VEHICLE electronics

The monthly magazine for automotive electronics engineers

Misra C: 2023 faces ‘a few weeks’ delay

Expected launch at Embedded World did not happen

The much-anticipated release of the Misra C: 2023 coding standards should be out in the next few weeks.

Some were expecting it to be launched during Misra’s session at the recent Embedded World conference, but the standards body just released amendment four to the existing standard.

This specifies rules and directives for multi-threading and atomic types as well as clarifications on existing guidance so as to align better with how developers use the C language today.

The group was expected to introduce Misra C: 2023, which consolidates previous versions of the guidelines into a single, comprehensive edition to facilitate compliance.

However, Misra chair Andrew Banks, a technical specialist at LDRA, said instead the group announced the imminent release of Misra C: 2023.

Perforce announced Misra C: 2023 support at Embedded World

“The expectation is that this will be released to the public within the next few weeks, pending final editorial tweaks,” he said.

But LDRA announced the addition of Misra C: 2023 guidelines to the static code analysis and reporting capabilities of its tool suite, see page 20.

And Perforce Software said the new version of its Helix QAC 2023.1 would provide complete coverage of amendment four and support for Misra C: 2023.

This year is the 25th anniversary of the publication of the original Misra C in 1998.

It is the standard for developing software in the C programming language where safety, security and code quality are essential.

It initially targeted the automotive market as it moved from assembly language to C.

Though still used for automotive, it is now also deployed in other safety-relevant industries.

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Blackberry opens Indian centre of excellence

Blackberry has set up an IoT centre of excellence, engineering and innovation in Hyderabad, India, to help build software-defined-vehicles (SDVs).

The engineering centre is recruiting embedded software engineers and will use the company’s safety-certified QNX products and Ivy in-vehicle software platform.

By the end of this year, the Hyderabad facility – set to be the second largest for Blackberry IoT globally, after Canada – will host over 100 software engineers including senior managers, technical project managers, product engineers, cloud software developers, and specialists in integration and service delivery.

“India is an important market for local and global manufacturers in automotive and IoT sectors, particularly in Hyderabad, an ecosystem of engineering talent,” said Mattias Eriksson, president of Blackberry IoT.

Responsible for innovation, embedded software and engineering services, the teams will use the QNX software development evaluation hardware and software to design and accelerate the development of systems that are safe, secure and offer real-time performance.

This includes the QNX Accelerate initiative, offering QNX in the cloud for product development and to reduce time to market for mission-critical industries including automotive, medical, industrial, robotics, aerospace, defence and heavy machinery.

Ivy software development will roll-out later in 2023, so developers and OEMs with operations in India can access benefits such as optimised data processing using on-vehicle machine learning.

Object lesson in vehicle vision

Aston University in the UK has completed a two-year knowledge transfer partnership (KTP) with Coventry-based transport technology firm Aurrigo resulting in machine vision to make its autonomous vehicles more capable.

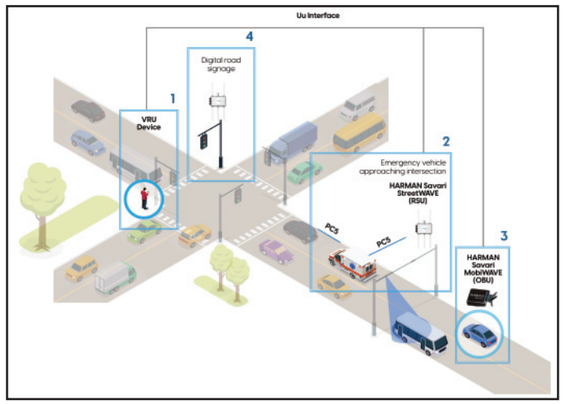
The project has led to the company’s driverless vehicles being able to see and recognise objects in greater detail.

Previously, the company’s driverless vehicles could only detect that there was an object in their path and not the type of object, so would just stop when they encountered something in their way.

The project team used computer vision, coupled with machine learning and artificial intelligence, to differentiate between objects of interest. The technology has been applied to the company’s airport Auto-Dolly, which can now differentiate between many different objects airside improving its operational performance.

“This KTP has been a great way for us to work with a new industrial partner while applying our expertise in deep learning and robotics to the exciting field of autonomous vehicles,” said George Vogiatzis, senior lecturer in computer science, who led the Aston University team.

ACM helps Harman test V2X cases



ACM and Harman test V2X technology

Samsung subsidiary Harman is working with the American Center for Mobility (ACM) to test real-world use cases of V2X road-ready technologies.

The V2X is enabled by roadside infrastructure and edge computing, and uses 5G for ubiquitous connectivity between vehicles, people and infrastructure to improve safety and efficiency.

ACM provides infrastructure to help validate complex products in real world conditions. It conducts real-world testing of 5G, V2X and MEC technologies.

Harman and ACM are testing vulnerable road user safety and video see-through and do-not-pass warning alerts using vision sensor share under real world conditions with varying degrees of constraints including weather, network capability and road conditions.

For example, see-through provides a low latency real-time augmented video feed of a vehicle ahead of the host vehicle. This enables visibility, reduces driver anxiety and increases safety while facilitating the host vehicle to perform a safe overtake manoeuvre using Harman's 5G TCU and Savari Mecwave.

The collaboration will let car makers test and experience their connected vehicles and demonstrate mobility use cases with the potential to scale.

Connected infrastructure can provide improved situational awareness to drivers and pedestrians, such as the notification of roadway hazards and traffic management.

"Having the ability to test these real-world scenarios demonstrates Harman's ability to combine fast, reliable 5G, V2X and MEC to deliver improved situational awareness between vehicles, vulnerable road users and infrastructure without the need for increased computing onboard every vehicle and personal devices," said Ram Iyer, senior vice president at Harman.

Reuben Sarkar, CEO of ACM, added: "Making best-in-class infrastructure widely available through partnerships for automakers to test in real-world test environments embodies our approach."

U-Power uses Renesas R-Car SoCs for EVs

Chinese EV start-up U Power is using Renesas' R-Car V4H and S4 systems-on-chip to build its high-performance vehicle computer (HPVC) and UP hub.

The two companies will also join forces in marketing these two ECUs.

As the core smart driving module of the UP Super Board, the HPVC offers flexible scalability in computing power through its pluggable, cascadable design.

The quantity and type of chips can be easily adjusted to accommodate the demands of autonomous driving from L2 to L4 and higher, allowing car users to upgrade their vehicles' computing power constantly.

The UP hub functions as a domain controller with central plus zonal gateways, using Renesas chips to support scalable ECU designs. This provides computing and communications. The hub covers all mainstream types of in-vehicle communication interfaces.

As a software-hardware integrated automobile operating system, the UP Super Board has capabilities that facilitate the creation of multi-type and multi-level EV products.

With a skateboard chassis at the core of its capabilities, U Power designs EVs for various applications. The company offers two flagship product lines, UP Super Board and UP Space. It has debuted China's first chassis-by-wire skateboard chassis, which will be mass produced later.

OpenSynergy ports Coqos to STM Stellar MCUs

OpenSynergy has announced the porting and availability of its Coqos hypervisor SDK to the ST Microelectronics Stellar integration MCUs.

The Berlin software company has worked closely with STM to demonstrate that the automotive virtual platform for real-time processors picks up the hardware virtualisation in the Stellar products and extends it.

With this virtualisation, automotive manufacturers can execute multiple functions and software on one piece of hardware, securely separated from other functions. This approach forms the technical basis for the coming generations of domain and zonal architectures.

Separation of functions by hardware virtualisation alone is not sufficient to exploit the enormous power of the latest automotive MCUs. Additional virtualisation technology, such as the Coqos hypervisor SDK, further enables the integration of numerous applications and runs several operating systems, on which the various functions are located, side by side.

In addition to the hypervisor, the virtual devices that OpenSynergy offers on its SDK let the systems communicate without additional hardware. Thus, physical Can buses are replaced by Virtio-Can, a Can implementation in shared memory instead of wires.

The exchange between virtual machines is also possible via Virtio-VSock or Virtio-Net depending on the application.

The hypervisor combined with Stellar virtualisation completely separates all software components from the hardware and enables both the operating systems and the applications running on them to be completely independent and without influence on each other. They can also be updated modularly.

Hardware virtualisation enables all functions of a domain to run together and simultaneously on a single MCU. With Stellar's multi-core design, the number of integrated functions can still be expanded for a zonal or domain approach.

Cisco puts mobile office in Mercedes E Class

Cisco is working with Mercedes-Benz to provide a mobile office in its E Class vehicles.

The cars will be equipped with Webex Meetings & Calling and use Webex AI audio capabilities to improve flexibility for hybrid workers.

The aim is to help people get work done safely, securely and comfortably in their vehicles.

The partnership makes it possible for an architect in the parking lot of a job site to collaborate with the team back at the firm, for example, or take a meeting between visiting a client and picking up the kids from school.

"Hybrid work is centred on the work you do, not where you do it, whether it's in the office, home, car or anywhere in between," said Jeetu Patel, Cisco executive VP. "The mobile office cannot progress without the reliable and secure collaboration technology that only Cisco can provide."

Drivers will be able to conduct frictionless meetings and calls with Meetings and enterprise grade calling with Webex. These features are all part of the Webex Suite.

Proprietary audio intelligence technology provides noise cancelation. This makes it easier to hear and be heard by singling out and boosting the clarity of an individual's voice while eliminating distracting background noises, such as road noise and, at times, co-passengers talking.

Webex in Mercedes-Benz E Class

For safety, when the vehicle is moving, meetings and calls will only use audio. When parked, users can harness Webex's full immersive collaboration experience, including video meetings, automatic AI-powered transcription, content sharing, and reactions such as a thumbs up or celebration emoji.

The 2024 E Class will be equipped with wifi and cellular data connection. Using either, drivers can download the Webex app from the Mercedes-Benz car app store to appear directly on the touchscreen of the vehicle's infotainment system.

This offering will be available globally in vehicles expected to arrive at dealerships this spring.

KDPOF and Würth in fibre optics pact

KDPOF and Würth Elektronik are working to advance automotive multi-gigabit Ethernet over fibre optics.

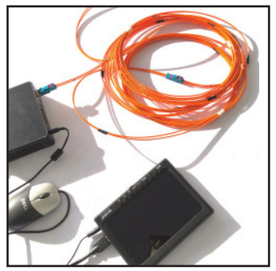
"As the auto industry approaches 100Gbit/s*m speed-length threshold, the move from copper to optical physical data transmission media is picking up speed," said Carlos Pardo, CEO of KDPOF.

To fulfil the needs of future connected and automated vehicles, KDPOF's automotive Ethernet provides links up to 100Gbit/s over glass optical fibres. Instead of various port components, this delivers a single-component, complete automotive multi-gigabit system.

"With a growing portfolio of automotive-grade components, we are able to support several innovative applications such as adas," said Alexander Gerfer, CTO of Würth Elektronik. "Our partnership with KDPOF marks an important step towards strengthening our presence in the field of automotive in-vehicle connectivity, where our EMC know-how is highly requested."

The connector systems are small, light-weight and inexpensive compared with previous ones. With cost-down and consistency in focus, optics, fibres, connectors and electronics already developed for nGbaseSR are leveraged.

- KDPOF's proposed IEEE 802.3cz standard has been advanced to the IEEE 802.3 standard approval ballot stage.



KDPOF and Würth develop automotive high-speed links over glass optical fibre

EV power electronics set for rapid growth

Demand for electric vehicle power electronics will dramatically increase in the next ten years, driven by rapid growth in the BEV market, where IDTechEx predicts a 15% CAGR globally for the next decade.

The weighted-average battery capacity of BEVs is increasing in all regions, piling pressure on battery supply chains, and creating uncertainty. The result is drive cycle efficiency must come to the forefront of powertrain design, meaning the time has come for high-voltage wide bandgap (WBG) power electronics.

While Si IGBTs have dominated the medium-to-high power device range for 20 years, including in EV power electronics, they are giving way to WBG materials such as SiC and GaN.

This will impact the design of power devices, including the package materials, as high voltage and high power-density modules operating at higher temperatures become the trend.

The two drivers often cited to move from 350-400V to 800V and beyond are higher power levels of DC fast charging (DCFC), for example, 350kW, and drive cycle efficiency gains.

DCFC compatibility today is a relatively weak driver due to low availability versus AC chargers and the high costs of 800V infrastructure.

Letters to the editor

Stopping Tesla

I noticed in the press some time ago that Tesla cars in China were running away unable to stop and crashing, causing death and injury.

I helped do electrical design work on electric cars in the USA in the 1980s.

I designed a simple low-tech system that does not need a computer (there were not any) to stop runaway electric vehicles, which could be quite simply and fairly cheaply used on Tesla and other electric cars.

I am not sure if it was ever used or even patented, although any patent would have long expired if it had. I could patent it but there are many workarounds that could use a similar system so would be pointless as this is what the large electric vehicle companies would do, as I would if asked to do it as a design engineer by any company.

Here is an unrelated example of my problem.

In the 1930s an engineer went to the Swan Vesta match company and told them he could cut their production costs by 30%. They asked him how. He explained if he told them they would thank him and he would get nothing.

Eventually, after a lot of discussions, they had a board meeting with lawyers present and after a contract was signed to give him 5% of their savings in production costs for the first year, he told them. All they had to do was remove the striker sandpaper strip from one side of the matchbox. If he had told them that without a binding contract, he would have got nothing.

So I can't tell you anything about how the system works.

If Tesla is not interested, I could offer it to BMW or Mercedes, who will do a full world patent covering everything and every angle costing thousands, which I do not have as I am retired.

Many thanks
Ron Angel

History lesson

The history article from Henry Quigley is an interesting read (Vehicle Electronics, March 2023). It contains a major error, though, stating right at the beginning that Ford's Model T was the first commercially available car.

In fact, this was the Benz Patent-Motorwagen, a full 22 years earlier.

Best regards
Johannes Wagner
Etas

Letters to the editor should be sent by email to editor@vehicle-electronics.biz

Infineon acquires GaN Systems for $830m

Infineon Technologies is to acquire GaN Systems for $830m.

GaN Systems specialises in GaN-based products for power conversion. The company is headquartered in Ottawa, Canada, and has more than 200 employees.

"GaN technology is paving the way for more energy-efficient and CO_2-savings that support decarbonisation," said Jochen Hanebeck, CEO of Infineon. "Adoption in applications like mobile charging, data centre power supplies, residential solar inverters, and onboard chargers for electric vehicles is at the tipping point, leading to a dynamic market growth."

He said the planned acquisition would significantly accelerate its GaN roadmap, based on R&D resources, application understanding and customer project pipeline.

"Following our strategy, the combination will further strengthen Infineon's leadership in power systems through mastery of all relevant power technologies, be it on silicon, silicon carbide or gallium nitride," said Hanebeck

Jim Witham, CEO of GaN Systems, added: "The GaN Systems team is excited about teaming up with Infineon to create highly differentiating customer offerings, based on bringing together complementary strengths. With our joint expertise, we will optimally leverage the potential of GaN. Combining GaN Systems' foundry corridors with Infineon's in-house manufacturing capacity enables maximum growth capability to serve the accelerating adoption of GaN in a wide range of our target markets."

He said he was very proud of what GaN Systems had accomplished so far and could not wait to help write the next chapter together with Infineon.

"As an integrated device manufacturer with a broad technology capability, Infineon enables us to unleash our full potential," he said.

As a wide bandgap material, GaN offers value by higher power density, higher efficiency and size reductions, especially at higher switching frequencies. These properties enable energy savings and smaller form factors, making GaN suitable for a wide range of applications.

Jim Witham

By 2027, market analysts expect the GaN revenue for power applications to grow by 56% CAGR to around $2bn. As such, GaN is becoming a key material for power semiconductors, alongside silicon and silicon-carbide, and coupled with new topologies, such as hybrid flyback and multi-level implementations.

In February 2022, Infineon announced doubling down on wide bandgap by investing more than €2bn in a frontend fab in Malaysia. The first wafers are due to leave the fab in the second half of 2024, adding to Infineon's existing wide bandgap manufacturing capacities in Austria.

The planned acquisition of GaN Systems in an all-cash transaction will be funded from existing liquidity. The transaction is subject to customary closing conditions, including regulatory approvals.

BMW picks OnSemi SiC for electric drivetrains

In a long-term supply agreement, BMW is to use OnSemi's Elite SiC technology in its electric drivetrains for 400V DC bus applications.

The 750V M3 die is in a full bridge power module delivering several hundred kilowatts.

The companies' collaboration during the development and integration of the electric drivetrain enabled OnSemi to provide differentiated and application-specific die, including optimised size and layout as well as performance and reliability.

Enhanced electrical and mechanical characteristics can produce high efficiency and lower overall losses while delivering better performance.

"With maximum range being a primary consideration for purchasing an EV, OnSemi's system approach for optimised performance across all of BMW's electric vehicles provides a key competitive advantage," said Asif Jakwani, senior vice president at OnSemi. "In addition, we are able to support the rapidly increasing demand for BMW's premium EVs by continuously ramping all production steps of our robust, vertically integrated SiC supply chain."

German government backs supercomputing project

Thirty partners from industry and universities are working on the Mannheim-CeCaS central car server research project to develop an automotive supercomputing platform.

The German government is donating around €46m of the €90m budget. The project will be led by Infineon.

Peter Schiefer: "No end in sight."

"The high level of acceptance enjoyed by driver assistance systems is a sign that there's no end in sight to the automation of driving," said Peter Schiefer, Infineon's division president for automotive. "Here we're also talking about digital sovereignty in the interest of a robust automotive industry in Germany and Europe."

Mannheim-CeCaS is dedicated to investigating and developing a holistic central computing platform for highly-automated vehicles. This is to fill a gap emerging for connected and electrified cars where their feasibility for everyday use still requires energy-efficient and economical high-end computers that can keep up with the increasing requirements on computing power and complexity and at the same time can meet the very high demands placed on automotive qualification.

This involves combining safety and performance and automotive supercomputing, including specially designed processors as well as interfaces and system architectures.

The central computing units are to be based on processors qualified for automotive applications and using non-planar transistor technology. Application-specific hardware accelerators and an adaptive software platform for autonomous vehicles will complement the processors.

This involves convolutional neural networks and event-driven neuromorphic accelerators.

The necessary modifications of the on-board power network are to be taken into account, as is an automotive-capable integrated circuit packaging. The consortium's objective is a complete Asil-D automotive qualification at the system level.

Major participants include Bosch, Continental and ZF Friedrichshafen, in addition to various Fraunhofer institutes and partners such as TU Munich and the Karlsruhe Institute of Technology.

The other participants are Hella, AVL Software & Functions, Ambrosys, Kernkonzept, Berliner Nanotest und Design, Missing Link Electronics, Inchron, Glück Engineering, STTech, Steinbeis ZFW, Swissbit, FZI Research Center for Information Technology, Munich University of Applied Sciences, and Universität zu Lübeck, Chemnitz University of Technology.

Eyeris uses Omnivision for 3D in-cabin monitoring

Eyeris Technologies is using Omnivision's dedicated NPU with 2Tops to deliver monocular 3D monitoring and automotive design flexibility.

They have integrated Eyeris' in-cabin monocular 3D sensing AI software with the Omnivsion OAX4600 system-on-chip (SoC) and its OX05B1S 5Mpixel RGB-IR global shutter sensor.

The combination provides depth-aware in-cabin monitoring AI software, using a single 2D image sensor with a dedicated NPU, and integrated RGB–IR ISP.

The form factor allows it to be packaged into space-constrained areas of the vehicle to improve in-vehicle safety, comfort and convenience.

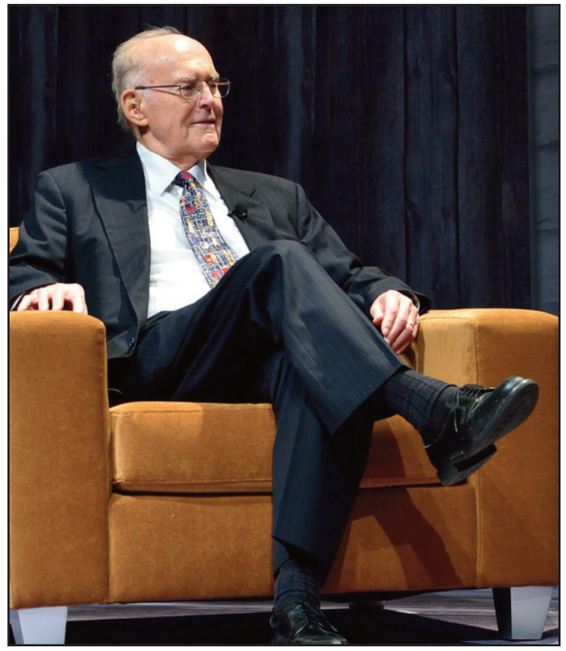
Eyeris monocular 3D sensing AI uses proprietary technology and deep neural networks that accurately regress depth information with 3D output from 2D image sensors, which applies to all in-cabin features. The neural networks models map the interior of a vehicle and accurately predict in three dimensions the location of occupants' face, body, hands, objects and everything else inside the car.

Gordon Moore, Intel co-founder, dies aged 94

Intel's co-founder Gordon Moore died peacefully at the age of 94 on Friday 24 March 2023 surrounded by family at his home in Hawaii.

Moore and his longtime colleague Robert Noyce founded Intel in July 1968. Moore initially served as executive vice president until 1975, when he became president. In 1979, Moore was named chairman of the board and chief executive officer, posts he held until 1987, when he gave up the CEO position and continued as chairman.

In 1997, Moore became chairman emeritus, stepping down in 2006.



Gordon Moore has died aged 94

During his lifetime, Moore dedicated his focus and energy to philanthropy, particularly environmental conservation, science and patient care improvements.

With his wife of 72 years, he established the Gordon and Betty Moore Foundation, which has donated more than $5.1bn to charitable causes since its founding in 2000.

Moore famously forecast in 1965 that the number of transistors on an integrated circuit would double every year, a prediction that came to be known as Moore's Law.

With his 1965 prediction proven correct, in 1975 he revised his estimate to the doubling of transistors on an IC every two years for the next ten years.

Regardless, the idea of chip technology growing exponentially became the driving force behind the semiconductor industry.

Intel's current CEO Pat Gelsinger said: "Gordon Moore defined the technology industry through his insight and vision. He was instrumental in revealing the power of transistors, and inspired technologists and entrepreneurs across the decades. We at Intel remain inspired by Moore's Law, and intend to pursue it until the periodic table is exhausted."

Prior to establishing Intel, Moore and Noyce participated in the founding of Fairchild Semiconductor, where they played central roles in the first commercial production of diffused silicon transistors and later the world's first commercially viable integrated circuits.

The two had previously worked together under William Shockley, the co-inventor of the transistor and founder of Shockley Semiconductor, which was the first semiconductor company established in what would become Silicon Valley.

Upon striking out on their own, Moore and Noyce hired future Intel CEO Andy Grove as the third employee, and the three of them built Intel into one of the world's great companies.

In 2022, Gelsinger announced the renaming of the Ronler Acres campus in Oregon – where Intel teams develop future process technologies – to Gordon Moore Park at Ronler Acres. The RA4 building that's home for much of Intel's technology development group was also renamed the Moore Center along with its café, The Gordon.

"I can think of no better way to honor Gordon and the profound impact he's had on this company than by bestowing his name on this campus," Gelsinger said at the event. "I hope we did you proud today, Gordon. And the world thanks you."

Moore was born in San Francisco on 3 January 1929 to Walter Harold and Florence Almira "Mira" Moore. He was educated at San Jose State University, the University of California at Berkeley, and the California Institute of Technology, where he was awarded a PhD in chemistry in 1954.

In 1950, Moore married Betty Irene Whitaker, who survives him. Moore is also survived by sons Kenneth and Steven and four grandchildren.

ILI adopts Andes and IAR functional safety

ILI Technology's TDDI touch and display driver integration ILI6600A SoC is using the Andes N25F-SE ISO 26262 certified V5 Risc-V CPU core and the IAR certified Embedded Workbench toolchain for Risc-V to support automotive functional safety.

The ILI6600A is an integrated amorphous, LTPS and oxide TFT LCD driver with an in-cell touch controller.

The joint offering from Andes and IAR is ISO 26262-certified and can help accelerate time to market by shortening the certification process.

The LCD driver in the ILI6600A supports up to three chips cascading and provides up to 16.7 million colours.

The touch panel controller uses a 32bit single-cycle instruction-set MCU. Its built-in hardware-accelerated computing modules provide data processing capabilities. With ILI's driver technology and algorithms, the touch controller improves the user experience with anti-noise ability and a high signal-to-noise ratio.

Andes and IAR help ILI meet safety standards

The AndesCore N25F-SE is an ISO 26262 full-compliance Risc-V CPU. As a safety enhancement edition of N25F, it is designed for automotive functional safety to prevent systematic and random hardware failures.

IAR Embedded Workbench for Risc-V is a certified integrated development environment including the IAR C/C++ compiler and a debugger.

"The ILI6600A is our first ISO 26262 Asil-B ready product, providing robust, real-time and certified fail detection functions," said Luen Wey, CEO of ILI Technology. "Its higher SNR makes excellent touch panel performance and brings a perfect user experience."

The ILI6600A has remote AI tuning tools. The AFE can scan up to 960-channel touch sensors and supports LongV and LongH scan.

Moreover, it also supports virtual touch keys and knob functions. And it has passed the automotive ESD, EMI and EMS tests and will soon be an AEC-Q100 grade-two qualified product.

"With the N25F-SE, we ensure customers can leverage our ISO 26262-certified CPU IP and safety package in their product certification process," said Charlie Su, CTO of Andes.

ILI has licensed several Andes V3 CPUs, the generation before its Risc-V compliant V5 cores.

"We have established the ISO 26262-certified development process for automotive processor cores up to Asil-D," said Su. "With the certified development process in place, we are ready to support the automotive supply chain with the roadmap of our ISO 26262 functional safety certified Risc-V cores."

Anders Holmberg, CTO of IAR, added: "Risc-V technology continues to move fast forward and break new ground for innovations."

GMV and U-Blox provide safe positioning

U-Blox's GNSS receiver hardware is being combined with GMV's safe correction service, sensor fusion and positioning engine to address the needs of automotive applications by providing a holistic safety approach that increases performance and reduces time-to-market costs.

U-Blox will directly commercialise the combination, including integration service and certification support to be provided jointly by U-Blox and GMV, for applications such as adas level 2+ and up to vehicle autonomy.

"We are thrilled to partner with U-Blox for a common purpose: deliver comprehensive safe positioning for the automotive industry," said Miguel Romay, general manager of GMV Satellite Navigation Systems.

U-Blox's head of product centres Andreas Thiel added: "For U-Blox, this is a natural fit; we are both committed to delivering high-performance and safe positioning for the automotive industry."

BACK TO BUSINESS

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

Soafee grows to meet SDV demand

The Scalable Open Architecture for Embedded Edge (Soafee) project is trying to recruit more members to grow the industry-led software-defined vehicle (SDV) collaboration defined by automakers, semiconductor suppliers, open source and independent software vendors, and cloud technology.

Set up about 18 months ago, its goal was to bring in companies to help define and understand the transition to SDVs.

Robert Day: "SDV is too big for anyone to do on their own."

"SDV is too big for anyone to do on their own," said Robert Day, automotive director at Arm and the company's representative on Soafee, "but we didn't want to start from scratch. So we looked at the cloud native world where they have a lot of tools for developing software, so we brought AWS [Amazon Web Services] in. They have been one of the most active members."

The aim is to take these tools for the cloud and develop them for the car. This meant dealing with different requirements such as safety and real-time responsiveness.

"We looked at what we needed to do with these tools to make them suitable for the car," said Day. "We have been recruiting new members to Soafee to help us do this. We have around seventy members now."

A big challenge has been dealing with mixed criticality in the car, something not found in most cloud applications. This has involved containers to make it easier to develop in the cloud and deploy in the vehicle.

"Car makers want continuous development," said Day, "so they can keep updating the vehicle. This increases the relationship with the car buyer and gives them monetisation opportunities. For the consumer, they see a relationship similar to what they have with their smartphone, with the car continually getting better while they own it."

Soafee is rolling out code in an open-source way while relying on companies to roll out their own commercial versions.

"It is cool," said Day. "We are getting people to roll things out, which is really good. Our silicon partners have been getting quite involved."

One example is South Korean automotive SoC supplier Telechips. It was showing its Dolphin 5 and N-Dolphin automotive chips.

To meet the performance, safety, power and scalability requirements of automotive applications such as adas and digital cockpits including IVI systems, Telechips selected a suite of Arm IP to power its automotive chips, including the Dolphin 5.

Using the Arm Mali-G78AE graphics processor with functional safety capabilities along with a Cortex-A76 processor and Arm Ethos-N78 neural processing unit, the Dolphin 5 is a high-performance, low-power SoC primed to meet the increasing demands of infotainment and adas in modern vehicles.

The N-Dolphin supports the execution of novel AI algorithms such as image processing for various in-car camera applications.

Both systems support the latest Android and Linux-based infotainment releases and integrate continuous cyber-security management capabilities.

Jeroen Baerents: "It is a growing market."

Transportation becomes key market for Advantech

Transportation has become an important vertical for Advantech, says the Taiwanese company's product sales manager Jeroen Baerents.

"It is a growing market, but it is wide in terms of applications," he said.

The range goes from digital signage for providing passenger information at airports to driver monitoring in vehicles.

"We see it being used for surveillance, driver behaviour monitoring and GPS location," said Baerents. "Buses can connect with bus-stops so displays can show when they are arriving. You can provide passenger identification on buses. We are seeing more automation."

The company was also showing products for railways with similar applications to those found on buses such as letting passengers connect to wifi on board, providing passenger information, and surveillance and security.

Products can also be used for preventative maintenance warnings. For example, they can monitor how often each door has been opened and closed and therefore predict when each will need a maintenance check.

For tunnels, the technology can be used for detecting vehicles entering the wrong way and provide appropriate warnings. They can also monitor and count the number of cars, motorcycles and people using the tunnels.

"We are also seeing a huge demand for electric vehicle charging stations," said Baerents. "You need to make them intelligent and connected with payment terminals. Overall, transportation is ten to fifteen per cent of our business."

Nuvoton ICs enhance battery performance

Nuvoton Technology showed a series of automotive and industrial battery monitoring ICs that can enhance battery durability, safety, performance and sustainability.

The KA84933UA and KA49517A and 522A battery monitoring ICs (BMICs) can detect a wide range of battery cell abnormalities and battery management system (BMS) failures, with diagnosis and safety functions.

High-precision voltage measurement helps extend the battery's lifetime and durability.

Nuvoton's battery deterioration diagnosis, using a BMIC on the battery pack, makes battery maintenance and reuse of battery materials much easier, protecting this resource and promoting sustainability.

"Nuvoton's battery management IC could provide safety, simplicity and scalability in various battery application segments, including mobility in two-wheelers, three-wheelers and four-wheelers with automotive grade plus Asil-D ready, and power storage in ESS and UPS as well," said Hsin-Lung Yang, Nuvoton president.

Hsin-Lung Yang

The Taiwanese company delivered around 30 million ICs to a dozen can makers in 2022. Yang predicted that this trend would keep growing sharply.

"We can provide diagnosis and safety functions to detect battery cell abnormalities and BMS failures," said Yang. "Meanwhile, high-precision voltage measurement errors could help extend the battery's duration and lifetime."

At the exhibition, the company also showed time-of-flight (ToF) sensors that simultaneously provide NIR-2D and 3D depth images with good sunlight tolerance and motion blur mitigation, making them suitable for applications from facial authentication to gesture recognition to obstacle detection.

They can also be used for driver monitoring applications.

DFI and Trend Micro boost vehicle security


Gary Chang

Taiwanese embedded motherboard specialist DFI has stepped into the electric vehicle (EV) market in recent years.

Alongside VicOne, the automotive cyber-security subsidiary of Trend Micro, it demonstrated technologies related to vehicle software security applications that enable more comprehensive network security protection for smart cities.

To demonstrate the AI computing and V2X technology used in connected vehicles and smart poles, DFI built a smart traffic intersection at Embedded World with road side units (RSUs), digital signage, intelligent edge computers, onboard units (OBU), in-vehicle AI computers and driver HMIs.

"We have intelligent traffic roadside components for outside and onboard computers for inside the vehicles," said Gary Chang, system manager at DFI.

DFI and VicOne showed a real C-V2X example of when a hacker uses vulnerabilities of smart devices to hack into and affect a vehicle or the safety of people and vehicles. After the built-in IDPS (xCarbon) of the OBU receives an abnormal message, it immediately communicates with the HMI and reports to the back end VSOC (xNexus) to take preventive actions.

VicOne's vehicle network security uses remote control of abnormal data signals and real-time warnings to help car manufacturers, fleet operators and system suppliers establish a more powerful vision of information security defence, and prevent and defend against hacker invasions.

With the rise of technologies related to EVs, the development of the internet of vehicles (IoV) has attracted attention and been integrated into smart cities. Various mobile vehicles, traffic signals and transportation infrastructure can share a large amount of data through the internet before performing backend AI computing to improve transportation efficiency and pedestrian safety.

DFI is deploying smart transportation and providing C-V2X IoV technologies.

Incorporating information security into transportation tools, fleet management and smart poles at the design stage can help public transportation or self-driving vehicles respond to new types of hacker attacks.

With the wave of infrastructure construction brought about by global industrial automation and digital transformation, DFI plans to collaborate with its partners to continue developing and integrating miniature edge computing products.

Microsys evaluation kit for SoMs

Microsys presented an evaluation kit for its Miriac systems-on-module (SoMs) based on NXP's S32G processors.

Deployed in vehicle networks as headless controllers, these integrated and scalable processors support adas and other functions for increasingly autonomous vehicles.

Developers can use the Miriac evaluation platform, which is designed as a modular single board computer, to test the performance balancing of their applications and to connect their Can, Lin, Flexray and 100baseT1 peripherals via automotive connectors.

The evaluation kit includes the S32G274A and/or S32G399A based Miriac SoMs, a carrier board in the shape of a dedicated modular SBC, and the appropriate power supply, cable sets and a pre-installed Linux image.

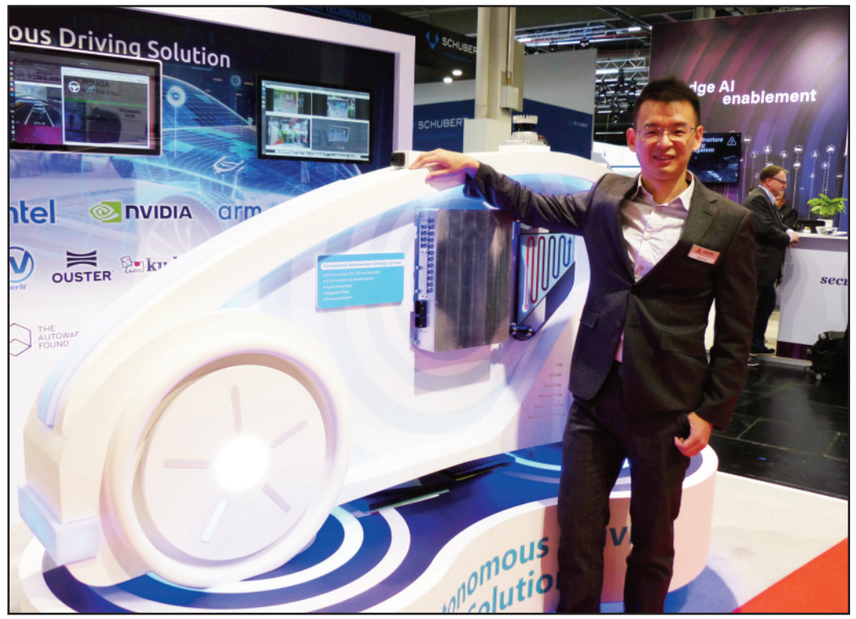
Developers of mixed-critical safety applications benefit from up to eight Arm Cortex-A53 cores and four Cortex-M7 dual-core lockstep pairs.

Adlink planning off-the-shelf autonomous driving computer

A combination of sensors and in-vehicle computers from Adlink is being tested on autonomous trucks and robotaxis in China with the goal of it being launched as a standard product by the end of this year.

The brain is the Taiwanese firm's Ava-3510 AI computing platform powered by Nvidia's Turing GPU and Intel Xeon processor. This does the calculations, predictions and computing.

The sensor fusion is carried out by the company's RQX-59 embedded robotics controller containing an Nvidia Jetson AGX Orin module.



Eddie Liu with the autonomous vehicle demo

"We need to make real-time AI decisions, so we need powerful hardware with redundancy," said Eddie Liu, Adlink's product manager.

The system being tested uses 3D lidar and up to eight cameras.

"Different sensors have strengths and weaknesses," said Liu, "so the sensor fusion combines the strengths."

The companies doing the proof-of-concept tests are buying the firm's off-the-shelf modules and combining them. As well as controlling the vehicles, the computers monitor themselves and can bring the car to a safe stop if they detect a fault.

"These companies are trying it out in China," said Liu. "By the end of the year, we hope to make it a standard product. We are also talking with some US customers, but in China the regulations are not so strict."

To help, Adlink has obtained ISO 26262 Asil-D functional safety certification. Through the implementation of this functional safety process, Adlink has established a comprehensive and rigorous process flow, from product planning, development, design and production to identifying and evaluating potential safety risks.

The company's technology has been deployed in robotaxis, autonomous shuttle buses and autonomous trucks with L3 and L4 vehicle autonomy.

The self-driving system of an autonomous vehicle is generally comprised of three integrated systems: perception ECU-sensor fusion; main ECU-AI decision making; and tracking system. The precise integration of these three systems enables the safe operation of autonomous vehicles on the road.

A well-designed decision and control system for an autonomous vehicle should be able to react effectively to changes in the road environment around the vehicle to ensure safety is always maintained.

Adlink provides professional and customised platform design services, including systems integration and thermal management and an anti-vibration design to provide Asian and North American users with a turnkey offering.

"There are shock and vibration challenges," said Liu.

Kit makes it easier to kick start development

Japanese embedded software firm eSol released its eMCos software development kit (SDK) to make it easier to kick start a development project and incorporate functional safety and mixed criticality when creating embedded software.

Centred around eSol's scalable eMCos multi-kernel rtos, the SDK provides a commercial bundle of CI and CD-ready tools and run-time software that reduce the complexity of developing and deploying embedded applications with mixed criticality.

"With one or two cores, there was not a problem," said Michael Grabowski, senior product marketing manager at eSol. "But Arm has an 80-core CPU for vehicles. We are starting to see 250-core CPUs. This is a solution for this problem."

Rolland Dudemaine, eSol's vice president of engineering, added that eMCos was "a good real-time platform for complex systems".

The SDK bundles development software components in a single all-in-one integrated software package, including one-stop standard support and maintenance.

Furthermore, to complement the SDK base software package, integrated add-ons are also available and handled in the same installation and licence activation environment.

Rolland Dudemain (left) and Michael Grabowski

The SDK has already been made available to eSol's key customers. Its first general release will be in April 2023. In the meantime, eSol will work on the SDK to ensure its functionality and quality remain high. Soon eSol will release further add-ons including ISO 26262 pre-certified licences and safety materials for functional safety in vehicles.

The company also announced that it had joined the Soafee (Scalable Open Architecture for Embedded Edge) special interest group (sig).

Soafee is an industry-led collaboration defined by automakers, semiconductor suppliers, cloud companies, and open-source and independent software vendors.

"Soafee wants to simulate an entire car in the cloud," said Dudemaine. "They want to create an environment similar to what is in a real car so the development team can work on it. It is a digital twin of the car."

As a Soafee partner, eSol plans to help the sig in its quest to deliver a cloud-native architecture for mixed-critical automotive applications. The architecture will be based on open-source software to encompass commercial and non-commercial offerings, and eSol's role will be to define a common platform for future OEM software architectures for software-defined vehicles (SDVs).

"We can start looking at what new features we can deploy when we have the real car," said Grabowski. "We can add more functionality, not just a Netflix app, but say face recognition or an added effect on the turn indicator."

Dudemain added: 'You can save a lot of development time if you can test complex features in the cloud."

Microchip IC authenticates parts in aftermarket

Microchip's TA010 with ECC signature and HMAC is an AEC-Q100 grade one qualified crypto-automotive IC that lets OEMs implement secure authentication into their design without requiring costly modifications.

Nicolas Demoulin

This should help them meet security requirements for future generations of their vehicles.

This can be used to ensure, for example, replacement parts for a vehicle bought in the aftermarket are authentic.

"It can be used for small systems in a vehicle that you need to approve," said Nicolas Demoulin, marketing manager at Microchip. "If a system is replaced, they can guarantee it is a genuine part."

For in-vehicle wireless phone chargers, it can be used to recognise the phone and ensure the charger delivers the right amount of charge.

"It identifies what the phone is so it delivers at the right power," said Demoulin. "If there is too much power, it can overheat."

Another application is in batteries for e-scooters and motorbikes where the batteries are swapped at charging stations.

"You want to make sure the battery is authenticated," said Demoulin, "so it won't damage the bike. We have seen these being implemented in Asian countries and the trend is spreading to other areas. We are seeing big value from these types of applications."

A slightly unusual application is in in-car air fresheners that need replacement cartridges. It can be used to check the correct cartridge is put in the dispenser.

"They want to make sure they can sell more cartridges to continue the revenue," he said.

Engineers can use the device to add security without needing detailed knowledge about security.

"We provide the security," said Demoulin.

LDRA adds support for latest Misra guidelines

LDRA is adding the latest Misra C: 2023 guidelines to the static code analysis and reporting capabilities of its tool suite.

The added capabilities help embedded developers in aerospace, defence, industrial, energy, medical device and automotive sectors identify and mitigate potentially dangerous code in increasingly complex and difficult-to-test multithreaded, multi-processor systems.

The show was due to see the introduction of Misra C: 2023, which consolidates previous versions of the guidelines into a single, comprehensive edition to facilitate compliance. However, this has now been delayed for a few weeks.

"Functional safety and security are our key markets," said Jim McElroy, vice president at LDRA. "And automotive is a significant piece of our business due to the requirements of Asil D. More security has been brought into the Misra standard. LDRA has been involved with Misra for some time."

The standard originated in automotive, but can now be found in other safety-critical applications.

"Misra C: 2023 sees an aggregation of all the documents into one standard," said McElroy. "This should make it easier to adopt the standard."

This includes the recently introduced amendment four that covers multi-threading applications.

Jim McElroy:" More security has been brought into Misra."

"Multi-threading is very key for automotive," said McElroy.

The company also announced the enhanced Cast-32A and A(M)C 20-193 validation capabilities of its tool suite for safety-critical, multi-core processor applications. These features cover the entire software development lifecycle and provide a robust certification framework in support of DO-178C software considerations for airborne systems and equipment certification.

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NXP moves vehicle processor to production

NXP Semiconductors was celebrating that its S32G3 vehicle network processors have gone into production following their initial launch in December 2021.

Software and pin-compatible with the S32G2, these devices have up to 2.5 times more applications processing performance, on-chip system memory and networking than the highest-performance S32G2 device.

To support intelligent software-defined vehicles, the S32G3 addresses a broader range of vehicle applications from safe microcontrollers to higher-performance domain controllers, safety processors and zonal vehicle compute applications.

"This gives us a huge boost in performance," said Brian Carlson, global marketing director at NXP.

Li Auto in China already has production vehicles on the road using the device.

"They moved really quickly with this," said Carlson. "The part can now be bought off the shelf and is available from distributors. It is right for Asil D; it is really popular as a safety processor."

The device provides Ethernet bandwidth on two ports and more on-chip system memory than the S32G2. Additionally, it doubles the number of isolation domains, which are critical for future ECU consolidation.

The EVB3 evaluation board, RDB3 reference design and GoldBox 3 rugged enclosure version, combined with a broad range of enablement software and the GoldVIP vehicle integration platform for rapid connected gateway development, provide platforms to accelerate evaluation, development, proof-of-concept and time to market.

"The GoldVIP integration platform means customers can develop application right out of the box," said Carlson. "GoldBox is the rugged version."

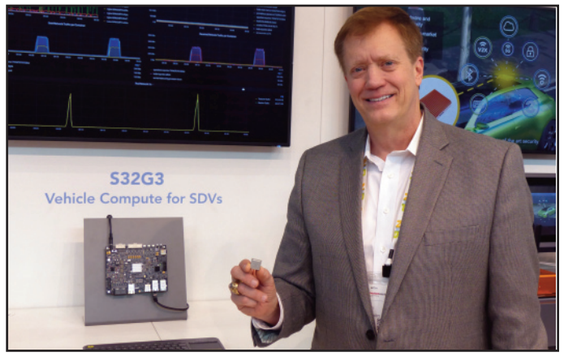
The show saw other companies supporting the processor, including LDRA, which announced tool suite support for the processors.

The tool suite, together with the NXP's S32 Design Studio IDE, can help reduce the cost and effort associated with developing, testing and certifying software that runs on the processors.

"We have integrated our tool suite to that device," said Jim McElroy, LDRA vice president.

And Green Hills Software has created an integrated platform for developing and deploying safe, secure and highly-performant vehicle network and domain controllers.

This expanded support combines connected car middleware with foundational software from Green Hills that includes the safety and security-certified MPU and MCU rtos, secure virtualisation and an integrated IDE.



Brian Carlson: "Huge boost in performance."

FUNCTIONAL SAFETY

Olivia Brandel discusses functional safety for gate drivers and traction inverter systems

As the demand for smart, automated and eco-friendly end-equipment continues to grow, industrial and automotive technologies are becoming increasingly electrified. With this trend also comes an increased emphasis on ensuring electronic systems not only meet standards of EV performance but safety standards as well.

In the automotive space specifically, the use of highly-configurable isolated gate drivers in traction inverter systems is growing as a means to improve EV performance and streamline functional safety certification. As vehicle manufacturers pivot to electronic systems such as traction inverters, so must the coverage of such systems by safety standards.

While traditional product safety refers to the elimination of risk from electrical shock, fire and mechanical hazards, functional safety specifically refers to electrical and electronic system hazards.

As technologies progress rapidly, many designers have to ramp up quickly on the broad world of functional safety.

Terms

To reduce equipment failures and personal injury, designs and processes must address hardware faults in accordance with international standards. Common

standards include ISO 26262 for automotive equipment and IEC 61508 for industrial equipment.

There are two types of hardware faults: systematic faults result from errors in the design or manufacturing process, and engineers can reduce these through continual process improvements; and random faults result from defects inherent to process or usage conditions, which engineers cannot fully eliminate.

One of the goals of ISO 26262 is to reduce the probability of random faults.

Automotive safety integrity levels (Asils) represent the level of risk, with set probability thresholds.

These levels range from Asil A (least stringent) to Asil D (most stringent).

This standard further categorises random faults into single-point and latent faults.

Single-point faults violate safety goals without the presence of a safety mechanism. For example, an overvoltage lockout mechanism seeks to detect an overvoltage at the device output.

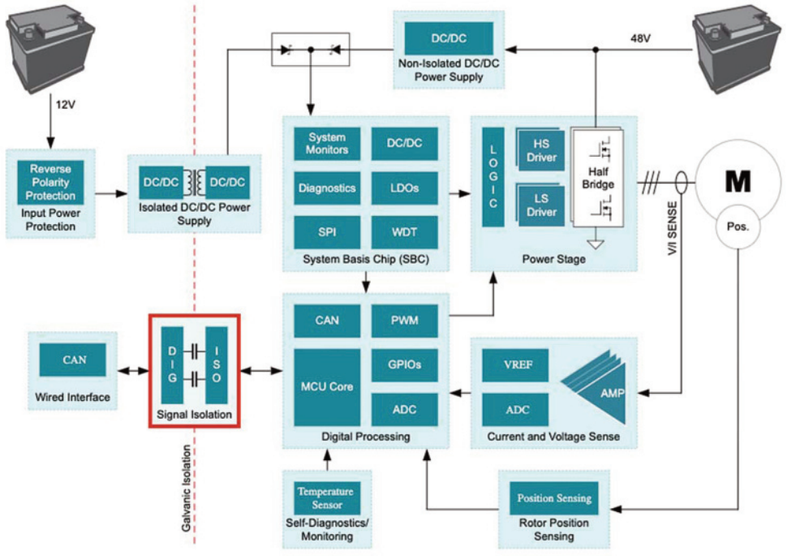
A multiple-point failure is the result of several independent faults that directly violate a safety goal (multiple-point faults).

A latent fault is a multiple-point fault whose presence is not detected by a safety mechanism nor perceived by the driver. For example, a fault occurring in the overvoltage lockout mechanism prevents it from detecting an overvoltage event.

This is a latent fault if it is not detected by another safety mechanism such as a diagnostic test at start-up or perceived by the driver. Thus, stringent Asils require monitoring and diagnostic circuits.

Analytical resources may include:

- Failure-in-time (FIT) rate, an estimate of the number of failures that could occur in a billion cumulative hours of a product's operation.
- Failure mode effects and diagnostic analysis (FMEDA), the probability of occurrence for failure modes and a quantified effectiveness of diagnostics.
- Fault-tree analysis (FTA), a qualitative analysis of random faults during operation.



Traction inverter design

ISO 26262 delineates two types of safety analysis – deductive and inductive. Deductive analysis, such as FTA, is a top-down approach. Inductive analysis, such as FMEDA, is a bottom-up approach.

Vehicle manufacturers define their safety goals and address them at the vehicle level.

Functional safety documentation should support hardware analysis at the product level.

Failure modes

Traction inverter failure modes can have mechanical and electronic causes. Functional safety designs focus on identifying the electronic causes and enabling corresponding safety mechanisms.

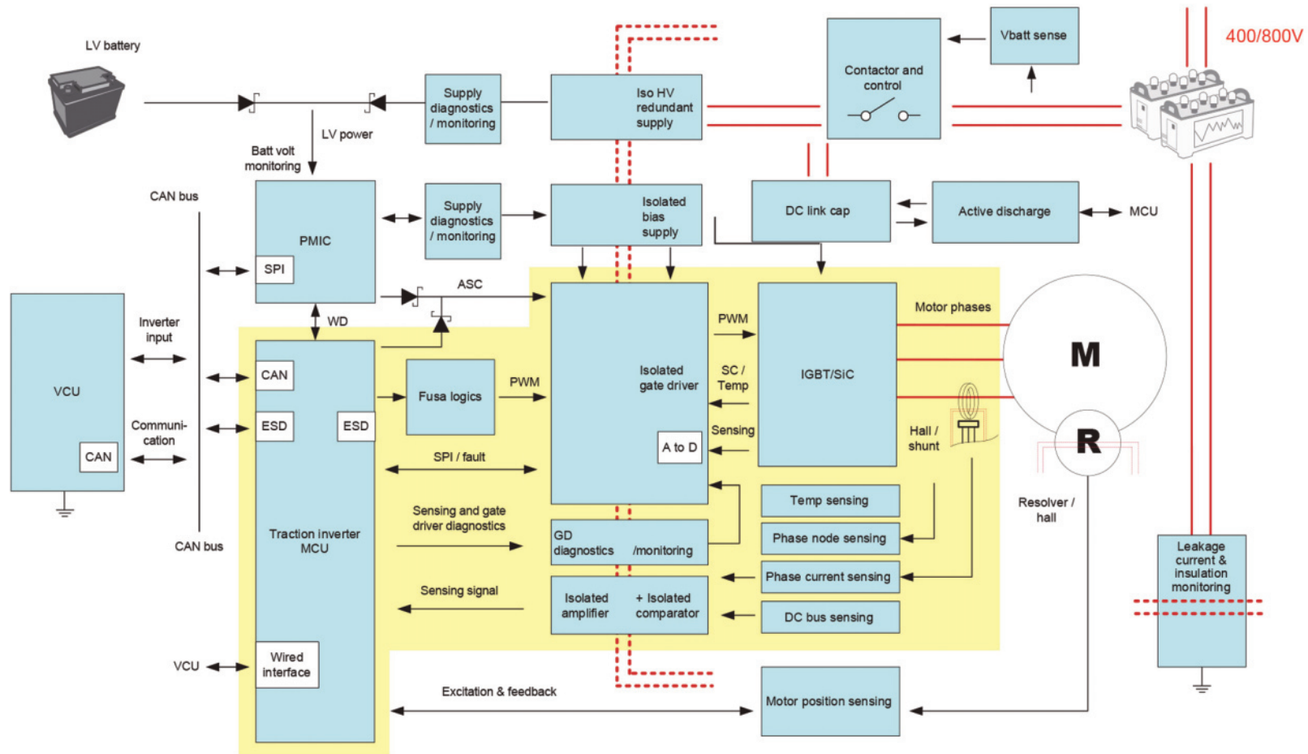
For example, an under-torque event in a traction inverter system may originate from a mechanical cause or an electronic cause, such as a power transistor short circuit or damage to the gate driver.

To prevent exposure to this type of risk, functional safety standards define ways to assess the risk level.

With these guidelines in mind, functional safety designs may include power transistor protection circuits and gate driver diagnostics.

ISO 26262 allows functional safety designs to use devices in each functional safety category. The protection and diagnostic circuits can be external or integrated into the gate driver.

Built-in self-test (BIST) can prevent latent faults that protection features cannot detect.



Block diagram of traction inverter

Much like functional safety-compliant devices, the failure modes of traction inverter systems can also be quite complex. A failure mode such as an unintended motor shutdown can stem from the power-management IC, microcontroller, motor or gate driver, and ties into many required protection features.

For example, each of these features can help prevent exposure to torque disturbances: undervoltage and overvoltage lockout; desaturation detection and overcurrent protection; two-level turnoff and soft turnoff; collector-emitter voltage (VCE) monitoring and clamping; and analogue-to-digital converter to monitor voltages on the secondary high-voltage side of the gate driver, such as power switch or gate driver temperature.

As systems grow more complex and electrified, so do the failure modes and management of random faults.

To meet the needs of modern systems, protection features, diagnostics and fault reporting, with ISO 26262 and the requirements of hybrid electric vehicle traction inverters, must be kept in mind.

Olivia Brandel is product marketing engineer for high-voltage power at Texas Instruments

POWER TECHNOLOGIES

Timothé Rossignol, Brian O'Mara, Kate O'Riordan, Guilhem Azzano, Maurizio Granato, Sarven Ipek and Wei Gu find the cost and performance sweet spot for battery management and traction inverter design

FINDING THE SWEET SPOT

Vehicle Electronics

Even with advances in battery technology and electromechanics, OEMs struggle to meet the mix of expectations on ultralow emissions, vehicle range and consumer affordability, but innovations in isolation, power management, magnetics sensing and battery management systems (BMS) can help.

There are two major disruptions affecting the future of vehicular transport and semiconductor technology. The first is a shift from the internal combustion engine to the electric motor drive. The second is the emergence of power switches used in motor drive systems that are based on wide band gap material.

These offer figures of merit in the order of ten times better than the incumbent based on silicon.

However, with the battery accounting for more than a quarter of the final vehicle cost, optimisation of energy use is one of the keys to achieving mass electric vehicle (EV) adoption.

Reaching this goal means recognising that every watt spent is critical and prioritising subsystem efficiency as the most important selection criteria in automotive system design.

Recent advancements in power management for the powertrain (see Fig. 1) – including isolated gate drivers, sensing and BMS – provide opportunities for designers to be creative to improve efficiency while keeping costs under control.

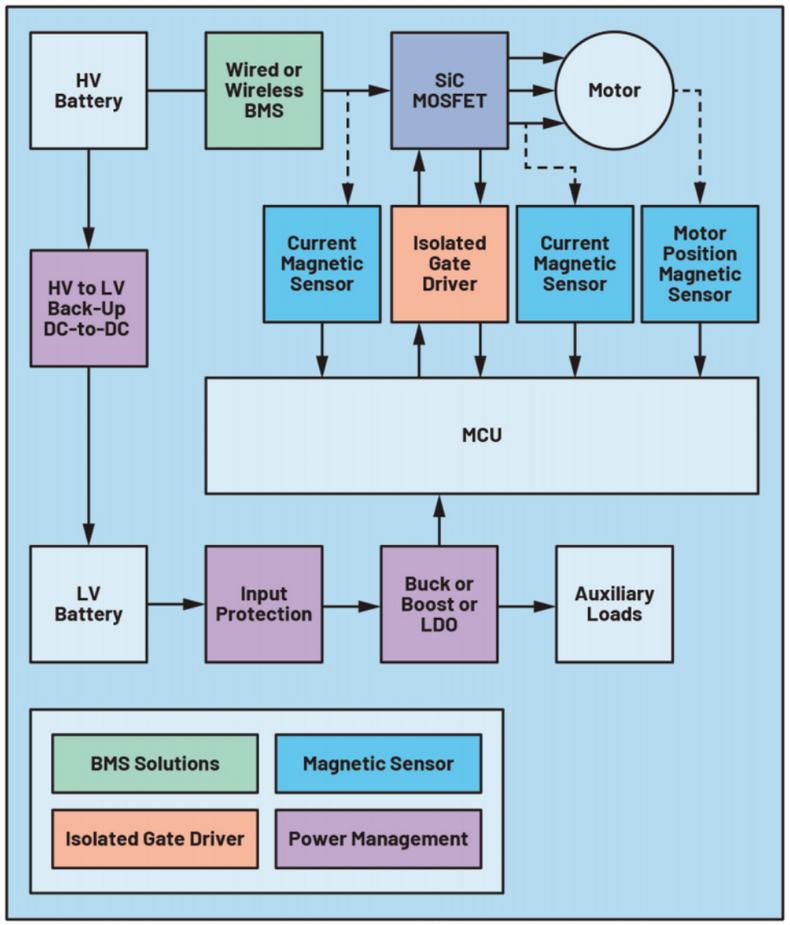


Fig. 1: EV powertrain system

Gate driver

Targeted for adoption by traction inverters in the EV drivetrain, silicon carbide (SiC) mosfets are expected to add between four and ten per cent more range for a standard EV driving cycle compared with existing silicon-based technologies. Properly exploited with supporting componentry, this power efficiency gain could represent a huge step forward in building consumer confidence in EV range, thereby accelerating EV adoption.

The first goal of the isolated gate driver is to protect persons and equipment from the high voltage present across the SiC switch. The second is to ensure short and accurate propagation delay through the isolation barrier.

Indeed, in leg configuration, as in traction inverter systems, there are two transistors – one high-side and one low-side – that should not be on at the same time to avoid short circuit. For this reason, the pulse-width modulation (PWM) signals coming from the microcontroller and going to the gates of the transistors need to have similar propagation delays.

Then, as any delays need to be compensated, short propagation delay allows for the fastest control loop.

In addition to this, the isolated gate driver will take care of setting the best switching sweet spot, controlling power switch overheating, detecting and protecting against short-circuit, as well as facilitating the insertion of the sub-block drive and switch function in an Asil-D system.

All intrinsic advantages of the SiC switch would be negated by common noise perturbations as well as extremely high and destructive voltage overshoot due to ultrafast voltage and current transients generated in a poorly managed power switch environment.

Broadly speaking, the SiC switch has a relatively simple function despite the underlying technology – it is only a three-terminal device – but it must be carefully interfaced.

Isolation

The high slew rate transients introduced by the SiC switch can corrupt data transmission across the isolation barrier, so measuring and understanding susceptibility to these transients are critical.

Technology based on transformers with thick polyimide insulation (see Fig. 2) exhibits ideal common-mode transient immunity (CMTI) with measured performances of up to 200V/ns and beyond.

Polyimide insulation technology unlocks the full potential of SiC switching time under safe operation.

Switching energy and electromagnetic compatibility (EMC) can likewise be increased to improve power performance and, ultimately, EV range. Higher drive capability allows designers to have faster edge rates and therefore reduces switching losses.

Higher drive capability not only helps with efficiency but also enables board space and cost savings by eliminating the need for external buffers allocated per gate driver.

Conversely, under certain conditions, the system may need to switch more slowly to achieve optimal efficiency, or even in stages that studies have shown can increase efficiency further.

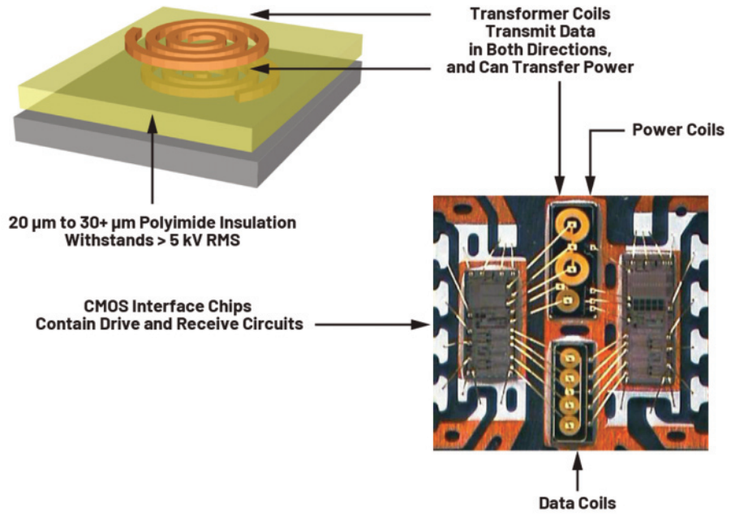


Fig. 2: Transformer with thick polyimide insulation; digital isolators use foundry cmos processes, and transformers are differential and provide common-mode transient immunity

Robustness

Short circuits are a major obstacle for SiC-based power switches (mosfets), given the smaller die sizes and exacting thermal envelopes. Gate drivers provide the short-circuit protections essential for EV powertrain reliability, safety and life cycle optimisation.

High performance gate drivers have proven their value in real-world testing. Across key parameters including short-circuit detection time and total fault clearance time, performance can be achieved down to 300ns and 800ns, respectively.

For additional safety and protection, test results have demonstrated the adjustable soft shutdown capabilities essential for smooth system operations.

Current sensor

As shown in Fig. 1, DC and phase current need to be sensed for the inverter control loop. With a SiC power switch, a higher switching rate and switching frequency is possible, which can lead to higher efficiency and better regulation of the load when the control loop is given enough phase margin.

To achieve a constant response and low phase delay at the switching frequency, the frequency of the current measurement needs to be at least a

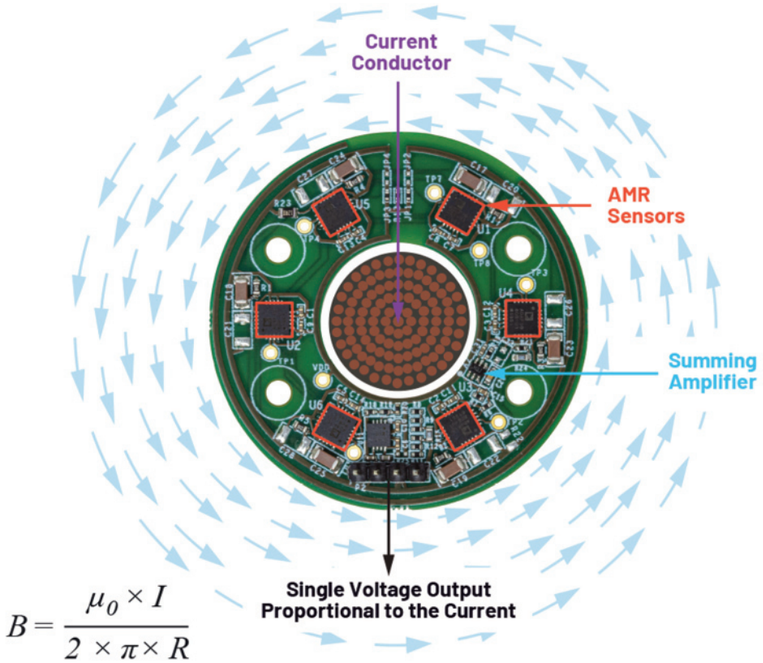


Fig. 3: Coreless sensing with a ring architecture

decade higher. This makes the bandwidth of current sensing a key element in fully using SiC switches.

Hall sensor

The traditional way of measuring current in traction inverters uses Hall sensors, which work by measuring the magnetic field generated by a current flowing through a conductor. However, their lack of sensitivity requires the use of a flux concentrator or magnetic core to amplify that magnetic field such that it can be measured.

Modules combining a Hall sensor and a magnetic core are widely available but can lead to significant design constraints. The modules are heavy, bulky and prone to mechanical damage, which may become a reliability issue resulting in field returns.

In addition, the presence of magnetic material in the core will impact strongly on the frequency response, unless special and expensive material is used.

Today the bandwidth of these modules is limited to 50kHz to 100kHz. This bandwidth limitation would require compromises to be made in the control loop, which will result in an overall reduction in performance.

Shunt

Another way of measuring lower current is through a shunt, a current sense amplifier and an analogue-to-digital converter (ADC).

Shunts have been around for many years, continuously improving over time to achieve the stability for which they are known.

However, two major downsides of a shunt are self-heating and the need for isolation in certain applications.

Self-heating may be reduced by decreasing the shunt resistance, but this will also reduce the amplitude of the signal of interest. Shunts also have a parasitic inductance, which limits the bandwidth of the current to be measured.

With such limitations, power systems must look to a different technology to solve their measurement problem.

MR sensors

MR sensors also work by measuring the magnetic field generated by a current flowing through a conductor. However, MR sensors can be significantly more sensitive than a Hall sensor, which removes the need for a magnetic core.

Without this barrier, the inherent capabilities of the MR sensor itself, such as high bandwidth, accuracy and low offset, allow for a simpler design.

The removal of the bulky magnetic core means additional attention must be paid to crosstalk between phases and the possibility of external magnetic interference.

Coreless sensing

Fig. 3 shows a method that is not only higher bandwidth, more accurate and lighter than a magnetic core-based option, but is also built on a standard PCB, thereby reducing complexity and integration cost.

It presents a ring architecture consisting of six anisotropic magnetoresistive (AMR) sensors arranged in a circle to integrate the magnetic field to be measured. The integration of the magnetic field will reject external stray fields, enabling high rejection of a homogeneous stray field and low crosstalk.

Each individual sensor senses the magnetic field generated by the wire and busbar placed in the centre of the board. The outputs of these sensors are summed in the analogue domain, and the resulting voltage output is directly proportional to the current flowing into the conductor.

The number of sensors used can be varied to achieve different levels of robustness to stray fields or to the tolerance of the wire placement within the ring. The diameter of the ring can be scaled up or down to match the targeted current range.

In this way, a single design approach but with potentially multiple sizes allows reuse across platforms, enabling shorter development times and cost reduction.

Power management

On the road towards the highest performance, every watt matters whether the EV is in on, standby or sleep mode. Power management technology can further increase the overall vehicle efficiency, which correlates to extra kilometres while not compromising on the best EMC performance from low current and low voltage to high current and high voltage applications.

Design

In functionally safe systems, continuity of voltage supply is critical. The generation of a local low voltage rail from the high voltage battery plays a key role.

In traditional isolated high voltage flyback converters, tight regulation is achieved using optocouplers to transfer regulation information from the secondary-side reference circuitry to the primary side.

The problem is optocouplers add significant complexity to isolated designs: there is propagation delay, aging and gain variation, all of which complicate power supply loop compensation

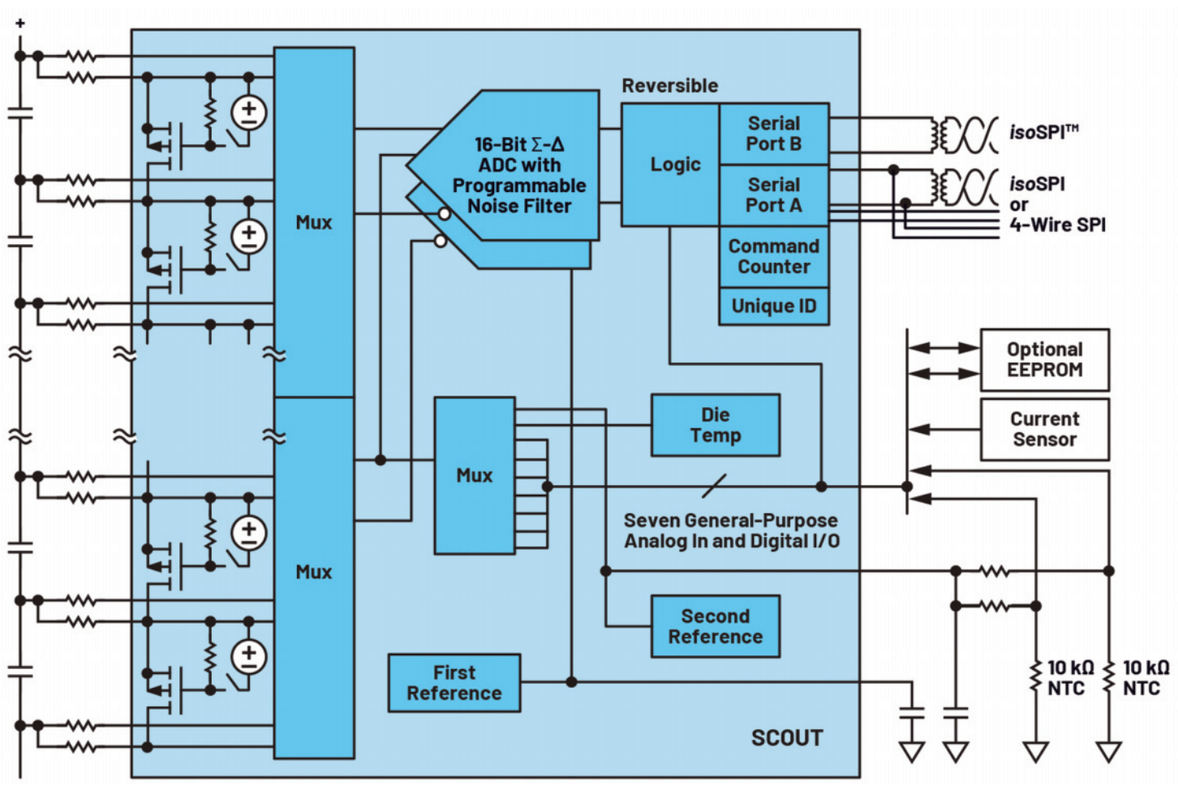


Fig. 4: Application diagram of a multicell option for BMS

and can reduce reliability.

Moreover, during start-up, either a bleeder resistor or high voltage start-up circuit is required to power up the IC initially. Unless an additional high-voltage mosfet is added to the start-up components, the bleeder resistor is a source of unwelcome power loss.

Optocoupler

By sampling the isolated output voltage from the third winding, no optocoupler is required for regulation.

The output voltage is programmed with two external resistors and a third optional temperature compensation resistor. Boundary mode operation helps achieve load regulation.

Because the output voltage is sensed when the secondary current is almost zero, no external load compensating resistors and capacitors are needed. As a result, this has a low component count, simplifying the design of an isolated flyback converter.

Start-up

With an internal depletion mode mosfet that has a negative threshold voltage and is normally on, there is no need for an external bleeder resistor or other start-up components. Once a local 12V capacitor is charged, the depletion mode mosfet turns off to reduce power loss.

Quiescent current

To achieve ultralow quiescent current, several mechanisms should be implemented.

The switching frequency should be reduced at light load while keeping the minimum current limit to reduce current while properly sampling the output voltage.

Battery management

A BMS closely monitors and manages the state of charge (SoC) of a multicell battery string.

For large, high voltage battery packs, such as those in an EV, accurate monitoring of each battery cell and the overall pack parameters are critical for achieving maximum usable capacity, while ensuring safe and reliable operation.

The accuracy of the BMS will free up more energy from the battery, which directly translates to the kilometres per charge an EV can deliver, increases the battery's overall lifetime, and as a result lowers the cost of ownership.

Wireless BMS

Wireless BMS (wBMS) represents a combination of three pillars, namely BMS performance, radio and network protocol technology.

A wBMS can be customised for automotive battery management use cases, delivering a safe, secure, robust and scalable end-to-end wBMS for EVs.

At the core of wBMS is the RF network. The network operates in the 2.4GHz band and is a redundant star topology. This means each node in the network can communicate directly to one of two managers.

The network also supports a two-hop failover mode where, in case of a communication failure, a node can continue to communicate by hopping back to the network manager via another node.

A wBMS is a purpose-built network for battery pack and EV environments. The wireless system integrates a 2.4GHz radio with a time channel hopping mac layer and a network layer that provides determinism as well as path, time and frequency diversity. These features combine to overcome the link and interference problems in the operational environment.

The elimination of the battery pack harness is one of the main characteristics that sets wBMS apart from BMS, see Figs. 5 and 6.

Depending on the pack architecture, this can save up to 90% of the wiring and up to 15% of the volume in the battery pack systems for EVs, resulting in less pack materials and the possibility of higher (energy) density packs.

The removal of the battery pack communications harnesses also eliminates a hard constraint on the car design. This enables a modular pack system leading to simpler packs, automated and robotic assembly, and time and cost-efficient manufacturing processes.

Simpler and more modular pack design opens the possibility of design reuse across a portfolio of EVs and results in a design flexibility that is unconstrained by accommodation of extensive harness and connector assemblies.

"Wireless BMS is projected to be more cost-effective and advantageous in the long run, offering possibilities for increasing battery energy densities, improving design reuse and flexibility, and enabling extended features"

Second life

To improve the overall carbon balance of a vehicle, it is critical to think about battery pack second life. The battery pack should be closely monitored during its entire life cycle, and wBMS makes this easy to implement.

At the start of life, a battery module can spend long durations in transport or in warehouse inventory before pack assembly. Wireless BMS enables continuous open-circuit voltage and temperature monitoring, which can identify early life failures before they become an issue.

Additionally, lifetime traceability and monitoring can also be stored and updated continuously on standalone wireless enabled battery modules before pack assembly and throughout the battery life cycle. These features combined with the elimination of the communications harness enable an easier and cost-effective transition to the battery pack's second life.

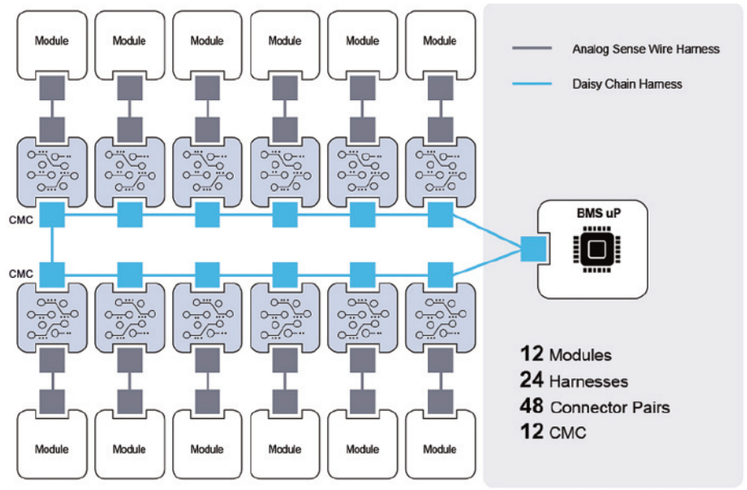


Fig. 5: Typical wired pack of 12 modules in a BMS

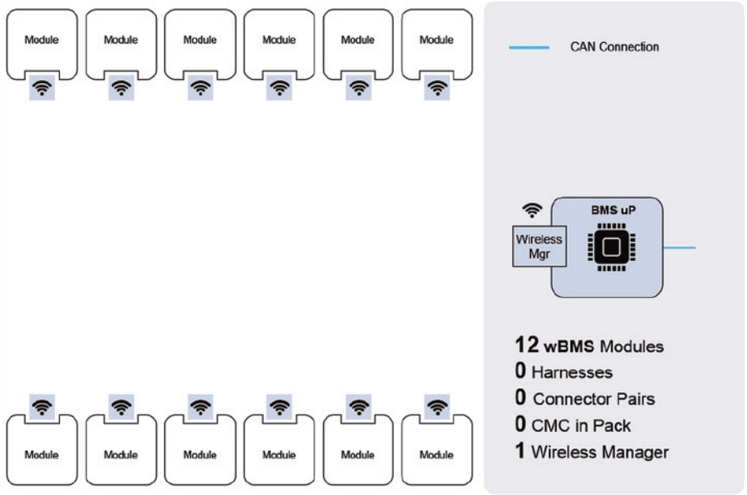


Fig. 6: Typical wireless pack of 12 modules in a wBMS

Conclusion

Although the challenge for OEMs in adopting wBMS lies in planning for significant investments in design, validation and manufacturing infrastructure, wBMS is projected to be much more cost-effective and otherwise advantageous in the long run, offering possibilities for increasing battery energy densities, improving design reuse and flexibility, and enabling extended features.

Timothé Rossignol, is marketing manager, Brian O'Mara automotive programme manager, Kate O'Riordan applications manager, Guilhem Azzano applications engineer, Maurizio Granato strategic marketing and applications manager, Sarven Ipek marketing manager, and Wei Gu applications director, all with Analog Devices

PRODUCTION

HIDDEN ENEMY

Elizabeth Norwood explains how to stop static driving down PCB production

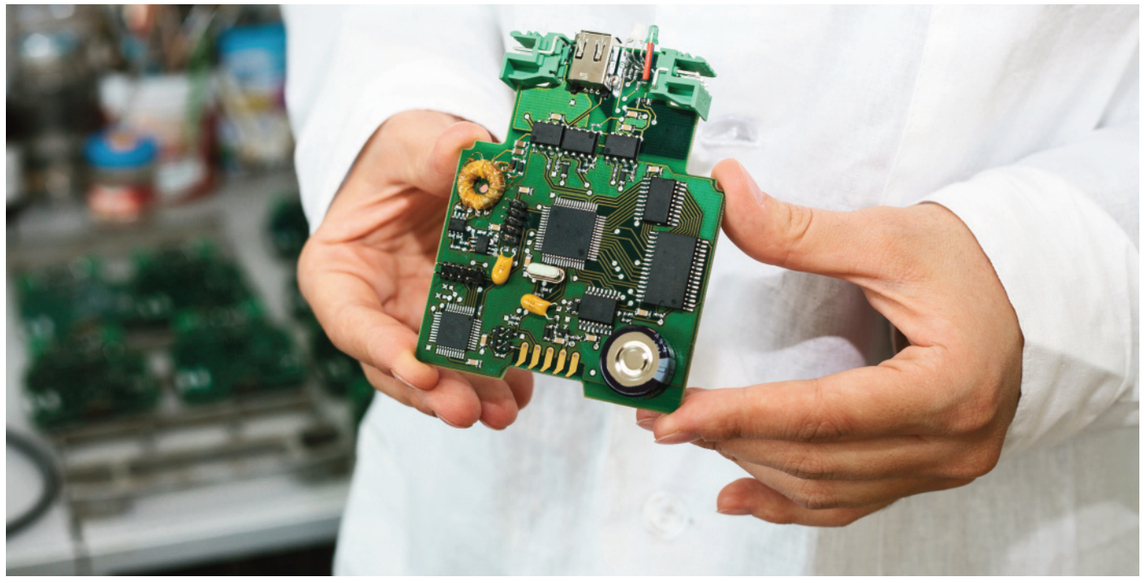
In 2000, electronics represented 18% of a total vehicle's cost. This figure is now 40% and is expected to climb to 45% by 2030. With the cost of semiconductors also increasing significantly from $312 per vehicle in 2013 to an estimated $600 today, it is clear to see why the electronics production should be closely managed.

The use of electronics is widespread in today's vehicles and can be found in everything from safety features such as airbags and seatbelts, to infotainment systems and engine management.

Automotive manufacturers must carefully manage the production of all electronic parts, including PCBs, to ensure every part works as it should. The risk of failing PCBs is heightened with the increased use of miniaturised PCBs required to facilitate a vehicle's high-tech applications.

The highly complex nature of these assemblies, which incorporate delicate components on compact, densely-packed boards, can be a reliability risk if their cleanliness and static control are not properly planned and executed.

One of the most common causes of PCB and electronic component failure, and a significant threat impacting the reliability of electronic systems in automobiles,



The most common source of ESD is through human touch

is electrostatic discharge (ESD). Some industry experts estimate that up to a third of PCB losses are due to ESD damage. It is therefore critical to take the necessary precautions to prevent ESD when manufacturing PCBs.

Damage

To put it simply, ESD is the rapid release of built-up charge between objects, causing electricity to flow between them.

It is created when two surfaces or objects at different levels of electrostatic charge come into close contact. When one is positively charged and the other negatively charged, the protons and electrons that carry these charges try to balance each other out by quickly exchanging at the point of contact. The sudden release or discharge of the built-up charge results in an ESD spike.

This can cause invisible, permanent damage to electro-sensitive parts, including everything from integrated circuits, mosfets and transformers, to transistors, capacitors, sensors, switches and relays.

ESD is identified as either latent or catastrophic damage. Catastrophic damage occurs when the device is permanently damaged. It is so severe it can usually be found via a performance test during quality control inspections. Unlike latent damage, catastrophic ESD is discovered during the early manufacturing stages, and thus has less impact on production time, yield and costs.

Latent damage is less obvious and nearly impossible to detect. The PCB can be partially degraded and continue to function as intended. The ESD damaged board may pass initial inspection, but will likely malfunction or fail sometime later in its lifespan, typically in the field. This can negatively affect a company's reputation by necessitating recalls and may also be extremely dangerous depending on the component failure.

Sources

There are many ways in which ESD can occur within a manufacturing facility, but the most common is through human touch. The human body and certain clothing can store a charge of 500 to 2500V of static electricity during a typical workday.

This can be enormously damaging to PCBs, so much so it is specifically listed in the international standard ISO 10605: 2008, which all automotive manufacturers should follow.

It specifies the electrostatic discharge test methods necessary to evaluate electronic modules intended for vehicle use and covers three areas: ESD in assembly, ESD caused by occupants, and ESD caused by service staff.

Some work areas are also more susceptible to electrostatic charges than others. For example, receiving, assembly, repair, cleaning, inspection and packaging are the most ESD-vulnerable production spaces. Other common sources of ESD include using ungrounded electrical equipment such as an oscilloscope when troubleshooting circuitry.

It is not just electronic equipment that forms an electrostatic charge. Standard equipment in manufacturing facilities, such as trolleys and conveyors, can also build up friction. Machinery or materials rubbing against each other are another common charge generator. Simply moving around a facility can also create ESD.

Any rapid air movement, for example, using compressed air to dry a PCB assembly or placing a fan nearby on a hot day, can be another source of ESD.

Removal

It is impossible to remove ESD completely from a production facility, but there are ways to reduce the risk. Even during the initial planning process, PCB designers can lay out their circuitry to be ESD-resistant.

By using more robust, less static-sensitive elements or by adding appropriate static protection circuits on the boards, the risk of ESD damage can be reduced.

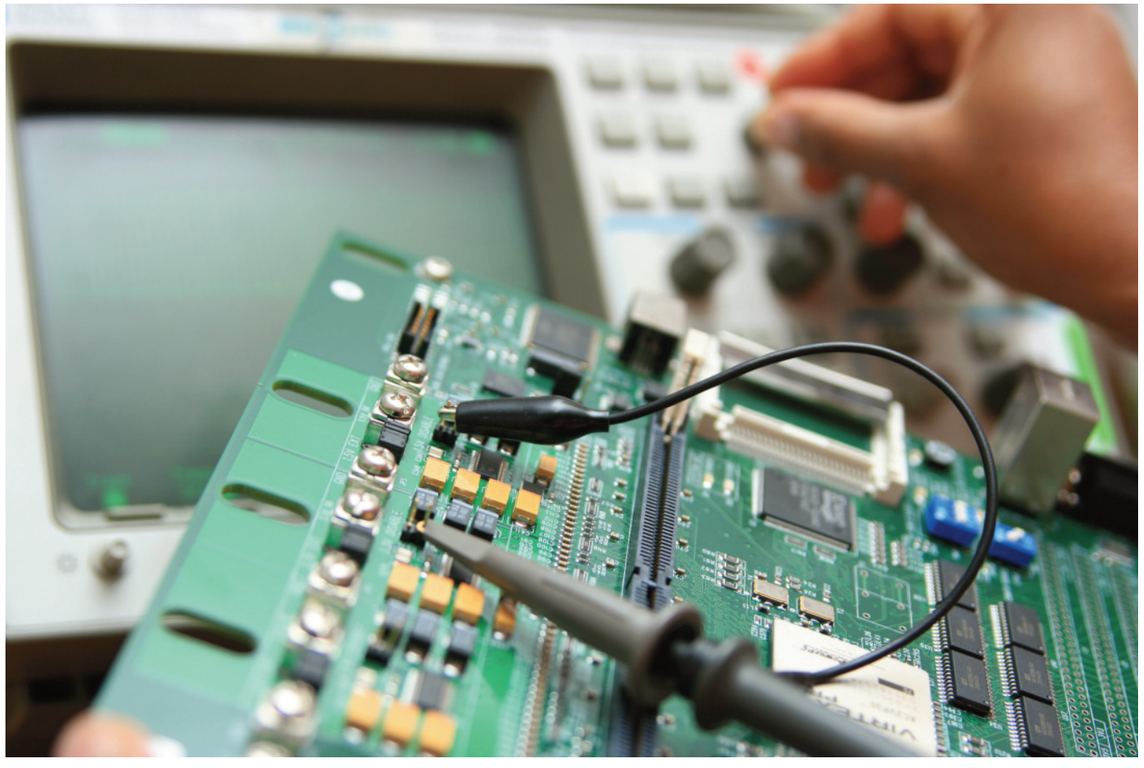
However, this may not be possible with some of the small and highly-sensitive electronic assemblies required within today's high-tech vehicles.

Furthermore, as PCBs become more sophisticated, their sensitivity to ESD spikes only grows; therefore, other methods to eliminate ESD should be explored.

Protection

There are several ways ESD can be reduced during SMT (surface mount technology) production. An effective ESD control strategy will use a combination of measures to reduce electrostatic charge in the work environment:

- Wear anti-static wrist straps or heel straps as a simple and effective way of dissipating static from workers. Wrist straps can be connected to a grounded line,



Testing or troubleshooting equipment often contributes to ESD contamination

keeping the person continuously grounded while they work on sensitive PCBs.

- Place conductive floor mats where technicians stand to help discharge static build-up from shoes.
- Ensure technicians wear anti-static clothing and shoe coverings.
- Ensure all work tables, floor mats and wrist straps are grounded.
- Keep air humidity in the production area between 40 and 70% to help prevent static build-up in the air.
- Do not use compressed air when drying PCBs as it can create static build-up.
- Remove all unnecessary items from the work area. Many items including worker smocks and even notepads and pens, can create ESD charges.
- Ensure the PCBs are shipped in static controlled containers.

Wipe away

Static charges are frequently on work surfaces and equipment used to build, clean and test PCBs. From wooden workbenches and metal storage racks, to vinyl chair cushions, synthetic floor mats and even vacuum de-soldering and soldering irons, nearly everything in or around the production line can be affected.

It is vital to dissipate the charge. This can be accomplished by routinely using pre-saturated, ESD-reducing cleaning wipes to wipe down all objects, including tools and work surfaces. A high-quality ESD cleaning wipe is also effective at removing grime, grease oil and fingerprint contamination, which can also be problematic to PCB reliability.

Cleaning tools

When cleaning the PCBs, it is important to consider the cleaning tools used in manufacturing. Some aerosol-style cleaning fluids and flux removers can generate up to 12kV of ESD. This build-up of charge comes from the friction of the static molecules as they move down the plastic spray tube, which is commonly used to dispense these cleaning products from the aerosol can.

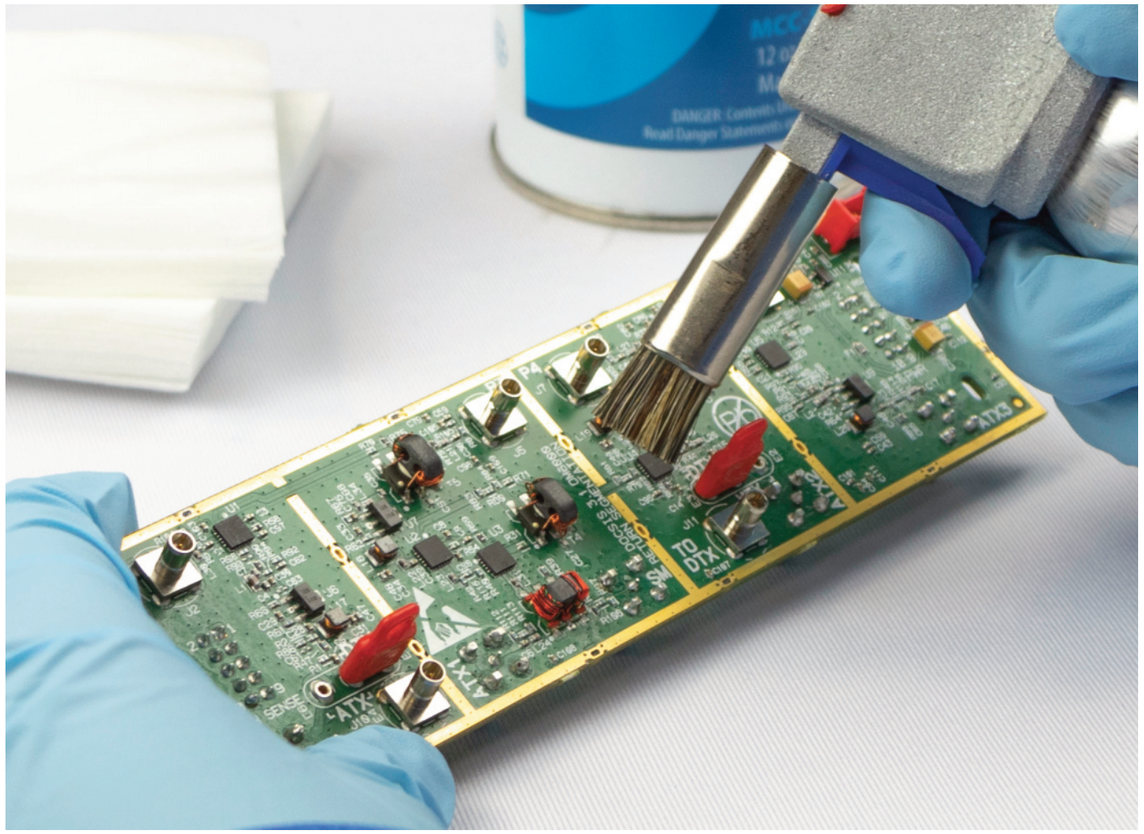
There are, however, static zapping dispensing tools made from durable aluminium and stainless steel that eradicate this problem. Attached to the top of the aerosol can, a stat-zap tool makes the cleaning technician part of the grounding circuit by maintaining contact with the static zapping tool itself.

As a result, charges are carried to the ground, reducing them to just 50V to prevent ESD damage.

Dispensers

Another tool that helps eliminate static is an ESD-safe controlled flux remover dispensing system.

Anti-static wrist straps help eliminate ESD build-up



A flux remover dispensing system helps eliminate static

This cleaning method helps control ESD by carrying down any charges to the ground and reducing the static going to the PCB or other sensitive electronic components.

Using a controlled flux remover dispensing system also delivers the correct amount of fluid to wet the PCB completely but without overspray or waste.

There are usually brush and syringe attachments included with the dispensing system to help control fluid flow even more. The attachments help the fluid more easily reach under the low surface mounted components for more thorough cleaning.

The scrubbing action of the brushes increases the effectiveness of the fluid, which loosens and rinses away contaminants.

Conclusion

As the decade progresses, more car makers will increase their use of PCBs and other electronics in their vehicles. The sophisticated electronics will allow vehicles to operate with little or no human input to control them.

Although this improves and enhances the driving experience, it can be challenging to produce the highly-complex electronics needed for use inside these vehicles.

Automotive electronics must be produced to the highest standards with any reliability or quality risk addressed at every stage. One of the most difficult to manage is ESD.

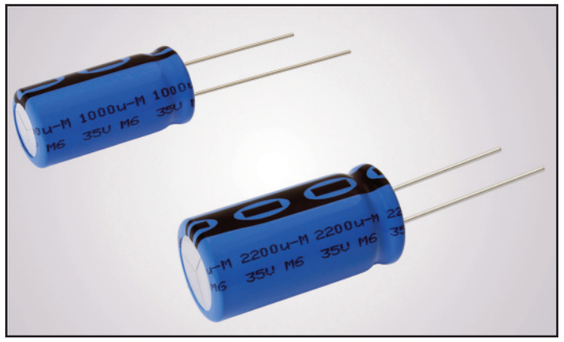
Therefore, PCB fabricators must develop strategies to combat PCB damage by reducing and managing ESD in their facilities. Using static reducing tools and practices can go a long way to eradicate this hidden enemy from the electronics production line.

Elizabeth Norwood is a senior chemist at MicroCare

Capacitors boost in same case size

Low impedance automotive-grade miniature aluminium electrolytic capacitors from Vishay deliver higher performance in smaller case sizes than the previous generation.

The BC 172 RLX series combines ripple currents up to 4.9A, temperature operation up to +105˚C, and useful life to 10,000hrs in 14 case sizes from 10 by 12mm to 18 by 40mm.



Compared with the previous generation, the AEC-Q200 qualified capacitors have lower impedance, higher capacitance for a given case size and voltage, and up to 54% higher ripple current at the same capacitance-voltage (CV) rating in smaller case sizes.

For example, while the previous generation has a ripple current of 1100mA at a CV rating of 1000F/10V in the 10 by 16mm case size, the 172 RLX delivers 1700mA in the 10 by 12mm case. This lets designers use fewer components.

Featuring radial leads and a cylindrical aluminium case with pressure relief, insulated with a blue sleeve, the series has rated voltages up to 50V, capacitance from 150μF to 15,000μF, and impedance down to 0.011Ω at +20˚C. The devices are charge- and discharge-proof.

As polarised aluminium electrolytic capacitors with a non-solid electrolyte, the RoHS-compliant devices are suitable for smoothing, filtering and buffering in switch mode power supplies, DC-DC converters, motor drives and control units.

Devices protect vehicle networks

Six ESD protection devices have been added to Nexperia's AEC-Q101 qualified portfolio.

The PESD2 Can-FD 36xx-Q devices can protect bus lines in automotive in-vehicle networks such as Lin, Can, Can-FD, Flexray and Sent from damage caused by ESD and other transients.

As data rates increase and vehicles feature more electrification, the need for ESD protection is becoming more critical.

In contrast to the battery voltage in cars and small vehicles, 24V board nets are typically used in lorries and commercial vehicles. ESD protection devices with operating voltages typically above 32V are needed to safeguard sensitive signal lines in 24V board nets.

Addressing these requirements, these devices have a maximum reverse standoff voltage of 36V and up to 22kV ESD protection. This is combined with a clamping voltage of 48V at an IPP of 1A to provide system-level robustness for in-vehicle networks.

UWB chipset

A UWB chipset from Samsung has single-digit centimetre accuracy.

The Exynos Connect U100 is for use in mobile, automotive and IoT devices, combining ranging and positioning capabilities with security to enable hyper-connectivity.

Leveraging time-of-arrival and 3D angle-of-arrival measurements, it provides an accuracy of single-digit centimetres and under five degrees. This makes it useful when tracking location where GPS is unavailable as well as for AR and VR.

The device integrates RF, baseband, embedded flash memory and power management IP.

In power-saving mode, it can increase battery life for mobile and automotive products as well as smart tracking tags.

A scrambled timestamp sequence function and a secure hardware encryption engine prevent external hacking.

It has been certified by the FiRa Consortium, and complies with CCC Digital Key Release 3.0.

Software aids Autosar ECU development

Version nine of Elektrobit's Tresos basic software helps car makers and suppliers develop ECUs based on the latest Autosar standard.

EB Tresos 9 supports Autosar R20-11 and integrates the onboard intrusion-detection capabilities in Can IDPS developed by Argus Cyber Security.

Vehicles incorporating ECUs based on Autosar basic software could reach 80% by 2027. EB Tresos 9 could let OEMs and tier-one suppliers standardising on Autosar reduce development costs and time.

It streamlines the development of software features that comply with the latest standards for security and safety including ISO/SAE 21434 for cyber security risk management and SAE J1979-2 for onboard emissions diagnostics, which will be mandatory for vehicles in the USA as of 2027.

It monitors traffic, detects threats and anomalies, and offers prevention mechanisms for common attack methods such as denial of service and brute force. And it fulfils the firmware-over-the-air requirements defined by Autosar for updating ECUs during normal vehicle operation.

The EB Tresos 9 roadmap includes measures for higher degree of automation for reducing costs and enhancing development efficiencies of teams, and a graphical user interface to make it easier and more intuitive to use.

Op amp handles high temperatures for years

With micro-power current consumption and up to +150˚C operating-temperature capability, the ST Microelectronics TSU111H 5V automotive operational amplifier delivers a combination of properties that are unusual to find in one device.

Qualified to AEC-Q100 temperature grade zero for -40 to +150˚C, the device withstands environments that experience extreme heat such as in braking systems, combustion-engine exhaust systems and fuel-cell generators.

The high maximum temperature enables use inside sensor control units placed close to sensors installed in the hottest areas for better measurement accuracy.

In less extreme environments, the device, with its extended temperature range, allows a mission profile up to three times longer than an equivalent grade-one device qualified at +125˚C.

As a grade-zero device, the op amp can operate continuously at +65˚C for more than 25 years, thereby serving the entire vehicle lifetime, while grade-one devices are specified for eight years without failure.

This is suitable for applications such as the battery-management system of hybrid and electric vehicles, which is never turned off and must consume the least possible power.

The typical supply current of 1.7μA ensures it places little load on the vehicle electrical supply. Also, the output voltage is exact to within 250μV at +25˚C, and 600μV over the full temperature range, ensuring high-accuracy signal conditioning in all applications and operating conditions.

A typical use is to enable precision measurements in the vehicle's on-board charger (OBC).

The device is in production now, housed in a SOT23-5L package. It is included in the firm's ten-year longevity programme that ensures long-term product availability for automotive and industrial projects.

UWB module enables digital car keys

An ultra-wideband (UWB) automotive grade module from Quectel is CCC and ICCE compliant to enable digital car keys with improved location and security.

The automotive grade AU30Q module is based on Qorvo's AEC-Q100 qualified DW3300Q UWB chipset. It enables precise real-time outdoor and indoor localisation and reliable wireless communication.

With an embedded antenna, it can improve location capabilities, enhancing security and data transmission, making it suitable for smart car access applications such as keyless entry, in-car passenger detection, personnel approaching detection, easy trunk access, wireless charging and battery swapping for electric vehicles.

The module supports UWB channels five (6.5GHz) and nine (8GHz) and offers data rates of 850kbit/s and 6.8Mbit/s. It can be adapted with an external MCU that has Can or Bluetooth connectivity.

The module can be used in single- and double-sided two-way ranging systems to locate assets. And it can implement real-time localisation systems as well as automated navigation systems in GPS-denied areas, with an accuracy of 10cm.

Measuring 12.0 by 25.0 by 2.4mm, the surface mounted module has two SPI interfaces to host the processor.

Engineering samples are available now.

LDO addresses 12 and 24V

A low quiescent wide input voltage LDO from Diodes addresses the needs of 12 and 24V automotive systems.

The AP7387Q low dropout (LDO) linear voltage regulator delivers a maximum output current of 150mA. Input voltage is 5 to 60V, and dropout voltage 700mV typical at a 100mA output current.

It provides engineering teams with a simple-to-implement point-of-load (PoL) for automotive audio, navigation, tail lights, transmission control units and battery management systems.

Quiescent current is 2μA. This is essential in systems that are permanently connected to a battery, helping extend runtime.

With a power supply rejection ratio (PSRR) of 70dB at 1kHz, the device is optimised for noise-sensitive functions. The LDO also exhibits a fast line-load transient response against rapid changes to the input voltage or load current.

It meets the load dump specifications of 12V internal combustion engine (ICE) vehicles such as cars, and 24V ICEs such as in buses, coaches and lorries.

Mosfet enters full production

Magnachip has started full-scale mass production of its 40V MXT mosfet optimised for electric water and oil pumps in electric vehicles.

This AMDUA-040-N070RH comes in a power dual flat no-lead (PDFN) 56 package to reduce PCB size by half compared with two 40V single-packaged mosfets.

The size provides flexibility in design and suits even the power seat modules of EVs.

The low RDS(on) reduces conduction losses, which means applications can be controlled efficiently.

It is AEC-Q101 qualified for performance and stability, because of the design of its core cells and terminations for automotive applications.

Supercapacitors

Kyocera AVX is expanding its SCC series to include automotive-certified supercapacitors.

The cylindrical supercapacitor were tested to AEC-Q200 and operate reliably in mechanically and electrically challenging conditions.

Applications include electronic-mechanical locking, ecall, electronic recording, regenerative braking, power and emergency power systems.

With a low ESR value, they have high capacitance and pulse power handling characteristics. In addition, the capacitors meet UL 810A, RoHS and Reach requirements.

They are available in 25F/2.7V, 100F/2.7V, 10F/3V, 35F/3V, 50F/3V and 100F/3V versions.

To extend backup times and battery life and to take advantage of instantaneous pulse power, they can be used alone or with primary or secondary batteries.

They have a low leakage current.

Current sensor hits Asil C

An Asil-C safety rated field current sensor from Allegro Microsystems is for electric vehicle powertrains.

The ACS37601 sensor suits traction and auxiliary inverter systems as well as battery management systems in electric vehicles.

The programmable linear Hall-effect current sensor IC has overcurrent, overtemperature and self-test capabilities. It is the firm's highest-accuracy field current sensor for applications requiring measurement capability greater than 200A.

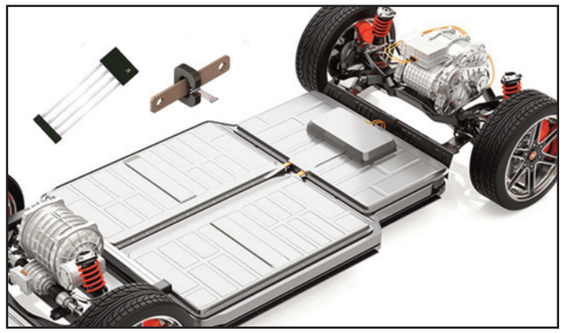
To be used with a C-core, it achieves 0.8% sensitivity error and less than 5mV offset error over the automotive temperature range and, with 30% less noise than legacy devices, this IC is suitable for battery management applications.

The operating bandwidth from DC to 240kHz and 2μs response time improve performance in DC battery charging and high-frequency automotive inverter applications.

It works with 5 or 3.3V power supplies.

Samples are available in a 1mm-thick, four-pin single in-line package (SIP), referred to as the KT package. The KT package is available in straight leads (suffix TN) as well as a lead-formed option (TH), enabling surface-mount assembly and tolerance to mechanical vibrations.

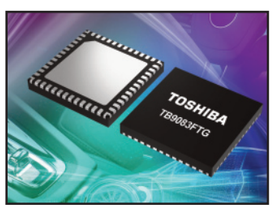
The package is lead (Pb) free, with 100% matt tin lead-frame plating.



Driver IC moves to production

Following a user sampling period, Toshiba's TB9083FTG mosfet gate driver has moved to large-scale production.

For use with brushless DC motors in modern automotive designs, the device is designed to ISO 26262 and supports up to Asil-D functional safety.



Applications include electric power steering, electric braking and shift-by-wire transmissions.

By implementing the AEC-Q100-qualified device, engineers can control and drive the external n-channel mosfets needed for three-phase BLDC motor driving.

A built-in fail-safe safety relay pre-driver complements the three-phase pre-driver. In addition, a charge pump, motor current detector circuit and internal oscillator circuitry are included, along with an SPI communication interface featuring an integrated CRC check.

There are multiple error detection functions such as undervoltage, overvoltage, over-temperature and an external mosfet VDS detector. The trigger threshold, response action and other settings can be configured via the SPI.

The driver IC is housed in a P-VQFN48-0707-0.50-005 package that measures 7.0 by 7.0mm.

GaN switches up to 100W

A 900V gallium-nitride (GaN) extension to Power Integrations' InnoSwitch3 family of flyback switcher ICs uses the company's PowiGaN technology to deliver up to 100W with better than 93% efficiency.

This eliminates the need for heat sinks and streamlines the design of space-challenged applications. They provide light-load efficiency making them suitable for auxiliary power in EVs during low-power sleep modes.

The AEC-Q100-qualified family suits EVs based on 400V bus systems where the switch provides more power and increased design margin for 12V battery-replacement systems, with better efficiency than silicon-based converters.

They can also be used in industrial applications such as appliances, three-phase motors and auxiliary power supply units in servers. They are pin-for-pin compatible with existing 725 and 750V InnoSwitch3-EP parts and offer an increased safety margin.

The 900V InnoSwitch3-EP and InnoSwitch3-AQ off-line CV and CC flyback switcher ICs employ synchronous rectification, a valley switching discontinuous conduction mode and continuous conduction mode flyback controller.

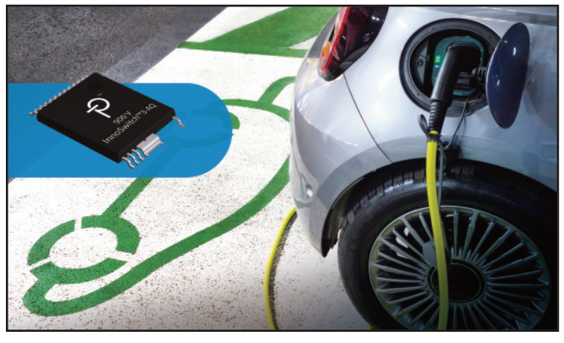
FluxLink communication technology enables the IC package to bridge the isolation barrier, optimising efficiency and eliminating the need for optocouplers.

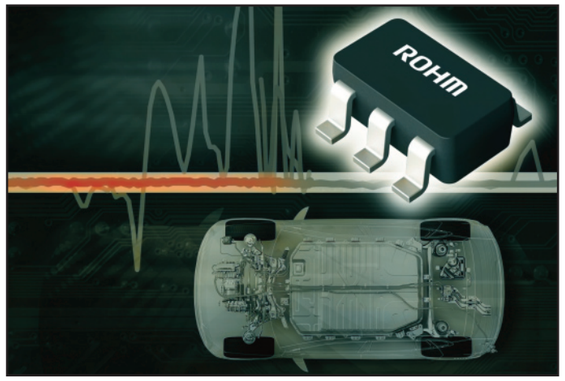
The ICs deliver up to 100W without heat sinks.

The InnoSwitch3-EP devices incorporate multiple protection features.

Devices are available with standard and peak power delivery options.

Automotive InnoSwitch3-AQ devices can also deliver 100W from a 400V bus and provide performance and protection features similar to those of 1.7kV SiC ICs used in 800V EVs.





Primary LDOs suit redundant supplies

Primary LDO regulators from Rohm have a rated input voltage of 45V and 50mA output current optimised for redundant power supplies that are increasingly being used in automotive applications to improve the reliability of vehicle power systems.

The 2.9 by 2.8mm BD7xxL05G-C series provide a maximum withstand voltage of 45V with typical current consumption of 6.0μA.

Unlike standard products with an overshoot of almost 1.3V that requires a large output capacitor to prevent the rated voltage of downstream devices such as sub-MCUs from being exceeded, these LDOs limit voltage overshoot to 0.1V, supporting smaller output capacitors.

Together with the elimination of a voltage clamping diode, this reduces board area by approximately 29% while reducing the number of additional circuits needed to configure redundant power supplies.

The series supports +125°C ambient temperature operation and is qualified to AEC-Q100.

They can be used as primary power supplies, despite their small size.

The LDOs suppress output voltage fluctuations to less than 50mV ±1% over the entire frequency band under ISO 11452-2 antenna irradiation testing.

In addition to redundant power supplies, the design makes them suitable for applications that operate when the engine is stopped.

They can be used in brake systems, body control modules, electric power steering, battery control units, adas ECUs, real-time clocks, drive recorders and door handle modules.

Supercapacitor works up to 105°C

A supercapacitor for automotive electronics from Kemet delivers 1000 hours at +85°C, 85% RH-rated voltage and has an operational temperature from -40 to +105°C.

The FMU supercapacitors are qualified to an automotive testing protocol. They are made in an ISO TS16949 certified plant and are subjected to PPAP, PSW and change control.

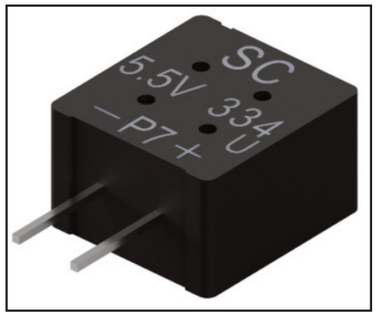
They suit automotive applications needing a main power system backup during a power loss, such as adas, autonomous vehicles and central gateway ECUs.

Supercapacitors help maintain the main power system's real-time clock or volatile memory when it is removed, such as during a power failure or when the main power system's battery has been removed for replacement.

Additionally, they offer power backup in equipment ranging from IoT devices, smart meters, medical devices and industrial computing.

Using supercapacitors for automotive electronics enables freedom from the design limits imposed by finite battery lifetimes. The open-circuit failure mode contrasts with typical short-circuit battery failures that may result in outgassing or ignition. Furthermore, supercapacitors are a cost-effective alternative to small backup batteries.

Depending on the type of load and current demand, they can store enough energy to provide backup for durations ranging from a few seconds to several hours.



A proprietary aqueous electrolyte solution provides durability against liquid leakage, vibrations and thermal shock, improving reliability in harsh environments. Aqueous electrolytes are highly conductive, have a low environmental impact, and are non-toxic and non-flammable.

Unlike a battery, supercapacitors store and release energy quickly through physical adsorption and the ions desorption in the electrolyte between its electrodes. With the supercapacitor's low internal resistance, these devices can fully charge within a few seconds.

In contrast, a secondary battery cell can take from ten minutes to several hours to charge fully. Moreover, there is no theoretical limit to the life cycle, whereas a lithium-ion secondary cell has a finite lifetime of about 500 cycles.

They also typically have a greater resistance to moisture absorption than organic compounds, resulting in a longer life with better stability.

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