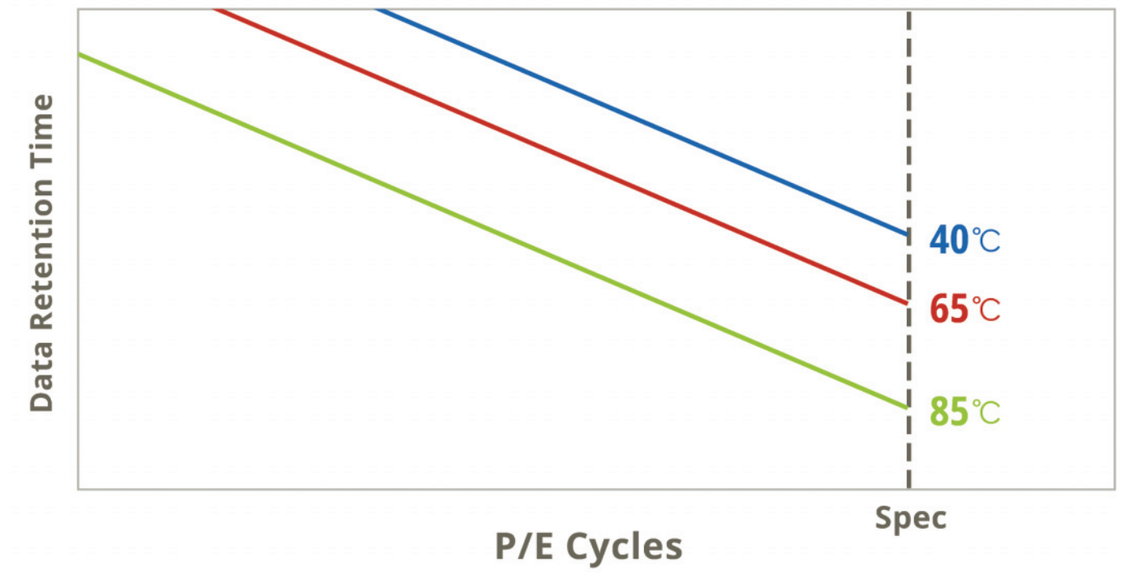


Fig. 3: Data retention in NAND flash cells dramatically declines as temperature rises

Storage controller

A NAND flash-based storage system consists of two basic elements: a NAND flash array and a NAND flash controller IC.

The basic role of the controller is the bridge between the NAND flash cells and the host processor that writes to and reads from the memory. The controller manages the mapping of bits to cell addresses.

Controller technology can extend data retention. As Fig. 3 shows, the acceleration of electron leakage from NAND flash memory cells at high temperatures dramatically shortens data retention, down to as little as two days at +85°C for an MLC cell that has undergone its rated maximum number of P/E cycles.

One way to solve this problem is to monitor the voltage at every cell in an array to detect those in which leakage has progressed to a critical state, and then to reprogramme at-risk cells.

This can extend NAND flash array lifetimes far beyond the nominal P/E cycle lifetime specified by the flash manufacturer, see Fig. 4.

The intelligence in this feature also includes responding automatically to temperature and scanning more frequently when operating at high temperature.

When a cell's oxide layer has degraded so much that it can no longer be sufficiently recharged, the function will repair it if possible, or retire it, thus avoiding any risk to data integrity.

The controller also implements global wear levelling, so P/E operations, and thus wear, are evenly allocated across an entire array.

The controller also provides the capability for the user to configure operation of TLC NAND flash to extend data integrity. A function can virtually group together TLC or MLC cells into a one-bit SLC-like configuration. This is ideal for use cases in which the nominal storage capacity in TLC mode is over-specified.

Operation with the feature turned on reduces the nominal capacity, but gives SLC-like data retention and data integrity performance.

Users can also have the ability to choose the ideal balance between data integrity and capacity for their application. In addition, a feature can automatically monitor the health status of the SSD, and trigger the controller to implement data protection and error correction operations when blocks or pages are at risk.

So now automotive manufacturers can embed robust solid-state storage into infotainment and adas ECUs with confidence that data integrity and data retention can meet users' expectations for vehicle lifetimes of ten years and beyond.

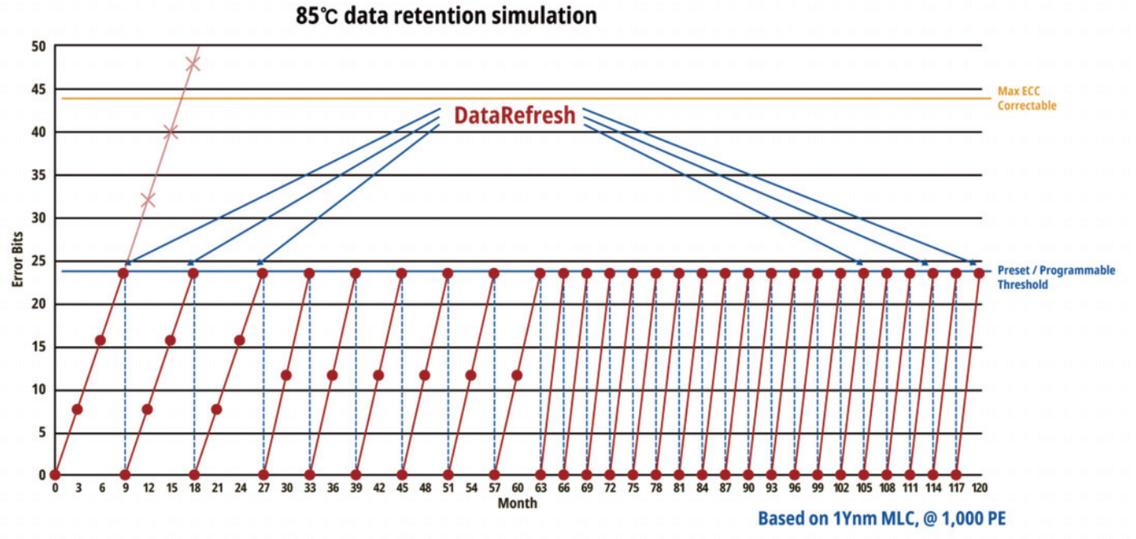
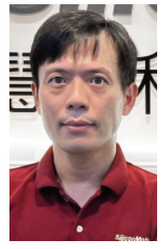


Fig. 4: Intelligent scan and data refresh to extend proactively data retention beyond typical NAND flash limitations

Jason Chien is embedded storage product marketing director at Silicon Motion

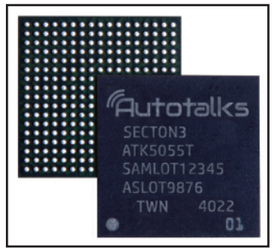


Chipsets support upcoming V2X

Chipsets from Autotalks are designed to support upcoming V2X requirements, including 5G-V2X for day-two scenarios.

Day-one V2X offers life-saving situational awareness alerts. Day-two V2X applications can use sensor data shared by other vehicles and enable critical actions such as automatic braking.

First samples are expected to be available in early 2023, and the first cars equipped with the chipsets are set to be available in 2025.



Current devices can only issue warnings. Braking the car requires functional-safety certification, available to ISO 26262 Asil B in the Tekton 3 and Secton 3 chipsets.

They support upcoming V2X requirements in both DSRC and C-V2X technologies, including the 5G-V2X (C-V2X release 16, 17 and 18) and IEEE802.11bd DSRC.

The chipsets support concurrently full backwards compatibility to any day-one vehicle, where each vehicle reports its own data, using either DSRC or LTE-V2X, with any day-two technology, where the vehicle also reports all the information detected by its sensors, for sensor sharing or cooperative perception.

The chipsets will embed low-latency V2X hardware security modules (eHSM) and hardware acceleration of line rate security verification. Tekton 3 also includes an optimised CPU scaled for days one and two V2X stack execution.

Autotalks' ZooZ micro-mobility V2X safety platform can prevent bike and scooter accidents and protect vulnerable road users such as pedestrians.

Switch controller enables flexible diagnostics

An automotive high-side switch controller from ST Microelectronics combines system-protection and diagnostic features with the firm's I2-t silicon-fuse technology.

As the first in the STi2 Fuse family with integrated I2-t protection, the VNF1048F is compatible with 12, 24 and 48V automotive power subsystems (board nets).

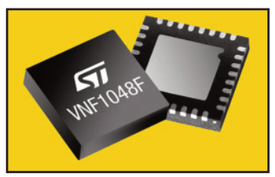
Its flexibility suits the latest automotive zonal electronic-electrical (EE) architectures that boost efficiency and reliability while supporting increased electrification and extra functions for smart driving.

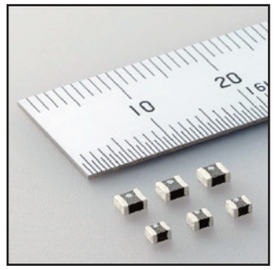
Its serial peripheral interface (SPI) is for a host microcontroller to configure and monitor system-protection and diagnostic features. These include under-voltage and over-temperature protection, thermal protection for the external high-side mosfet, desaturation shutdown, and I2-t fuse settings.

Digital current sensing is built in. Integrated analogue-to-digital converters monitor the temperature-sensing thermistor voltage, output voltage and mosfet drain-source voltage.

The I2-t fuse provides fast-acting, resettable and reliable over-current protection. Silicon fuses also help simplify vehicle wiring harnesses and reduce weight by eliminating user-accessible fuse boxes and the associated cabling and installation overheads.

It is in production and available in a QFN 32L 5 by 5mm 32-lead package.





Power inductors

The MCoil LCEN wire-wound metal power inductors from Taiyo Yuden are qualified to AEC-Q200.

The series consists of 13 items in two sizes, including the LCENA 2016 MKTR24M0NK at 2.0 by 1.6 by 1.2mm; height is the maximum value.

This power inductor product is for use as a choke coil in power supply circuits for automotive body and information systems.

The wire-wound inductor is designed based on the metal power inductor MCoil ME series, and maintains its advantages of a large current and a low DC resistance.

The MKTR24M0NK has an inductance of 0.24μH and simultaneously features DC superposition characteristics with a saturation current at 6.8A and a DC resistance of 18mΩ; both are the maximum values.

This can contribute to the downsizing and power consumption reduction of power supply circuits for adas units and instrument clusters.

Image sensor meets ISO 26262

An ISO 26262-compliant high-resolution 3D image sensor has been introduced by Infineon in collaboration with 3D time-of-flight (ToF) expert PMD Technologies.

Such 3D depth sensors can play a key role in monitoring systems in the vehicle cabin. They are essential to meet regulations as well as NCap ratings and to realise the vision of the driver becoming a passenger.

The second-generation Real 3 automotive image sensor can handle reliable and secure facial authentication, allowing seamless connectivity for any type of service that requires authentication such as payment, battery charging or accessing private data.

In addition, the same camera meets requirements for driver monitoring to detect driver distraction and fatigue. This enables the offering of a driver monitoring system with secure 3D facial recognition using only one ToF camera.

The sensor comes in a 9 by 9mm plastic BGA package and has a VGA system resolution of 640 x 480 pixels with an image circle of 4mm. This allows lens sizes similar to those in smartphones.

The resolution makes it suitable for camera applications with a wide field of view, such as complete front-row occupant monitoring systems. The resulting 3D body models enable accurate estimates of occupant size and weight, as well as precise passenger and seat position data, which is key information for intelligent airbag deployment and restraint systems.

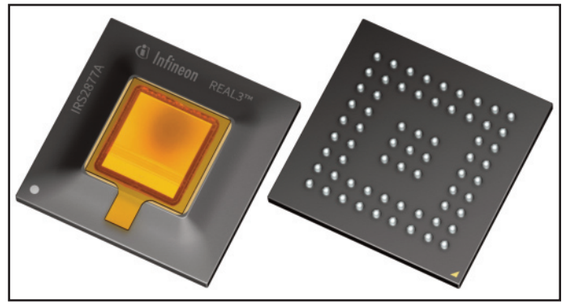
The chip is qualified to AEC-Q100 grade two and is being developed according to ISO 26262 Asil-B standard.

Besides safety critical applications, the 3D data allow for comfort features such as gesture control or intuitive interior lighting that follows passengers' movements. Additionally, the imager might be used in environmental perception scenarios as a flash-lidar based on safety conformity.

It is also suitable for adjacent applications in mobile robotics, drones and other autonomous use cases where reliability and safety is needed to protect operators.

The ToF technology provides reliable distance information and a 2D grayscale image of the entire scene under all ambient light conditions – at night, in sunlight, and under heavily changing lighting conditions.

Development samples of the IRS2877A 3D image sensor chip are available now and series production has begun. The IRS2877AS ISO 26262 compliant variant will be available for series production by the end of this year.



UWB IP extended to cover CCC Digital Key 3.0

Ceva's RivieraWaves ultra-wideband (UWB) IP has been extended with the RW-UWB-CCC Mac software package to support the Car Connectivity Consortium (CCC) Digital Key 3.0 specification.

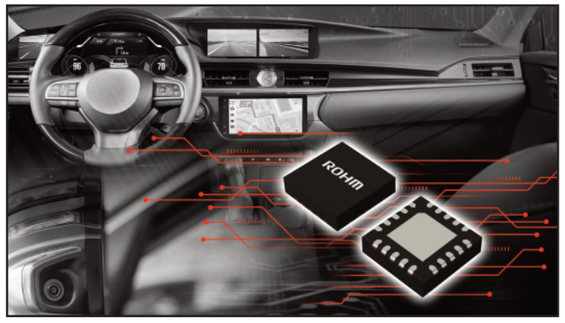
Already licensed to one of the largest players in the automotive semiconductor industry for its digital key product line, the Digital Key 3.0 compliant UWB IP allows chip vendors and OEMs to create and customise secure digital keys for automotive keyless entry systems.

The CCC Digital Key lets mobile devices store, authenticate and share digital keys for vehicles in a secure, location-aware and private way that works everywhere.

Release 3.0 is built around UWB in combination with Bluetooth Low Energy connectivity. ABI Research anticipates that around 25% of cars shipping in 2025 will come equipped with UWB access technology, with UWB expected to become the major mobile car access technology in the future.

The IP, with its coherent demodulation architecture and ranging algorithms, delivers ranging accuracy in complex, non-line-of-sight real life scenarios. In addition to the standard compliant packet formats, it also supports customisable packet formats to enable low power proprietary modes to extend the battery life of key fobs.

Asil-B PMICs suit camera adas modules



ISO 26262 Asil-B compliant PMICs from Rohm are for automotive camera modules in adas applications.

As part of the ComfySil series, the BD868xx-MUF-C ICs meet functional safety requirements to facilitate safety design in vehicles equipped with adas.

The four power supply systems (three DC-DC and one LDO) necessary for automotive cameras are integrated into a 3.5 by 3.5mm package.

They are equipped with an anomaly status notification mechanism for the likes of abnormal voltage detection and feedback via I²C. This reduces the number of components by three, which results into a 25% smaller mounting area. Further miniaturisation is possible by optimising for individual applications.

At the same time, various output voltage and sequence control settings can be configured to meet the requirements of cmos image sensors from different manufacturers, simplifying development.

As well as the four units (BD868-A0MUF-C, B0MUF-C, C0MUF-C and D0MUF-C) that comply with ISO 26262 Asil B, the line will include the non-ISO 26262-compliant BD868-C1MUF-C for users that do not require Asil compliance.

Also, the company can provide the products based on user setup requirements such as output voltages, voltage tolerances, sequencing and functional safety.

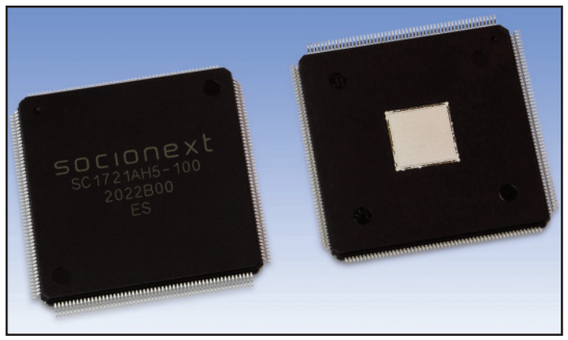
Applications include rear view and perimeter cameras, drive recorders, and driver monitoring systems.

Display controllers meet Asil-B requirements

Smart display controllers from Socionext have been ISO 26262 certified for functional safety.

The SC1721, SC1722 and SC1723 have started sampling.

These fourth-generation controllers are equipped with an Apix 3 serdes-repeater function that allows daisy-chaining of multiple smart display controllers, enabling up to four display connections in a chain.



This function can improve the wiring efficiency of the vehicle and facilitate the cooperation of multiple displays.

In addition, the company's proprietary Seeris 2D graphics IP is integrated with functions such as LED control and pixel compensation by local dimming, and warping-on-the-fly dynamic interpolation of the warp map.

A mechanism monitors external LED driver error detection and internal algorithm, and supports Asil-B functional safety by complying with the ISO 26262 development process.

These features enable architectures, such as panoramic displays for dashboards, to meet a growing trend of larger multi-display applications.

The SC1721AH5 is in a 24 by 24mm EP-LQFP-216 package. Video output resolution is 1920 x 1080.

The SC1722AK3 is in a 23 by 23mm TE-BGA-437 package. Video resolution is 3480 x 1080.

And the SC1723AK3 comes in a 23 by 23mm TE-BGA-427 package. Video resolution is 3480 x 2160.

Video input on all three is LVDS or Open LDI.

Connectivity framework for software-defined vehicles

Real-Time Innovations (RTI) has announced Connext Drive 2.0, a production-grade connectivity framework for software-defined vehicles.

It can accelerate direct integrations into Autosar Classic and ROS 2, enabling developers to leverage data-centric connectivity with familiar ecosystem architectures. This allows a faster start to build on existing, familiar platforms and eliminates the need for custom programming.

It also reduces overall complexity and cost, while building a future-proof, evolving system.

Using safety-certification components and teleoperation plug-ins, Connext Drive is based on the DDS data connectivity standard that has been adopted by Autosar and ROS. This should help OEMs design multiple vehicle architectures by selecting the features and functions for any use case.

Tools bridge Autosar Classic ECU modelling and configuration workflows for rapid and scalable communication of embedded, real-time and secure systems. This integration simplifies the design and evolution of DDS-enabled automotive ECUs.

A growing library of tools eases ROS 2 and Connext Drive ecosystem integration, providing ROS 2 developers with a bridge to production-grade systems. Through this integration, users can slash latency in their ROS 2 systems through a custom ROS middleware wrapper developed by RTI.

The Connext Drive Launcher helps users design a vehicle according to a specific use case, including EE, adas, teleoperations, simulation or high-performance compute. By selecting the features for a use case, developers can increase productivity and accelerate time to market.

Users can ease project development with direct access to the full set of utilities, services and tools.

It includes components safety-certified to Asil-D levels by TÜV SÜD.

Additionally, it includes interoperability with QNX for Safety over Arm v8 and Autosar Classic OS over Infineon Tricore.

Connext Drive 2.0 is in production vehicles on the road in the USA, Europe and Asia.



DC-DC converters suit rail vehicles

With the RMD500 series, Recom offers 500W DC-DC converters for transportation, especially rail vehicles.

Their 4:1 input voltage range can cover input voltages from 43 to 137.5V DC (nominal 72V resp 110V) in a range with isolated and regulated 24V output. That is possible due to a reinforced isolation system.

The converter has a constant efficiency of 95% and is parallel connectable in n+1 redundancy. The baseplate mounting allows an operating temperature of -40 to +70 or +85°C for class OT4 plus ST1 and ST2. That provides full power over the entire temperature range without the need for derating or additional fans.

Film capacitor handles high humidity

A low profile, AEC-Q200 metallised polypropylene film capacitor from Vishay suits high humidity automotive use.

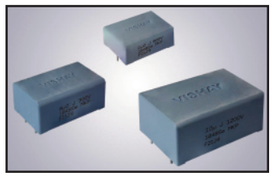
The Roederstein MKP-1848Se DC-Link can withstand temperature humidity bias (THB) testing of +60°C/93% relative humidity for 56 days at rated voltage.

The automotive-grade capacitor is available in the four building heights of 12, 15, 18 and 24mm and in 12 standard dimension options.

With its low-profile design and high resistance to humidity, the radial device is suitable for space-constrained automotive applications, including hvac, on-board and inductive battery charging, air conditioning compressors, and motor drives for electric (EV) and plug-in hybrid electric vehicles (PHEV).

The device has rated capacitance from 1 to 75μF and ESR down to 3mΩ.

The RoHS-compliant device provides ripple current capabilities up to 27A and rated voltages of 500, 700, 900 and 1200V DC at +85°C.



Common mode chokes suit harsh environments



With a nanocrystalline metal core, Kemet's SCF-XV AEC-Q200 qualified common mode chokes are said to achieve higher inductance and impedance values, a broader frequency response, and a smaller footprint.

This series fulfils the growing need for high voltage automotive and harsh environment industrial EMI filtering applications.

The series offers up to 1kV AC and DC. The nanocrystalline metal core results in a reduced footprint, rated current range from 5 to 35A, DCR from 0.65 to 40.3mΩ, operating temperature from -40 to +150˚C, vertical and horizontal layouts, and three outer core diameters of 19, 25 and 29mm.

The toroidal coils are designed with nanocrystalline metal cores and are useful in various noise countermeasure fields.

These features position the series for EMI suppression.

They address design engineers' needs with various characteristics for automotive and harsh environment industrial applications.

They are suitable for use in the EV automotive market, supporting the industry's trend to increase the vehicle-installed lithium-ion battery pack voltage to limit drive train currents.

They also address the trend of miniaturisation and operation in harsh environments.

Applications include onboard chargers for EVs and PHEVs, e-compressors, wireless charging systems with 85kHz, medium power drives for power steering, air conditioning, and mild hybrid 48V systems.

Pico-resolver is Asil ready for rotor detection

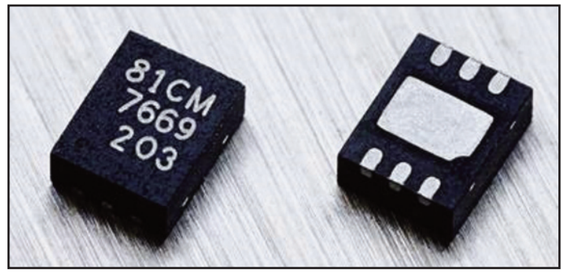
A 3D magnetic resolver IC from Melexis is optimised for robust motor design and is Asil ready.

The MLX90381 AEC-Q100 and ISO 26262 compliant pico-resolver is for industrial and automotive applications. Its 2 by 2.5mm DFN-6 package enables sensored mechatronic miniaturisation.

It is programmable at module level and is suitable for rotor position detection.

The device combines the advantages of a small outline and reliable analogue outputs providing sine and cosine signals.

Leveraging the firm's tri-axis Hall technology, it can be used for absolute rotary position sensing and, leveraging its low latency and fast response, measures rotational speeds above 50,000rpm.



The pico-resolver improves low-speed accuracy and noise performance, and supports stall detection. It can be used with DC, brushless DC and permanent magnet synchronous motors in applications such as e-valves and e-bike motors.

It is also a good fit for automotive safety-related systems as it is AEC-Q100 and ISO 26262 compliant (Asil B SEooC).

The device combines easily with the firm's family of smart embedded Lin drivers. These include the MLX81330/32 (up to 10W) for directly driving flaps, valves and single-coil fans and pumps.

Additionally, it works with the MLX813-40/44/46 pre-drivers (up to 2000W), which are incorporated into power blowers, engine cooling fans, pumps, window lifters, seat adjusters and sunroofs.

Thanks to its selectable magnetic field axes (X/Y, X/Z and Z/Y), it can handle on-axis position sensing as well as off-axis through-shaft sensing.

The sensitivity and filter bandwidth of each axis can be programmed directly through the device's I²C interface.

Position sensors combine VHT and TMR

Magnetic position sensors from Allegro Microsystems are for adas applications that require high levels of accuracy and heterogeneous signal redundancy.



The A33110 and A33115 combine the company's vertical Hall technology (VHT) with tunnelling magnetoresistance (TMR) in a sensor package.

These angle sensors are the first of their kind to feature this technology combination in a single package.

Electric power steering (EPS) with precise motor control capabilities, as well as brake-by-wire or electromechanical braking with fast response time, commonly use giant magnetoresistance (GMR) or Hall-effect sensors. Compared with the GMR equivalents, the TMR-on-silicon technology offers improved resolution and accuracy, providing up to eight times greater sensitivity.

Measured against traditional Hall-effect sensors, the improvement in resolution is more pronounced.

The VHT enables accurate safety checks, including low-field and missing-magnet detection.

These high-resolution sensors are Asil-D compliant, with heterogeneous redundancy reducing the likelihood of dependent failures by leveraging the best of both TMR technology and VHT.

The sensors provide magnetic angle sensing via both the primary (TMR) and secondary (VHT) transducers, each of which are processed by two independent channels, each with independent regulators and temperature sensors.

This configuration enables the high levels of safety and diagnostic coverage needed for automated driving, including on-chip channel-to-channel angle comparison and independent processing in digital signal paths, with no shared digital resources.

Algorithms deliver the fast response time, independent gain-offset correction, angle calculation and linearisation capabilities needed by safety-critical adas applications.

The A33115 also includes a turns counter that tracks motion in 90˚ increments and a low-power mode with a user-programmable duty cycle that reduces power consumption when the IC is in a key-off position.

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

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

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

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

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

© 2022 Vehicle Electronics
ISSN 2055-1177

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