VEHICLE electronics

The monthly magazine for automotive electronics engineers

Bosch opens wafer fab early to tackle auto chip shortage

Bosch has brought forward the start of production at its new wafer fab in Dresden because of the global shortage in automotive chips.

Chip production for automotive users will now start in September after the plant has ramped up from July with devices for power tools.



Production starts at Dresden wafer fab

The September start is three months earlier than planned with the hope the factory will become an important part of the semiconductor manufacturing network.

On 72,000m^2 of floor space, 250 people are already working in the wafer fab. The workforce is set to grow to roughly 700 once construction work has been completed.

"Electronic components equipped with chips from Dresden will make applications such as automated and resource-conserving driving possible, as well as the best possible occupant protection," said Harald Kroeger, member of Bosch's board. "Chips for vehicles are the ultimate discipline in semiconductor technology. This is because in cars, these small building blocks have to be especially robust."

All the roughly 100 machines and lines in the 10,000m^2 cleanroom at the 300mm wafer fab are electronically connected with each other and with the complex building infrastructure by means of a central database.

To make this possible, 300km of data lines were laid. Such a setup allows as many as 1000 data channels to be recorded for each machine in real time, and relayed to a server in the plant.

The wafers are transported from machine to machine by a completely automatic system featuring individual pods, each of which can transport up to 25 wafers. There is no longer any manual transportation at all.

Augmented reality (AR) glasses and tablets let users see digital content superimposed on the real environment. For example, an AR app lets energy data from the fab be displayed in a virtual model of the building.

Issue 91
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IN THIS ISSUE

2: EBV and Infineon in SiC collaboration

4: UL trains Arm in functional safety

5: NXP moves to TSMC 16nm Finfet

9: Analog Devices on EV development

10: Foxconn and PTT joint venture

12: Nexperia invests $700m in R&D

13: Privacy laws for connected cars

17: Progress with autonomous vehicles

23: DC-DC supply sources and sinks

27: Rear-seat entertainment

31: Inside Jaguar's R-Dynamic Black

35: Product news

40: Contact details

EBV and Infineon collaborate on SiC for EVs

EBV Elektronik is working closely with Infineon on the manufacturer's silicon carbide (SiC) based CoolSiC technology, which delivers benefits for engineers designing power systems for electric vehicles as well as other market sectors and applications.

Infineon and EBV will cooperate over the next year and beyond to accelerate the deployment of energy-efficient power devices with CoolSiC technologies.

There is strong global demand for improved, smaller and more cost-effective power conversion systems, especially for the fast-growing EV market. SiC delivers advantages over silicon, including higher voltage operation, wider operating temperature ranges and higher switching frequencies.

Infineon's CoolSiC technology builds on these to deliver efficiency and reliability across various applications such as battery charging, photovoltaic inverters, motor drives, energy storage and power supplies.

The CoolSiC portfolio ranges from SiC-based diodes and discrete mosfets to hybrid and full SiC modules.

"The SiC market is expected to grow at a CAGR of 30 per cent over the next five years," said PY Ferrard, corporate vice president at Infineon. "We anticipate that EBV can be a cornerstone of our strategy to realise our goals for our CoolSiC portfolio."

As part of the cooperation between the two companies, available from EBV is an entry-level evaluation board from Infineon to provide engineers and developers with a simple way to try out the possibilities of CoolSiC technology.

The board is ready for use to evaluate the performance of the 650 or 1200V CoolSiC mosfets, which will require soldering to the board depending on the user application.

Remote driving for delivery robots



Imperium Drive is carrying out a remote driving technology for autonomous mobility trial in partnership with LMAD, a French start-up developing robot-enabled delivery fleets. Further UK-based trials are due later this year.

The partnership with LMAD is enabling the launch of autonomous last-kilometre delivery services in France. The remote driving system is helping LMAD's delivery robots overcome problematic scenarios that their onboard autonomous technology cannot deal with to ensure safe operation in busy urban environments.

The cellular connectivity enables remote human supervision and intervention as a back-up safety measure for the onboard autonomy system. It provides the whole remote driving stack, from the software onboard the robot to the control centre on the other end. This allows a human to pilot the robot remotely in more complex segments of its route and adapt quickly to navigate unexpected obstacles.

Sensible 4 and Panasonic partner on self-driving test

A test project is levering the synergies between Sensible 4's self-driving software and Panasonic's inertial measurement unit (IMU).

Based in Finland, Sensible 4 pioneers software for autonomous driving under real-life and particular weather conditions.

The IMU plays an essential role in the sensor fusion process, which merges and synchronises the data with other sensors, such as odometry, GNSS and lidar.

"The IMU is employed to rectify the point cloud and thus impacts the accuracy of lidar data," said Fredrik Forssell from Sensible 4. "Our software is expected to be ideally flexible and reliable to next-gen sensor hardware, and of course we are utterly excited to now commence this in depth-testing period with the six-axis sensor from Panasonic. We are curious about the outcomes, but strongly believe in ground-breaking insights on the alignment of software and hardware for autonomous driving."



Sensible 4 and Panasonic test self-driving vehicles

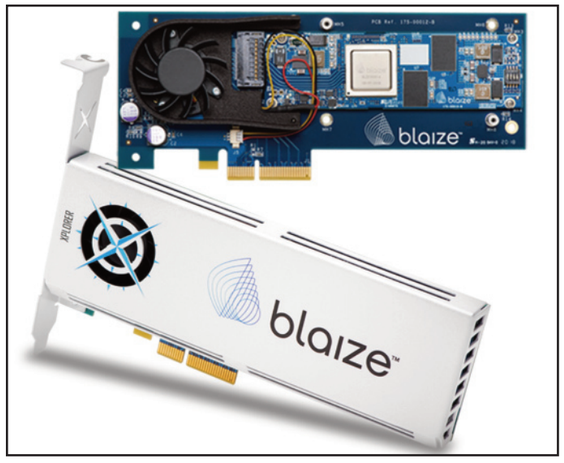
Specialists of both companies shortly will kick-off an evaluation period with tests and analyses.

"This project is a special one to all of us," said Ryosuke Toda from product marketing at Panasonic. "We are deeply interested in sending out our new sensor to this freezing baptism by fire to Finland and learn more on its readiness to contribute to that new level of mobility that we are all eagerly waiting for."

Mind Labs uses Blaize for AI traffic surveillance

South Korean firm Minds Lab has extended its Maum.ai AI-as-a-service (AIaaS) cloud service to the edge running on the Blaize Xplorer X1600P PCIe accelerator and using Blaize AI software.

The platform combines edge AI devices and Maum AI cloud to improve and expand services with more usability. Minds Lab is using Blaize initially for its Edge AI Road, Edge AI Street and Edge AI Home services, all of which are AI-based CCTV enabled.



Blaize Xplorer X1600P PCIe accelerator

Edge AI Road provides traffic surveillance such as car and licence plate detection and speed and lane infringements. Edge AI Street provides pavement and close to home surveillance of pedestrian traffic and unusual behaviour such as break-ins. Edge AI Home monitors activities in public and private interior spaces.

"The artificial intelligence CCTV applied with Minds Lab's Edge AI is effective in monitoring objects and analysing data efficiently and quickly," said Hoon Paek, CTO of Minds Lab. "Based on the Blaize edge AI hardware, we plan to combine Minds Lab's AI technology to provide full-scale services to the Edge AI platform market in Korea, the USA and abroad."

The platform lets users download AI applications as one downloads an app for a mobile phone.

"Maum.ai at the edge is an example of how Blaize hardware and software deliver the right balance of performance with low power, low latency and programmability to enable compute for breakthrough productisation of AI at the edge," said Dinakar Munagala, CEO of Blaize.

UL trains Arm users in functional safety

UL is offering functional safety training to Arm's customers.

The training programmes will address semiconductors and functional safety standards such as ISO 26262.

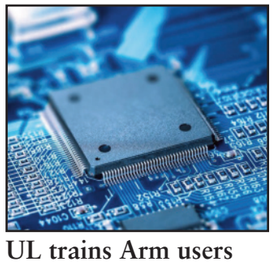
From certification training to introductory-level courses specific to ISO 26262, UL has a team to help OEMs and their suppliers build the technical competency they need to improve product and systems safety.

"UL's functional safety team is rooted in the belief that safety comes first," said Jody Nelson, managing director of UL's energy and industrial automation division.

Complementing the training expertise, UL's functional safety assessment and audit services cover components, hardware, software, end products, organisational processes, cyclic project processes and software tools. This includes autonomous vehicles, machine safety and robotics, industrial control systems, consumer smart home products, smart factories and supply chains.

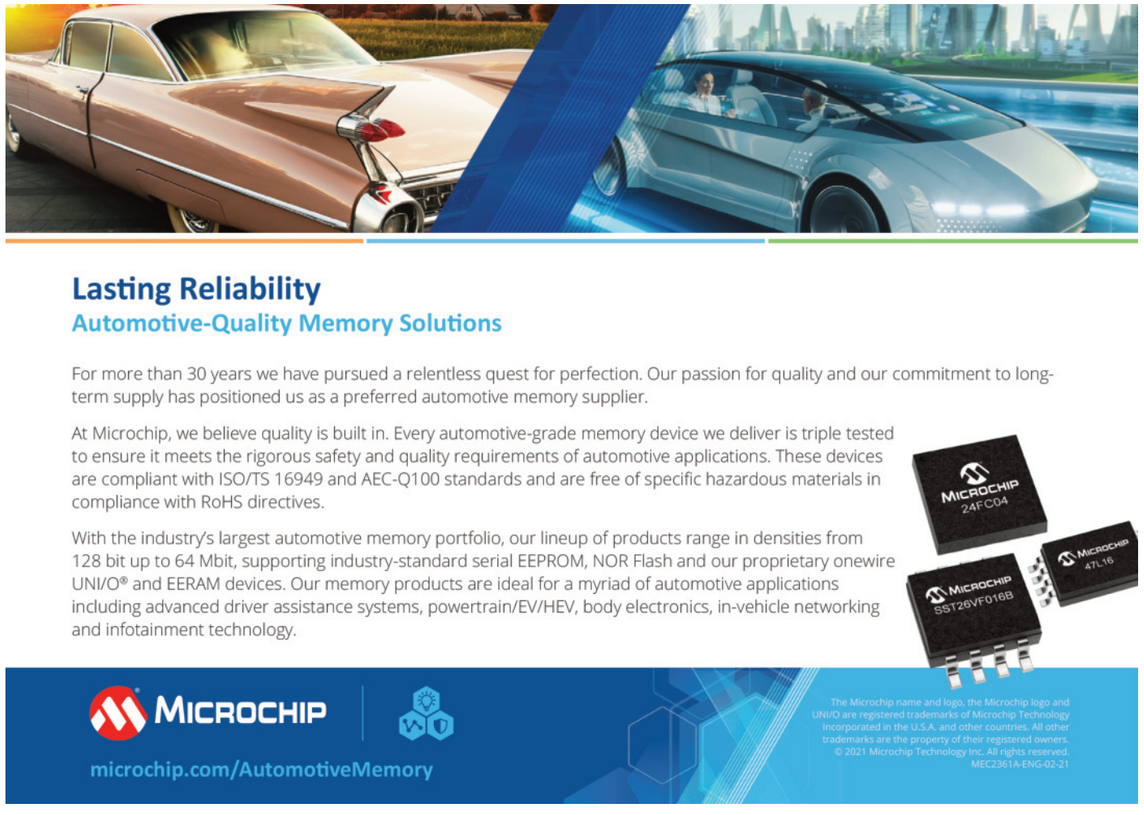
UL's initial activity as a member of the Arm programme will be a training course for engineers seeking to apply ISO 26262 to their safety-related semiconductor programmes. The course will address functional safety for semiconductor technologies and components including microcontrollers, analogue and mixed-signal designs, programmable logic devices, memories and intellectual property blocks.

Functional safety analyses such as dependent failure analysis and failure modes, effects and diagnostic analysis will be presented from a semiconductor point of view.



UL trains Arm users

The three-day virtual training with optional personal certification exam is open to Arm customers as well as the public and takes place from 27 to 29 July.



NXP moves to TSMC 16nm Finfet

Announced at last month's Computex, NXP is taking its vehicle network processors into volume production on TSMC's 16nm Finfet process technology.

This marks the migration of NXP's S32 family of processors to more advanced process nodes as automobiles continue to evolve into more powerful computing platforms.

NXP's innovation in this family can help car makers simplify vehicle architecture and deliver fully connected and configurable vehicles.

The vehicle networking processors enable service-oriented gateways for secure cloud connectivity and over-the-air updates that can unlock data-driven services such as usage-based insurance and vehicle health management.

The processors also serve as domain and zonal controllers to enable vehicle architectures and as Asil-D safety processors in adas and autonomous drive systems.

"Vehicles have become sophisticated computing platforms with semiconductors controlling a wide range of sensors, digital cockpits, wireless connectivity and more," said TSMC CEO CC Wei. "TSMC's comprehensive portfolio of automotive process technologies and services enable our customers to innovate to make cars safer, smarter and greener."

The move to TSMC's 16nm technology has allowed NXP to consolidate multiple devices into one, creating a system-on-chip that reduces the processor's footprint.



Processors on TSMC's 16nm Finfet process

"NXP's release of 16nm processors for radar and vehicle networking is the next milestone in turning cars into intelligent, connected robots on wheels that are safe, secure and enjoyable," said Kurt Sievers, CEO of NXP, at the Computex CEO forum. "We have a long history of partnership with TSMC and appreciate their support during this extraordinary period of shortage."

He said this paved the way towards its future S32 processing platform with harmonised software infrastructure in TSMC's 5nm process.

The radar processor's implementation in 16nm provides car makers with a scalable product for NCap and corner radar as well as long-range front radar and multi-mode use cases such as simultaneous blind-spot detection, lane change assistance and elevation sensing.

TSMC's 16nm technology enables NXP's automotive processors to harness the power of Finfet transistors for the first time, combining improved performance and rigorous automotive process qualifications to deliver safe computing power.

WM Motor picks Blackberry for SUV

WM Motor has selected Blackberry's QNX Neutrino rtos, SDP 7.0 software development platform and hypervisor to power its W6 SUV.

The deployment will enhance the safety of the mass-produced, all-electric W6. The companies announced in 2019 that QNX software had been selected for WM Motor's third-generation SUVs.

Armed with the cloud computing power of handling over a million tera operations per second, the W6 is China's first mass-produced vehicle that can autonomously perform parking manoeuvres.

The model has electronic architecture and is powered by silicon technology, a 5G base band and an autonomous driving domain controller. The digital cockpit has shortened the information processing time and expanded the dimensions of information capture so the system can keenly perceive the subtle needs of the users in the cockpit.

The W6 allows for design flexibility and scalability to consolidate multiple systems with mixed criticality and different operating environments on one hardware platform, reducing the initial development and long-term costs while providing functional safety and security.



Visteon and Qualcomm smart cockpit for Geely

An intelligent cockpit developed by Visteon, ECarX and Qualcomm has made its debut in Geely's flagship SUV.

The Xingyue L SUV will be the first production vehicle to use the co-developed cockpit.

Visteon's SmartCore cockpit domain controller with the Qualcomm Snapdragon automotive cockpit platforms have been integrated into ECarX's intelligent cockpit. Collaboration by the three created technology that helps global car makers deliver a more connected, enjoyable and safer driving experience, said Sachin Lawande, CEO of Visteon.

"Visteon's work with ECarX and Qualcomm brings a personalised digital experience to the automotive industry," said Lawande. "Each company's technical teams have shown their skills in development, design and integration, and that they are capable of delivering a modern digital cockpit experience for the global auto industry."

Using Snapdragon, SmartCore supports in-vehicle HMI functions to provide drivers and passengers personalised information. The cockpit can also be upgraded wirelessly over-the-air.

"Visteon and Qualcomm have been ideal to work with to achieve this goal," said Ziyu Shen, CEO of ECarX.

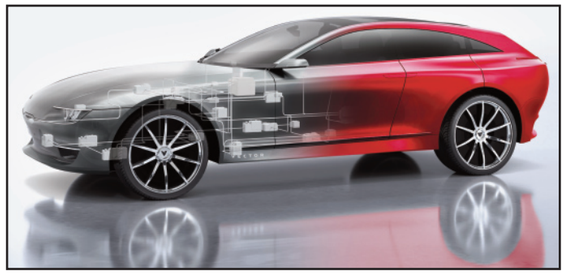
Visteon and Qualcomm have worked together since 2018 developing cockpits for ECarX.

The Xingyue L SUV debuted at the 2021 Shanghai Auto Show and is the first production vehicle with the cockpit.

Features include AI-based voice assistance, intelligent centre-control monitor, and immersive driving information and entertainment options.



Intelligent cockpit in Xingyue L SUV



Vector and Somit from engineering to aftersales

Vector helps workshops deal with connected cars

Automotive software firm Vector is cooperating with aftersales specialist Somit to equip workshops with the information they need to support rapidly changing automotive technology.

As mechanical systems continue to lose prominence and electronics and software come to the fore, a parallel transformation in aftersales systems and services is required if standards of customer service are to be maintained.

Radically different E/E architectures, more software features and the pace of change present a fresh set of challenges to technicians. It is thus critical they are provided accurate and up-to-date information that is quick and simple to use.

With the shift towards in-house software development, and an increasing use of data driven design tools, much of the information required by these aftersales exists in engineering. Despite this, effective reuse of engineering data in aftersales remains limited.

Standards have made some progress to improve this, however their effectiveness is limited by a lack of end-to-end process and tool support. With combined expertise spanning the engineering and aftersales lifecycle, Vector and Somit aim to overcome these limitations.

Working together with engineering and aftersales, the companies plan to deliver insights, training, processes and integrations that make cooperation and data sharing easier. This should bring benefits in terms of quality, efficiency, speed and cost.

Vector and Somit want to talk with OEMs who would like to share their experience, difficulties and ambitions for the delivery of aftersales systems that keep pace with connected vehicles and equip workshops for the latest vehicle technology.

NI acquires MonoDrive to boost adas simulation

National Instruments (NI) has acquired MonoDrive, a specialist in high fidelity simulation software for adas and autonomous vehicle development.

The takeover expands NI's reach in adas and simulation markets and should let its transportation customers accelerate the development, test and deployment of safer autonomous systems.

The design cycles for adas are complex and automotive OEMs and suppliers need systems that streamline the transitions between simulation, lab-based and physical test environments to create safer vehicles. Disparate tools cause siloed processes and time-to-market delays, and lead to higher costs.

NI will leverage MonoDrive's expertise in signal processing and simulation to accelerate the delivery of adas through high fidelity driving environments capable of modelling numerous sensors and thousands of real-time scenarios.

This, combined with NI's software-connected systems, should help transportation users streamline the transitions between simulation, lab-based and physical testing environments.

"The combination of MonoDrive's advanced software and NI's strong position in adas will enable smooth transitions across our customers' software validation workflows," said Chad Chesney, NI vice president. "This in turn delivers greater test efficiency, coverage and more realistic testing scenarios to help automotive manufacturers get safe and reliable autonomous vehicles on the road faster."

Celite Milbrandt, CEO of MonoDrive, added: "We believe the combination of NI and MonoDrive products will help our customers accelerate their goal of deploying safer vehicles."

NI has also announced a collaboration with simulation company Ansys to recreate real-world simulation to validate sensors and inject data into software and hardware under test in real time. This should provide insights into how products perform by bridging the worlds of simulated and physical test.



Sharing better for EV work, says Analog Devices director

As the popularity of electric vehicles increases, the need for electronics companies to work more closely with car makers is intensifying, according to Gina Aquilano, technology director of Analog Devices' automotive business unit, speaking during a recent webinar.

She said there was a shared vision on the goods that needed to be delivered and described the current situation as "super exciting".



Gina Aquilano: "Super exciting."

Sharing ideas, she said, was accelerating innovation and producing better products that hit the end goals of sustainability, such as faster charging, longer range and extended battery life.

But she said that cost was still a barrier to many taking the electric vehicle route despite prices falling and being not that much more expensive than vehicles with internal combustion engines.

Another element that needed improving, she said, was quality and that meant more traceability, trust and transparency in terms of battery health.

She said this could be used to counter some of the bad press that electric vehicles had received, such as catching fire and burning down houses and garages. These stories can make consumers hesitate.

One of Analog Devices' contributions to this field is the development of a wireless battery management system.

A wired system can lead to a lot of work wiring the batteries together and humans often have to get in there physically and make the connections, she said. This can be different for each car and leads to a more manual manufacturing process; robots often struggle.

The idea of a wireless system is to get rid of the wiring harness. It can also scale quickly using the same modular design.

As soon as the wireless device is attached, the manufacturer can start collecting data, even in pre-production, helping reduce recalls if a battery is not up to scratch. This can also be used to see if a battery is suitable for second life and in what type of application.

She said it was better to reuse a battery first and then look at recycling to lower the carbon footprint, but this also needed to work economically.

The aim was to streamline the process from the car to a second life application, she said, adding that she was passionate about sustainability and electrification.

STM drives Arrival EVs

ST Microelectronics is providing semiconductor technologies for Arrival's electric vehicles, including microcontrollers and power and battery-management devices.

STM's technology will help Arrival produce future-proofed zero-emission commercial vehicles as part of an integrated mobility ecosystem.

The microcontrollers are for Arrival's modular ECU platform.

Arrival uses in-house developed hardware, software and robotics to enable production in decentralised microfactories. These microfactories can be deployed around the world to service demand and supercharge local communities by hiring local talent, using local supply chains and paying local taxes.

Arrival's entire vehicle portfolio, including its van, bus and recently announced car, which is being designed in partnership with Uber for ride-hailing, will use STM technology.

"We have been working with Arrival since their early stages, and we are proud of the journey accomplished together as they head towards production," said Michael Anfang, executive vice president at STM.

Foxconn dips into EVs with PTT joint venture

Taiwanese electronics giant Foxconn is collaborating with PTT, a technology conglomerate in Thailand, on the development of electric vehicles.

The two firms signed a memorandum of understanding to set up an open platform for producing EVs and key components to serve the EV sector in Thailand.

The platform, comprising hardware and software, will be available to all automobile players in Thailand looking to accelerate their production and sales of EVs in the Asean region.

This will give PTT access to Foxconn's smart manufacturing and car technology.

The partners aim to set up an end-to-end production platform that provides instant scale to the local EV industry in Thailand.

Automobile players in Thailand that wish to assemble electric vehicles will be able to access the entire value chain of services offered by a joint venture being set up as part of this project.

Through this, PTT and Foxconn aspire to shape the future of mobility in Thailand and propel the country towards a sustainable, emissions-free future.

Auttapol Rerkpiboon, CEO of PTT, said the agreement was a milestone for PTT's EV value chain businesses to foster sustainable growth while addressing the changing era of future energy, especially transportation and mobility.

Young Liu, chair of Foxconn, said the platform and Foxconn's business model would meet the demand of the future EV market.

"Regarding PTT's development in EV and battery charging infrastructure, Foxconn can contribute our expertise and technology to gradually build a complete and vertically integrated EV industry in Thailand," Liu said. "Through this open model and local industrial advantages, we believe that Thailand will become a leader in the global EV evolution, and show the world that the Eastern Detroit can continue to shine in the field of EVs."

The partnership will involve transfer of knowledge and technology, helping Thai people build skills in future-oriented industries and break through the middle-income trap, while also allowing Thai consumers to gain access to cost-competitive and sustainable mobility with locally produced EVs.



Auttapol Rerkpiboon (left) and Young Liu

Denso picks Siemens for model-based development

Denso has selected Siemens software for the technological foundation of its model-based development (MBD).

By using model-based simulations, Denso can resolve existing issues as well as investigate design possibilities early in the process and before physical models are built. This is expected to reduce time needed for product development, cut costs, increase design quality and improve competitiveness.

Siemens will underpin the project through process consulting, conducting pilot projects at the design site, and establishing modelling processes.

By using the Simcenter simulation and test applications, Denso can drive simulation in the development process. Simcenter is being deployed for designers who can conduct 1D system simulation alongside analysis specialists while Teamcenter software enables seamless distribution of model data among global sites.

"Thanks to high quality Siemens software products, expertise in consulting and technical service, our three-year MBD pilot has been successful," said Masaki Suzuoki, general manager at Denso. "Full-scale deployment will start throughout the company in Japan and abroad and we look forward to support from Siemens that can help us accelerate MBD deployment across business domains."

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Nexperia invests $700m in fabs and R&D

Nexperia is investing $700m over the next 12 to 15 months in its European wafer fabs, assembly factories in Asia and global R&D sites.

The investment will boost manufacturing capacity at all sites while supporting research and development into areas such as gallium nitride (GaN) wide bandgap semiconductors and power management ICs. It will also underpin recruitment activities, with Nexperia looking to attract chip designers and engineers.



Nexperia's Hamburg fab in Germany

"This is an exciting time in the global semiconductor market, which has mounted a resurgence since the challenges of the first half of last year," said Achim Kempe, Nexperia's chief operating officer. "Nexperia reported robust product sales of $1.4bn in 2020, with demand accelerating rapidly in Q3 and Q4. That momentum has been maintained so far this year, and we expect it to continue over the long term. The $700m investment will ensure that we continue to provide the technology and manufacturing capacity needed to deliver products in volumes that support increasing demand."

The capacity of the Hamburg fab in Germany – which produces more than 35,000 wafers (8in-equivalent) per month (70bn semiconductors per year) – will increase 20 per cent from mid-2022. In the UK, capacity at Nexperia's dedicated trench-mos fab in Manchester will rise ten per cent by mid-2022 from the current 24,000 wafers (8in-equivalent) per month.

There will also be an expansion of R&D activities, with new laboratories and other facilities across all sites. This includes Nexperia's headquarters in Nijmegen, where the analogue and logic business group is located.

Recruitment activities will be stepped up, as Nexperia looks to fill over 200 global vacancies primarily across various technical roles.

"Even before the pandemic started, Nexperia had a strong global growth strategy in place," said Toni Versluijs, general manager of Nexperia's mosfets and GaN fets business. "These efforts are now paying off. An example is the imminent release of our first power mosfet from the new 8in production line in Manchester. As the recovery continues, we are committed to ongoing investment in products, processes and people across our factories and R&D facilities. This sustained activity reflects our belief in the long-term prospects for the power semiconductor sector."

Konrad and LHP deliver adas workflow management

Konrad Technologies and LHP Engineering are collaborating to deliver workflow management with test automation for adas and automated driving functional safety standards.

To ensure adas and automated driving systems comply with safety standards, manufacturers need a method for testing and validating performance. LHP and Konrad are leveraging their experiences in functional safety and sensor test, respectively, to develop a cohesive testing and tracking workflow process for several safety standards such as Sotif and Euro NCap.

"Konrad provides test automation tools for radar, camera, lidar and adas overall," said Steve Neemeh, chief technology officer at LHP. "LHP provides state-of-the-art functional safety workflows and tools."

CONNECTED CARS

PRIVACY MATTERS

Garikayi Madzudzo looks at the implications of privacy laws in today's connected car world

CONNECTED CARS

Research shows there are major privacy implications in today's connected vehicles. When the General Data Protection Regulation (GDPR) was introduced in May 2018, it was a step-change which overhauled the way in which businesses processed and handled personal data.

It also brought about awareness of the importance of privacy and the protection of personal data to the general public.

This issue has only grown more significant with the accelerating pace of connected technology deployment in vehicles, with everything from connected applications, telematics and black-box insurance to mobile phone use.

Insights

In-vehicle data collection and processing has increased in content type and volume, and now encompasses a vast array of personal information including phone numbers, address books, emails, location history, browsing history, preferences and driving habits. This collection and processing also take place in a complex ecosystem, including not just the vehicle but the phones, networks and, ultimately, infrastructure to which it connects.

Furthermore, industry sources estimate that on average about 480Tbyte of data were collected by every automotive manufacturer in 2013, and it is expected that this will increase to 11.1Pbyte per year by 2021.

Looking into the future, it is predicted that connected vehicles will create up to 4000Gbyte of data per day, which is over 1400Tbyte per year. With such large volumes of personal information being collected, it is inevitable that privacy will be a challenge. All the above will only increase with the rise of connected and autonomous vehicles.

Thus, recognising the importance of user privacy in connected vehicles, recent research explored the current state of user privacy and how it was presented to consumers in a modern vehicle.

Research

A survey of 1038 car owners from Germany, Italy and the UK was conducted, asking a series of questions based on GDPR principles to establish how consumers saw privacy in the connected vehicles they owned.

From a dealer's perspective, compliance with GDPR is clear. The findings indicate that a good proportion of recipients (70%) across the three countries received a request to consent from the dealer to collect personal data, while around two-thirds (68%) received a consent request from the dealer to store personal data.

However, once inside the vehicle, the need to comply with GDPR as it stands is less clear. This is the case even if the operator of any of the connected features gathering personal data – such as location – could be considered a data controller. This was reflected in the numbers: less than half (45%) received a request to consent to collect personal data once using technology inside the vehicle, less than half (47%) to store personal data and only a third (35%) to share it.



Research found just 60% of drivers were given the option to choose whether their personal data could be shared with third-party companies

Only 60% of the study's participants were given the option to choose whether their personal data could be shared with third-party companies and were informed of third-party companies that would have access to their data by the dealer and/or vehicle.

Default consent was also prevalent, with around one in three recipients (32%) responding that they were opted in by default. Almost half (42%) said they were not made aware they could withdraw their consent from either the vehicle or the dealer.

Approaches

Based on the findings, it is recommended that manufacturers revisit their governance procedures and start to explore new approaches to ensure fair use of personal information. One such method is to look at increased transparency with regards to collection of personal data for the unique automotive use cases.

An example of this is looking at where to place privacy notices such that two different owners can find them easily. Another recommendation could be to give consumers the power to erase private information completely from vehicles so there is no danger of leakage if the vehicle was resold or scrapped.

Implementing privacy best practice, such as that espoused by GDPR, would build on existing measures for protecting users. This would ultimately lead to increased consumer trust in technologies and is vital in ensuring mass adoption of future connected vehicles.



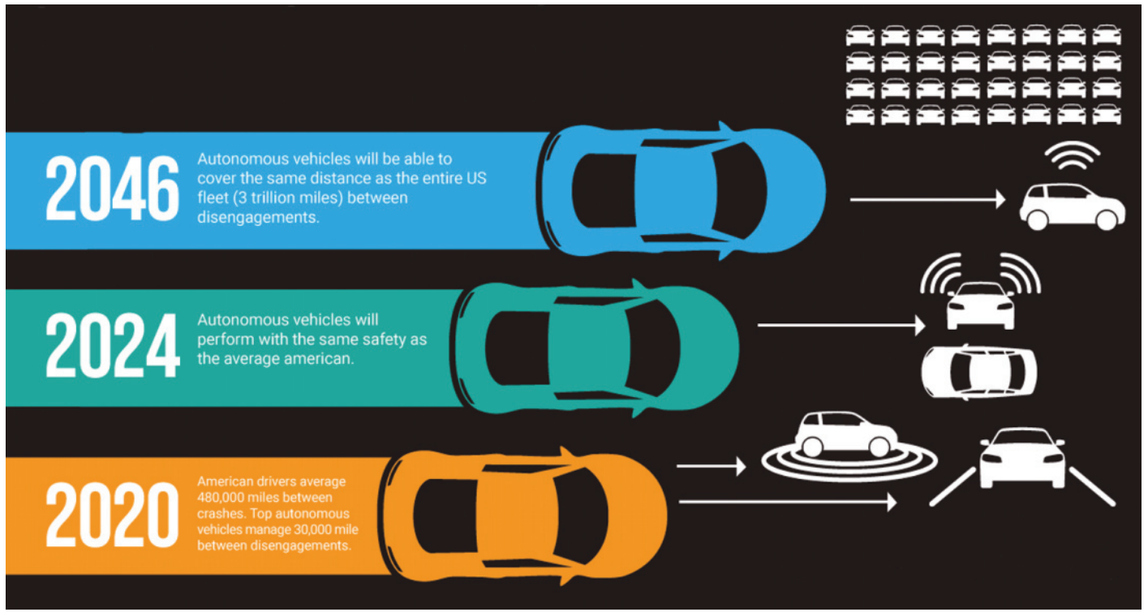
Garikayi Madzudzo is a cyber-security research scientist at Horiba Mira

AUTONOMOUS VEHICLES

INVASION

James Jeffs examines progress in the drive towards autonomous vehicles

AutoX has gained a driverless testing licence in the USA



Analysis of California DMV and NHTSA data (Source IDTechEx)

Autonomous cars will be here in two years. This has been a standard sentence from the industry for the past five years or so. Now there is good reason to expect autonomous ride-hailing services to hit our roads within three years.

So, what happened in the past year in the world of autonomy to give this confidence boost? Well, a few things actually. Breaking the previous year down into the most significant advancements: Covid-19 has kick-started the next phase of autonomous testing; technology maturity continues to more than double year on year; sensor prices are coming down and performance is increasing; and there are genuine autonomous services available, just in very limited conditions.

Covid-19

The pandemic has undoubtedly had a devastating impact on the world over the past year or so. However, opportunity can often be found in the face of adversity, and this was the case for autonomy.

At the beginning of the pandemic, the companies that had been testing autonomous services with safety or backup drivers behind the wheel – Waymo, Cruise, Baidu, Pony and so on – were forced to cease testing. There was concern about the social contact between the riders and the safety drivers being a factor in spreading the pandemic.

Here is where the opportunity was presented; it seemed that the safest way to continue testing was without the safety driver behind the wheel.

In July 2020, AutoX became the first MaaS (mobility-as-a-service) company to gain a driverless testing licence, a world-first which allowed it to operate driverless vehicles in California.

Nuro did achieve this milestone previously, however it does not carry people, only parcels

The new licence type allowed AutoX to operate a fully autonomous service in San Jose, limited to roads with a posted speed limit of 72kmph or less. Following that, another six companies have been granted licences in California and others have gained similar licences for parts of China.

Covid-19 may have been the catalyst needed to transition from safety-driver-based testing to fully autonomous testing. This is not to say that the industry was not ready for the transition, but the pandemic definitely put pressure on the governing bodies to progress to the next step.

Maturity

MaaS operators have been testing their autonomous technology in California since 2015, and since then they have been publishing reports about the performance of their systems. The most important outcome from these data is the kilometres per disengagement metric, which describes the average distance an autonomous vehicle can travel without human intervention.

Analysis of these data shows exponential growth in the kilometres per disengagement, with the figure more than doubling each year. By extrapolating this growth, within three years autonomous vehicles will be performing more safely than the average American driver.

The research went one step further and found that within 25 years autonomous vehicles would be able to travel the same annual distance as the entire US fleet without a single disengagement.

There are still obstacles to overcome, such as testing in more urbanised areas and the establishment of cost-effective sensor suites. Waymo and Cruise have recently gained permission



Apple has implemented lidar on the iPhone 12 Pro

to test in the urban centres of San Francisco which will help with the former.

Lidar

While Apple is perpetually generating hype, and not much more, when it comes to autonomy, it has inadvertently had an enormous impact when it comes to sensors.

In November 2020, Apple announced its new model line-up, with new features, one of which was the implementation of lidar on the iPhone 12 Pro and iPad Pro. Apple is using the ranging features of lidar to improve distancing for auto-focus and improve augmented reality features.

However, the knock-on effect of this mass-market adoption of lidar is the price reduction of key components applicable to automotive lidar.

Velodyne has said its Velarray H800 lidar unit will have a price tag of less than $500, a massive improvement compared with the around $10,000 lidar price tags of a couple of years ago, and around $75,000 before that.

Lidar is a vital sensor for autonomous vehicles; it provides image quality sufficient for object classification like a camera, while also bringing the night-time performance and ranging abilities of a radar.

This is particularly crucial for night-time operation, where a camera struggles with poor light and radar cannot provide enough image quality.

Sensor suites are now being seen with seven lidar units, hence being able to source lidars at a reasonable price is vital for the mass production of MaaS ready vehicles.

Imaging radar

Another sensor advancement to get excited about is the emergence of imaging radars. Incumbent radars have 12 virtual channels, similar to pixels in a camera, which allows them to detect an object and return its distance and speed.

When fused with information from a camera, this is incredibly powerful as the system can detect an object (another car, for example), classify it using the wealth of data from the camera, then attach an accurate speed and distance from the radar.



Velodyne's Velarray H800 lidar is set for Olli's 3D printed electric self-driving shuttle

However, when the camera is not functioning well, such as at night, in direct light, in heavy fog and so on, then the only information the system has is an object at x distance moving at y kilometres per hour.

This is clearly not sufficient to operate autonomously as the object detected could be an innocuous bridge to drive under or a stationary vehicle.

This is where imaging radars come in. Imaging radars, such as Continental's ARS540, have around 200 virtual channels, which allows them to make the distinctions described. Furthermore, Arbe is bringing a radar to the market with 2000 virtual channels.

While Arbe is in the start-up phase, it has already agreed to supply 400,000 units to AutoX. Mobileye, a subsidiary of Intel, has also said it plans to bring a 2000 virtual channel radar to market, although its won't be ready for a few more years.

These advancements in the cost and performance of sensors certainly provide a little more confidence in the growing performance of autonomous vehicles.

Today

Today, someone can pay for a driverless autonomous vehicle to pick them up and take them to their destination, in a fully autonomous service. The service is provided by Baidu and the destination must be one of eight stops around the Shougang Park area of Beijing.

Yes, this is a limited example with only ten vehicles in operation, but it is happening, and it is only a small progression from other autonomous services which are not yet commercial.

For example, AutoX recently celebrated 100 days of continuous driverless testing in the city of Shenzhen, China. There are also eight companies testing driverless MaaS in California and neighbouring states, with many offering fully autonomous services in limited areas.

The next steps are likely to be the commercialisation of the current testing sites. Then a progressive roll out from suburbs to cities, then from cities to more cities, much in the same way as Uber was expanded city by city at the start of the last decade.

Some MaaS providers say 2023 for the start of this rollout and, according to current analysis, this doesn't seem a million kilometres away.



James Jeffs is a technology analyst at IDTechEx

AUTONOMOUS VEHICLES



Baidu has started a autonomous vehicle service around Shougang Park in Beijing

POWER TECHNOLOGIES

CURRENT AFFAIRS



Victor Khasiev explains how a bipolar, bidirectional DC-DC supply can source and sink current from 5 to 24V input

Most electronic systems depend on power voltage rails that are either positive or negative, but a few applications require individual rails that can be both.

In these situations, positive or negative power is supplied by the same terminal, that is, the output voltage of the supply can be adjusted through its entire voltage range, smoothly transitioning across polarity.

For instance, some automotive and audio applications require, in addition to traditional voltage sources, power supplies that can function as a load and sinking current from the output terminals. Regenerative braking in automotive systems is one example.

Single terminal, bipolar power supplies are documented, but those that can operate during input voltage drops, such as cold crank conditions, while continuing to provide bidirectional functionality are not. But it is possible for a device to be immune to input voltage changes while generating power and enabling reverse current flow, that is, from output to input.

Circuit

Fig. 1 shows a two-stage power supply, which centres around a four-quadrant controller (stage two), U1. This four-quadrant converter is fed by an intermediate bus converter, V_{inter} (stage one), supplying an output voltage in a minimum-maximum range of 12 to 24V, nominally 12 to 16V, matching the nominal voltage range of the standard automotive battery rail.

The output of the complete two-stage converter is ±10V delivering a 3A current to the load. The output voltage is controlled by the voltage source control signal at the CTRL pin of controller U1.

The low-pass filter CF, RF alleviates sharp changes in control voltage. The power train includes two mosfets, n-channel QN1 and p-channel QP1; two discrete inductors, L1 and L2; and an output filter.

The choice of two discrete inductors instead of a single coupled inductor extends the range of suitable magnetics and allows the use of previously approved and tested chokes. The output filter is composed exclusively of ceramic capacitors because of the dual polarity nature of the output.

The input voltage range of the full two-stage converter is 5 to 24V, to cover cold cranking voltage drops in automotive electronics and brownouts in industrial applications.

The boost converter (stage one), based on controller U2, maintains the voltage of the intermediate bus at or above 12V whenever the converter is enabled. The powertrain of the boost converter includes inductor L3 and mosfets Q1 and Q2. The two-stage arrangement allows normal operation of the downstream four-quadrant converter to deliver ±10V to the load at all operational conditions.

Sourcing

The oscillogram in Fig. 2 shows the circuit of Fig. 1 in action. When an input voltage is applied at V_{in}, the boost converter regulates its output, V_{inter}, to 12V if the input falls below this level. If V_{in} exceeds the 12V

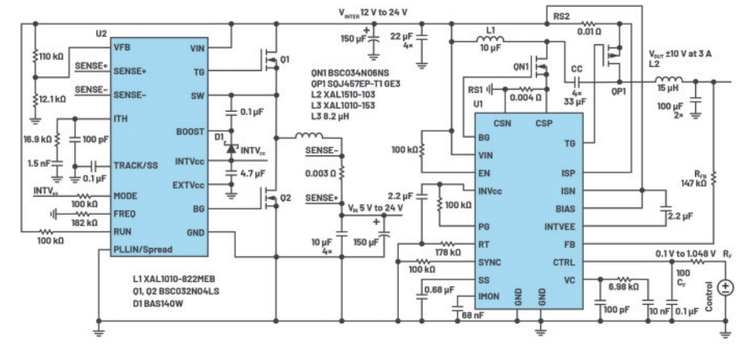


Fig. 1: Electrical schematic of bipolar, bidirectional, two-terminal power supply: V_{in} = 5 to 24V, V_{out} = ±10V at 3A

typical for a nominal 12V automotive rail, then the boost converter enters pass-through or wire mode. In this mode, the top mosfet Q1 is enhanced at 100% duty cycle, always on operation, so no switching occurs; the voltage, V_{inter}, applied to a four-quadrant converter remains relatively stable and equal to V_{in}.

This approach greatly increases system efficiency over a typical two-stage device, namely, a boost converter followed by buck/inverting. This is because efficiency in pass-through mode, where the system will spend most of its time, can be near 100%, essentially turning the power system into a single-stage converter.

If the input voltage drops below the 12V level – for example, during a cold cranking event – then the boost converter resumes switching to regulate V_{inter} to 12V. This approach allows the four-quadrant converter to deliver ±10V, even when facing sharp drops of the input voltage.

When the control voltage is at its maximum – in this case 1.048V – the converter output is +10V. If the control voltage is at its minimum (100mV), the converter output is -10V.

Control voltage versus output voltage is shown in Fig. 3, where the control voltage is a 60Hz sinusoidal signal frequency with a peak-to-peak amplitude of 0.9048V. The resulting converter output is a correspondingly 60Hz sine wave with a peak-to-peak amplitude of 20V. The output smoothly changes from -10 to +10V.

In this mode, the four-quadrant converter regulates the output voltage. The output voltage is sensed by U1 through the resistor RFB at its FB pin.

The voltage at that pin is compared with the control voltage and, from that comparison, the converter's duty cycle – that is, the gate signal on QN1 – is adjusted to keep the output voltage in regulation.

If V_{inter}, control or V_{out} changes, the duty cycle is modulated to regulate the output accordingly. Mosfet QP1 switches

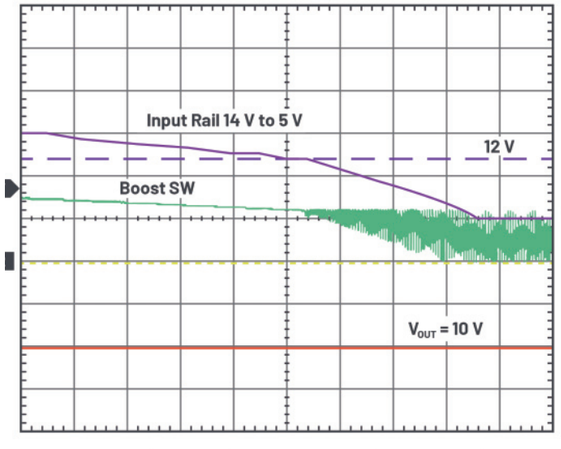


Fig. 2: Waveforms showing V_{in} dropping from 14 to 5V; V_{in} = 5V/div, V_{out} T = 5V/div, boost SW = 10V/div, and the time scale is 200µs/div

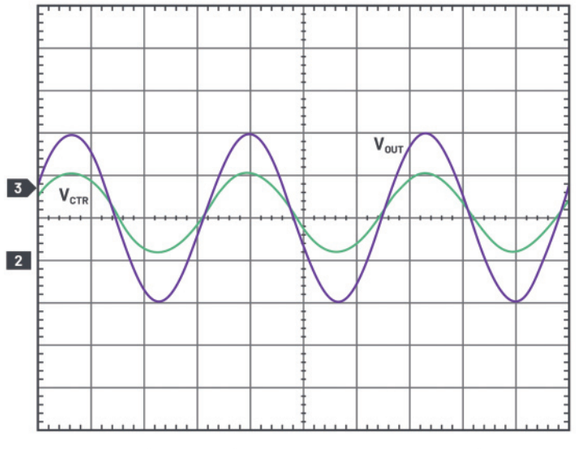


Fig. 3: Waveforms of sine wave output as function of the sine control signal; V_{CTRL}= 0.5V/div, V_{out} = 5V/div, and the time scale is 5ms/div

in sync with QN1 for synchronous rectification to increase efficiency, as shown in Fig. 4.

Sinking

This two-stage regulator can operate as a current source or a current sink. In current sink mode, current and power flow in reverse from the output, V_{out}, to the input, V_{in}. This is important for automotive electronics and some audio systems.

For settling on verbiage when describing this mode, V_{out} will now be referred to as the input and V_{in} will now be referred to as the output. Furthermore, this article only considers applications where V_{inter} bus voltage is equal to or greater than the minimum 12V.

During reverse current flow, the four-quadrant converter regulates output current that passes from V_{out} to V_{in}; the converter does not regulate voltage in this mode. The four-quadrant controller senses output current as the voltage drop across the sense resistor, RS2 in Fig. 1, and regulates its duty cycle to keep this voltage drop at a set value, 50mV, for this.

As a four-quadrant converter generates voltage on the V_{inter} bus that exceeds the specified minimum, the boost converter enters pass-through mode with top mosfet Q1 always on and delivers the pre-set value of the output current to V_{in} (load) terminals with the smallest losses possible.

This mode of operation was benchtop verified and tested. To do so, the V_{out} of the circuit in Fig. 1 was connected to a lab power supply set to 12.5V and the V_{in} to an electronic load, with the current through the converter set to 4.5A. The thermal image of the four-quadrant converter is shown in Fig. 5.

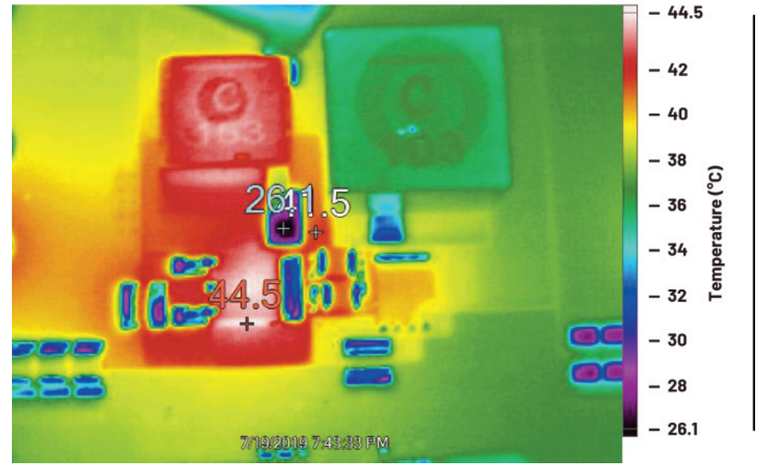


Fig. 5: Thermal image of the four-quadrant converter powertrain in load (reverse current) mode; a 4.5A current flows from V_{out} terminals to V_{in} from a 12.5V source at V_{out}

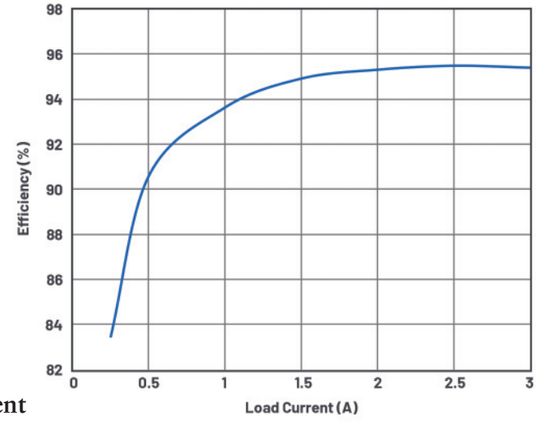


Fig. 4: Efficiency versus load current

Conclusion

The converter presented in this article is for a bipolar, bidirectional power supply. A few specific features contribute to the performance: synchronous rectification yields high efficiency, and the simple, dedicated control scheme makes for an easy interface to any type of host processor and external control circuitry.

This solves the problem of unstable input voltages, including fast transients, and guarantees stable output voltage in all operating conditions. The devices chosen increase efficiency and ease of design.



Victor Khasiev is senior applications engineer at Analog Devices

INFOTAINMENT

What's going on in the back seat?



A look at developments in rear-seat entertainment technology

Once the preserve of passengers lounging in high-end premium vehicles, rear-seat entertainment (RSE) technology has undergone a tentative journey over the past ten years and is only now about to explode.

Screen size and resolution are obvious enhancements to the in-vehicle experience but, according to software firm VNC Automotive, the gradual move towards advanced levels of autonomous functionality is set to herald the biggest shift yet in the way the technology is integrated and used. Some of the steps could even make physical screen technology redundant.

"Future adoption of levels three, four and five autonomous vehicles could result in us spending more time in our cars, but less time physically driving them," said Peter Galek, VNC Automotive product engineering director. "Ultimate removal of driver accountability and road-focus has the potential to completely alter the role of RSE and the vehicle in general."

He said the advent of digital TV, streaming and gaming had already altered the way people consume media at home and on the move, and this trend was gradually becoming more prevalent in personal transport, too.

"The pandemic has played its part in accelerating the evolution of our media consumption habits," he said.

Data from Ofcom suggest that UK streaming services alone have enjoyed 12 million new sign-ups during Covid-19 and that viewing times on these services have risen 71% on 2019's figures.

"But we are nearing a revolutionary age for content consumption in-vehicle," he said, explaining that RSE had already become less of a premium-only product and was a key factor influencing the decision of car buyers of the most popular models.

VNC Automotive, with over a decade's experience in passenger vehicle systems now used in more than 35 million vehicles worldwide, has already launched its Cobalt Share, which targets RSE and BYOD (bring your own device) users by sharing multimedia content from multiple mobile sources to vehicle screens, which hints at the evolving requirements of car passengers in 2021.

"We are living in a one-click society, be that for ordering items for next-day delivery, operating home devices or vehicle connectivity," said Galek. "We have been spoiled by convenience and it's imperative that this is reflected in ease of use, even as technology evolves and functionality is added."

Crucially, this needn't only benefit entertainment use-cases.

"The way we work has been evolving over the past decade and technology has expanded the boundaries of the traditional office environment," he said. "Emails can be checked and meetings attended via portable devices while on the move."

The pandemic has accelerated this shift to remote working and reduced the reliance on physical communal office space. An ability to connect swiftly to a vehicle's screens, as widespread travel resumes, means this work doesn't have to be completed at home or an office, but remotely from the back of a taxi or form of executive travel.

In the future, this could promote collaborative working as business is less affected by travel; connecting seamlessly between home or when on the move, checking emails or joining meetings streamed to common screen workstations viewed by multiple stakeholders in an executive MPV, for example, or even a level-five autonomous vehicle with the driver involved, too.



Peter Galek: "The vehicle could become a crucial part of a passenger's network."

"The basic technology to provide this level of experience and connectivity exists," he said, "and we would expect demand to increase as customer awareness grows and the working environment continues to evolve as we emerge from the pandemic."

Galek explained that format commonality was vital for a seamless multi-vehicle integration, as compatibility issues between device manufacturers or auto makers' proprietary systems would provide a short- to mid-term hurdle to overcome.

Advancements to mobile networks such as 5G offer potential, however.

"We could see a scenario whereby enhanced synchronisation enables the vehicle to become a crucial part of a passenger's network of inter-connected devices that make up their work or personal hub," he said. "Rather than simply streaming from your phone to a screen, you're seamlessly immersed into the mobile environment."

Such a scenario, he said, opened up the potential for revenue streams for vehicle manufacturers, operators and content providers: screens in private hire vehicles could become digital billboards streaming advertisements, targeted campaigns or public service announcements.



Rear-seat entertainment has become less of a premium product

Future

Through modern LCD or OLED technologies, vehicle screen resolution is advancing at a considerable rate. However, the added cost of screen supply and integration, hardware certification and crash safety validation provide barriers to adoption. Automotive applications must also typically be able to withstand temperature extremes of -40 to +85˚C, plus offer touchscreen functionality including haptic feedback.

According to Galek, however, this represents an opportunity rather than a challenge.

RSE is a chance for vehicle manufacturers to offer differentiation and step away from the shared-parts feel of some premium ergonomics and interactive systems. Possibilities such as zonal, smart audio controls to adjust personal volumes and focus content already enhance the in-vehicle experience, but the potential to bring such functionality under the control of a device or app takes this to the next level of integration.

Such connectivity also offers a future-proofing opportunity, enabling remote updates and upgrades via mobile internet or cloud-based technology to avoid building in inherently outdated technology – the latest interface or fully bespoke layout, welcome screen or personalised settings are all potential realities.

"A car's sound system is already often the best system owned by a customer," Galek said. "If vehicles are to evolve to become, with the integration of autonomous functionality, a mobility space as opposed to a traditional car, could we see the emergence of home-from-home entertainment systems?"

Families sitting on their drive to enjoy the ultimate cinematic or latest multi-player gaming experience, or doing so during journeys in an augmented reality – where a progress map appears over a semi-transparent window, or restaurant details are projected as they pass – serve to demonstrate the breadth of potential for RSE technologies.

"The future may look beyond screens in the rear, to projections on to any flatform surface, such as the windows, and incorporate augmented reality technology to truly make the vehicle an extension of your living or work space," Galek said.

ON THE ROAD

UPPING THE E-PACE



Jaguar has increased connectivity for the R-Dynamic Black Edition

Jaguar has updated the connectivity features for the latest version of its E-Pace range, the R-Dynamic Black Edition, which is said to elevate the compact SUV's dynamic design and visual appeal with a bespoke choice of exterior elements.

The R-Dynamic Black Edition expands the E-Pace range, which includes Jaguar's Premium Transverse architecture, a choice of Ingenium powertrains – including plug-in hybrid (PHEV) and mild hybrid electric vehicle (MHEV) technologies – connectivity and luxurious interiors.

Added technologies, including wireless Apple CarPlay, will add convenience and connectivity. Wireless Android Auto will also be available at the same time, making E-Pace ownership more connected than ever.

Black Edition

The distinctive Black Edition is based on the E-Pace R-Dynamic S. It offers specially selected design elements that are said to give it a more dynamic and sophisticated presence.

The design includes gloss black door mirror caps and gloss black detailing to the front bumper and lower grille surround, main grille surround and grille tips. The side window surround and side vent – complete with the Jaguar leaper – also feature a gloss black finish, along with the Jaguar script and rear badging. Distinctive 19in satin grey alloy wheels with contrasting red brake callipers, privacy glass and a panoramic roof complete the exterior.

The edition is available with all E-Pace exterior colours, including Ostuni white. The distinctive finish has more depth and substance, and complements E-Pace's contemporary exterior design.

Inside, it delivers heightened luxury, enhanced connectivity and refinement. The focal point of the interior design is the curved 29cm HD touchscreen integrated into the central instrument panel.

The large touchscreen operates the intuitive Pivi Pro infotainment system, which provides clarity and allows the driver to carry out 90 per cent of common tasks within two taps from the home screen thanks to its simplified menu structure.

The vehicle comes with a choice of 2.0-litre Ingenium MHEV powertrains, ranging from the D165 and D200 diesels to the P200 petrol, all with a nine-speed automatic transmission and all-wheel drive (AWD) as standard.

AWD makes use of second-generation standard driveline technology that automatically distributes torque between the front and rear wheels to ensure optimum traction. This uses driveline disconnect technology that intelligently disengages AWD to optimise efficiency, for example when cruising at constant speeds.

Specification

There are more technology and

connectivity options, with wireless Apple CarPlay and wireless Android Auto available soon as standard. Both will be available via a SOTA update for all Pivi Pro equipped E-Pace models, seamlessly replicating the user's smartphone display on the central touchscreen and giving drivers multiple methods of controlling infotainment and phone functions. The car is also available with wireless device charging.

The Pivi Pro infotainment system has a range of embedded apps, fast start-up from its own dedicated power source and dual-sim technology for streaming media and downloading updates simultaneously.

The technology is complemented by the optional 31.2cm HD interactive driver display with enhanced graphics, a configurable layout with digital dials, media information, phone functions or full-screen mapping for the navigation system. With the optional head-up display, the interior technology ensures the driver is provided with numerous ways of configuring the set-up in the most convenient way.

The cabin air purification system improves interior air quality through Nanoe technology, which removes allergens and unpleasant odours. The system uses PM2.5 filtration, which captures ultra-fine particles – including PM2.5 particulates – to improve occupant health and wellbeing and is activated by pressing the Purify button on the central touchscreen.

Auto high beam assist is fitted as standard on E-Pace S models, previously standard on SE and HSE derivatives, while the seating options have been simplified. Meridian Audio sound is standard from SE specification and memory functions for the door mirrors and seats are standard on S models.

All R-Dynamic models have configurable dynamics as standard, allowing drivers to hone detailed aspects of the E-Pace's driving dynamics, including throttle and gearbox responses, as well as steering settings and suspension – where adaptive dynamics is specified – to tailor the driving characteristics to suit individual preferences.



Wireless Apple CarPlay and Android Auto will be standard

Architecture

Jaguar Land Rover's PTA premium transverse architecture ensures availability with the latest electrified powertrain technologies, as well as delivering improved ride comfort.

New engine mounts contribute to enhanced throttle response, while the suspension layout ensures a comfortable ride while retaining Jaguar's trademark dynamics.

This is all complemented by the interior, which is more tranquil than ever thanks to the body architecture, which reduces vibrations and noise transfer into the cabin.

Powertrains

Jaguar E-Pace is available with a three-cylinder P300e PHEV powertrain, plus four-cylinder petrol and diesel Ingenium engines, using MHEV technology to improve performance, refinement and efficiency.

The P300e PHEV powertrain combines a 200PS 1.5-litre three-cylinder Ingenium petrol engine and a 109PS (80kW) electric rear axle drive motor to deliver 0-100km/h in 6.5s with CO_2 emissions from 44g/km and fuel efficiency up to 2.0l/100km (WLTP TEH combined).



E-Pace drivers will be more connected than ever

The P300e powertrain operates in one of three modes: hybrid, EV or save:

- Hybrid mode uses both the petrol engine and the electric motor in the most responsive and efficient way, intelligently switching between pure EV driving and using the petrol engine
- EV mode provides zero-emissions driving for up to 55km
- Save mode enables the driver to recover up to 85 per cent of battery charge, which can be deployed later in a journey, for example in urban areas

On powertrains fitted with MHEV technology, a belt integrated starter generator recuperates energy usually lost during braking or deceleration, which is stored in a 48V lithium-ion battery beneath the boot floor. This stored energy is then redeployed during acceleration for enhanced responses, or when the vehicle's stop-start system is required, making the process more refined and faster to react.

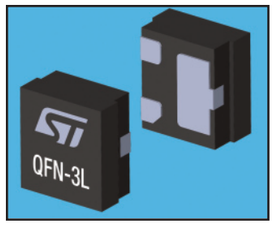
Heading up the petrol engine range is the 300PS MHEV variant which produces 400Nm of torque delivering 0-100km/h in 6.9s. Available exclusively in the 300 Sport with Jaguar's second-generation active driveline AWD system, it delivers all-wheel traction with dynamic capability.

TVS protects Can and Can-FD

A dual automotive-qualified low-capacitance transient voltage suppressor (TVS) from ST Microelectronics protects Can and Can-FD interfaces.

At 1.1 by 1.0mm, the ESD Can03-2BM3Y meets the automotive industry's need for small and high-performing protection devices for the increasing numbers of high-density ECUs such as for adas, autonomous driving controllers and gateways.

Using this device, designers can save 75% or more of the PCB space needed by conventional TVSs in sot-23-3L and sot-323-3L packages.



It ensures transient protection with clamping voltage as low as 33V (8/20μs at 1A) and 37V for transmission-line pulse at 16A.

Passing ISO 16750-2 jump-start and reversed-battery tests, the device can withstand 15kV ESD contact discharge (ISO 10605) and, with 3.3A peak pulse rating, handle strong current surges.

On top of Can and Can-FD, the line capacitance of 3.3pF allows the TVS to protect high-speed and high-data-rate buses such as Flexray and USB. In addition, the low csapacitance eases PCB design by allowing extra margin when laying out signal paths.

The maximum junction temperature rating of +175˚C will allow deployment in locations throughout the vehicle, from the cabin to the engine compartment.

With leakage current of 50nA at 24V, the device reduces battery drain when the vehicle is turned off, helping preserve the state of charge and increase driving range in electric vehicles.

It is in production now in the leadless DFN1110 package, which has wettable flanks that facilitate high-speed automatic optical inspection after soldering.

ISP suits multicamera architectures

A companion image signal processor (ISP) from Omnivision provides design flexibility for automotive single- and multicamera architectures, helping OEMs future-proof their designs.

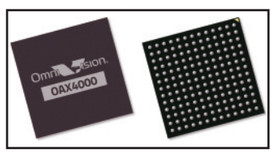
Combined with the firm's sensors, the OAX4000 suits applications both inside and outside of the vehicle, including surround-view systems, e-mirror, and interior and autonomous driving cameras.

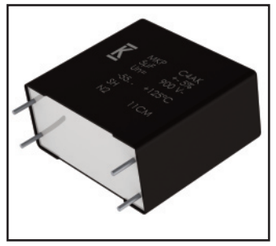
The asic can process data streams from up to four cameras at 3MP or one at 8MP. It supports multiple colour filter array (CFA) patterns and provides the option to output stream for both machine vision and human viewing pipelines independently.

Additionally, the imaging pipeline has been upgraded to provide better image quality. This includes a tone-mapping algorithm.

It is a companion ISP for the firm's HDR sensors, designed to provide a complete multicamera viewing application with fully processed YUV output. It can process up to four camera modules with 140dB HDR, along with LED flicker mitigation and 8MP resolution.

It supports multiple CFA patterns, including Bayer, RCCB, RGB-IR and RYYCy.





Film capacitor

A high-temperature DC-link film capacitor from Kemet is for extended lifetime requirements in automotive and green energy applications.

The C4AK smoothing film capacitor offers high temperature and high capacitance density for EVs and green energy power electronics that need high heat resistance and safety.

For use in automotive, green and industrial applications, these metallised film capacitors are suitable for DC filtering and DC-link use.

Growing demand for EVs requires electronic components that are compact, lightweight and have high dielectric capacitance coupled with high heat resistance for extended operation. Additionally, capacitors used in converter and motor drive inverters require assurance of high-temperature performance.

The device provides an alternative to current capacitors. It has a radial box style for PCB mounting, low profile, two to four leads, and surpasses AEC-Q200 requirements.

BMS extended to cover Asil-D

Analog Devices has expanded its portfolio of battery management system (BMS) products to include Asil-D functional safety and low-power features to enable continuous battery monitoring.

The devices support key battery chemistries including zero-cobalt LFP (lithium iron phosphate) for mass market electric vehicles and energy storage systems for reuse and recycling of battery packs.

The ADBMS6815 measures up to 12 battery cells in series and the ADBMS6817 up to eight. Both have a maximum lifetime total measurement error of 1.5mV, a stackable architecture for high voltage battery packs and a built-in isoSPI interface.

Features include 2Mbit isolated serial communications, low EMI susceptibility and emissions, bidirectional for broken wire protection, and capacitor or transformer coupled. They use a single twisted pair, up to 20m.

They are designed for use in ISO 26262 applications at Asil-D and are hot plug tolerant without external protection. There are diagnostics features for IC and application circuit failure modes. It takes 304μs to measure all cells in a system.



They contain a 16bit ADC with programmable noise filter.

Passive cell balancing is up to 300mA per channel with programmable PWM. There are seven GPIO or analogue inputs. These include temperature or other sensor inputs and are configurable as an I²C or SPI master.

Sleep state supply current is 5.5μA.

They come in 48-lead LQFP packages with exposed pads and are AEC-Q100 qualified.

Module combines 5G and C-V2X

A 5G plus C-V2X automotive-grade module from Neoway Technology is based on the Qualcomm SA515M device.

The A590 complies with IATF 16949 and ACE-Q100, and can operate from -40 to +85˚C.

Measuring 52 by 52mm, it supports 5G, C-V2X, ecall, dual sim dual active (DSDA) and GNSS multi-frequency multi-satellite.

It supports positioning systems such as GPS and BDS, and can implement precision positioning, by using RTK and QDR, regardless of whether in open spaces or in tunnels and basements.



The module supports the simultaneous working of two cards, and can keep the data services of two operators online at the same time. This reduces network coverage blind areas, guarantees the online rate and improves the safety of smart driving.

By using a bandwidth aggregation and balancing mechanism and link quality prediction algorithm, it can guarantee the data quality of priority services, implementing more stable wireless communications and safer driving experience.

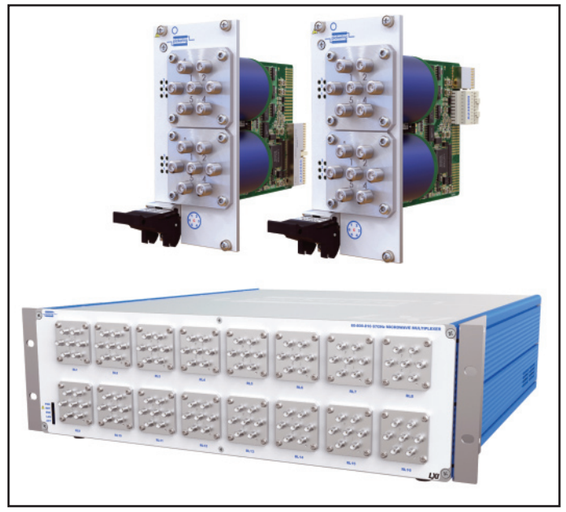
A seamless combination of software and hardware security includes start-up, system and communications security.

It can be used in smart connected vehicle scenarios, such as T-Box, smart antenna, OBU, RSU, smart cockpit and vehicle central control, providing support for safe driving of smart vehicles and even autonomous driving.

Microwave multiplexers up to 67GHz

Microwave multiplexers from Pickering Interfaces are available with a maximum frequency of 67GHz in SP4T and SP6T form factors.

The higher frequency PXI and PXIe multiplexers (model 40/42-785C) and LXI multiplexers (models 60-800 and 60-803) maintain the same physical dimensions as existing lower frequency products, enabling users to upgrade to 67GHz products while maintaining the same slot count and rack height within their test systems.



The introduction of the PXIe format to the microwave multiplexers includes the entire range from 3 to 67GHz.

Applications for these higher frequency modules are ATE systems for aerospace, military and automotive radar, high-frequency communications plus 5G telecommunications and semiconductor test.

The multiplexers are available in unterminated SP4T and SP6T forms using the SMA-1.85 connector interface.

The components used exhibit virtually identical performance up to 50GHz when compared with existing 50GHz switches. This helps maintain performance characteristics for legacy test systems that were previously based on 50GHz components.

In addition, the relays in the 67GHz multiplexers have the same life expectancy of two million operations as lower frequency products from the company.

The 67GHz SP4T and SP6T relays can also be specified in Pickering's turnkey LXI microwave switch and signal routing subsystems. Test engineers can specify their required mix of switch types (SPDT, transfer and so on), frequency and interconnection, plus any non-switching RF products to create a custom option for a specific testing requirement.

Device provides GNSS positioning for adas

Hexagon Novatel has introduced the PIM222A automotive GNSS positioning products for adas and autonomy.

The device delivers precise positioning in demanding applications for mass deployment in adas and autonomous vehicles.

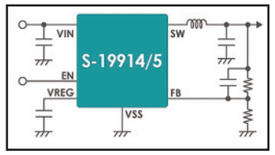
Built with automotive-qualified hardware in a package that is easy to integrate, it leverages Span technology from Novatel to provide accurate position data in urban environments that challenge GNSS availability.

Deeply coupled GNSS receivers and inertial measurement units ensure continuous availability of position, velocity and attitude if satellite signals are briefly blocked.

The device, which was created in collaboration with ST Microelectronics, is a lightweight, power-efficient, solder-down module that increases integration flexibility. The receiver design can be applied to low-, medium- and high-production volumes while retaining an array of features, including options such as multi-frequency, multi-constellation, RTK and dual-antenna precision.

The degree of slow-speed and initialisation performance is increased with the dual antenna, enabling better positioning performance in adas and autonomous driving.





Switching regulator

The S-19914/5 low-EMI step-down switching regulator from Ablic is for automotive use.

It integrates a spread-spectrum clock generation circuit that reduces the conducted emission and radiated emission generated by the IC. Specifically, it reduces conducted emission to a third of the company's previous model.

The device is housed in a 2.0 by 3.0 by 0.5mm HSNT-8 (2030) package to help downsize camera modules. It is PPAP capable and meets AEC-Q100 grade one.

The spread-spectrum clock generation circuit is for adjusting the oscillation frequency to suppress emission peaks generated by specific frequencies, for example, 2.2MHz or higher.

It has a fast transient response and low ripple. PWM and PFM control is selectable. Input is 36V, 45V rating.

As well as automotive camera modules, it can be used for engine, transmission, suspension, ABS, EV, HEV, PHEV and other device applications.

Bidirectional 48 to 12V converter

A 1.5kW, two-phase 48 to 12V bidirectional converter from EPC operates with 97% efficiency in a small footprint.

The EPC9137 is scalable in that two converters can be paralleled to achieve 3kW or three paralleled to achieve 4.5kW.

The board has four EPC2206 100V eGaN fets and is controlled by a module that includes the Microchip DS Pic33 CK256MP503 16bit digital controller.

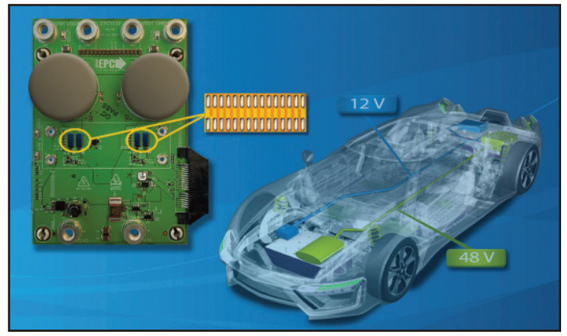
By 2025, one of every ten vehicles sold worldwide is projected to be a 48V mild hybrid. These 48V systems will require a 48 to12V bidirectional converter, with power ranging from 1.5 to 6kW.

The eGaN fets can operate with 97% efficiency at 250kHz switching frequency, enabling 800W/phase compared with 600W/phase for silicon-based products, which are limited due to the limitation on the inductor current at 100kHz maximum switching frequency.

By using GaN fets, it is possible to reduce the number of phases from five to four for a 3.5kW converter while increasing efficiency. The efficiency of a four-phase GaN converter operating at 250kHz is 1.5% higher than a five-phase silicon mosfet-based converter operating at 100kHz.

Overall, the DC-DC converter is three times faster, more than 35% smaller and lighter, and offers 1.5% higher efficiency compared with silicon mosfets.

Additionally, the efficiency and thermal performance of GaN fets enables air cooling instead of water cooling and the small size reduces the need for heat-dissipating aluminium housing.



Switches make direct connections

In-cabin switches from EAO have direct wiring connections and operate on 12 and 24V vehicle systems.

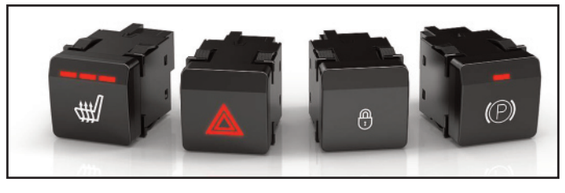
The 09 series of vehicle interior control devices now include the Universal Switch family for E1 application.

With IP5K4 protection, they suit in-cab control applications in electric vehicles, buses, lorries and special vehicles.

There is a choice of ISO 7000 or customised symbol markings. Flexible mounting allows single- or double-row arrays.

The durable surface finish provides the operator with a tactile and haptic experience. Devices are available with firm- or soft-click feedback in long- and short-travel variants.

The modular ergonomic automotive design features an integrated connector recess, enabling an array of up to twelve switches to be installed in a standard Din ISO 7736 radio slot.



Mosfets score on power density

A 0.55mΩ $R_{DS(on)}$ 40V power mosfet from Nexperia comes in the LFPak 88 package for automotive (BUK7S0R5-40H) and industrial (PSMNR55-40SSH) applications.

These devices are the lowest $R_{DS(on)}$ 40V parts the company has produced and they deliver power densities more than 50 times greater than traditional D2Pak devices. They also offer improved performance in avalanche and linear mode, increasing ruggedness and reliability.

Measuring 8 by 8 by 1.7mm, the mosfets have linear mode and safe operating area (SOA) characteristics for safe and reliable switching at high current conditions.

SOA at 1ms, 20VDS operating conditions is 35A due to a combination of silicon and package, while at 10ms, 20VDS where the package dominates, SOA is 17A.

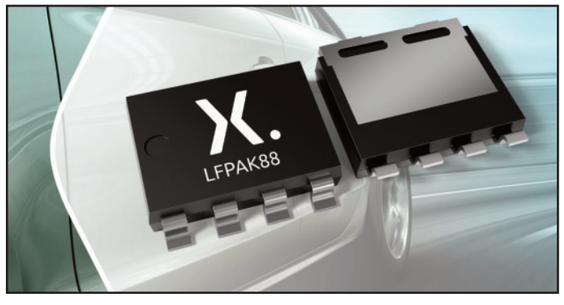
The devices are said to have the best single pulse avalanche rating (EAS) at 2.3J and ID current rating of 500A, which is a measured rather than theoretical limit.

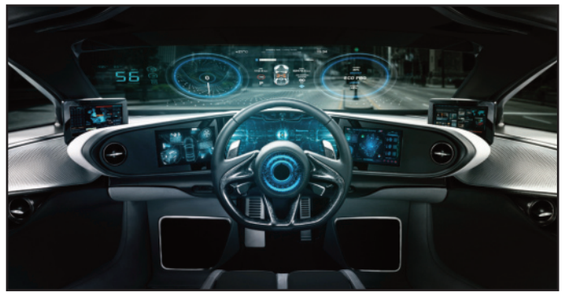
Designers can replace two paralleled old-style components with one LFPak 88, simplifying manufacturing and increasing reliability.

The AEC-Q101-qualified BUK7S0R5-40H parts deliver more than twice the reliability performance demanded by the automotive standard.

Applications include braking, power steering, reverse battery protection, e-fuse, DC-DC converter and motor control applications.

The industrial mosfets suit battery isolation, current limitation, e-fuse, motor control, synchronous rectification and load switch applications in power tools, appliances, fans, e-bikes, scooters and wheelchairs.





Software suite backs Arm GPU

Core AVI has announced a suite of Vulkan-based safety-critical graphics and compute libraries supporting the Arm Mali-G78AE GPU for the automotive, industrial and avionics markets.

The Mali-G78AE is Arm's first GPU IP for safety critical applications. The software includes a Vulkan safety driver, GP GPU algorithms, libraries for Open GL SC1 and SC2, TrueCore, and safety certification artefacts.

These safety-critical software drivers and libraries will be available to support semiconductor designers, OEMs and tier-one developers.

The automotive safety software meets ISO 26262 Asil-D requirements. The software supports the GPUs for safe rendering, adas and autonomy in certified automotive, industrial and avionics applications.

Developed with support from Arm, the software takes advantage of the performance, safety, flexibility and scalability of the GPU, which has safety features to enhance the determinism and robustness of software running on the GPU.

Flexible partitioning lets the GPU isolate in the time and space domains, allowing multiple applications to share the GPU safely and securely.

The software is designed to the Khronos Group's open standards for graphics and compute and will be compatible with various certified real-time operating systems as well as Automotive Grade Linux.

Because the suite is based on the Vulkan safety standard for graphics and compute, the driver allows applications to run directly safety-critical graphics and compute algorithms such as FFT, matrix manipulation and image filtering.

SoCs enable AI from edge to endpoint

Artificial intelligence (AI) SoCs from Xilinx are for edge applications in automotive, robotics, healthcare and aerospace.

The Versal AI Edge devices can enable AI from the edge to the endpoint. They have four times the AI performance-per-watt versus GPUs and ten times more compute density compared with previous adaptive SoCs.

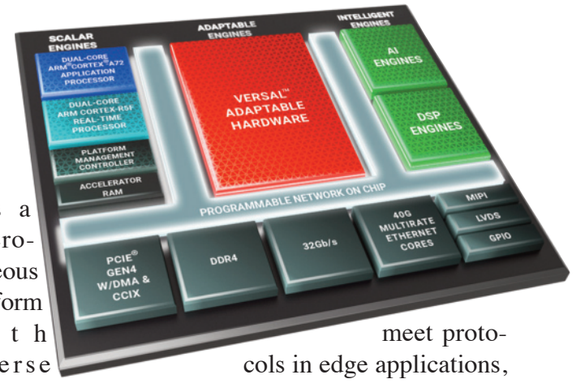
The adaptive compute acceleration platforms (ACAPs) deliver intelligence to applications such as automated driving with high levels of functional safety.

They integrate accelerator ram with an enhanced memory hierarchy for evolving AI algorithms.

AI-enabled automated systems require high compute density that can accelerate applications from sensor to AI to real-time control. These devices achieve this by delivering ten times the compute density versus Zynq UltraScale+ MPSoCs, enabling more intelligent autonomous systems.

Additionally, the devices support multiple safety standards including ISO 26262, where vendors can meet Asil-C random hardware integrity and Asil-D systematic integrity levels.

They take the production-proven 7nm Versal architecture and reduce it for AI compute at low latency, with power efficiency down to 6W and safety and security measures for edge applications.



As a heterogeneous platform with diverse processors, they match the engine to the algorithm, with scalar engines for embedded compute, adaptable engines for sensor fusion and hardware adaptability, and intelligent engines for AI inference that scales up to 479Tops for signal processing workloads for vision, radar, lidar and software-defined radio.

Connectivity blocks include LPDDR-4266, 32Gbit/s transceivers to meet protocols in edge applications, 40G multi-rate Ethernet, PCIe Gen4 with CCIX, and native Mipi support for vision sensors up to 8Mpixel resolution for level-two adas and above.

They include Vivado design tools for hardware developers, Vitis unified software platform for software developers, Vitis AI for data scientists, and domain-specific operating systems, frameworks and acceleration libraries for target applications.

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