ElectronicsWeekly

Election must not risk UK's digital strategy

The next government must protect UK's global status in digital industries and boost skills

RICHARD WILSON

TechUK and the IET have called for a reinforcement of the current focus on skills and digital innovation after June's snap general election.

"Tech businesses will be looking to the UK's political parties to set out clear plans for how they intend to support economic stability and to keep the UK at the forefront of global technological innovation and digitisation," said Julian David, CEO of techUK.

Professor John Perkins, chair of the IET's skills panel said: "The Brexit vote and the snap general election being called provides the ideal opportunity to highlight the engineering skills shortage in the UK head-on and hear how the political parties would tackle it.

"We need to see commitment that the government's industrial strategy, which included boosting STEM skills as one of its 10 pillars, has support over the long term to ensure a pipeline of future engineering talent."

On Brexit David said: "This election comes at an extraordinarily important time for the UK's digital economy."

The eventual Brexit deal is expected to have a significant impact on the tech sector, as it is closely integrated with the rest of Europe in terms of trade, legislation and research.

TechUK has outlined concerns about a sudden exit from the customs union, leading to increased delays for goods in transit and new contractual obligations on tech companies which could cause interruptions in supply chains.

Ben Hall, managing consultant at recruitment consultancy, MRL Group, said the election provides an opportunity to address the skills issue facing the UK, especially in terms of funding for engineering and computer science in schools and universities. (*See Skill Seekers, p22*). "As educational funding will be a key theme running up to the election it will be interesting to see whether party manifestos include this topic; and furthermore if they address solutions on how to mend the skills shortage plaguing UK companies."

David added: "The next government will need to demonstrate that it understands the needs of the UK's most dynamic businesses by developing a new approach to skills and education fit for the 21st century."

Perkins said: "We may be living in turbulent political times but it's a great time to be an engineer: demand far outstrips supply, salaries are rising and there are fantastic career prospects for tomorrow's engineers. But we cannot rely on these factors to attract enough engineers to address the growing skills shortage in the UK."

MAKE A CAREER IN ENGINEERING AN ASPIRATION

A drive to produce more engineers must target females

Page 22

Apple move hits Imagination share price

Imagination Technologies' share price fell to below 100p for the first time since 2009 last week as the fall-out continued from Apple's announcement that it was planning to stop using Imagination's GPUs.

The company's value fell by more than 60% at the start of April when it was revealed that Apple had given notice that it was developing its own GPU technology and would drop Imagination's within two years.

Apple: extending control of supply chain

Shares in Imagination fell overnight from around 270p to just over 100p, and were trading at 99p as markets opened last Friday (21 April), as *Electronics Weekly* went to press.

This is the latest in a series of Apple moves to take control of its own technology.

See Analysis, p8

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Bidders line up as Toshiba chip sale nears end game

Industrial and global politics muddy the waters as sharks circle mortally-wounded Toshiba in search of an opportunity to score

DAVID MANNERS

Bidding for Toshiba's chip unit has become one of the most interesting M&A sagas the industry has ever seen with government interventions and huge bids.

The scene changes daily but, as *Electronics Weekly* went to press, four key bid groups were in the frame for the business, led by Hon Hai, Western Digital, Hynix and Broadcom, with bids understood to be as high as $27bn.

The winner of the bidding process will be declared in June.

Recent developments have been marked by concerns in the US and Japan that Toshiba's technology will leak to China, where the government is funding two 300,000 wafer-per-month memory fabs. The country's electronics sector lacks 3D NAND process technology and the government appears prepared to pay any money to get it.

Hon Hai's bid worries Japan's authorities because Hon Hai manufactures in China and the fear is that the Chinese will acquire Toshiba's process technology.

To make its bid more acceptable, Hon Hai has called on Sharp, in which it has a 66% stake, to say it will take 10% of Toshiba; on Apple, from which it derives half its revenues, to take a 20% stake; and Dell and Amazon to each take 10% stakes. Another, unnamed, Japanese company may take another 10% stake. Hon Hai has also asked Softbank of Japan to intercede with the Japanese authorities.

Japan is also wary of Hon Hai because of its 2016 takeover of Sharp, which started with a high bid that was gradually whittled down to a low purchase price as Hon Hai found holes in Sharp's accounts.

The Japanese government has also intervened in the process, with funds Innovation Network Corp of Japan (INCJ) and Development Bank of Japan (DBJ) trying, and apparently failing, to persuade other Japanese companies to join in a purchasing consortium.

There have also been elements of scandal after Toshiba's auditors, PricewaterhouseCoopers, refused to sign off its third quarter accounts. Toshiba opted to publish numbers anyway at the start of April, while warning that there was "material uncertainty" about its ability to continue as a going concern. It posted a loss of ¥647.8bn ($5.9bn) for 2016 and is looking to fill a $9bn hole in its balance sheet caused by problems in its US nuclear unit Westinghouse, which filed for Chapter 11 bankruptcy protection in the US in March.

Toshiba's headquarters in Tokyo

Western Digital, meanwhile, says it can block the auction because it is a "very serious breach of joint venture agreements" in a fab deal with Toshiba. Its contract disputes must be arbitrated in San Francisco under International Chamber of Commerce rules, which could delay the sale.

Western Digital wants exclusive rights to negotiate with Toshiba and is talking to INCJ and DBJ about them joining in with a bid.

Broadcom, meanwhile, is bidding with US private equity firm SilverLake and may be joined by INCJ and DBJ.

Korean group Hynix is making a joint bid with US private equity business Bain Capital. It has also talked to Japanese banks about including them. As *Electronics Weekly* went to press, the head of Hynix, Chey Tae-won, was due to meet the Toshiba board on 24 April.

THIS WEEK'S TAKEAWAYS

260

260 jobs are under threat as US manufacturer announces plans to close Scots electro-mechanical engineering factory
P6

12,000

Only 12,000 TR808 drum synthesisers were made but the analogue device gained a cult following that still persists. (Obituary of Ikutaro Kakehashi)
P16

21

There are 21 categories in the 2017 Elektra European Electronics Industry Awards. Full details of how to enter
P24

NEWS IN BRIEF

The chip market will grow 12.3% this year, according to Gartner, reaching $386bn. PC DRAM pricing has doubled since the middle of 2016, said Gartner. A 4Gbit module that cost $12.50 has jumped to just under $25. NAND flash ASPs increased sequentially in the second half of 2016 and the first quarter of 2017.

ST has invested $2.5m in the Irish fabless company Decawave. The ST investment comes through ST New Ventures – ST's six year-old venture capital arm. Decawave has now raised over $30m from LG, Dermot Desmond's IIU vehicle, Bank of Ireland private clients,the Texas-based Charnov family, and SC Partners of France.

E.Ink and Sony Semiconductor are to set up a joint venture to develop, manufacture and market products that use electronic paper displays. E.Ink and Sony will have 35% each of the business, with the remaining 30% held by venture capital companies. The joint venture aims to create new electronic paper display products and systems and to grow the market of e-paper-based solutions.

MasterCard plans to launch a biometric credit card in Europe later this year that will authenticate a purchase via fingerprint ID. Trials of the system are under way in South Africa. Apple Pay and Android Pay both use fingerprint ID.

The Arduino CTC 101 education kit for teaching the fundamentals of electronics, programming and mechatronics is now being sold exclusively in Europe by RS Components. Aimed at 13- to 17-year-olds, the kit has five themed modules and offers more than 25 hands-on experiments.

5G demonstration for the Winter Olympics

Joint project will link terrestrial wireless with satellite comms to prepare 5G for 2018 games

STEVE BUSH

French research lab Leti has announced the establishment of a European and South Korean joint project intended to deliver the world's first fully integrated and operational 5G prototype at the 2018 Winter Olympics.

Called 5G Champion, the project aims to showcase key enabling technologies and create a proof-of-concept environment at the games, which take place in PyeongChang, South Korea in February.

It will be the work of eight European and 13 Korean partners (*see box*) and have 5G radio-access, core-network and satellite technologies.

Leti telecoms strategy director Emilio Calvanese Strinati said the project "will allow maximum visibility for the available technology two years ahead of the official launch of 5G in 2020".

According to Leti, the project will be the first time ever that terrestrial wireless communication, including enablers such as mmWave access, will be combined with satellite communication.

The Grenoble-based research institute said this would form a 5G network with multi-radio-access technologies [multi-RAT] that are optimised to serve user equipment. The project will focus on five key areas:

- improving latency in the millisecond range
- providing high throughput in very dense user environments
- enabling cost-effective network management
- enhancing quality of service in high-speed mobility conditions, high precision/integrity location and timing estimation
- allowing ubiquitous service provisioning, as well as flexibility in equipment reconfiguration through software.

See Comment, page 14

Project partners

Europe: Leti, Nokia, Intel Deutschland, Thales AS, Fraunhofer HHI, University of Oulu, Tlepespazio, iMinds

South Korea: Electronics and Telecommunications Research Institute (ETRI) (the Korean project coordinator), SK Telecom, KT, SMRT, Eluon, Clever Logic, Insoft, Mobigen, HFR, Gwangju Institute of Science and Technology, Seoul National University, Dankook University and Hanyang University.

5G smart bandage trial due

Smart bandages that connect to 5G networks to update doctors on the healing progress of a wound are likely to begin trials within a year.

Swansea University's Institute of Life Sciences (ILS) is developing the bandages, which would include sensors that can detect complications such as blood clots or infections and pass the information to doctors via 5G networks.

The programme would also collect data through patients smartphones about their activity levels, which can affect the speed of recovery.

Ultimately, the technology will collect a range of data that would help doctors assess the patient's treatment needs and reduce the need for unnecessary appointments.

The research is part of Swansea's £1.3bn Swansea Bay City programme, which aims to create a 5G test hub.

Professor Marc Clement, chairman of the ILS, told the BBC that the future holds "a world where there's the ability to vary the treatment to the individual, the lifestyle and the pattern of life".

The bandages will be manufactured using 3D printing technology.

Clement described the project as a "multi-technology approach" that incorporates nanotechnology, nanoelectronics, printing and coating biochemistry.

NI gives $1m to NYU for 5G radio

National Instruments (NI) is working with the wireless research centre at the New York University Tandon School of Engineering to fund the development of millimetre-wave (mmWave) communications, channel measurement and channel emulation research for 5G communications.

NI has given almost $1m to the group, including equipping labs with software defined radio kit and software.

MmWave frequencies have been proposed by the FCC, 3GPP and other standardisation bodies for 5G fixed and mobile networks.

IET and union call for support for returnees

Professionals' trade union Prospect and the IET present a united front on reclaiming skilled workers

RICHARD WILSON

Engineering employers need to stop seeing career breaks as a problem if the industry is to overcome its skills shortage, the Institution of Engineering and Technology (IET) and trade union Prospect have argued.

The organisations are working together to help employers in the engineering and technology sectors to attract a wider talent pool, including career returners.

They have published a guide for employers, *Supporting the Step Back into STEM Careers*, hot on the heels of the government's new investment in schemes to help returners. It highlights the importance of offering flexible working and rethinking how and where to advertise jobs. It also outlines the importance of developing a more inclusive and diverse internal culture.

Watson: Career breaks should be valued

IET president Jeremy Watson said: "As the engineering skills shortage continues to grow, our sector must move away from the misconception that career breaks get in the way and are a problem. Instead, STEM employers should view career breaks as periods of self-development and develop a culture that accommodates and values these breaks and the skills and competence of those members of staff that are currently being overlooked and sidelined."

The IET states that sidelining of highly skilled, experienced engineers and other STEM professionals in favour of candidates with continuous service is exacerbating the skills shortage.

Sue Ferns, deputy general secretary at Prospect, the union for professionals, said: "Engineering still faces significant challenges of gender segregation and, particularly at a time of skill shortages, needs to draw on all of the UK's talents and expertise."

For more on skills see p24

Binder chooses Anglia to handle its connectors

Circular connector specialist Binder has appointed Anglia Components as distributor for the UK and Ireland.

The move is part of a strategy to grow its customer reach across industry sectors such as automation, measurement and control, medical and renewable energy.

Specifically, Anglia will stock items from the Binder range of sub-miniature and miniature circular data and power connectors.

"We are constantly looking at ways to expand and gain access to markets, applications and customers that we don't currently reach," said Binder UK managing director David Phillips.

"We've explored a relationship with Anglia very thoroughly, and they have fully demonstrated their ability to help us grow, particularly with UK based CEMs," he said. "Anglia is unique in the UK market both in terms of its size and the professionalism with which they go to market."

Survey says hacks cost firms £20K

Almost seven in 10 large businesses have faced cyber attacks, racking up an average cost of £20,000, according to the *Cyber Security Breaches Survey 2017* compiled by the Department of Culture Media and Sport.

The survey shows that businesses that hold electronic personal data about customers were much more likely to suffer cyber breaches than those that do not (51% compared to 37%).

The survey also revealed that almost a quarter of those attacked experienced a temporary loss of files; one fifth had software or systems corrupted; one in 10 lost access to third-party systems on which they relied; and one in 10 had their website taken down or slowed.

MoD image processing team to boost surveillance

The Ministry of Defence (MoD) Defence Science and Technology Laboratory (DSTL) has contracted a team to enhance its capabilities in real-time image processing.

The team will also demonstrate the latest adaptive capabilities that FPGA-based SoCs can deliver to defence and security surveillance applications.

Led by Plextek Services the team includes RFEL and 4Sight Imaging.

To develop the platform, it will be expected to solve complex defence vision and surveillance problems, facilitating the rapid incorporation of best-in-class video-processing algorithms while bridging the gap between research prototypes and deployable equipment.

Plextek business manager for defence, Peter Doig, said: "RFEL and Plextek have brought together their expertise with DSTL and 4Sight's adaptive algorithms, to create a single environment that delivers a robust proving tool."

For more on high-reliability systems, see p20

NEWS IN BRIEF

Qualcomm Technologies has selected an RF test system from Rohde & Schwarz to test and characterise its first generation 5G RF transceiver (SDR051). Qualcomm announced its Snapdragon X50 5G modem platform in October 2016. It supports download speeds of up to 5Gbit/s, initially using very wide bandwidths available in the 28GHz millimetre wave band.

An energy efficiency benchmark for microcontrollers and Bluetooth radios used in IoT designs has been created by the US-based EEMBC. Called the IoTMark-BLE, it is the first of a suite of benchmarks that the EEMBC is proposing to create through its IoT working group.

NXP has produced a near field communication (NFC) tag to track bottles of booze. Packaging company Guala Closures Group worked with NXP on the chip. The tag uses NXP's NTAG 213 Tag Tamper technology to check the origin of the bottle, detect whether it has been opened, and create a URL for each bottle.

An EU-funded project has been launched to help businesses meet the challenge posed by data. The University of Southampton's electronics department will play a lead role. Data Pitch aims to create what it calls an 'innovation ecosystem' where larger organisations and startups can work together to use data as an enabler to solve their business problems.

Facebook is developing technology to allow people to use just their thoughts to instruct a mobile phones to type at up to 100 words per minute. The social media giant has put together a team of 60 people, including machine learning and neural prosthetics experts, to develop the system, which could also contribute to its plans for augmented reality applications.

Synapse Design of Santa Clara, California has bought Asilicon of Ranchi Jharkand, Bangalore. The deal brings Synapse 80 engineers and a second design centre in India. Over the past year, Synapse Design has taped out 35 complex SoCs using process technology ranging from 28nm to 7nm.

260 jobs to go as US firm closes Scots site

Jabil scraps plans for Livingston 'centre of excellence' and opts instead to close the site down

JOSH BROOKS

Electronics manufacturing services giant Jabil has announced plans to end manufacturing at its Livingston site with the loss of 260 jobs.

The group has begun a consultation with staff at the facility about the planned closure and expects to end manufacturing at the site in a phased run-down that will be complete by the end of the year. Around 100 support staff will continue to work at the site and the company said that its Ayr facility would not be affected.

Jabil Livingston provides a range of EMS services, according to the group's website, including complex electronics assembly and complex mechanical and electronics assembly. The bulk of its work is for emerging technologies in the energy generation, storage and monitoring, instrumentation and telecoms sectors.

Jabil factfile

- Founded: 1966
- CEO: Mark Mondello
- HQ: St Petersburg, Florida, US
- Locations: 100 facilities in 28 countries
- Employees: 180,000
- Revenue: $17.9bn in 2015
- Key services: engineering, manufacturing and supply chain

The company said: "Following a detailed strategic review of the Jabil Livingston site business plan and future loading requirements, we have concluded that there is unsustainable current and future demand to support the viability of the site."

The company added that the decision was "in no way a reflection on the hard work, dedication and loyalty of our Livingston-based employees" and said that it would support them through the consultation process and their future job-hunting.

The announcement comes just two years after the group announced a major £12.5m investment in its Livingston operation that was intended to create about 200 jobs and was supported by the Scottish government. According the *The Scotsman* that deal was secured by First Minister Nicola Sturgeon on a trip to the US to meet with the company. At the time, it was reported that Jabil planned to create a centre of excellence at Livingston, one of only three in its global portfolio of companies.

EMS business Lenalea Electronics is investing more than £1m in a new 1,500m² factory in County Armagh and increasing its workforce from 25 to over 30. The new facility, currently being constructed in Markethill, will produce circuit board assemblies for clients in sectors including quarrying, scientific research, and consumer electronics. The company, founded in 2000, has customers across the UK and Ireland, as well as in Europe and North America. Pictured, from the left, are Lenalea production manager Neil McMullan, Sheila Donaghy of Ulster Bank, which is supporting the project, and Lenalea project manager David Foster.

TI's Greenock fab in peril

Hopes are fading that a buyer will be found for Texas Instruments' (TI) Greenock fab, according to local councillors. TI announced plans last year to phase out production at the facility by 2020, which currently employs more than 300 people, but said it would also seek a buyer.

Councillor Stephen McCabe told *The Greenock Telegraph*: "It's looking increasingly unlikely that anyone will take over the plant as a going concern. There is no longer any 'live' interest in it. It is not beyond the bounds of possibility that further interest will emerge, but we now have to think about alternative uses for the site."

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Apple presses on with vertical ambitions

David Manners considers the implications for suppliers of Apple's latest moves in IP and silicon

Eleven years after Steve Jobs' 1997 'second coming' as CEO of Apple he bought processor design company Palo Alto Semiconductor for $287m.

In 1997 Apple had been 90 days away from bankruptcy but by 2008 its finances were transformed by the iMac, iPod and iPhone. Buying PA Semi signalled that Apple wanted control over its silicon – and could afford it.

Four years on, in 2012, the fruit of the PA acquisition was the Apple A6 system-on-chip (SoC) which used Apple-designed, ARM-compatible (but not ARM-licensed) CPUs called Swift.

For mobile processors the situation was clear – from now on, Apple made its own. For the rest of the silicon industry the message was also clear: Apple can dump you. It may take a while, but it can be done.

As the world's second largest buyer of silicon last year, spending $30bn to buy 9% of the world's supply of ICs, Apple's procurement strategy has a massive effect on the semiconductor industry.

GPU vision

That strategy has now turned to graphics processing units (GPUs), with Apple poaching engineers from Imagination, setting up a GPU design centre in London and telling Imagination it won't need its GPU IP in a couple of years.

It didn't happen overnight. Apple first licensed Imagination's GPUs in 2008. About four years later it started customising Imagination's IP to design proprietary GPUs based on the Imagination architecture, with the first results implemented in the 2014 A8 SoC.

Imagination has huffed and puffed about suing Apple if Apple's GPUs infringe Imagination patents. But, even if Apple is concerned about a writ from Imagination, which is doubtful, Apple could license IP from Nvidia, AMD or ARM. Or it could have – and may well have – developed its own GPU architecture already.

After CPUs and GPUs, the next Apple-grab for proprietary silicon could be power management chips. Rattling Dialog's cage is the fact that Apple may be setting up PMIC design centres in Munich and California, according to a *Reuters* report.

Recognising its dependency on Apple, which accounts for around 70% of its revenues, Dialog tried, and failed, to buy AMS last year. It must now be considering other options for minimising the effects of a design-out.

Audio chips are another possibility for Apple to internalise its silicon sourcing.

Here the potential casualty is Cirrus Logic, acquirer of Wolfson after Wolfson lost its Apple slots. Cirrus Logic is dependent on Apple for around 80% of its revenues.

Then, of course, there's Intel, which supplies x86s for iMacs. There has been talk for years that Apple will cut them out in favour of proprietary processors. With the poisonous state of relations between Qualcomm and Apple it would be understandable if Apple wanted to free itself of Qualcomm's modem and the company's attendant royalty demands, so it may well be looking to integrate the modem on to its mobile SoCs and so eliminate both Qualcomm and Intel from its modem slot.

Both Skyworks and Qorvo derive around 40% of their sales from Apple for their RF components and both must be feeling vulnerable to an Apple in-house design effort.

Sensors drive

Sensor technology is another area where Apple is increasing its in-house expertise, which is a potential worry for ST and InvenSense. With ST, Apple is developing 3D image sensors at Crolles which are expected to be used to deliver augmented reality features to this year's iPhone.

Other sensor projects at Apple include bio-medical device development with one, five-year-old, project about to begin feasibility trials of a non-invasive blood sugar monitor, possibly using optical sensors shining light through the skin, for the treatment of diabetes. Apple hired a team of biomedical engineers out of medical research companies to work on the project in Palo Alto.

If the iWatch is ever to fly, it will probably need capabilities like this. There are almost certainly more, secret, silicon-based projects to provide new mobile functions in Apple's $10bn annual R&D budget.

However, the company's next major move into silicon could be another acquisition. Nine years after the PA Semi purchase, Apple, now the world's most valuable company, is rumoured to be joining its assembly partner Hon Hai in a $27bn bid for Toshiba's chip business..

That would give Apple fab as well as design and, as Hon Hai already owns Sharp, it would also give Apple a stake in OLED technology.

With silicon design, fab, 3D NAND and displays – Apple would be very much nearer to the vertically integrated model of its chief rival Samsung.

Is Apple setting up a power management IC (PMIC) design centre at its California campus?

KNOWLEDGE IS POWER

Massive power density in the smallest packages

Microchip Technology now offers an integrated switching power module designed specifically for height-constrained telecom, industrial and solid-state drive (SSD) applications. These products come in an impressive thermally-enhanced package that incorporates inductors and passive components into a single, molded power converter. The slim packages simplifies board design, saves space and eliminates concern over passive components that may introduce unexpected electromagnetic interference (EMI).

Highlights

- Variety of module package offerings (small to large, fit to application)
- High power density with integrated magnetic and passive components
- Performance (efficiency, thermal, transient response)
- Reliable (power and thermal stress tested)
- Low EMI (CISPR 22 Class B ratings on modules)

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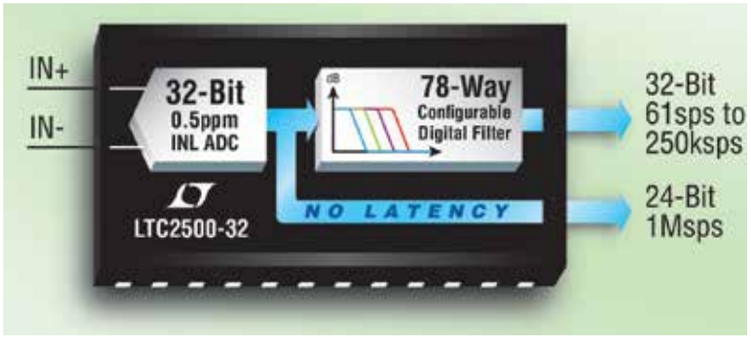
32-bit SAR ADC has filtered and no-latency output options

Linear's latest analogue-to-digital converter hits 2ppm non-linearity and up to 148dB dynamic range, with seven filter types

RICHARD WILSON

A 32-bit successive approximation register (SAR) analogue-to-digital converter (ADC) with dual outputs and digital filters to optimise signal bandwidth has been introduced by Linear Technology, now part of Analog Devices.

The LTC2500-32 provides a digitally-filtered output that achieves up to 148dB of dynamic range as well as a no-latency output comprising an over-range detection bit, a 24-bit representation of the input voltage difference, and a 7-bit representation of the common mode input voltage. The no-latency output is matched to the digitally filtered output, avoiding the mismatch and drift typical of applications requiring an additional faster ADC to monitor signal integrity in parallel with a precision ADC. Each of the two outputs provides an accurate representation of the voltage difference applied between the two input terminals.



The integrated configurable digital filter offers seven filter types and 13 different down-sampling factors. This allows designers to trade off bandwidth, filter response and noise performance for each application.

The ADC has specified linearity of 0.5ppm typical and 2ppm guaranteed maximum INL, and negligibly low gain and offset drift over wide temperature ranges.

Wearables power controller works down to 0.7V for button cells

Maxim Integrated has unveiled the MAX20310, a power management IC for wearables that will work from as little as 0.7V and up to 2V, for operation from single zinc-air, silver oxide and alkaline cells.

The aim is to allow disposable rather than rechargeable cells to be used to remove the need for charging components and, in clinical environments, remove the need for contacts, clips, and charging ports where germs may linger. The firm, said: "In clinical environments, primary cell architectures can create hermetically sealed units to safely disinfect between use or even dispose of completely to inhibit patient-to-patient infection."

Using a single-inductor two-output architecture with two linear regulators, the chip drives four power outputs from a single inductor.

For pre-use product storage, there is a 10nA 'battery seal' mode.

Operation is over -40°C to +85°C, and it comes in a 1.63x1.63mm wafer-level package.

An application circuit in the abridged datasheet (full not publicly available) shows the chip being used with a MAX32620 ARM Cortex-M4F based microcontroller.

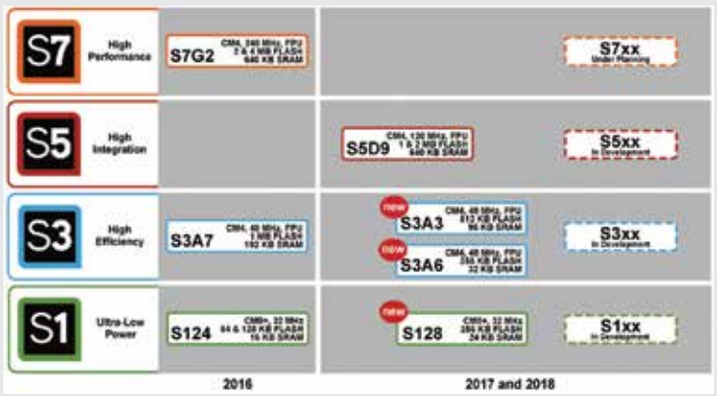
PRODUCT OF THE WEEK

Renesas adds more MCU options to its IoT range

RICHARD WILSON

Renesas Electronics has added new microcontrollers to its Synergy range of IoT-focused devices and software.

With the latest MCUs – S128, S3A3 and S3A6 families – there are now 57 devices based on ARM Cortex-M CPU cores covering operating frequencies from 32MHz up to 240MHz, and on-chip flash memory sizes of 64kB, 128kB, 256kB, 512kB, 1MB, 2MB, and 4MB.



Renesas Synergy platform roadmap includes microcontrollers, tools, software

The 20 new Synergy MCU devices in the S128, S3A6, and S3A3 groups are sampling now to lead customers and will be available to the general market in June.

With Synergy, Renesas combines the ARM Cortex-M series microcontrollers with verified software and a software suite which has its own APIs.

Peter Carbone, vice-president of the Synergy business at Renesas, said: "With the addition of these latest three MCU groups to the MCU portfolio of the Synergy platform, it now covers the entire selection range of memory and package sizes our customers request, and we provide the ability to easily scale up and down between them, which includes software and tools to reduce redesign efforts."

System developers with leaner requirements can select devices from the S3A3 and S3A6 groups to scale their applications down to 512kB and 256kB flash memory as needed, compared to the existing 1MB flash MCUs in the S3A7 group.

The S128 group extends selections for ultra-low power applications that require larger memory up to 256kB, or require additional analog signal conditioning, compared to the existing S124 group MCUs.

LDO accepts inputs to 24V

A low dropout regulator from Diodes has launched with a 3.5V to 24V input range which allows for operation from standard 5V, 9V and 12V system power rails with sufficient overhead to cope with supply transients.

The dropout voltage is 250mV at an output voltage of 5V and load current of 50mA, while the device's low quiescent current of 1.8μA minimises standby power and extends the operating life of battery-powered equipment.

Regulated output voltage variants at 3.0V, 3.3V, 4.15V, 4.4V and 5.0V are offered, supporting common point-of-load requirements.

The AP7380 LDO regulator is designed to maintain a room temperature output accuracy of 1.0% under all I/O voltage conditions up to a maximum rated load current of 150mA.

Colour sensor maps LED light outputs

AMS has introduced a tunable-white lighting smart system sensor to provide closed-loop colour temperature tuning and daylight compensation.

The AS7225 has an embedded tri-stimulus CIE XYZ colour sensor with direct mapping to the International Commission on Illumination (CIE) 1931 colour space which is recognised as the standard co-ordinate definition for human colour perception.

CCT and daylighting tuning directives are communicated to the host microprocessor via an industry-standard I^2C interface. The sensor is available in a 4.5x4.7mm LGA package, for designing into luminaires, light-engines and larger replacement lamps.

The device provides precise CCT tuning direction between configured warm and cool white LED strings in a luminaire. The AS7225 can also be used looking outward in luminaire designs to provide daylight control.

Solid state relay is DIN-mountable

Relay offers high-speed switching with integral heatsink for process control in automation

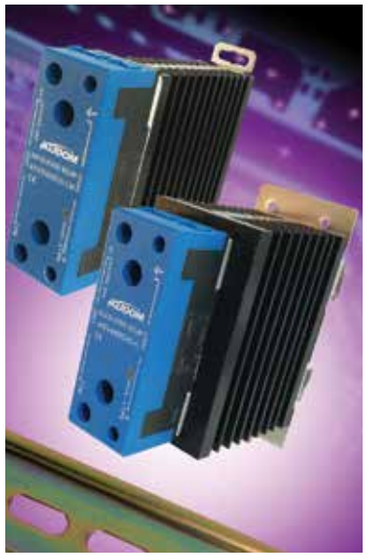
RICHARD WILSON

For high-speed switching applications, Switchtec is selling Kudom's KSV series solid state relays (SSR) which are DIN rail-mountable and come with an integral heatsink.

Intended for use in applications including PLC interface duties and process control in automation, the relays are supplied complete with a built-in heat sink, DIN rail mounts and surface mount clip.

The SSRs have a fast operating time of 1ms and provide silent switching.

The KSV series is available in four current ratings, 10A, 20A, 30A and 40A and are suitable for switching loads up to 280Vac or 530Vac for 240Vac and 480Vac relays respectively.



The relays are available with control voltages of 4Vdc-32Vdc or 90Vac-280Vac, dependent on the version selected.

All types are available with zero-crossing turn-on to minimise electrical interference, or random turn-on for fast switching applications.

The 10A, 20A and 30A relay versions measure 81x30x110mm,and the 40A version is 120x 50x110mm.

KSV relays are supplied fitted with a built-in LED that displays the 'on' status of the relay when lit.

The relays can operate in an ambient temperature range of -30°C to 80°C.

Sensor benefits from larger back-lit pixels

ON Semiconductor has developed its first CMOS image sensor based on a 2.2µm back-side illuminated pixel technology. Intended for security and surveillance applications, the AR0521 is a small optical format of 7.13mm, five-megapixel image sensor with an active pixel array of 2,592x1,944.

It captures images in either linear or high dynamic range (HDR) modes with rolling-shutter readout. It also incorporates camera functions such as binning, windowing, and both video and single frame modes.

The device has 8-, 10-, or 12-bit outputs and supports video performance at 5MP 60 frames per second (fps) with a 1,440p mode for 16:9 video.

The sensor's low-light performance is due to the larger 2.2µm back-side illuminated pixel that offers higher linear full well and lower noise than a smaller pixel.

German ARM-based computers come to UK

German manufacturer Garz & Fricke's range of ARM-based single-board-computers (SBCs) and human machine interfaces (HMI) are now available in the UK through distributor AndersDX.

The Garz & Fricke SBCs will be available with semi customised TFT displays. The boards and drivers are specified with standard TFT modules, but AndersDX has said it will customise the base design to the requirements of each project, by adding toughened glass, thick glass, decorated cover lenses, extended cover lenses, buttons and other features.

The distributor will also sell standard products, including full turnkey HMIs as well as custom HMIs for retail and kiosk applications.

Sascha Ullrich, head of sales at Garz & Fricke, believes AndersDX can help build a strong presence for the German supplier in the UK market. "This partnership gives Garz & Fricke a footprint in the UK, both commercially and technically," said Ullrich.

AndersDX will sell and support Garz & Fricke embedded computing platforms in computer-on-modules and SBCs based on ARM9, ARM11 and ARM Cortex-A8 architectures.

Open-frame or cased HMI with the SBC pre-integrated with a compatible 4.3-inch – 10.4-inch P-CAP touch display will also be available in the UK.

NXP adds IDE for MCUs based on ARM Cortex-M cores

NXP Semiconductors has released the MCUXpresso, an integrated development environment (IDE) for its LPC and Kinetis microcontrollers, which are based on ARM Cortex-M cores.

The IDE is intended to make use of the capabilities of its MCUXpresso software development kit (SDK) and configuration tools. The Eclipse-based framework provides access to new project wizards and clone projects.

The IDE supports full-featured, advanced debugging with unlimited code size and code profiling in the free offering.

It adds advanced trace features in the professional edition, and preserves existing hardware investments by supporting Freedom, Tower System, LPCXpresso boards and custom hardware platforms.

This SDK release also adds new device support and includes examples and project files.

The MCUXpresso SDK also now includes support for NXP's NTAG I^2C Plus connected NFC tag for home-automation and consumer applications.

It will also soon support the FRDM-KW41Z board, which adds Bluetooth low energy (BLE) v4.2 and IEEE 802.15.4 RF connectivity.

The configuration environment offers a pins and clocks tool for dynamic generation of initialisation C code.

Autonomous vehicle platform collects raw data in real time

EDA tool meets SAE Level 5 standards as it processes sensor data without the need for pre-processing microcontrollers

RICHARD WILSON

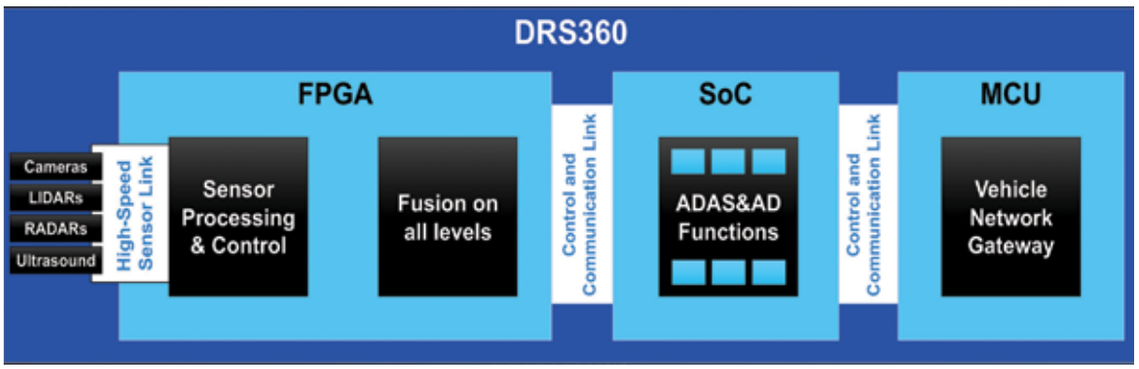
Mentor, the EDA design tool firm recently acquired by Siemens, has introduced a design platform for automated driving systems.

With autonomous vehicles dependent on data from various sensor systems, the platform will capture data in real time from radar, lidar, vision and other sensors.

The DRS360 platform has sensing accuracy and overall system efficiency required for SAE Level 5 autonomous vehicles. It directly transmits unfiltered information from all system sensors to a central processing unit, where raw sensor data is fused in real time at all levels. It accepts raw data from the sensors so does not require pre-processing microcontrollers in system sensor nodes.

The advantage of this is low latency and improved real-time performance.

The system employs data transport techniques to further lower system latency by minimising physical bus structures, hardware interfaces and complex, time-triggered Ethernet backbones. This architecture also enables situation-adaptive redundancy and dynamic resolution by using centralised, unfiltered sensor data to ensure enhanced accuracy and reliability.



DRS 360 – Centralised raw data fusion

The product's optimised signal processing software, advanced algorithms, and compute-optimised neural networks for machine learning run on a seamlessly integrated, automotive-grade platform.

Wally Rhines, CEO and chairman of Mentor, said: "Mentor has extended its investment to the automated driving technology sector. We look forward to playing a major role in helping the industry realise the massive potential and benefits of the autonomous vehicles era."

Supplied by Mentor's automotive division, the DRS360 platform has been designed to meet the safety, cost, power, thermal and emissions requirements for deployment in ISO 26262 ASIL D-compliant systems.

Data processing at the heart of the systems is provided by a Xilinx Zynq UltraScale+ MPSoC device in the first generation, while accommodating SoCs and safety controllers based on either X86- or ARM-based architectures.

Explore more at:
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RICHARD WILSON, EDITOR

5G technology is speeding way ahead of its market

The 'how' of 5G may be clear, but no-one has explained why consumers should care

The first operational 5G network could be working in time for the 2018 Winter Olympics, perhaps two years ahead of the anticipated launch date for the next-generation mobile communications technology.

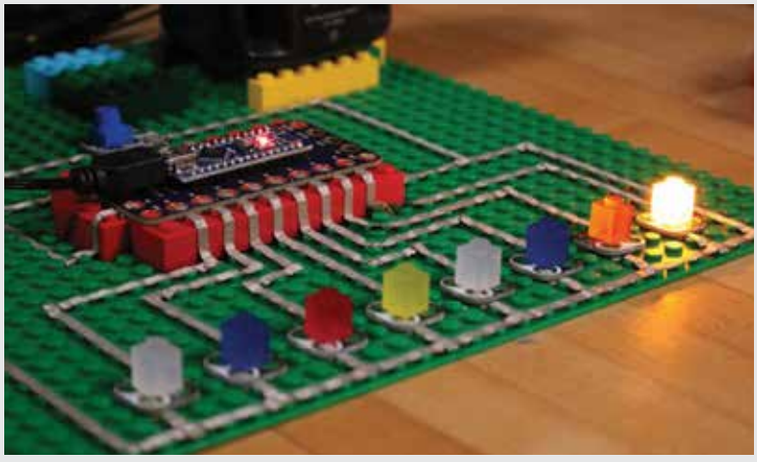
The core technologies for 5G wireless networks – millimetre-wave transmission and massive MIMO radio transmission – are coming to fruition faster than was anticipated just a few years ago. So big has been the focus on 5G that it looks like being ready before the long-established 2020 launch target.

The problem is that the market may not be ready for 5G. In his book, *The 5G Myth*, wireless comms expert professor William Webb says that rather than heralding a huge mobile advance, users will simply not value the higher data rates promised and will not need the higher capacity forecast. He argues that the 5G vision is flawed because mobile operators are not profitable enough to afford it.

The effort that is being put into developing the 60GHz radio transmission and 500MHz radio channel bandwidth has not been matched by a similar effort to explain what 5G services will offer the mobile market. So it is not surprising that financially-pressed mobile operators are not jumping at the opportunity to plan their investment for 5G networks.

Operators in Europe think there is too much EC-inspired downward pressure on prices, too many operators and too much regulation. Mega-investment for 5G does not look all that attractive to them. Especially so as they are not yet sure what 5G will give the mobile business which is different and better than 4G.

THE BIG PICTURE



There's no escaping Lego these days. Crazy Circuits is currently crowdfunding its Lego (and Arduino)-compatible modular electronics 'learning platform' on the crowdfunding site Kickstarter. Designed to work on top of the plastic bricks, they can enable children's creations to shine, move, and make noise. You can also program sketches for Arduino operation. The kit includes conductive tape, conductive thread and conductive inks and paints for paper and material craft.

MANNERISMS

Getting horizontal turned out to be good for business

Ten years ago there was a lively debate about whether companies needed their own fabs

Today the vertical *versus* horizontal debate about the right approach to the technology industry has been decided in favour of horizontal, but 10 years ago it was still very much a current issue.

In 2007, NXP – the re-named Philips Semiconductors which had recently been spun out of Philips – was run by Frans van Houten, now CEO of Philips.

"Most consumer electronics companies are de-verticalising their supply chains", said van Houten back in 2007. "Selectively de-verticalising the supply chain means Philips Semiconductors works with de-verticalised customers to make the chips," he said.

This contrasted with the position of the Japanese. "How you make the product attractive to consumers in terms of features and quality decides the competitiveness of the product," said Satoru Ito, at that time president and CEO of Renesas. "That is more suited to the integrated vertical business model of the Japanese companies," he said.

Ito and other Japanese chip industry leaders saw their vertical business model as being inherently superior when it came to consumer electronics to the horizontal business model of the US companies, which bought components from a host of suppliers and assembled them anywhere in the world.

Van Houten made the right call in 2007

Ten years ago, van Houten was inclining to the American view. "I strongly believe that you need to work with suppliers that are best in class. De-verticalising is a strategy to work with the best partners in the supply chain," he said.

He dismissed the Japanese predilection for the vertical model, saying simply: "There are some companies in Japan that are behind in terms of outsourcing."

He insisted: "De-verticalisation doesn't stop our customers from working interactively on what is defining the silicon."

Another surprising attitude, for an IDM, is that van Houten didn't believe that having its own fabs necessarily gave Philips Semiconductors an edge in the market. "Pure CMOS technology is more and more of a commodity which does not necessarily give competitive advantage," he said. "We invest in process technology, and it's important to have access to process technology, but it's not important that we manufacture the products ourselves."

And that is the way the world went, while much of the Japanese semiconductor industry disappeared.

Simplicity is key to clarifying node-naming mess

"Let's clear up the node naming mess," Intel's process guru Mark Bohr has said. He proposes a density metric Gordon Moore would have approved of – the number of transistors per square millimetre. Nice and simple.

But then Bohr goes on to add 'weighting factors' and comes up with a formula for measuring transistor density which is not simple:

```
0.6xNAND2 Tr Count +
0.4x Scan Flip Flop Tr Count
= number of transistors/mm².
```

A simpler approach might be to name a process after its minimum feature size. The features on Intel's 10nm process measure:

- 34nm fin pitch
- 53nm fin height
- 36nm minimum metal pitch
- 272nm cell height
- 54nm gate pitch.

Nothing there about anything measuring 10nm.

Gordon Moore was a much greater scientist than anyone Intel has today, and he explains things simply. In 1965 Moore said: "The complexity for minimum component cost has increased at a rate of roughly a factor of two per year." Nice and simple.

Intel quoted it this month as: 'The number of transistors and resistors on a chip doubles every 24 months." The change in timing is OK, Moore acknowledged that later on, but why does a marketing department make up a quotation from its co-founder? It seems pointless and it discredits Intel.

TWEETS OF THE WEEK

HRH @TheDukeOfYork officially opens @theamrc Factory 2050, on Sheffield's Advanced Manufacturing Campus http://bit.ly/2poqh5V @TheAMRC

German car industry to limit automotive OBD interface access to when car is stationary. Should improve security. @WilliamMarshal1

Have you ever wondered what it's like to work in the space industry? @SatAppsCatapult

70% of people will live in urban areas by 2040. Here some #futurecities scenarios: https://youtu.be/uZRHPIL9mLc #SmartUrbanFutures #smartcities @Catapult_UK

.@verizon launches industry's first LTE-M nationwide #IoT network. Read more in this #ConnectedLiving blog http://gsma.at/2OdRzVN @GSMA

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Ikutaro Kakehashi, creator of drum machine that defined decades of electronic music

The electronic music pioneer and founder of Roland, Ikutaro Kakehashi, has died at the age of 87

Ikutaro Kakehashi, the engineer and founder of Roland whose drum machines defined the rhythm of much of the electronic music of the past 40 years, has died aged 87.

Kakehashi, who started Roland in 1972, was the creator of drum machines that delivered the beats and tones that became central to the sound of hip-hop and electronic music.

His technology was used by artists from the Beastie Boys and Run DMC to Portishead, the Prodigy and Kanye West.

The TR-808, which launched in 1980, was one of the first programmable drum machines

Slave to the rhythm no more

Arguably his most famous drum machine was the iconic TR-808.

Launched in 1980, the analogue TR-808 was one of the earliest programmable drum machines, allowing users to create their own rhythms rather than being limited to using preprogrammed presets.

Despite being a commercial failure and being discontinued in 1983 after only 12,000 units were manufactured, it developed a cult following for the new sounds it offered which were completely synthesised rather than being based on samples.

A particular favourite was its deep bass drum. Kanye West's 2008 album *808s and Heartbreak* paid tribute to the machine (*see box*).

Kakehashi was also a co-inventor of the MIDI (musical instrument digital interface) standard in the early 1980s with Dave Smith of Sequential Circuits, a development that earned them both a Technical Grammy Award in 2013. MIDI protocols define the digital interface and connectors that allow muscal instruments and effects generators to communicate with computers.

Kakehashi was born in Osaka and began his career in electronics repairing electronic organs in the 1950s, while running an electrical appliance shop.

Smith told the BBC he "was just an amazing man, a good friend, a very good competitor, of course, and just innovative continually all that time".

In 1960 he founded Ace Electronics Industries, or Ace Tone, which built electronic organs, drum machines, effects pedals and amplifiers. Its FR-1 Rhythm Ace machine, which featured four buttons to manually play each drum sound – cymbal, claves, cowbell and bass drum – was adopted by Hammond Organ Company to be incorporated into its range of home organs.

In 1972, Kakehashi founded Roland Corporation in Osaka.

The company went on to develop a huge range of electronic musical instruments under the Roland brand; professional video, audio and computer music equipment under the V-MODA brand; and guitar equipment under the BOSS brand.

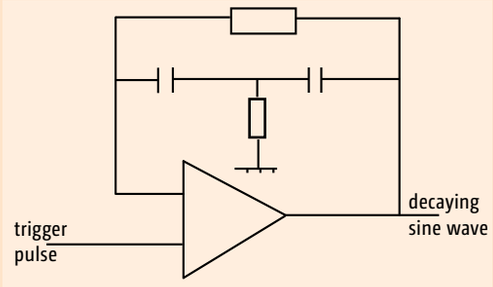
Kakehashi retired from Roland in 2013, leaving behind him a company with factories across the world and more than 2,500 employees.

The music world and fellow engineers have paid tribute to Kakehashi, who died on 1 April.

Writing on Facebook, Roland developer Tommy Snyder, who worked with Kakehashi for 38 years, said: "He was a super funny, wonderful and gifted human being, and his contributions to the musical instrument world, and music, touched millions of people worldwide."

Getting inside the TR808 drum synthesiser

I thought I had already written about the bass ('kick') drum synthesiser in the Roland TR808 but, searching the *Electronics Weekly* archive, I can't find it, *writes our Engineer in Wonderland blogger.*

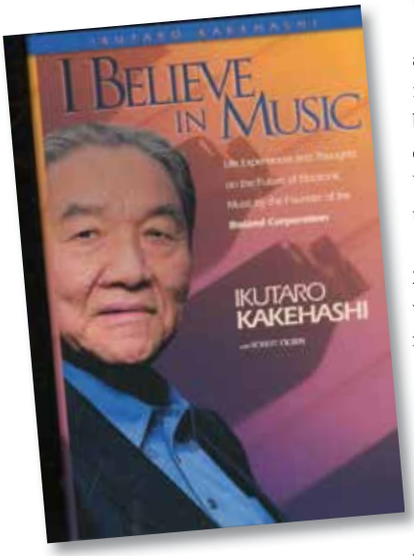


Hearing of the death of its inventor, Ikutaro Kakehashi, reminded me of it again.

The particular kick drum sound is heard on many famous synth-band tracks, and the band '808 State' took its name from the machine.

The circuit is essentially an op-amp with a bridge-T filter in its feedback loop (*see diagram*).

In the Roland design, it is a bit more complex – Mr Google will find you a full circuit, like this one.



Ikutaro Kakehashi's memoir, *I believe in music*, was published in 2002 to mark the 30th anniversary of the founding of the Roland Corporation

ENGINEER IN WONDERLAND

Graphene desalination filter

Manchester University has claimed a way of manipulating graphene to give it a new role

As reverse-osmosis desalination membranes already exist, I was keen to hear what was new about the Manchester University announcement that its researchers had made a graphene desalination membrane.

Graphene oxide has been mooted as a filtering material, but it cannot filter out small molecules like dissolved sodium chloride because the 'holes' are too big – particularly because they expand a bit in a water environment.

Looking at the abstract of the research paper, 'Tunable sieving of ions using graphene oxide membranes' in *Nature Nanotechnology*, the breakthrough seems to be that the researchers have found a way to stop the expansion.

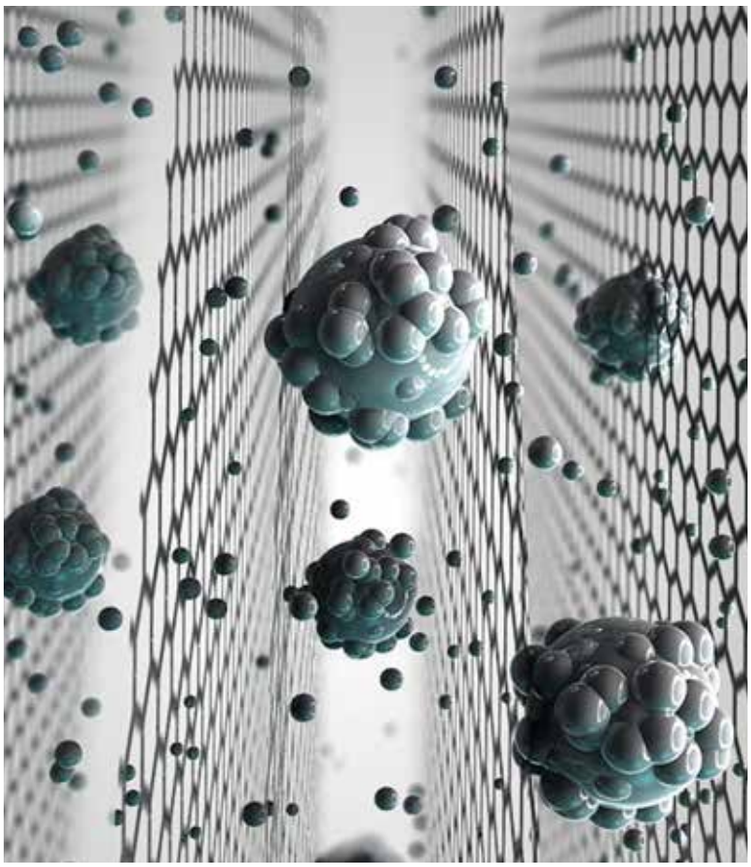
"The developed membranes are not only useful for desalination, but the atomic scale tunability of the pore size also opens new opportunity to fabricate membranes with on-demand filtration capable of filtering out ions according to their sizes," said researcher Jijo Abraham.

It looks like it is necessary to know that dissolved salt molecules travel around with a shell of water molecules, which is what I think Manchester is talking about when it calls them 'hydrated'.

The filtering structure is layers of graphene oxide 100µm thick (prepared by filtering flakes) with alternating layers of epoxy – the epoxy provides the necessary 'physical confinement'.

Water is forced sideways through the filtering structure, flowing parallel to the epoxy layers sideways through the graphene oxide flakes – so it is not passing through layers of graphene, but finding its way along its surface, squeezing between flakes. The thickness of this edge-on filter was 4mm.

According to the paper's abstract, graphene oxide membranes usually have a permeation cutoff of 0.9nm, determined by inter-layer spacing of 1.35nm of the laminates swollen in water.



Water is forced sideways through the filtering structure

With physical confinement [provided by the epoxy layers] this 1.35nm can be adjusted to between 0.98nm and 0.64nm, says the abstract.

With these, ion permeation is thermally activated with energy barriers of between 10kJ/mol and 100kJ/mol – depending on layer spacing.

"We demonstrate a simple scalable method to obtain graphene-based membranes with limited swelling, which exhibit 97% rejection for NaCi," say the researchers in the abstract.

As reverse-osmosis equipment already exists, I wonder:

- How much pressure is needed to force salty water through the process, given that it is hundreds of psi for existing membranes, and pumping this is what makes the process so energy intensive?

Manchester's answer, according to the paper, is that "modelling of practically relevant filtration processes shows that an increase in water permeation rates above the rates currently achieved (between 2 and 3litre/m^2×h×bar) would not contribute greatly to the overall efficiency of desalination".

- How easy it is for the more-salty water to get out of the membrane backwards (its anti-clogging characteristic)?
- Do the components last long?
- Can it be made cheaply enough?

GADGET MASTER

Imagine Blue winners take on IoT challenge

We flagged the launch of the Bluetooth SIG 'Imagine Blue' competition to reward innovative use of Bluetooth technology. Well, the prizes have now been awarded.

The winners of the competition aimed to "champion the next generation of internet of things (IoT) innovations", were announced at Bluetooth World 2017, in Santa Clara.

Cassia Networks won the prototype category for a Telehealth system that connects the Cassia Bluetooth router with smart medical equipment, to provide "a more effective and automated IoT telehealth solution for at-home care".

The router collects vital signs and other data from a medical device connected via Bluetooth to the Cassia router and securely forwards it to a service provider's cloud server. According to the SIG, this enables remote patient monitoring in real-time, reducing costs to both patients and providers, while improving patient compliance and overall patient care.

The company was presented with a $10,000 cash prize.

"We found that 99% of smart medical devices use Bluetooth technology, so we created the Telehealth Solution to give patients a plug-and-play solution for in-home monitoring while giving healthcare providers an unprecedented ability to manage thousands of devices from one centralised interface," said Felix Zhao, founder and CEO of Cassia Networks.

Sara Du was named winner of the student category, for her Bluejay system, receiving a $5,000 cash prize. Bluejay transmits a survivor's location via Bluetooth, from a mobile app, to drones sent out by emergency responders during natural disaster or other crisis, making search and rescue missions more efficient, helping to save more lives and reduce operating costs.

Build failsafes into the supply chain

Product recalls in the consumer electronics sector are likely to increase, causing damage to the industry, warns Mark Waterman

News of the next product recall in the consumer electronics sector is never far away. Recent examples, such as the problems that led to the withdrawal of Samsung's Galaxy Note 7, have tarnished the reputation of some much-respected global brands. This trend is likely to increase and has the potential to destroy companies and damage burgeoning industry sectors.

Historically, the implications of electronic product failure were limited to a small number of customers being inconvenienced, a minimal increase in operational costs and possibly some minor brand-value erosion. Manufacturers traditionally focused on reducing the probability of failures occurring by ensuring tight control of manufacturing processes. Best practice is to avoid transferring risk to suppliers and instead to control the quality of multiple tiers of the supply chain.

In traditional safety-critical industries, such as aerospace and defence, subassemblies are thoroughly stress-tested before being approved for use. But in consumer electronics the customer undertakes most of this testing when the product is in use. It has always been cheaper to replace a few defective devices than to thoroughly test each one before sale.

While it is easy to assume that product failures are the result of quality control slip-ups in the manufacturing process, they are increasingly likely to be due to faults occurring where new products are pushing the envelope of current knowledge and capabilities. Software and hardware complexity, new technologies being commercialised for the first time and shortening development cycles will test the ability to design in low failure-rates.

So what if one in every one million devices fails? The higher energy demands of mobile devices and the connectivity of household goods to the internet of things will significantly increase the social and business impact of failure events – people are inevitably going to get hurt in the process.

> "Manufacturers should prioritise the supplier assessment process

Sales of Samsung's Galaxy S7 took a hit last year after battery problems caused phones to explode – consumer confidence in the product now seems to be restored

The rules of the game are changing and anyone who manufactures consumer electronics that have the potential to cause harm should assume that the worst case failure will happen at some point.

The legal, financial and brand implications of failure will all become more of an issue, so assuming the inevitability of failure and focusing efforts on mitigation – alongside prevention – has become crucial.

Graceful degradation

Design strategies are necessary to mitigate the impact of product failure to the user. For example, in the Airbus 330/340 flight control system, this is achieved by replicating sensors, computers and actuators and providing 'graceful degradation' in the event of a system failure. In a degraded state, essential facilities remain available, allowing the pilot to safely fly and land the aircraft.

A similar approach needs to be adopted for consumer products.

While a successful mitigation strategy assumes failure, the Samsung case also highlights the importance of effective supply chain control in preventing costly operational disruption. Since the problems with batteries overheating occurred the manufacturer has faced criticism for passing the blame to its suppliers. Autocratic buyer behaviour could have a part to play in this.

The firm's approach also reveals gaps in the quality-assurance processes and general supply chain control. While it is easy to blame suppliers after the event, it is important to remember that from a consumer's perspective responsibility for product quality ultimately lies with the brand owner.

To ensure a 'quality-first' culture, manufacturers should prioritise the supplier assessment process, ensuring that manufacturing policies and processes are appropriate to the product's risk profile and the volume being produced.

While it goes without saying that manufacturers should aim to stay close to suppliers whenever possible, it is important to understand which partners are mission-critical. Companies like Samsung will have tens of thousands of suppliers and a detailed audit of each one is probably unrealistic. A smarter application of resources would involve identifying those parts most likely to pose function or safety risks and concentrating checks in these areas.

Supply chain

Another common mistake is neglecting to look beyond the first tier of the supply chain. While it can be tempting for manufacturers to transfer risk to suppliers and sub-contractors, in reality this risk simply becomes less visible.

Manufacturers can avoid unseen risks by adopting a holistic and collaborative approach to preventing product failure. This should involve acquiring in-depth understanding of how risk affects each part of the supply chain, as well as ensuring that suppliers appreciate the bigger picture by including them early in the design process.

To ensure that operations remain commercially viable it is vital that manufacturers seek to foster a balance between quality and cost. By clearly stating their priorities from the start of commercial negotiations and conducting sufficient due diligence, companies can avoid a lack of compliance with quality standards.

The race to market in the consumer electronics industry is here to stay. This pressure to launch, combined with the unrealistic nature of high-volume stress-testing, means manufacturers must adopt a new approach to design, quality control and supply chain management, which assumes some degree of failure from the start.

The ability to communicate good mitigation strategies to consumers could become a strategic differentiator, or a vital defence tool in legal proceedings.

About the author

Mark Waterman is a consultant at supply chain firm, Vendigital

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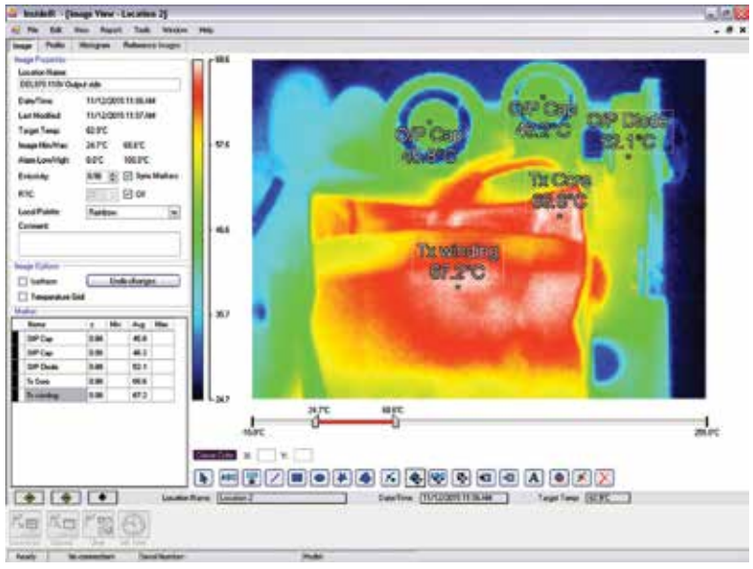
Power supply design and the art of thermal engineering

Efficient power supply design can reduce over-heating which can limit product lifetime in high-rel systems, writes **Martin Brabham**

When it comes to reliability in electronics heat is the enemy, as much for power supplies as the rest of the system. One way to see this is to use the 'Arrhenius equation' which shows how much excess thermal energy affects lifetime: each 10°C rise in temperature reduces the average lifetime of an electronic device roughly by half.

Anything you can do to mitigate heat production and to channel it away from the system will pay off in product lifetime. So power supply design plays an important role in minimising thermal problems.



Computational fluid dynamics allow heat flow in a system to be modelled

Strategy

Thermal mitigation strategies range from system-level design and integration techniques to the circuit topology used by the power supply itself – this matters because it feeds directly into heat generation. A 250W power supply that operates at full load with an efficiency of 85% will dissipate more than 44W in heat: one just 5% more efficient will waste 16W less.

One of the most effective ways to improve efficiency is to move to resonant or quasi-resonant topologies. The resonance makes it possible to switch active components when little or no current or voltage is present, which reduces both stress and switching losses.

There is no one-size-fits-all answer for deploying resonant topologies. Zero-current switching (ZCS), for example, tends to be used in high-power applications. At the start of each cycle, charge flows into a capacitor in the resonant filter and its voltage rises towards a maximum. The circuit is then switched to allow the energy stored in the capacitor to transfer to an inductor in the output stage until the current drops to zero and the switch can be turned off again ready for the next cycle. During the switching phase, the voltage can change rapidly and this can cause coupling to gate-drive circuitry through the power transistor's Miller capacitance, which slows down the switching process.

High-power circuits based on insulated-gate bipolar transistors (IGBTs) rather than field-effect transistors (FETs) suffer more from tail currents when switched off – which favours the ZCS strategy.

A zero-voltage switching (ZVS) supply rearranges the passive components, better suiting FET-based circuits.

The topology allows current to flow first into an inductor then, when the switch feeding the inductor is turned off, the energy flows into the resonant capacitor. The switching events occur as the voltage approaches zero.

Stay cool

Although the use of high-efficiency power supply design reduces the heating effect, some is inevitable and needs to be directed out of the system. In most applications, convection conveys much of the excess thermal energy.

Forced-air cooling – usually driven by fans – helps the convection process but it typically adds noise and takes up more space in the design. Without forced-air cooling, careful design of heatsinks and component placement can ensure good convection performance.

Conduction is a secondary avenue for heat removal and is a primary consideration in space-constrained designs. The high copper content of a PCB and the metal of an enclosure can both be harnessed to provide good paths for heat flow.

Simulation provides information about how heat will build up in a system design and can be directed away from critical components. Using techniques derived from computational fluid dynamics, the power supply and its components are represented as a 3D mesh of elements that generate and absorb heat from the PCB or the air. This requires expertise and experience. The mesh must be tuned to concentrate on critical areas of the design and on components that are most likely to affect thermal behaviour. Calibration to real-world conditions is also important to make sure the simulation is accurate.

Conversely, heat can be useful in some parts of the power supply. In many diodes that handle high power levels the forward resistance drops with an increase in temperature. If heat is directed over these diodes, efficiency will go up. Channelling heat away from capacitors will improve lifetime.

Heating effects also play into component selection. The effective series resistance (ESR) has an impact on power-handling capacitors, leading to the production of excess waste heat. Those parts of the circuit will favour low-ESR capacitors or using multiple capacitors to reduce the overall ESR. Armed with information from thermal simulation and accurate models of heat generation in the supply, an engineering team can make intelligent trade-offs.

Simulation cannot account for every eventuality, but reliability can be maintained during thermal excursions caused by external factors.

About the author

Martin Brabham is managing director at Stadium Stontronics

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Skill seekers


We need to encourage more women to see engineering as a challenge worth taking on

New talent management strategies are a must in light of the current need for skills, writes **Ben Hall**

Despite the electronics industry being home to some of the most cutting-edge employers – all offering myriad opportunities for professionals – the fact remains that there simply isn't enough talent in the market.

Not only are employers increasingly having to source staff from overseas, but they are also having to invest heavily in their employee and applicant value proposition to ensure that they stand every chance of securing the talent that is available in the market.

As worries increase about the long-term availability of labour once the UK has left the European Union, effective talent management strategies have never been so important.

So where are talent shortages most acute, and what can the industry and employers do to ensure that the UK remains a competitive player in this global marketplace?

The state of the sector

Recent research suggests that the electronics industry in the UK contributes £80bn to the economy, so it is no surprise that it employs – and requires – a workforce of considerable scale. Thanks to rapid technological advances and an increasingly mature and demanding consumer base, the skill sets across the industry are not only diverse, but also hard to come by.

This is compounded by an ever evolving landscape – products and services are becoming increasingly technologically advanced and as a result some of the skill sets in demand have simply never existed before. This, in turn, has resulted in a shortage across the board.

This is particularly the case in the engineering field which, as we are all too aware, has been plagued by a dearth of talent for as long as I can remember.

Where is the home-grown talent?

The fact that there is a lack of engineers is not a new phenomenon – it has been a significant problem for many years.

In fact recent research suggests that the UK has a shortfall of at least 20,000 engineers each year – a worrying statistic, given that there have been ongoing initiatives to address this.

Perhaps the answer, then, is two-fold.

First and foremost, a 'get them early' initiative is imperative – whereby the field of engineering is promoted at an earlier stage to those in education who have, crucially, not yet decided what career route they wish to take.

Initiatives aimed at A-level students are admirable, but they are arguably too late if the pupil in question has not chosen the necessary subjects – such as physics and maths – that they will need to pursue a career in the field.

Second, and just as important, is to encourage consideration of careers in the field of engineering to girls and young women. It is no secret that the engineering arena is male dominated.

Any drive to produce more engineers will need to include females who, at present, make up only 10% of the engineering workforce.

The use of role models of both successful men and women is clearly vital if we are to increase the UK's own engineering population.

Looking at alternatives

I would argue that we also need to open our eyes to the reality that not all engineers have to take the traditional route of studying for a university degree to enter the field.

If the UK can put a greater focus on vocational subjects – which can, after all, be appropriate for pupils who either don't want to

> "A drive to produce more engineers will need to target females

Images: Shutterstock

Demand for engineers is ramping up in automotive and semiconductors

In the automotive arena there is a huge requirement for talent in the connected vehicle sector. The huge advances in the sector have transformed the traditional car into a technology-led machine.

The intrinsic devices which make this up – from the infotainment systems to the diagnostic and safety features – all require the skills of engineers who are increasingly sought by car manufacturers in this highly competitive arena.

Another area where demand is simply outstripping the supply of engineers is across the semiconductor industry.

This is perhaps not surprising when we look at the number of semiconductor components used in devices taken for granted in everyday life.

Semiconductor engineers are in short supply, although the components are essential to most modern devices

You would be hard–pressed to find a technological device – from a smartphone, TV or audio equipment to smart meters and LED lighting – where semiconductors don't form the essential core.

And as demand only increases for these sophisticated devices from both consumers and businesses, the production and design of these intricate semiconductors is only going to gain pace.

go through university or cannot – we would open the doors to a much larger talent pool in the long run.

Programmes such as the government's recently announced T-levels – proposing technical qualifications for students aged over 16 – not only target pupils at a younger age when they are making decisions about their future job prospects, but can also encourage the take-up of engineering to a demographic that has previously been excluded from the workforce.

Effective talent management

While ensuring that the UK produces enough home-grown engineers is one thing, it is also crucial that employers should be in a position to attract – and retain – the talent that is in the market already.

In years gone by, savvy organisations placed a great emphasis on creating a credible employee value proposition (EVP) to ensure that staff were engaged and motivated.

In today's market, firms need both to have a strong EVP and also simultaneously to invest in an applicant value proposition (AVP).

An effective AVP crucially identifies the motivators and aspirations of each target demographic, as well as the best communication methods for each.

Messages used to attract millennials and Generation Z will be a far cry from those required to target female engineers looking to return to work after a career break, for example.

By fine-tuning not only the benefits available to each segment of a target workforce, but also the way the best people are found and how to communicate with them, organisations can put themselves one step ahead of the competition.

An aging population, the risk that Brexit poses to the freedom of movement of workers and the ever-changing customer base all lead to a market where the competition for talent in the electronics industry cannot be won without effective and ongoing talent management strategies.

The success of businesses will therefore rely on making sure that they have the right people in the right place and at the right time.

About the author

Ben Hall is managing consultant at recruitment consultancy MRL Group

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Company of the Year will be chosen from among the winners of each of the individual categories.
(Entries are NOT invited for this award)

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(Entries are NOT invited for this award)

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This award category is open to companies that derive most of their revenues from the sale of components, systems or software products which are manufactured by their principals. They must have business operations in the UK.

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The Elektra Awards promotes exceptional technical innovation

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This award will be presented for the passive or electromechanical component which demonstrates technical capabilities and usefulness that differentiate it from competitor products.

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This award will be presented for a system or component product which can be used in the development of renewable energy systems such as solar, wind, tidal or energy harvesting systems and components. Eligible products will include hardware/software systems or semiconductor products.

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This award will be presented for an analogue or mixed-signal semiconductor product which demonstrates technical capabilities and usefulness which differentiate it from competitor products and has been introduced in the past 12 months.

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The internet makes us aware of impressive consumer product innovations from around the world. In this category visitors to the *Electronics Weekly* website are invited to select the consumer electronic product innovation which they feel makes the most inspirational use of technology. A shortlist of products will be selected by the editor.

How To Enter

All entries should be submitted through www.elektraawards.co.uk. Please ensure you have thoroughly checked the categories and criteria page before entering into the awards, to make sure you are eligible to enter. Do you have all the relevant information to hand before you begin? Ensure you have the following ready before advancing. Your entry should include:

- Name and contact details of entering company, university or individual.
- If submitted by a representing agency, name and contact details of the agency.
- Product name and part number entered, or project name entered (where applicable).
- A supporting statement of no more than 500 words which should explain why you believe this entry is worthy of an award. The supporting statement should highlight factors which differentiate the performance of the product, company, university, or individual and should include information relevant to the category and related to the judging criteria (see each category criteria for more information).
- At least one high resolution image (resolution 300dpi, in a .jpg or EPS format).

Key dates

- **Closing date – 16 June 2017**
- **Shortlist announcement – 6 September 2017**
- **Elektra Awards ceremony and party – 6 December 2017**

www.elektraawards.co.uk

Life of H J Round

Part 2: the era of broadcasting

This is the conclusion of an article by W J Baker of the Marconi Company, published by *Electronics Weekly* on 18 and 25 May 1966, celebrating the life of H J Round, the British engineer who, a century ago, helped to invent what became electronics

Probably the most significant single event in the history of radio communication was the discovery that the thermionic triode valve could act as a generator of continuous radio waves, and could therefore provide, among other things, a carrier wave for telephony.

This forward stride was made in 1913-14 (curiously enough, two years alter the effect had been noted in a semiconductor by Dr Eccles).

It may seem remarkable, in view of the fact that the mode valve had already been in existence for five or six years, that the discovery of its oscillatory properties had not been made by accident, that is, brought about by unintentional positive feedback. The triodes of those days were, however, woefully inefficient and little more than laboratory curiosities.

H J Round, after the Amazon incident referred to in the previous issue (29 March 2017) and a further spell at the Glace Bay station Nova Scotia, returned to England to become deeply immersed in problems of valve amplification, during which period he experimented with various forms of grids in valves he had had specially made.

At that time C S (Charles Samuel) Franklin, another eminent engineer of the Marconi Company, returned from Germany with samples of Lieben-Reisz valve-type relays and with the information that Alexander Meissner had claimed that such valves could be made to generate oscillations. This was news indeed, for the possibility had occurred to both Round and Franklin.

Henry Joseph Round, pictured in his own private workshop at home in 1966

Meissner took out a German patent to this effect on 9 April 1913, but the apparatus he had used in his experiments was inefficient.

The Leiben-Reisz valve was a 'soft' valve using ions to provide the conducting path between cathode and anode, and with a Wehnelt cathode of lime-coated platinum.

This type of cathode is stated to have lasted only for a few minutes in Meissner's circuit and the power output to have been small. Nevertheless, he achieved radio telephony over a distance of 36km with the apparatus.

Round and Franklin both continued their individual researches, while, unknown to anyone, EH Armstrong in the USA was also working on the problem. In the event, all filed patents almost simultaneously. Meissner was first (9 April 1913), C S Franklin a close second (12 June 1913), Armstrong third (20 October 1913) and Round fourth (29 May 1914).

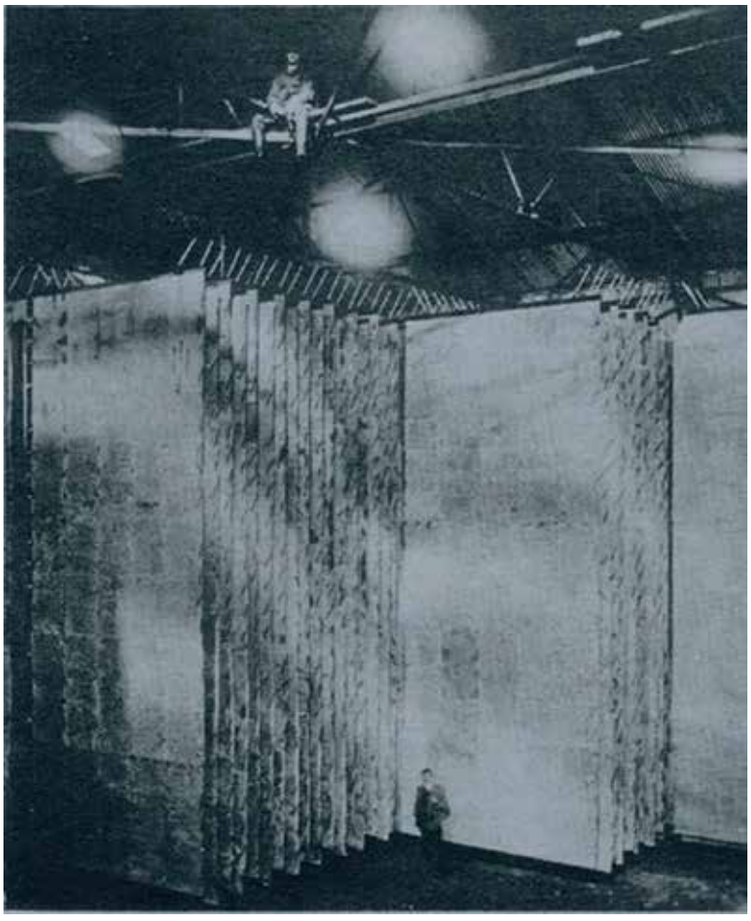
More efficient

The situation needs some qualification, however. Franklin's patent related to regeneration as a means of improving receiver signal strength, although the wording of his application makes it clear that he knew of the valve's

property of oscillation. Round, who on paper was a year behind Meissner, developed a much more efficient valve and circuit and had given a demonstration of valve radio telephony between Marconi House and the Savoy Hotel, London, in 1913.

Round's work was consolidated in the early months of 1914 when he and Guglielmo Marconi carried out radio telephone tests between several Italian warships off the coast of Sicily. Excellent performances were obtained between ships at anchor and on the high seas, with ranges of up to 44 miles.

A valve which Round had patented in 1913 used an oxide-coated filament surrounded by a thimble-shaped nickel grid and a cylindrical nickel anode. This type of anode became extensively used. Other patents taken out by him in 1913-14 include that for an independently heated cathode, an auto-heterodyne circuit and a comprehensive transmission patent which included the first use of automatic grid bias.



A vast early Marconi capacitor, dated around 1912, at Clifden radio station in Connemara, Éire

War work

With the onset of the Great War [World War 1], Round redoubled his activities. Several receivers were put into commission for interception purposes; the first valve direction finder was put into operation at Broomfield, Chelmsford, and other important developments relating to valve circuits were carried out there. The valves used were of the 'soft' type, tricky to operate but capable of a very useful degree of amplification.

Round's war work on direction finding has already been mentioned in the previous issue, but in addition to this he was responsible with Major Prince, another distinguished Marconi engineer, for the design of the first aircraft telephony transmitters and receivers in 1916.

Round designed the first aircraft radio valves around which the MK1 airborne transmitters and receivers were produced. The amplitude control modulations system and the Round valve receiver with adjustable coupling were also developed at this time. For his services, Captain Round (as he now was), was awarded the Military Cross.

By the end of the war the art of wireless telephony had developed enormously from its crude beginnings in 1914.

Once more back in civilian life with the Marconi Company, both Round and Franklin continued their researches each with different ends in view.

Round was mainly concerned with valve improvements and the investigation of their possibilities in general communications; Franklin was using valved transmitters for the short-wave experiments which culminated in the development of the beam system.

In March of that year he directed the installation of a wireless telephone transmitter at Ballybunion, Ireland. This station, operating on 3,800 metres, was the first European telephony station to be heard on the other side of the Atlantic.

This was followed later in the year by experimental work at Chelmsford, first with a 6kW transmitter and (in 1920) with one of 14kW. These carried out a series of range tests upon which amateur wireless enthusiasts were invited to report, which they did, from all over the British Isles and the Continent. The tests (which often consisted of a recital of railway stations) sometimes had musical items interspersed among them to relieve the monotony. This innovation brought shoals of appreciative reports, which were the original impetus for the establishment of an entertainment broadcast service.

'Old Stagers' may possibly recall the wireless telephony news service which was inaugurated from this station on 23 February 1920, on a wavelength of 2,500metres, the broadcast by Dame Nellie Melba on 15 June 1920 and, two years later, the experimental concerts from 'Two Emma Tock', Writtle [near Chelmsford], which led to the establishment of the original 2LO at Marconi House in the Strand. The 2LO transmitter was designed by Captain Round. This station [2LO] was the first to be taken over by the BBC in its formation in 1922.

During the period of hectic activity which followed, Round carried out a great deal of research connected with this new field of entertainment broadcasting, of which he had rather inadvertently become the father in this country.

The artificial echo system and the Sykes-Round microphone are but two of his many contributions to the early stages at the art.

In parallel with all this work Round was also carrying out another huge project. This was the redesign of the Marconi nigh-power stations at Caernarvon from spark to valve transmission.

The Caernarvon station was equipped with a power panel consisting of 56 MT2 valves with a high tension supply of 10kV DC. On 19 November 1921, using the new equipment, signals from this station were received in Australia.

One of the many problems which beset designers at that time was that of obtaining a reasonable amount of RF amplification from the triode valve. In practice this resolved itself into finding ways and means of minimising the by-passing effect of the internal grid/anode capacity.

Round, in 1913, was probably the first to tackle this, doing so by providing an external neutralising circuit, but this method (later adopted by others) left much to be desired.

His 'Q' valve of 1916 attacked the problem at source by enclosing the electrodes in a glass tube closely fitting around the anode, and by bringing out the grid and anode connections on opposite sides of the tube.

His V24 valve (1919) was a further step in the same direction, having the grid and anode closer to the filament.

Around these two types of valve the Marconi 55 receiver was designed. This embodied six V24's as RF amplifiers and a 'Q' as detector and the tuning was by dust core (here again, Round's early experiments were bearing fruit).

Forerunner

In the following year he evolved the FE1 valve, which incorporated a shield between grid and anode to reduce the inter-electrode capacity still further. Other work intervened, and it was not until 1925 that he was again able to give

serious thought to the matter. The result of his further investigations was that in 1927 the DES screened grid valve was introduced as the forerunner of a series which revolutionised receiver design with an unprecedented degree of signal magnification per stage. He followed this patent (taken out in 1926) with another in the following year for the RF pentode.

Round's book, *The shielded four-electrode valve*, was published in 1927.

Going back in time to 1920 Round, in addition to all his other activities, had designed valve receivers for ships and had constructed the first batch of maritime valved transmitters.

In 1921 the Marconi Research Group was formed from various discrete research units, and Round was appointed as its first chief. (At approximately the same time Franklin became Chief of Independent Research.)

Round's output in the 1920s was truly astonishing. He designed the 'Straight Eight' receiver; he produced a gramophone recording system (this was licensed to the Vocalion Company), and designed a large-audience public address system which was used to relay King George V's speech at the Wembley Exhibitions.

Cinema boom

Patents for improvements to valves, to loudspeakers, to gramophone pick-ups, to portable receivers, to amplifiers, to microphones, to sound recording systems, to antennas – all these and more were filed.

Round also anticipated the cinema boom brought about by the advent of the talking picture. In 1930, when gramophone discs mechanically synchronised to the film were the order of the day, we find a Round patent – the forerunner of many such – for recording sound on film.

One talking picture system he devised ('Visatone', which incorporates inventions for obtaining constant speed and for a high frequency galvanometer) was licensed to Stoll.

In 1931, he elected to resign from the Marconi Company in order to set up in private practice as a research consultant. He continued to be closely

> In 1919, Round constructed prototypes of transmitters of up to 20kW

associated with the company, however, and returned in 1937 in an advisory capacity for work on echo sounding.

Shortly after the outbreak of World War II he worked for the Admiralty on ASDIC [Anti-submarine detection investigation committee, now 'sonar'], continuing in this until 1950. There followed further work for the Marconi organisation, during which period he invented new magneto-strictive devices for use in the production of Marconi International Marine Company echo sounders.

He also introduced the first permanently magnetised nickel transducers and the first belt recording system for echo sounders.

Other inventions continued to pour forth – his last on record is dated 1962 – and one hopes there will be many more.

Alert as ever

Today in 1966, nearing 85, he has been until recently a frequent and always a welcome visitor at Chelmsford, as mentally and physically alert as ever.

The name of C S Franklin has cropped up more than once in this account. This is inevitable, since he and Round were the Castor and Pollux of the Marconi Company.

They joined within a year or so of each other. Both had a thorough grounding in electrical theory; both were brilliant and practical engineers; both became personal assistants to Marconi and had an unswerving loyalty to him.

Franklin, like Round, was a prolific inventor whose ideas did much to shape the company's destiny. Both rose to positions of equal eminence as Chiefs of Research.

Physically, both were short in stature and both were non-conformists in the secular sense; one cannot imagine either of them being happy as cogs in a modern large laboratory set-up. But from that point onward a common denominator is harder to find.

Franklin – tiny, frail, diffident – had an almost psychic intuitive approach to a problem. Round – robust, bluff, extrovert, rather Churchillian even to the cigar – has what might be described as a commonsense approach, if it were not so very uncommon.

Lucid

He has the uncanny ability to turn a problem inside out if need be to arrive at a solution. Yet when he explains it later – and in his day he wrote a number of papers and technical treatise – his exposition is so lucid and devoid of window dressing that the reader is left with no questions to ask.

It would not be surprising to find that Round and Franklin had been implacable enemies. In fact, despite the rivalry that undoubtedly existed, they were very good friends, although this did not prevent them from sniping good-humouredly at each other whenever they met.

On such occasions it was a joy to stand in the wings and listen. But never would anything even remotely derogatory be said in the other's absence.

It is a sad commentary on the human sense of values that while the country sees fit to honour pop groups and other nonentities, Round's services to science and industry have never received any British recognition whatever; neither has any tangible recognition been conferred by the learned societies, although the prized Armstrong Medal was presented to him by the Radio Club of America in 1952.

Surely we owe something to the man who, among other things, played so significant a part in founding broadcasting, direction-finding, aviation electronics and indeed (by his work on the thermionic valve) the entire industry as we have it today?

HJ Round died three months after this article was first published.

Captain Henry Joseph Round
(2 June 1881 – 17 August 1966)

Charles Samuel Franklin (1879–1964)

On Round's Armstrong Medal

According to Round's grandson David Jervis, in December 1952 Henry Round travelled to New York to be guest of honour at the 43rd Anniversary of the Radio Club of America and to receive the prized Armstrong Medal.

Only 10 were ever awarded. Edwin Howard Armstrong – described as the most prolific and influential inventor in radio history – paid a 20-minute tribute to Round and, having explained the vital role he played in WW1, said in a voice brimming with emotion: "I and some others here this evening have some first-hand knowledge of the magnitude of the problems faced and successfully solved by Captain Round.

"We all join belatedly in the privilege of honouring him tonight and I know that all of you will join with us in expressing the hope that in the event of any future disturbance of the peace of the world which, God forbid, we have, that we have again with us on our side, helping us, the future Captain Rounds who will do as good a job for us as he did over thirty years ago."

The citation was read as follows: "The Armstrong Medal of the Radio Club of America for the year 1952 is awarded to Henry Joseph Round in recognition of his unexcelled contribution to the art of direction and position finding by radio; for the invention and amplifying and receiving means for short waves of unparalleled sensitivity and for the application of his discoveries to the cause of freedom and to the rendering of service to mankind."

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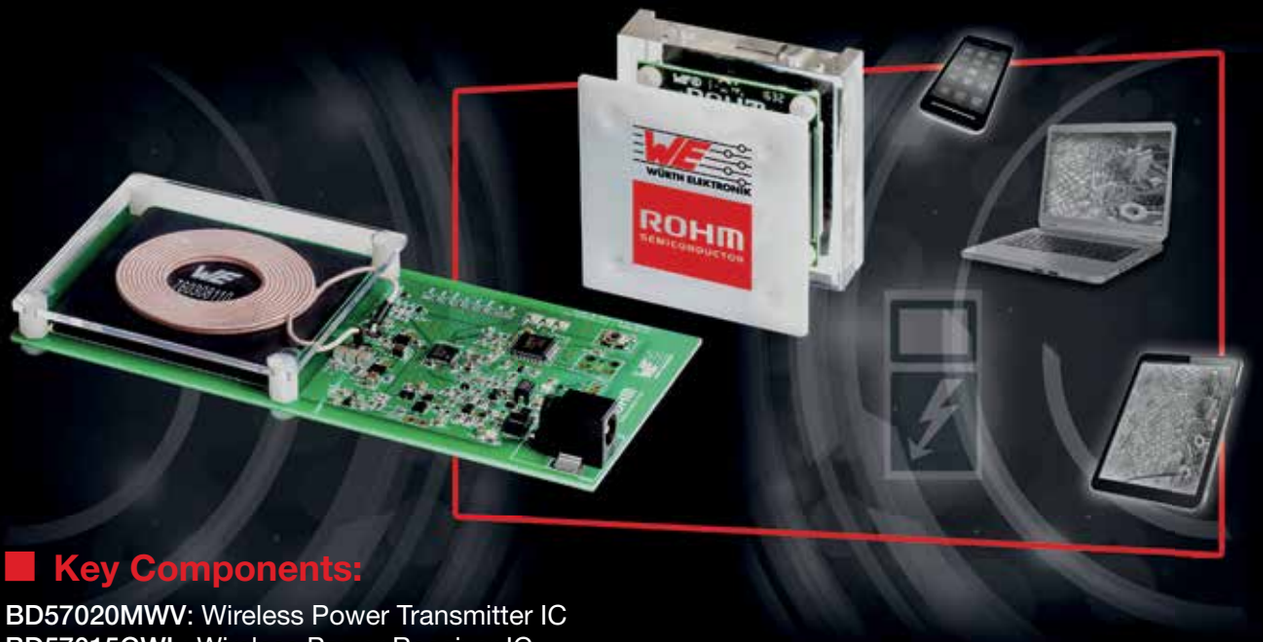
Wireless Power Design Kit

Qi Medium Power compliant

ROHM Semiconductor and Würth Elektronik developed a plug & play wireless power solution to demonstrate the advantages of wireless power. This gives you the opportunity to test and integrate a wireless power solution into your product design.



Key Components:

BD57020MWV: Wireless Power Transmitter IC
BD57015GWL: Wireless Power Receiver IC
ML610Q772-B03: Microcontroller for MP

Main Features:

- Plug & Play Medium Power (15 W) Wireless Power Design Kit
- Compliant with Qi Standard of the Wireless Power Consortium (WPC)
- Complete solution consisting of Tx, Rx and LED Load module
- Flexible and modular approach for fast integration of wireless power in your product design

Applications:

- Portable devices used in a clean area, where connectors pose a risk of polluting e.g. medical facilities and (industrial) clean rooms
- Devices with a large number of mating cycles to avoid connector damage
- Headsets
- Battery operating portable devices
- Smartphones, Tablets

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