ADVANCING ARTIFICIAL INTELLIGENCE

As technology evolves so computing is having to move beyond traditional architectures.
“My experience with Digi-Key has been EXCELLENT! And I am talking about the whole process… Web Site - excellent, pricing - excellent, packaging - excellent, and delivery - excellent. Thank you very much for your service.”

Digi-Key Customer since 2015

What Our Customers Are Saying...

“I prefer Digi-Key to any other supplier. Easier on-line shopping. Great Customer service and most important, best parts search engine.”

Engineer, Digi-Key Customer since 2009

“You guys are big enough now that if you don’t stock a part, it’s a safe bet that I shouldn’t design around it. You guys are great. Keep up the good work!”

Manufacturer, Digi-Key Customer since 2005

0800 587 0991 • 0800 904 7786
Digi-Key.co.uk

6 million+ products online | 650+ industry-leading suppliers | 100% franchised distributor
COMMENT  5
They say that timing is everything and the recent fortunes of two UK companies appear to confirm that

NEWS
Thermal Report suggests engineers are too reliant on outmoded technology  6
Researchers may have found a MEMs alternative to silicon based computing  7
ams looks to focus on its four pillars - optical, imaging, environmental and audio sensors  8
Multi-chip module covers preferred band for mmWave  9
LED technology developer named overall winner at this year’s British Engineering Excellence Awards  10

INTERVIEW  12
The project begins
Newly appointed as the CEO of the Compound Semiconductor Applications Catapult, Stephen Doran talks about his vision for the catapult and the wider industry

COVER STORY
Accelerating artificial intelligence
As the impact of artificial intelligence grows so companies are turning to neuromorphic computing which simulates the functionality of the human brain

AUTOMOTIVE ELECTRONICS
Securing V2X communications
While connected car V2X technology is gaining speed, security considerations are keeping pace, according to Gregory Rudy
Powering industry change
A fabless company looks to take advantage of industry disruption with an SoC targeted at electric vehicle power conversion

DIRECTIVES & STANDARDS  24
Managing standards
Adrian Scrase, CTO, European Telecommunications Standards Institute, talks about the work of the Institute and the technological challenges ahead

MIXED SIGNAL & ANALOGUE  26
An amp for every occasion
Despite the trend towards integration, the choice of opamps available to design engineers has never been wider

INTERCONNECTION  29
Smaller, lighter and faster
As the military gets smarter so the demand for innovative connector solutions continues to grow ever faster

MISSION STATEMENT
‘New Electronics keeps designers and managers abreast of the latest developments in the world’s fastest moving industry’
Microchip offers the most complete portfolio for Controller Area Network (CAN) and Local Interconnect Networking (LIN) solutions worldwide. Our solutions have ultra-low power design in mind and a high level of integration, minimising system cost and complexity.

**CAN – Key Features**
- Flexible data-rate/partial networking capable (ISO 11898-1/2/5/6 and SAEJ2284)
- Unique features and high levels of EMC performance with and without Common Mode Choke
- Grade 0 (Temperature: −40 to +150°C) automotive-approved options

**LIN – Key Features**
- Industry’s first to comply with new automotive OEM hardware recommendations
- Broad portfolio of transceivers, System-Basis Chips (SBCs) and System-in-Package (SiP) devices
- SBC options allow for easy transition to different product options
They say timing is everything and the recent fortunes of two UK electronics companies appear to confirm that.

Let’s start with Imagination Technologies. The IP developer ran into stormy waters a couple of years ago as the stream of licenses on which its business depended dwindled. Those problems saw long term CEO Sir Hossein Yassaie thrown overboard.

Now, what was seen as one of the jewels in the UK electronics crown has been sold to Canyon Bridge, a Chinese backed investment vehicle, in a deal which values it at $550million – a quarter of what it was seen to be worth in its prime. In a separate deal, Imagination has sold its MIPS operation to a US consortium for $65m.

What does the deal mean for Imagination? On the face of it, not a lot. There has been a commitment by Canyon Bridge to maintain operations in the UK and to invest. But with Canyon Bridge’s apparent focus on Asia, how long will that commitment last? And if there is opportunity in Asia, why hasn’t Imagination exploited it already?

Meanwhile, Plessey Semiconductors has come out of a long period of uncertainty. Once another jewel in the UK electronics industry’s crown, Plessey was sold a number of times, renamed, refocused and generally kicked around. But a management buyout and a particularly incisive acquisition of technology has put it in a strong position in a burgeoning global market. That acquisition was GaN on silicon technology, which it is using to manufacture LEDs which enable new types of lighting product.

GaN on Si LEDs not only emit more lumens per unit area, but also dissipate heat more quickly. The result, it claims, are smaller, more reliable LEDs.

And Plessey’s LED expertise has seen it win the Grand Prix at this year’s British Engineering Excellence Awards. According to the judges, ‘Plessey has created the right product for the right market at the right time. In particular, its development of GaN on silicon technology has helped to improve LED efficiency and the judges are heartened to see innovation from a UK semiconductor company’.

Nothing like being in the right place at the right time.

Graham Pitcher, Group Editor (graham.pitcher@markallengroup.com)
Thermal engineers relying on outdated processes

STATE OF THERMAL REPORT IDENTIFIES NUMEROUS BOTTLENECKS. NEIL TYLER REPORTS

According to a State of Thermal report from 6SigmaET, some 66% of thermal engineers must wait at least a day for their thermal simulations to solve. The report surveyed 170 thermal engineers in the electronics industry – including users of nine of the top thermal simulation suites – and asked them to share their views on thermal simulation.

Thermal simulations of electronics are being modelled in ever increasing detail requiring specialist software and powerful hardware. While 66% of thermal engineers must spend a day or more waiting for their equations to solve, 32% are able to complete this step in under an hour suggesting a drastic difference in the capabilities of the thermal simulation packages currently on the market.

According to 6SigmaET’s research there are a number of bottlenecks within the traditional thermal simulation process. Some 39% of thermal engineers must spend over an hour simply importing their CAD models from a design suite into their current simulation platform, while 51% consider the initial model creation stage to be too slow.

Despite these concerns, 60% of thermal engineers have not switched simulation provider for over 3 years, while almost half have never switched.

Commenting on these findings, Tom Gregory, Product Manager at 6SigmaET said, “Given the advancements made in thermal engineering over the last ten years, it’s concerning to see so many engineers still relying on outdated processes and technology to complete their designs. Through advancements such as cloud-solving, there is no reason why engineers should be spending days solving their simulations.

“Our research highlights significant loyalty, with many engineers preferring to maintain a slow or unreliable system that they know, rather than switch to a more modern – yet less familiar – tool. To address this, we believe that many of today’s simulation providers must look to simplify their suites, increasingly automating processes to cut down build times, speed up solving and ultimately shorten the average time-to-market for designs. By incorporating the latest cloud-solving technology, a familiar user interface designed to mimic traditional business software packages, an unstructured-grid solver and automated processes, the latest version of 6SigmaET overcomes all of these issues.”

Imec unveils MOMS based pressure sensor

Belgian nanotechnology research centre imec has developed a pressure sensor based on micro-optomechanical systems (MOMS) technology. The device is said to exhibit excellent measurement precision over a large pressure range while being compact, resistant to EMI. Applications are expected to include high-quality sensing, particularly in the medical and life sciences sectors.

“Our advanced sensor could be used in a variety of (biomedical) applications, such as intracranial pressure or intravascular blood pressure monitoring, where high-quality remote sensing is required. The sensor has also proven its biocompatibility and can be used in combination with MRI technology as there are no metal parts,” said Xavier Rottenberg, principal member of imec’s technical staff.

MEMS-based pressure sensors are said to be popular due to their good performance and small size. Optical fibre sensors, meanwhile, are suitable for use in harsh environments, but are less integrated and more complex and expensive.

Imec’s MOMS-based device is said to combine the best of both worlds, as evidenced by its high precision. Tests have shown root mean square precision of less than 1Pa across a range that could reach 100kPa.
MEMS based approach to shake up computing?

RESEARCHERS MAY HAVE FOUND A MEMS ALTERNATIVE TO SILICON BASED COMPUTING. GRAHAM PITCHER REPORTS.

Researchers at the King Abdullah University of Science and Technology (KAUST) may have developed a MEMS based alternative to silicon based computing. According to the team, vibrating mechanical switches could be cascaded to perform complex computational operations and that the approach could take computing further than today’s technologies.

Researcher Saad Ilyas said: “Electromechanical systems offer a major advantage over existing technology in that they are leakage free; unlike electrical transistors, they only consume power when switched. They also require fewer gates per computing function, resulting in lower complexity, and can be fabricated with higher integration densities – it is even predicted that these systems could be scaled down to the molecular level.”

While MEMS have been investigated in the past for logic operations, the team says it has been a challenge to devise a mode of operation that allows such logic gates to be cascaded to form arbitrary computational functions.

Nizar Jaber and lead researcher Mohammad Younis have developed a technique by which logic operations can be performed using frequency mixing, which holds great potential for cascading. “We use an electrical signal as an input,” said Jaber, “which causes a clamped polymer microbeam to vibrate at a certain resonance frequency. This in turn generates motional current as an electrical signal with the same frequency, which could then be cascaded into the input of another MEMS logic gate.”

‘Simple’ process to manufacture flexible electronics

A development by the University of Wisconsin-Madison is claimed to allow manufacturers to add smart wireless capabilities to any object that curves, bends, stretches or moves.

The team has built what it says is the most functional flexible transistor and claims it has also developed a fast, simple and inexpensive fabrication process which can scale to the commercial level. Targets for the new transistor include wearable sensors and computers.

The group’s work is based on BiCMOS thin-film transistors, supporting analogue and digital functionality. However, the team says that making traditional BiCMOS flexible electronics is difficult, as the process takes several months and requires many delicate, high-temperature steps.

Professor Jack Ma and his team fabricated flexible electronics on a single-crystal silicon nanomembrane on a single bendable piece of plastic. The process is said to eliminate many steps and to slash the time and cost of making transistors. “In industry, they need to finish these in three months,” he said. “We finished it in a week.”

He says his group’s simpler high-temperature process can scale to industry-level production.

Delivering nanosecond accuracy

Microsemi has launched a Serval-T Ethernet switch product family that is able to deliver nanosecond accurate IEEE 1588 solutions capable of meeting next-generation 5G network as well as location-based service requirements.

The family of devices, which includes Serval-T (VSC7415), Serval-TE (VSC7435) and Serval-TE10 (VSC7437), integrates Microsemi’s Carrier Ethernet Switch capabilities with an on-chip phase-locked loop (PLL), helping to expand the company’s portfolio of access networking and timing solutions.

The devices are intended to deliver a flexible combination of 1GE, 2.5GE and 10GE, and are suitable to access communication equipment such as mobile backhaul, small cell and Ethernet access devices (EAD)/network interface devices (NID).

The products leverage a virtualized service aware architecture (ViSAA), which is a silicon implementation that is differentiated by a hardware-based Ethernet service, and also provides operation, administration and maintenance (OAM), service activation testing (SAT) and protection switching capabilities.
Over the past few years ams has changed radically having significantly reduced its historically broad portfolio of products to now specialise in the design and manufacture of advanced sensors solutions that can be found at the heart of many different products and technologies, from smartphones and mobile devices to smart homes and buildings, industrial automation, medical technology and connected vehicles.

Speaking last month at a press event held at the company’s head office in Graz, Austria the company’s CEO Alexander Everke said that ams had been engaged in a broad number of fields.

“Major changes to the portfolio were required and since 2015 we have fundamentally changed direction and are now focused purely on delivering sensors across a number of key vertical markets.

Our sensor portfolio, based on the company’s four pillars, is focused on optical, imaging, environmental and audio sensors and we have been able to take a strong position in all of them.”

Alexander Everke

“With sensors now touching almost every aspect of the digital world that is transforming all our lives, from the environment to personal health, we as a company are now focused on delivering high performance sensor solutions, sensor ICs, interfaces and related software.

“We’re targeting consumer and communications (C&C) and the automotive, industrial and medical (AIM) segments,” he explained. “Based on our revenues in the first half of 2017 those separate areas are pretty evenly split 50:50, in future we want to shift the emphasis towards the consumer space.”

According to Everke the company is looking to differentiate its offering in terms of power, integration and sensitivity, “We’re looking to grow the business by creating solutions that our competitors wont be able to deliver.

“To that end we have 1000 engineers located around the world in the US, Europe and the Far East across 21 design and three manufacturing locations and are currently supporting more than 8000 customers globally.”

Growth is key to the company’s strategy going forward and its focus on sensor technology appears to be paying dividends, with sales racing ahead by 20-30 percent quarter on quarter.

“We’re looking at growing the business at an annual rate of over 40 percent from 2016-19,” says Everke.

“We have a balanced portfolio and have the technologies capable of addressing the megatrends that are unfolding around us every day.

“Sensors is a broad field, so we decided to focus the company’s portfolio on what we call the four pillars which are optical, imaging, environmental and audio sensors and we have worked hard to take a strong position in all of them.

The portfolio, according to Everke, addresses the fastest growing segments in the semiconductor space.

“The growth engine is starting to really kick in,” he says. “The segments we are targeting are ones in which margins are significantly more attractive and where it is still possible to improve performance by using technology and innovation.

“In other sensor areas innovation is already at the edge,” he argues.

According to Everke, “Looking to the future we can use technology to better differentiate our products and crucially none of our competitors have the four pillars we have. In four to five years’ time we will be able to combine these technologies – audio with environmental, optical and imaging for example. Those companies that are unable to do likewise will not be able to compete.”

Everke sees miniaturisation and integration as key differentiators in this market, “as is software, in which we as a company are also heavily investing.”

He continues, “We see the future integration of sensor solutions as key; few, if any of our competitors are able to offer the combination of technologies we can.”

According to Everke the majority of the company’s future investment will be focused on these technologies.

“It’s a simple strategy,” he believes. “ams looks to deal directly with its larger customers while relying on its distribution channels to support smaller customers.

Acquisitions are also playing an important part in the company’s strategy.

“It’s important to have the right people in place and to be able to deliver a complete solution,” Everke believes.

Over the past two years ams has made a series of acquisitions to support its sensor focused growth strategy.

“This year we bought Heptagon, a high end optical packaging specialist and Princeton Optronics to enhance our 3D sensing, AR/VR and automotive applications.”

Everke made it clear that unlike many competitors any acquisition the company makes would have to be driven by the company’s overall technology requirements.

“We are looking solely for technology that will help us to differentiate our product. If it helps, we’ll look to acquire it.

“We need to own those technologies if we are to be serious about delivering a complete solution,” he contends.

“Take 3D sensing, for example. Each new generation of product will become more complex and we need to be able to improve and optimise the solutions we are looking to deliver.

“We believe it’s important that we have that capability in house.”

Primed for growth

TODAY A DESIGNER AND MANUFACTURER OF ADVANCED SENSOR SOLUTIONS, AMS HAS CHANGED RADICALLY IN RECENT YEARS. NEIL TYLER REPORTS

“Our sensor portfolio, based on the company’s four pillars, is focused on optical, imaging, environmental and audio sensors and we have been able to take a strong position in all of them.”

Alexander Everke
Multi-chip module addresses ‘Pioneer Band’

MULTI-CHIP MODULE COVERS PREFERRED BAND FOR MMWAVE 5G.

NEIL TYLER REPORTS

Design house, Plextek RFI, has developed a multi-chip module (MCM) to cover the recently-designated European ‘Pioneer Band’ for millimetre-wave (mmWave) 5G around 26GHz. The development of the Front-End Module (FEM) was carried out in collaboration with Filtronic Broadband.

“The band 24.25 to 27.5GHz was designated at the end of last year by the EU Radio Spectrum Policy Group (RSPG) as the preferred band, or ‘Pioneer Band’, for mmWave 5G,” said Liam Devlin, CEO of Plextek RFI.

The FEM comprises a GaAs low-noise amplifier (LNA), power amplifier (PA) and transmit/receive switch housed in a custom laminate surface-mount (SMT) package measuring 10mm x 10mm. The receive path gain is 20dB across the full band, with a noise figure of 3.5dB. Transmit path gain is 19dB, and the output referred third order intermodulation (IP3) is +36dBm. Low-loss RF filtering has been integrated into the package structure, with a band-pass filter after the LNA and a harmonic rejection filter after the PA. Insertion loss figures are 0.7dB for the band-pass filter and 0.2dB for the harmonic rejection filter.

Progress in developing photonic synapses

Scientists at the Universities of Exeter, Oxford and Münster believe they have made a crucial step towards developing chips that can mimic the way the human brain stores and processes information. The team combined phase-change materials with specially designed integrated photonic circuits to deliver a biological-like synaptic response and they claim that these photonic synapses can operate 1000 times faster than those of the human brain.

Professor Harish Bhaskaran from Oxford University said “Via a network of neurons and synapses, the brain can process and store vast amounts of information simultaneously, using only a few tens of Watts.”

According to Exeter Professor David Wright, “Conventional computers have none of the learning and parallel processing of the human brain but by developing brain-like computing architectures and working in the optical domain we can take advantage of the upcoming silicon photonics revolution.

XP Power acquires Comdel

XP Power has acquired Comdel, a US-based designer and manufacturer of radio frequency (RF) power supplies. The $23 million deal expands XP Power’s product offering into RF power, complementing its range of AC-DC and DC-DC power supplies.

Comdel will become the RF Power Division of XP Power and Comdel’s CEO, Scott Johnson, will remain with the business to head up the new division.

The deal brings a number of new customers to XP Power, particularly in the photovoltaic and induction heating industries.

Commenting on the acquisition Duncan Penny (above), Chief Executive of XP Power, said: “The acquisition will enable us to provide our existing customers with a comprehensive product offering in RF power, a market segment with robust demand fundamentals but one in which we did not previously specialise.”

Lighter, smaller, more durable connectors for any application

OMNETICS

CONNECTOR CORPORATION

www.omnetics.com | sales@omnetics.com

www.newelectronics.co.uk 10 October 2017
Plessey Semiconductors has won the Grand Prix at this year’s British Engineering Excellence Awards for its development of GaN on silicon technology and using it to create LEDs which enable new types of lighting product. According to Plessey, GaN on Si LEDs not only emit more lumens per unit area, but also dissipate heat more quickly. The result, it claims, are smaller, more reliable LEDs.

The judges were impressed. “Plessey has created the right product for the right market at the right time,” they said. “In particular, its development of GaN on silicon technology has helped to improve LED efficiency and the judges are heartened to see innovation from a UK semiconductor company.”

Plessey has developed the manufacturing process to the point where it can make 6in GaN on Si wafers, bringing a range of performance and commercial advantages over other approaches. It has deployed this technology in its LUCIAN PLW7070 LED, in which a single die GaN on Si LED produces 30% more light than comparable devices at half the cost.

Peratech’s 3D Multi-Touch Matrix Sensor was named New Electronic Product of the Year. The passive array of force touch sensors, which features its QTC technology, not only determines position in the X and Y axes, but also adds the third-dimension of pressure. Working even with gloved hands and with stylus, the sensors are said by Peratech to open a whole new world of control options, including force based zoom, scroll and select.

Rob Hanson, Young Design Engineer of the Year, works for Designability; a national charity which creates life-changing assistive technologies. The judges said: “Rob Hanson is an unsung hero, exhibiting excellent use of engineering skills in a difficult arena. He has delivered great designs and is a shining example to other engineers.”

Our Design Engineer of the Year, Jake Wallis from Lontra, has addressed the fundamental geometry of a compressor rotor and is a major contributor to 10 patent filings. As Lontra’s principal engineer, he has changed the design process so that engineers work more closely to create more sophisticated and commercially appropriate products.

New to the BEEAs this year is Engineering Ambassador of the Year. Our winner Iulia Motoc is an Academic Ambassador for the University of Kent, a STEM Ambassador and an Ambassador for the Queen Elizabeth Prize for Engineering. She is involved in judging the First Lego League, presenting at the Big Bang Fair, participating in ‘I’m an engineer; get me out of here!’ and is helping to prepare schools for the Primary Engineer Leaders Award.

According to the judges: “Iulia is a dynamo who has thrown herself into everything in order to ensure as many young people as possible are exposed to the potential of an exciting career in engineering and technology.”

In another new category, Smith Myers was named winner of the New Aerospace Product of the Year for its Artemis system, which uses a missing person’s mobile phone to pinpoint their location. Other winners were: Consultancy of the Year – Drive System Design; Design Team of the Year – Kliklok’s ITC project; Materials Application of the Year – Plessey Semiconductors; New Mechanical Product of The Year – Aeristech’s uCharger; Start Up of The Year – Open Bionics; and Small Company of The Year – Diamond Hard Surfaces.

The following Highly Commended awards were made: Consultancy of the Year – Penso Group; Design Team of the Year – PRaVDA/University of Lincoln; Engineering Ambassador of the Year – TDK-Lambda UK; and Small Company of the Year – Emblation.
IGBTs for Automotive and Industrial Applications

**RGS Series (Automotive)**
- Package: TO-247N
- 650V, 1200V
- Short circuit withstand time: 8-10 µs
- Low switching noise
- Built-in very fast & soft recovery FRD
- Based upon AEC-Q101

**RGP Series (Ignition)**
- Package: TO-252 (DPAK), TO-263S (D2PAK)
- $BV_{ces} = 360V$ to 560V
- Low saturation voltage typ. 1.6V
- Avalanche energy 250 mJ to 500 mJ ($T_j=25^\circ C$)
- Built-in ESD protection diode for gate
- Built-in resistor between gate and emitter (Opt.)
- Based upon AEC-Q101

**RGTV / RGW Series (Industrial)**
- High efficiency
- Smooth and oscillation-free turn-off
- Soft co-packaged diode
- Light punch through & thin wafer technologies
- Package: TO-247N & isolated TO-3PFM
- 650V / 30, 50, 80A: RGTV @ $T_c = 100^\circ C$
- 650V / 30, 40, 50A: RGW @ $T_c = 100^\circ C$
- Low saturation voltage typ. 1.5V ($T_j=25^\circ C$)
- Short circuit withstand time 2 µs (RGTV)

**Visit us!**
- [sps ipc drives](#)
- Nuremberg
- 28. - 30.11.2017
- Hall 1, Stand 320

[Sign Up for ROHM E-Newsletter](#)
Just over a week ago Stephen Doran took up his position as CEO of the Compound Semiconductor Applications Catapult. His remit, to accelerate UK industry’s access and ability to exploit advances in compound semiconductor (CS) industries.

“I want to establish the UK as the premier location for compound semiconductors, and the Catapult offers the UK its best opportunity to achieve this and to become a leader in this technology,” Doran says.

“I want to use the expertise and facilities available to the Catapult to accelerate the introduction of UK developed compound semiconductor technology into advanced systems and ensure that the UK has, and plays, a central part in the developing global supply chain.”

From faster internet connections to improved battery life compound semiconductors can, and are already, improving on the performance of silicon.

“Silicon has proved a great substrate,” says Doran, “but it is fast reaching its speed limit or ‘mobility’, which determines how fast a microprocessor can work.”

Silicon is a single element semiconductor material but by combining two elements, it is possible to create a compound semiconductor which can support much higher ‘mobility’, so faster microprocessors.

“Using compound semiconductors we will be able to supply improved display technologies, deliver faster mobile technology, offer better support gesture control, develop more efficient engine management systems – we may even be able to double the range of electric vehicles, for example - and enable many more devices to operate at temperatures beyond that of current silicon technology,” Doran suggests.

“Our role will be to use the CSA Catapult to provide a link, or bridge, between companies developing novel semiconductor materials, topologies and devices with those companies developing applications and, where necessary, with those organisations looking to provide the finance.”

The CSA Catapult will itself provide commercial support to the sector where gaps exist in the marketplace, Doran explains.

“The Catapult has a unique set of skills to hand and we can support companies providing access to research, services, insight and technical or commercial validation.”

But as well as commercial support it will also offer support in terms of opportunities to collaborate and advice on funding as well as access to expertise from engineers and scientists.

Pioneering CS technology

Doran brings over 20 years of experience to the position, having previously worked at Motorola, Wolfson Microelectronics and Raytheon.

“It’s been a career spent developing and delivering new products at the cutting edge,” he says.

At Motorola he helped develop new mobile products for the European and Asian markets; served as chief operating officer at Wolfson, working alongside the CEO to reposition the company and transform the company’s portfolio and then ran Raytheon’s operations in the UK where he was Director of Operations and Transformation.

“The insights I gleaned from those years in business will now be applied to running the Catapult and placing the UK at the forefront of an industry that some analysts predict could be worth £125billion by 2025,” he explains. “Over a long period of time I have worked to bring new designs and systems to market; working with industry partners our aim will be to ensure the successful application of pioneering CS technology in the UK.”

While measuring the size of the CS industry isn’t quite an exact science, definitions can be a little hazy, recent research suggests that the UK’s share of the global market currently stands at around 9 percent.

“That’s a sizeable slice of a fast-growing market and we don’t want to simply stand still, we want to grow that share,” Doran says.

“We are operating on a pretty level playing field, at the moment. The UK has a good mix of SMEs and Tier One companies in this space and we are currently engaging with a lot of them, and that will accelerate going forward,” Doran suggests. “We need to develop market intelligence and better understand the market. At this point in time, you need to listen twice as much as you talk,” he says.

The Catapult, part of the UK’s nationwide
Before joining the Compound Semiconductor Application catapult Doran worked for 25 years in the electronics industry. Prior to his role as Director of Operations and Transformation at Raytheon UK, he served as Chief Operating Officer at Wolfson Microelectronics, a company specialising in signal processing and mixed signal audio semiconductors.

His work with Motorola saw him with responsibility for new product development and commercial strategy.

The emerging international CS cluster in South Wales received a further boost just a few weeks ago when Infineon Technologies signed a definitive agreement with a company called Neptune 6 under which the latter will be acquiring the old International Rectifier (IR) site in Newport.

The move was welcomed by Doran. “We want to create a campus feel across the cluster, akin to the Fraunhofers in Germany, where academia and industry can come together and collaborate,” he explains.

Doran’s years with Motorola, Wolfson and Raytheon saw him travel extensively around the globe. “I was always struck by the number of former UK residents I met working overseas, especially after the demise of Silicon Glenn. Why weren’t they working in the UK and why do we undervalue our technologists, when compared to other comparable economies? Assuming the leadership of the Catapult is important to me as I want to ensure we bring that talent back to the UK and that the economy delivers on its potential.

“The talent is certainly there and we want to make the most of it and at the CSA Catapult we are determined to create an environment that not only encourages innovation but ultimately attracts Tier Ones back to the UK.”
As a concept artificial intelligence (AI) has been around for many years. It has been at the heart of numerous science fiction novels and films over the decades, but today AI as a technology, let alone a concept, is fast becoming a reality.

Research breakthroughs in machine learning are being driven by advances in computing power, memory, storage, network connectivity, sensors and the software that helps to bring all of this together. Combined with advances in neural networks, which mimic the processes of real neurons, they are bringing AI nearer to reality, enabling new classes of intelligent predictive analytics and devices.

In a world of deep machine learning, systems will be able to process information at a very sophisticated level and, helped by complex decisions could be made faster and adapted over time. Where societal and industrial problems can be autonomously solved using learned experiences,” says Dr Michael Mayberry, corporate vice president and managing director of Intel Labs.

“It’s a future where first responders, using image-recognition applications, will be able to analyse streetlight camera images and quickly solve missing or abducted person reports, or a future where robots are more autonomous and performance efficiency is increased dramatically.”

But while there are benefits to be derived from deploying AI, there are also threats that have been identified and concerns that have been raised.

Earlier this year, the United Nations (UN) warned that robots could ultimately destabilise the world, while the wide scale deployment of robots by industry could risk the return of mass unemployment.
Artificial Intelligence

COVER STORY

Worries were also expressed over the deployment of autonomous devices by criminal organisations or rogue states.

Research from PwC, the consultancy, suggests that 30% of jobs in Britain could potentially be under threat from breakthroughs in artificial intelligence and its research raised the possibility that governments might have to consider legislating for quotas of human workers in the future.

At a recent gathering of leaders in robotics and artificial intelligence, the head of Tesla, Elon Musk, warned of the dangers of artificial intelligence in weaponry, while Professor Stephen Hawking, speaking last year, raised the prospect that powerful artificial intelligence could prove to be ‘either the best or the worst thing ever to happen to humanity’.

If artificial intelligence is to be viewed as a boon to society, what benefits will machines that can learn from their results to improve their programming bring to society and industry alike?

As AI enables machines to learn, reason, act and adapt then the benefits to all sorts of different industries could be enormous and profound, whether through amplifying human capabilities, automating tedious or dangerous tasks, and solving problems faster.

The ultimate potential of AI is enormous, so where are we on this particular road? How much of this is wishful thinking and how much anchored in reality?

Computer giant Intel talks of ‘upstreaming’ artificial intelligence, by which it means engaging much earlier in the production process and reducing barriers to entry for developers, data scientists and technologists so they can ‘unleash the potential of their hardware capabilities’.

Intel also talks about the importance of the AI ecosystem and engaging with it early by delivering essential training, tools and resources to developers, data scientists and students, so that they can share their expertise and knowledge with the rest of the community and help to drive rapid AI adoption and innovation, making ‘artificial intelligence available for all’.

According to Mayberry: “An increasing need for collection, analysis and decision-making from highly dynamic and unstructured natural data is driving demand for compute that may outpace both classic CPU and GPU architectures.”

Robert Bleacher, who is senior vice president, marketing and business development, with Brainchip, agrees. “At Brainchip, we are using AI in our vision systems. “What we are seeing today are fundamental changes in the way that computing is done and how semiconductors are being designed and manufactured. From our standpoint, as a company, the technology holds a lot of promise and is very exciting.

“AI offers an opportunity to do something really revolutionary and will give rise to new chip architectures. What we are seeing is a renaissance in start-ups involved in machine learning and AI.”

Bleacher warns that, while there’s a lot of talk about AI and many companies suggest that they are ‘doing it’, there is certainly a lot of ‘froth’ in the market.

“You need to ‘peel the onion’ to see what is actually happening and whether AI, as strictly defined, is actually being used,” he suggests.

Neuromorphic computing

In a move designed to address evolving technology and to drive computing beyond its traditional architectures, Intel has been working on specialised architectures that can accelerate classic compute platforms.

Intel is not only investing in artificial intelligence (AI) but also in what is called neuromorphic computing.

“Neuromorphic computing builds on decades of research and collaboration that started with work first carried out by Professor Carver Mead at CalTec, who was known for his foundational work in semiconductor design,” explains Mayberry.

Prof Mead’s work combined aspects of chip expertise with physics and biology.

“The ideas were simple, but revolutionary: comparing machines with the human brain. The field of study continues to be highly collaborative and supportive of furthering the science,” says Mayberry.

As part of an effort within Intel Labs, Intel has developed a self-learning neuromorphic chip – codenamed Loihi – that mimics how the brain functions by learning and decision-making from feedback based on various modes of feedback from the environment.

The chip uses data to learn and make inferences, gets smarter over time and does not need to be trained in the traditional way. It takes a novel approach to computing via asynchronous spiking.

The test chip’s features include: a fully asynchronous neuromorphic many core mesh that supports a wide range of sparse, hierarchical and recurrent neural network topologies with each neuron capable of communicating with thousands of other neurons, while each neuromorphic core includes a learning engine that can be programmed to adapt network parameters during operation, supporting supervised, unsupervised, reinforcement and other learning paradigms.

“We believe AI is in its infancy and more architectures and methods – like Loihi – will continue emerging that raises the bar for AI. Neuromorphic computing draws inspiration from our current
understanding of the brain’s architecture and its associated computations,” says Mayberry.

The brain’s neural networks relay information with pulses or spikes, modulates the synpatic strengths or weight of the interconnections based on timing of these spikes, and then stores these changes locally at the interconnections.

Intelligent behaviours emerge from interactions between multiple regions within the brain’s neural networks and its environment.

“Machine learning models such as deep learning have made tremendous recent advancements by using extensive training datasets to recognise objects and events,” says Mayberry.

Brainchip is the first company to launch a product using neuromorphic computing, with the unveiling of Brainchip Studio in July 2017 and, more recently, the Brainchip Accelerator.

“Neuromorphic computing has many attractive characteristics,” explains Bleacher. “The technology we use, spiking neural networks, has the ability to be trained instantly and offer higher accuracy, all with a much reduced compute overhead.”

According to the company these features are crucial, especially for those users who don’t have massive datasets to work with.

“Law enforcement agencies or intelligence organisations looking for a suspect, won’t have thousands of images to work with. Our technology is able to learn from experience and, unlike Deep Learning machines, doesn’t require millions of samples; it learns instantaneously,” Bleacher explains.

“Neurons in our brains learn through selective reinforcement or inhibition of synapses and neuron thresholds; learning occurs when the input is intense or repeated. Our fully digital neurons process input spikes in parallel, so you don’t need a massive network.

“Our Accelerator is the first commercial implementation of a hardware accelerated spiking neural network system,” according to Bleacher, “and should be seen as a significant milestone in the development of neuromorphic computing.”

Intended primarily for use in surveillance, the Accelerator is able to process images much faster and is said to improve the accuracy of object recognition. Six BrainChip Accelerator cores perform user-defined image scaling, spike generation, and spiking neural network comparison to recognise objects or faces.

Potential benefits
The potential benefits from self-learning chips are seemingly limitless. While Brainchip has focused on vision systems, another example could involve a person’s heartbeat reading under various conditions – after jogging, following a meal or before going to bed.

A neuromorphic-based system could take the data and then determine a ‘normal’ heartbeat. The system can then monitor incoming heart data continuously in order to flag patterns that do not match that defined as ‘normal’.

Another use case is in cybersecurity, where an abnormality or difference in data streams could be identified as a breach or a hack since the system has learned what ‘normal’ is under various contexts.

Intel’s Loihi research test chip includes digital circuits that are able to mimic the brain’s basic mechanics, making machine learning faster and more efficient while requiring lower compute power.

The Loihi chip combines training and inference on a single chip which will allow machines to be autonomous and to adapt in real time instead of waiting for the next update from the cloud.

Researchers have demonstrated learning at a rate that is a 1million times improvement, compared with other typical spiking neural nets as measured by total operations to achieve a given accuracy when solving MNIST digit recognition problems.

The self-learning capabilities have enormous potential to improve automotive and industrial applications as well as personal robotics – any application that would benefit from autonomous operation and continuous learning in an unstructured environment.

Not only is it efficient but, according to Intel, it is up to 1000 times more energy-efficient than general purpose computing required for typical training systems.

Early next year, the Loihi test chip will be shared with leading university and research institutions looking to focus on advancing AI.

AI supported by advances in computing and algorithmic innovation, is expected to impact society on a spectacular scale, but as AI workloads grow more diverse and complex, new disruptive approaches like neuromorphic computing will be required when it comes to computing architectures.
The Efus A9X is another compact and inexpensive module in efus form factor designed for easy interfacing and simple baseboard.

- The module offers up to 1GB RAM, 1GB NAND Flash, and 32GB eMMC.
- Available interfaces are 2 x Gigabit-Ethernet, 2 x USB, 2 x CAN, 2 x I2C, 2 x SPI, 4 x UART, GPIOs, 2 x SD-Card, I2S or AC97 for audio, PCIe as well as analogue and digital camera.
- A WLAN /Bluetooth module with chip antenna or antenna socket is an option.
- Displays can be connected via digital RGB and LVDS (up to WXGA).
- A resistive as well as a capacitive touch controller can be connected via the I2C interface.
- Operating systems supported are Linux, WEC2013/7 and Android. Long term availability to 2025.

www.mansky.co.uk

Manhattan Skyline Ltd.
Unit 5, Bracknell Business Centre, Downmill Road,
Bracknell, Berkshire RG12 1QS, UK
www.mansky.co.uk
Tel: 01344 307733

Fast
8 hour service for PCBs • 4 day service for assembly
Reliable
Express services: On time or FREE
Unique
Online assembly from 1 component

Presentation at EDS 2017, 19th Oct
Meet us at stand J52

www.pcb-pool.com
sales@pcb-pool.com
Free Phone UK: 0800 389 8560

PLASTIC ENCLOSURES
Highly attractive and ergonomic cases moulded in UV-stable and flame retardant plastic. Ideal for modern desktop and wall mounted electronics. Flat or with sloping front panel, with or without a recess for a membrane keypad or touch screen. Optional IP 65 sealing kit.

OKW ENCLOSURES LTD
Tel. 01489 583858
www.okw.co.uk

www.newelectronics.co.uk 10 October 2017
Securing V2X communications

While connected car V2X technology is gaining speed, security considerations are keeping pace. By Gregory Rudy.

Test drive any new car and you’ll discover the automotive industry is in the middle of a connected car revolution. From rear view cameras and blind spot detectors to adaptive cruise control and lane assist, an unprecedented amount of electronics is being added each year in the name of improving safety and the driving experience.

Despite these advances, vehicle advanced driver assistance systems (ADAS) are still operating as standalone systems. Each vehicle acts as an island among islands, executing a continuous loop of observe and react similar to human drivers, only faster. However, we can’t react to what we don’t see – and the same is true for even the highest resolution cameras. Dedicated short range communication and 5G wireless communication is changing this forever.

Vehicle-to-anything (V2X) communication is the next generation of connected car capability, allowing for real-time communication between vehicles, road-side equipment, traffic management centres and smart devices. The technology is being heavily promoted by the US Department of Transportation (USDOT) through issuance of a new proposed rule mandate last year and continued funding of proof of concept prototypes, now evolving into connected vehicle pilot programmes across Florida, New York and Wyoming. The reasoning behind the support dates back to decades of research. A 2011 study concluded that ‘deployment of connected vehicle systems and the combined use of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) applications have the potential to address 81% of unimpaired driver crashes in all vehicle types’. Put into context, of the 32,885 traffic deaths that year, more than 26,500 accidents could have been prevented.

Starting with the 2017 Cadillac, V2X-enabled vehicles will be able to send and receive basic safety messages through a wireless radio link. Received messages are combined with current ADAS inputs to extend visibility beyond sight lines to prevent accidents. Several basic safety messages are broadcast per second in moving vehicles, including speed, GPS, position, size and brake status. These messages are received by vehicles within a 300m range and used to determine necessary alerts and actions. With V2V applications like left turn assist and emergency electronic brake light, accidents due to fog and weather will be a thing of the past.

USDOT understands the success of V2X technology depends on cybersecurity and integrity of the safety messages. For V2X to be successful, the system must be designed so hackers are prohibited from modifying messages in transit and sending false messages as a valid end entity (EE). An EE is any system, vehicle or roadside equipment communicating on the network. For this reason, USDOT has partnered with Crash Avoidance Metrics Partners (CAMP), a consortium of seven major automotive manufacturers, to develop the security specifications and proof of concept prototypes behind V2X. The research performed by CAMP and its security
industry partners are setting the groundwork for the deployment of the largest public key infrastructure (PKI) in history, once the new proposed rule making policy (NHTSA-2016-0126) goes into effect.

CAMP and industry partners continue to refine the IEEE1609.2 protocol stack and Security Credential Management System (SCMS) to protect safety messages and driver privacy. IEEE 1609.2 operates on EE devices, much like any network stack, to send and receive messages over any wireless link. Implicit certificates are used in the protocol to reduce size and keep EE devices from having to know each other beforehand. All outgoing safety messages are digitally signed, while incoming messages are verified to ensure they can be trusted.

V2X security uses digital signatures, per IEEE 1609.2-2016, to preserve the integrity of basic safety messages. Since vehicles and roadside equipment need to trust each other, a certificate is included with each message containing a public key corresponding to the private key used to sign the data. When messages are received, the EE first verifies the certificate before using the enclosed public key to check the data. As with all PKIs, the certificate is trusted because it was created and signed by a certificate authority (CA).

The V2X certificate authority consists of sub CA systems, each authorised to generate certificates, under a common root. The CAMP SCMS Proof of Concept Implementation Project provides security services for federally funded V2V and V2I connected vehicle pilot programmes through 2020. The purpose is for research and development only, with the goal of ‘extracting policies, procedures and lessons learned from the design, deployment and operations with a focus on generating public documents for stakeholders who are interested in establishing a National SCMS’.

For commercial development, the INTEGRITY Security Services (ISS) Certificate Management Service (CMS) offers test and production certificates for all OEMs and suppliers preparing for the Notice of Proposed Rulemaking mandate. The ISS CMS distributes V2V and V2I certificates securely direct to vehicle and roadside communication devices. The ISS CMS supports both secure distribution of certificates in manufacturing and over-the-air top-off refills.

In order to ensure interoperability and security of end entity V2X devices, the industry is looking towards the OmniAir Consortium to develop technical specifications. OmniAir has more than 40 participating members and is assuming a leadership role in interoperability testing by organising the next ‘Plugfest by the Bay’, which takes place in San Francisco from 16 to 20 October. Vendors from around the world are coming together to verify interoperability, prior to engaging in OmniAir’s certification process. The previous event in May saw more than 200 attendees from 35 companies and 17 different countries. With test certificates provided by the ISS CMS, vendors are able to verify the CAMP specified EE-to-SCMS message protocol and responses including Enrolment Certificate Signing and Pseudonym Certificate requests.

Kerckoffs’ principle states that a crypto system should be secure, even if everything about the system, except the key, is public knowledge. The same is true for V2X. While interoperability testing continues, industry has begun discussing how production keys should be protected within an EE. Power on self-tests, secure boot, separation and secure updates are recommended to protect the reliability of the EE and V2X signing keys. Along with certification according to the US Federal Information Processing Standard, the merit of each security feature is being evaluated to determine the best solution. “Independent, third party certification for interoperable devices is a vital step that reveals a level of readiness and maturity of the technology,” said OmniAir’s executive director Jason Conley. “Security certificate authorities are also looking at third party certification to meet standards defined by USDOT and OmniAir before granting production certificates.”

V2X technology is about to improve vehicle safety substantially – made possible by years of research engineering a new real-time wireless network where security is built-in from the ground up. Certification ensures proper implementation of standards and should be necessary prior to receiving credentials, all leading to the ultimate goal of V2X technology, to produce messages we can trust. With security addressed, application developers are free to innovate new ways to share critical information and further save lives.
All routes lead to SWINDON...

Experts in Mixed Signal ASIC, SoC and SiP solutions

www.swindonsilicon.co.uk
Over the last decade or so, the semiconductor content of cars has increased dramatically; not only in terms of value, but also in terms of the number of components being deployed. And yet, despite the continual advances in semiconductor technology, the components available to car manufacturers – known in the industry as OEMs – don’t always meet their requirements.

“There are big changes in the automotive world,” said Bruno Paucard, CEO of fabless company Silicon Mobility. “While everyone knows about autonomous driving, there’s also the move to electrification. The electric vehicle (EV) market will be huge, but there are still problems to be solved, such as charging. We have technology that can help to solve some of the big issues in this area.”

Although Silicon Mobility is a recent start up, its technology is rooted in developments by French fabless company Scaleo, which went into liquidation in 2016. In particular, Silicon Mobility is developing the OLEA range of field programmable control units (FPCU), described as a flexible electronic device specialised in rapid computing and decision making in a safe and deterministic fashion. “Our first solution is the T222,” Paucard noted, “which is designed to change the way in which inverters in electric vehicles are put together.”

He believes that one of the biggest problems in this area is that most of the technology comes from ‘another age’. “When you apply that technology to a motor, you pay a price due to the software bottleneck.” He explained that when you want to control something mechanical, reaction times are often in the millisecond range, rather than microseconds. “Motors in modern EVs need to be controlled differently,” he contended. And Paucard thinks the OLEA T222 is a solution.

The T222 is an SoC combining an ARM Cortex-R5 CPU with a programmable logic fabric developed in house (see fig 1). “About half of the companies we talk to want an MCU based solution,” Paucard noted, “while the rest want an FPGA based device. We offer a combination of the technologies and call it an FPCU so they know that it’s something different.”

Paucard sees a number of issues relating to control of e-motors. “Functional safety is important,” he said. “Performance is important. Customers want a device that allows the motor’s operating range to be expanded and for energy to be converted more efficiently during transition stages, such as acceleration or braking. And any controller needs to contain faults..."
and correct them quickly. But there’s also the question of size and thermal management.

“When you put all these together, you start to ask whether it’s a good idea to process information sequentially; what will be the effects of delays? If not sequential, then it has to be parallel processing. But do you use a big CPU or local processing?”

“We have developed a local parallel processing architecture that deterministic and which runs up to 40 times faster than other solutions.”

Highlighting the difference, Paucard suggested that while the T222 can run at up to 250kHz, competitive solutions may only run as fast as 15kHz. “When it comes to acceleration, we can guarantee a response time of less than 1µs,” he asserted, adding “when you use parallel flexible logic for signal processing, you’re not using the CPU, which reduces power consumption by up to 100 times.”

In particular, the T222 is said to address the limitations of ‘legacy’ CPUs. Amongst the issues which Silicon Mobility says it targets are: hard real-time control loop frequencies; non-deterministic architectures; software-based functional safety with no acceleration; high power consumption and heat generation; and software dependency from the use of proprietary cores.

In the OLEA architecture, the programmable logic fabric is called the Flexible Logic Unit (FLU). This is linked to generic and register based configurable peripherals, which Silicon Mobility calls Powertrain ready Peripherals. These form a dedicated interface for the control of actuators and sensors, as well as local data processing. This block is called Advanced Motor Event Control, or AMEC.

With the FPCU architecture, the programmable logic fabric – the flexible logic unit, or FLU – hosts the hard real-time processing algorithms and processes incoming data from sensors, updating actuators independent of the CPU. This allows the CPU to handle functions which don’t need rapid responses.

While the FLU is FPGA-like, it can’t be programmed directly “It looks like an FPGA,” said Paucard, “but it isn’t. It’s difficult to put an FPGA inside a car, so we had to do something to make it functionally safe. It was developed in house and is 100% tested.”

Tightly coupled with the SiLant block, the flash based fabric comprises a matrix of Cluster Logic Blocks, which are a combination of four input look up tables and small DSP blocks. The FLU is designed to meet ASIL requirements and has been hardened to provide maximum reliability.

“In hybrid vehicles,” Paucard pointed out, “motor controllers have two things to process. One is critical fast loop operations, such as torque regulation. The other is slow loop operations, such as speed regulation. The FPCU can process both, while managing the operations as a whole. The fast loop runs on the FLU, while the slow loop runs on the CPU, which also handles communications and housekeeping.”

The SiLant block – short for Safety Integrated Level Agent – is an ASIL-D compliant architecture providing fault coverage and counter measures. Included is a so called Sanity Checker, which provides BIST functionality to detect faults in the logic and memory parts of safety mechanisms. Other features include execution flow control and execution sequence control. “Functional safety is important,” Paucard asserted. “You need to contain faults and correct them quickly.”

Although the T222 will be launched with a single Cortex-R5 core, the use of a phantom core means it can run in lock step. “Future products will probably have more cores,” Paucard continued.

“It’s a flexible hardware based solution that can be focused on energy conversion, but is part of a platform that can be applied to different areas of the car.”

Paucard believes the disruption hitting the auto industry is moving many tasks previously handled by hardware into the software domain. “If you’re an OEM and see disruption from new entrants like Tesla, you need help to find innovative ways of solving problems. Companies like Silicon Mobility and MobilEye are doing things which OEMs can’t.”

One short term development with OLEA will be the introduction of OLEA APP, which will help OEMs to fine tune the T222 to meet specific range, durability and performance targets. The app will work with OLEA LIB, which includes specialised math functions, along with accurate e-motor and battery control. Additions to the OLEA range will address different areas of the car.

The FPCU is set to be manufactured on Globalfoundries’ 55nm Low Power Extended platform, which is automotive qualified, and production is expected early in 2018. “We’re already working with OEMs and Tier 1s in Europe, Asia and North America and the T222 is being designed in. We’re expecting cars featuring the device to be on the road by the end of 2018.

“The automotive business is very attractive when you’re a semiconductor company,” Paucard concluded.
WHAT DRIVES AUTONOMOUS VEHICLES IS WHAT DRIVES US

As an automotive engineer, you have a lot riding on your ability to confidently and efficiently navigate the future of smart, self-driving vehicles. But testing these vehicles is simply too complex, costly, and time consuming for today's traditional methods. With the flexibility of an open, software-centric platform, the widest breadth of I/O, and system-wide synchronization, NI is the only vendor to provide an end-to-end solution to fully simulate and test today's driver-assisted technologies and tomorrow's fully autonomous vehicles.

The road to autonomy is paved with smarter test. Visit ni.com/automotive to see how.
Adrian Scrase, CTO, of the European Telecommunications Standards Institute (ETSI) talks to Neil Tyler about the work of the Institute and the technological challenges ahead.

With over 860 members the European Telecommunications Standards Institute (ETSI) produces globally applicable standards for a broad range of information and communications technologies, from fixed, mobile and radio to broadcast and Internet technologies.

“We support a broad range of technologies,” explains ETSI’s CTO, Adrian Scrase, “and we can honestly say that our standards for GSM, DECT, smart cards and electronic signatures have helped to revolutionise the world we live in.”

One of three standards bodies recognised by the European Union ETSI was established nearly thirty years ago.

“Since then we’ve learned to adapt our structures and behaviours in the face of a rapidly changing telecommunications market,” Scrase says.

ETSI provides a venue for its members to write the standards they need to support new products and services.

“Our membership is large and diverse comprising of manufacturers, research bodies, network operators and governmental bodies. While we are European based and were initially founded to serve European needs, ETSI has become a highly respected producer of technical standards used around the world.”

When it comes to creating standards ETSI works to make the process both efficient and fast.

“When you are considering a new standard critical mass is vital. We require a quorum of four members who are like minded to bring their proposals forward. They will be tasked to build a community of interested parties and formulate a clear technical description of what the proposed standard should, and should not, include. There is then an approval process and if it’s agreed, it will be placed with either one of the Institute’s existing committees or a new one will be established.”

ETSI comprises of a General Assembly which meets twice a year and has a board that runs day to day business. The board oversees a number of technical committees, specification groups, projects and partnership projects.

“We have worked to push power down to the technical level,” Scrase says. “Standards should really be the domain of the technical experts.”

Standards are evolving and having to change as the technologies they look to support move at break neck speed.

“Understandably there is a fear that standards will slow things down,” explains Scrase. “It’s an interesting point worth debating but you don’t tend to have standards going straight to market, it takes time for them to be formulated.

“Industry wants standards because of their obvious benefits. It’s no longer cost effective to operate in national or regional markets, companies are looking for economies of scale and to drive down component costs, and they want interoperability between different systems.

“Standards are crucial in achieving this and we are continually looking to speed up the standards process. Writing a standard is in the hands of the experts, so it is not time dependent but there are a minimum number of days that meetings will be required to discuss proposals and we keep members informed of upcoming gatherings. The process is in the hands of the industry”

Technological developments and the convergence of different technologies is putting pressure on standards making processes, but crucially the influence of bigger members is limited.

“ETSI has plenty of mechanisms in place to prevent abuse, both regulatory and legal in nature. The standards process has a number of guiding rules to which we adhere; our aim is to establish a consensus and that is well documented. While votes are possible we prefer a consensus, we don’t want votes that divide our community ‘for and against’ a proposal.”

Many government bodies are members of ETSI providing direct input into its operations.

“The growing trend has been a move away from regulations to standards,” Scrase contends, “and while standards can result from regulations from government most legislators prefer the industry to voluntarily manage itself. Governments tend to only get involved where industry cannot agree on a solution.
The technology ETSI is contending with is changing fast.

“5G is an obvious example,” Scrase points out. “It comprises of many different components and we are involved in a number of partnership projects. 5G is dependent on specifications that we have written and, as such, ETSI has a pivotal role to perform in standards development.”

Scrase also points to the body’s work in energy efficiency.

“Whatever the system, there is an issue around energy efficiency and our work applies to many varied technical domains.”

ETSI is also developing standards for intelligent transport.

“You can see the results of some of our work in autonomous vehicles when it comes to data exchange and crash avoidance systems, all of which are dependent on radio standards written by ETSI members. Going forward we will have a significant role to play in this developing market.”

Whether ETSI is compiling standards for satellite ground stations or consumer goods, security is a critical issue.

“We have to ensure devices are secure,” says Scrase. “Up until a few years ago security was not seen as an issue, but today hackers are making systems less secure while they are becoming more complex and more open to attack.

“We have to assume that people will be looking to challenge new systems and seek out their vulnerabilities and ETSI is playing a proactive role in establishing standards around security. Today it’s accepted that security cannot be an afterthought and that it comes before everything else. You cannot design a system then add security.”

According to Scrase ETSI works closely with public agencies and experts to ensure that systems are designed to provide enhanced levels of security.

“All the emerging technologies we are seeing today, such as virtual and augmented reality, result in new products coming to market which in turn require new standards. Standardisation follows “first to market” products so we need to really understand the commercial landscape before introducing new standards.

“Standards are necessary as without them it would be almost impossible to ensure interoperability and commonality; users want to be able to use one headset and not be tied to one manufacturer or product.”

Scrase also makes the point that standards have an important role to play in reassuring investors looking to put money into new products and technologies.

“Standards provide a level of assurance otherwise all investors would make decisions on speculation,” he suggests.

Looking again at security ETSI has to consider possible future developments, second guessing what the world might look like in ten to twenty years.

“Take quantum computing,” Scrase explains. “If we are designing systems today they will need to be secure in the future, so we need to take into account the impact of quantum computing on current designs. And in a world where connectivity is driving nearly all markets we need to ensure the ubiquity of connected devices and how the data they generate is collected, disseminated and used.

“It’s hard to see how these various issues will manifest themselves as the rate of change makes it hard to predict.”

ETSI is working with a range of bodies and industries to address these problems.

“We are trying to become more flexible and responsive and are now allowing non-members to participate in the standards process,” he suggests.

“5G and the IoT are likely to manifest themselves in most future products, so how do we encourage industries to engage with us?”

“We’ve had real success with the automotive industry which has been adopting standards that we have developed together and end users, such as the police and ambulance services, are now far more engaged and active in working with standards bodies.”

ETSI will only succeed if we work with others, concedes Scrase.

“Working together is far better and ETSI has a strong belief in the importance of partnership.”
Originally developed to support analogue computers, the op amp has an elegantly simple core design. Simply by wiring in different feedback configurations using passives, it can be massaged into roles that include buffers and integrators as well as high-gain amplifiers. It is little wonder the op amp has been as successful as it has been.

Because the op amp is so readily tuneable, we might expect a few core parts to do almost any job, and for the circuit to be ripe for integration. In practice, the choice of discrete op amps has never been wider.

Steve Logan, executive business manager for Maxim Integrated’s core products groups, says: “If you don’t need terribly high bandwidth, high voltage for industrial systems or very low voltage for portable designs, those are times when op amps can be integrated.”

Op amps often interface electronics to the outside world, so they need to take account of numerous subtly different edge cases, which pushes designers to discrete options. Each variant uses a specific choice of process and circuit topology to take on a job. Logan cites the wrist-worn heart rate monitor, which measures the light reflected back from a green LED. In these systems, input current noise has a large effect on signal quality, calling for op amps that can deliver much lower levels than generic options.

Signal-conditioning of systems can turn out to be more complex than first appears, Logan says. “One application that’s not immediately obvious is driving a high-speed, high-resolution SAR A/D converter; it can be pretty demanding circuitry. The difference between a SAR and sigma-delta is in how it takes a big gulp of current. The op amp has to settle quickly, so you are talking settling time, slew rate and total harmonic distortion. You may need multiple stages to get the settling time, along with an input buffer, plus a gain stage and filter stage in front of that. You might think at first: how tough can it be? Then it turns into a two- or three-stage op-amp circuit.”

Dwight Byrd, marketing manager at Texas Instruments, says: “As demand for further sensors and signals increases, better conditioning and amplification of the sensor becomes paramount, thus making the proliferation of op amps possible.”

Art Eck, senior product marketing manager at Microchip Technology, adds: “We see a trend toward more designer op amps: op amps that are built for a particular application or set of applications.”

Microchip product marketing manager Kevin Tretter notes changes in application needs are creating new problems for op-amp components to address. “With the rapid expansion of wireless capabilities the industry has seen over the years, the presence of electromagnetic interference is becoming a larger issue. Sensitive analogue sensor circuits commonly sit next to wireless communication systems.”

An amp for every occasion

Despite the trend towards integration, the choice of op amps available to designers has never been wider. By Chris Edwards.
modules. More and more amplifier manufacturers are trying to combat the adverse effects by implementing on-chip filtering."

Increased noise is partly a by-product of the shrinking size of many designs, as well as the recent focus on making systems more aware of their surrounding environment. “A lot of designs call for sensors to be added, but for boards to be shrunk,” Logan says.

Byrd notes: “Where the biggest driver in further technology trends comes in is package size. Previously, an SC-70 package was considered one of the smallest one-channel op amps available. Now, SOT553 is becoming commonplace.”

Logan says the trend continues all the way to wafer-level packages, measuring just more than 1mm on the longer side. Such tiny packages support the idea of an ‘analogue insurance policy’, where op amps and similar parts provide additional conditioning and protection such as buffering to integrated mixed-signal SoCs. “For a little extra size and cost, you can add these functions and make them more robust. The wafer-level package lets you do that.”

Tom Kugelstadt, principal applications engineer at Renesas subsidiary Intersil, says there is potential for circuit-level advances that could reduce the need for op-amp proliferation and so aid integration. “The biggest inevitable tradeoff is between low-power and high-bandwidth, or high-speed. In general, high-speed amplifiers require the fast charging and discharging of the gate capacitances of the internal transistors. This requires increases in bias and supply currents, which often leads to increased offset current and voltages. While high-speed op amps have improved significantly in these parameters, they still tower a magnitude above their low-speed, precision counterparts.

“However, there are circuit topologies that aim for increased precision while trading only a minute portion of their high-speed performance. These designs, known as composite amplifiers, consist of a precision amp in open-loop and a high-speed amp in a closed-loop differential configuration.”

The multiple novel circuit topologies that have appeared over the past few decades to deal with problems such as temperature drift and power consumption can have unexpected side effects that designers need to take into account. That adds to the complexity of picking the right op amp.

Logan points to the use of chopper-stabilised amplifiers. “These are great for low offsets, but push the noise out to a single frequency. One that pushes it out to 60kHz is great for DC, but if you have signals that reach 50kHz, you start to get into the noise skirt. These are nuanced things you might not see immediately from the datasheet.”

Frequency-related interactions often need careful examination, says Byrd, and datasheets should show them. “If the output impedance is relatively low and unchanging over a frequency range, it is normally indicative that the op amp will be more stable than one that does have a wide varying output impedance. The output impedance will be interacting directly with the op amp load, and normally a capacitor, it would create various filters as the frequency and therefore the output impedance changes.”

Kugelstadt says interactions with manufacturing choices at the PCB level can introduce unforeseen issues. “High-precision designs using auto-zeroing amplifiers can suffer in precision from asymmetric circuit design. Here, the solder joints around the amplifier form thermocouples that contribute more differential input voltage than the specified offset in the data sheet. Customers unfamiliar with this pitfall blame the device manufacturer for overstating its device performance. The remedy is good application support, such as including layout guidelines in the application section of the data sheet.”

Ying Zhou, TI marketing manager, points out the need to consider how the op amp is designed, particularly if the op amp is being co-opted for a secondary purpose. “If a dual- or quad-channel op amp is already used elsewhere on the board, sometimes the engineers would assign the left channels for comparator functions,” she says.

Although many op amps have input clamping diodes to protect the input transistors but these can affect their behaviour as comparators. Zhou says ‘mux friendly’ versions of op amps that remove the clamps make them more suitable for use as comparators.

Logan notes: “Getting an evaluation kit and putting it on the board is a great thing to do. There is a lot of pin compatibility out there, so you can easily drop another one in to check its performance. But, you do have the issue of having a lot to choose from.”

Tretter concludes: “The industry continues to strive to create the ‘ideal op amp’ and, although we continually get closer to that ideal, there will always be design trade-offs among speed, noise, power usage, size, etc. These trade-offs, coupled with continually growing application specific needs, will continue to drive a variety of amplifier types.”

“Mux friendly versions of op amps are more suitable for use as comparators.”

Ying Zhou

Below: The MAX44250 evaluation kit, one of many such kits available to design engineers
INNOVATIVE CONNECTIVITY SOLUTIONS

NEW

MiniMax 06 and USB3.0
- High density
- Signal & power

UltiMate Power
- IP68/IP69K or hermetic sealing
- Blind mating

LP360 Wearable
- Low profile, easy integration
- 360° mating
- Fully cleanable

See us at EDS, Stand K42
call +44 (0)23 9245 9600
or email Sales@fischerconnectors.co.uk

Visit us on Stand G30
at EDS to find out more

www.fischerconnectors.com

www.andersdx.com

Delivering your Design Goals

From display to full embedded system, the andersDX design team can help you build a product on time, on budget and on spec!
Emerging technologies, whether that’s artificial intelligence, the use of big data analytics, or smart wearable devices and drones, are being appropriated by the world’s military to help improve the effectiveness and capabilities of their armed forces.

As the technology landscape continues to evolve and becomes ever more complex, so more traditional electronic components are having to evolve to support new capabilities.

Connectors may not be considered the most technological of products, but they haven’t been immune to the mega trends sweeping through many industries, not least the need to supply components that are smaller but also lighter and smarter.

In the military space, those changes are significant with product performance and electrical integrity having a huge impact on connector systems and their design, whether in terms of the equipment being used by soldiers, rugged displays, communications equipment or in vehicle electronics.

“Today’s newer electronic instruments can neither afford the space or the weight required by older cabling and connector systems,” says Bob Stanton, technology director at Omnetics. “High performance product is required and it needs to offer customers space and weight benefits but without impacting on performance, reliability or functionality.”

A growing list of connector suppliers are working on replacing two or three connectors with one miniature, dense multi-functional connector, for example, and that is having an impact on the kinds of cables people are looking to choose.

ODU, a supplier of connector system’s, has been working on developing connectors suitable for use with multiple interfaces that will be connecting the soldier of the future with their weapons and communications as well as with military vehicles and, according to the company’s managing director, Nick Harper, has been focused on developing one connector family capable of meeting the requirements for every application. (ODU has been heavily involved with supplying over 100,000 helmet connectors as part of the Ministry of Defence’s Bowman programme.)

While engineers are looking to supply smaller, more compact, connectors they have to also ensure that they are able to withstand temperature extremes, vibration, and be able to operate in an environment that might be sandy, wet or dirty – all of which could compromise the integrity of the connector.

New surface treatments and technologies are being developed specifically to address the extreme environmental conditions expected in the military space.

For example, connector manufacturer, LEMO, has developed NiCorAl a corrosion resistant conductive surface treatment that offers an alternative to Cadmium.

Miniaturisation

“New technologies are driving continuous miniaturisation of electronic equipment for communications, computing, surveillance, sensing and navigation,” says Stanton. “Whether soldier-worn or on-board a unmanned aerial vehicle (UAV) or unmanned ground vehicle (UGV), small size and light weight are demanded – but no performance compromises can ever be accepted.”

Many of the older military specification models are becoming outdated in the face of growing demands for micro- and nano-sized connectors that are needed to address the requirements of higher-technology electronics.

“Trusted military connectors like MIL-DTL-24308 D-subs are being superseded by smaller, lighter alternatives like 83513 and 32139 Micro- or Nano-Ds,” explains Stanton. “Smaller can never mean weaker, though,” he warns. “Although they have very fine pitch (0.64mm for the Nano-Ds), they must be able to withstand environmental hazards like extremes of heat and cold and exposure to corrosive chemicals.”

In order to address this, Omnetics uses open-ended beryllium-copper pins, which are shaped to maintain four continuous points of contact and
Ben Green, Head of New Business at Harwin, agrees. “A key method for protecting front-line troops and ensuring that lives are not placed into unnecessarily dangerous situations is through greater use of smart technology. The interest in UAVs and UGVs has grown significantly, as a result.”

UAVs and UGVs enable the military to undertake a number of operations – including detailed surveillance, the transportation of vital supplies and even recovery missions – without placing service personnel at risk. “These types of vehicles have to rely on the incorporation of sophisticated electronic circuitry and, in turn, the support of high reliability cabling/interconnects – so that the power needed to drive the motors for propulsion purposes and data from an array of different sensors to allow timely manoeuvring can be delivered,” Green says.

“Soldiers can be under huge pressure in action, so speed and convenience are also critical. “At Omnetics we have designed innovative latching Nano-D families that connect securely without fiddly jackscrews, and which pass the stringent MIL-DTL-32139 shock and vibration specifications,” Stanton explains.

Military connectors are also having to contend with another important trend and that is the dramatic increase in the amount of data that is being routed between devices and people.

More data requires more sensors and where data is time critical and where interference is unacceptable connectors that are smaller and more rugged are required.

**Technological arms race**

“Keeping the technological upper hand is critical to ensure military success,” explains Stanton. “Today’s military forces need to maintain their superiority in unfamiliar environments from mountainous deserts to urban areas and, accordingly, soldiers need to be quick on their feet, and unmanned aerial and ground vehicles are increasingly in demand for dangerous missions, close to the enemy.”

“Whether soldier-worn or on-board a UAV or UGV, small size and light weight are demanded.”

To address these demands, defence agencies and their military contractors need to be able to collaborate with suppliers who can provide them with robust, high performance components in small form factors.

“The connectors specified as part of UAV/UGV design and development activity, for example, as with any other military-related application, need to possess elevated levels of reliability, as well as exhibiting high degrees resilience to electro-magnetic interference (EMI),” Green contends.

“Dealing with all these different aspects is clearly challenging, so engaging with the right supplier is absolutely critical,” he concludes.

But there is another reason why equipment needs to be compact, lightweight, and technically advanced, according to Stanton.

“Today’s arms races increasingly pit professional armies against militias that are adept at harnessing powerful consumer technologies, whether that’s smartphones, mobile data, GPS or quadcopters.”

“Overcoming these challenges demands smart thinking about even the finest of details – and that includes the connector.”

Ben Green

Above: Military connectors are having to contend with a dramatic increase in data rates

“Whether soldier-worn or on-board a UAV or UGV, small size and light weight are demanded.”

“Keeping the technological upper hand is critical to ensure military success,” explains Stanton. “Today’s military forces need to maintain their superiority in unfamiliar environments from mountainous deserts to urban areas and, accordingly, soldiers need to be quick on their feet, and unmanned aerial and ground vehicles are increasingly in demand for dangerous missions, close to the enemy.”

“Whether soldier-worn or on-board a UAV or UGV, small size and light weight are demanded.”

To address these demands, defence agencies and their military contractors need to be able to collaborate with suppliers who can provide them with robust, high performance components in small form factors.

“The connectors specified as part of UAV/UGV design and development activity, for example, as with any other military-related application, need to possess elevated levels of reliability, as well as exhibiting high degrees resilience to electro-magnetic interference (EMI),” Green contends.

“Dealing with all these different aspects is clearly challenging, so engaging with the right supplier is absolutely critical,” he concludes.

But there is another reason why equipment needs to be compact, lightweight, and technically advanced, according to Stanton.

“Today’s arms races increasingly pit professional armies against militias that are adept at harnessing powerful consumer technologies, whether that’s smartphones, mobile data, GPS or quadcopters.”

“Overcoming these challenges demands smart thinking about even the finest of details – and that includes the connector.”

Ben Green

Above: Military connectors are having to contend with a dramatic increase in data rates
Master your Bill of Materials with greater intelligence

mouser.co.uk/bomtool