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NAVIGATING COVID-19

As the impact of Covid-19 plays out how has the electronics industry responded and what could the post-pandemic future hold?

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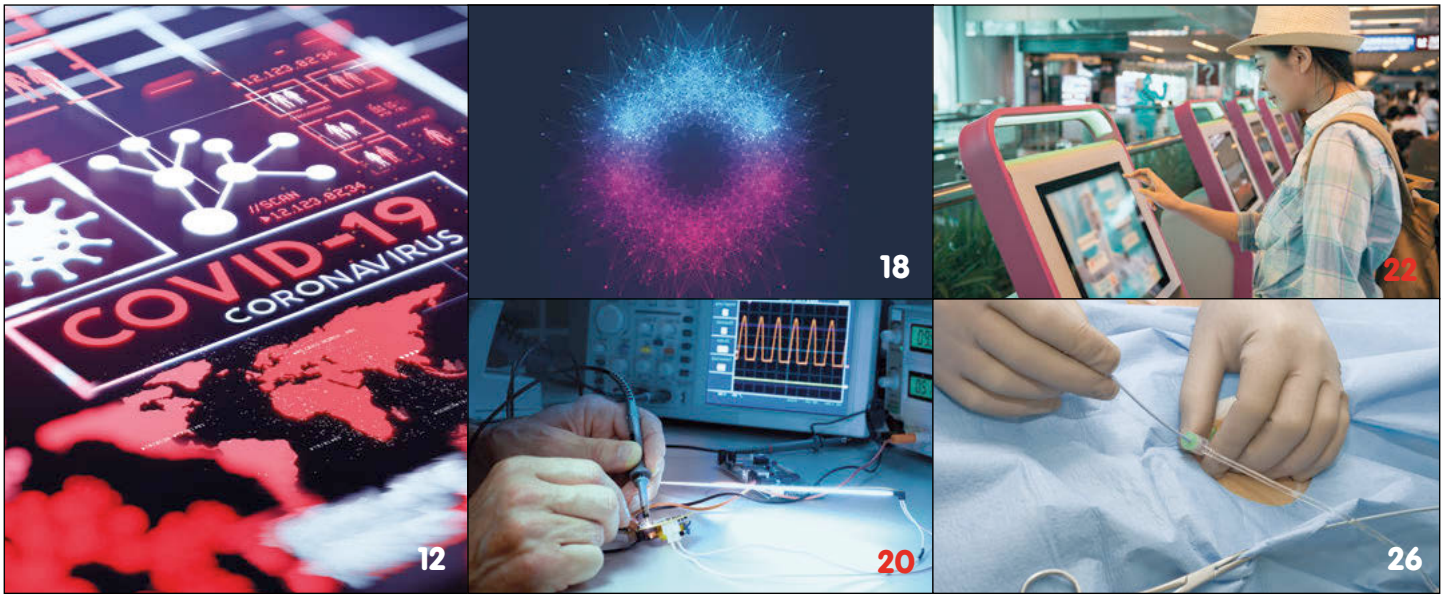

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Preparing for the 'New Normal'

AS THE IMPACT OF COVID-19 CONTINUES TO PLAY OUT, RESEARCH SHOWS THAT MANY COMPANIES HAVE A STRATEGY FOR THE FUTURE

In this issue New Electronics takes a look at how companies, here in the UK and around the world, have responded to the turmoil caused by the Covid-19 pandemic.

The virus's impact has been profound both in terms of supply and demand and, although we are starting to see a slow recovery of sorts, it's fair to say that for many it is far too early to quantify the impact it's had, and will have, on the global economy.

Much has been made of a "return to a new normal," but at the moment it is almost impossible to know what that will look like in the weeks and months ahead.

But, as with any crisis, there will always be new business opportunities that will arise, especially out of one that has had such a significant impact on how people work, rest and play.

Research conducted by ByteSnap Design in the UK found that many UK electronics companies have a clear strategy for the future, as well as a sound grasp of the effects the virus has had on the electronics industry.

Thirty six per cent said they expected a drop in demand, 18 per cent said they were planning for further supply chain disruption, 13 per cent saw increased opportunities while a further 9 per cent saw a need for more on-shoring.

A majority of those questioned, surprisingly or should that be optimistically, expected the UK to be back to 'normal' within the next twelve months. whatever that 'normal' is.

While concerns are growing about the virus's economic impact it's interesting to note that companies see opportunities arising out of the crisis, especially in terms of medical technology and the IoT, and that those companies that put the effort into continuing to innovate were expected to bounce back more quickly. The report suggests that those companies that don't keep up with technology will ultimately fail - but there's nothing new in that!

In fact the top three ways respondents suggested for weathering the pandemic and its aftermath were, after innovating at 30%, being more flexible (29%), followed by the need to be lean and engaging in good financial management.

Concerns with supply chain disruption saw a sizeable number of respondents looking to de-risk their supply chains. Many were concerned about over-extended and fragile supply chains, design and manufacturing security and an over-reliance on imports from China – a finding that was reinforced by the fact that 80% of respondents said that they would be considering more on-shoring.

The electronics industry has experienced many 'Black Swan' events in its history, but it is certainly fair to say that Covid-19 is one that has dramatically moved the goalposts for both the private and the public sector.

One benefit that has come out of the crisis, however, is the impact technology has had in helping us to carry on living our lives and that the digital transformation, whether that's more teleworking or automation, that we have seen in the past few years has now moved front and centre.

Neil Tyler, Editor (neil.tyler@markallengroup.com)

"Research has found that many UK electronics companies have a clear strategy for the future, as well as a sound grasp of the effects the virus has had on the electronics industry both now and in the future."

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Grant awarded to disruptive Bizen transistor technology

SEARCH FOR THE NEXT RECEIVES GRANT TO CONTINUE WORK INTO ITS TRANSISTOR PROCESS TECHNOLOGY. **NEIL TYLER** REPORTS

Start-up Search For The Next (SFN) has announced that its Bizen transistor technology has received an award worth £1.7m which will drive forward the development of the enabling transistor process technology. The grant has been made by the 'Driving the Electric Revolution Challenge' program, part of UKRI's Industrial Strategy Challenge Fund, which aims to position the UK to benefit from the economic opportunities from the global transition to clean technologies and electrification.

Bizen is a semiconductor process that applies the principles of quantum tunnel mechanics to any computing or power technology. When compared to CMOS, it results in a five-fold lead time reduction - down from 15 weeks to just three weeks. Moreover, the new process achieves a three-fold increase in gate density that produces a matching three-fold reduction in die size. Bizen also halves the number of process layers required. All this is achieved while equalling or bettering the speed and low power capabilities offered by current CMOS devices.

David Summerland, CEO SFN said "We are extremely pleased that the UK government has recognised the key role that Bizen will play in enabling the UK to meet its ambitious net zero targets. My challenge to industry is this: have a look at Bizen and we are sure that you'll see that it's impossible to produce a wide variety of ICs at a lower cost or on a shorter TTM. Truly, CMOS is history."

Bizen technology lets designers create a simpler circuit with far fewer layers and increased logic density. For example, the number of layers needed for a Bizen device range from four to eight for devices supporting low to high voltage operation, compared with ten to seventeen for CMOS. Using Bizen it will become possible to build complex devices in the large geometry fabs that exist in the UK.

Since mid-2018, SFN has been working with Semefab for process development and qualification leading to device production. First test chips are planned for this summer.

Accelerated FPGA-based processor design

Lattice Semiconductor has announced Lattice Propel, a software solution that's intended to accelerate the development of applications based on low power, small form factor Lattice FPGAs.

Developers of any skill level will now be able to design Lattice FPGA-based applications by enabling the easy assembly of components from a robust IP library that includes a RISC-V processor core and numerous peripherals.

Propel's correct-by-construction development tools automate much of the design process and it combines system hardware and software design into one tool framework, so software developers can begin creating system software before hardware is available and get products to market faster.

Key components of the Lattice Propel design environment include:

Lattice Propel Builder, a resource-rich system IP integration environment supported by a complete set of GUI and command line tools. Builder provides customers with access to a regularly updated IP server that allows developers to implement new IP on Lattice FPGA-based designs in a matter of minutes. The server currently offers eight processor and peripheral IP cores, including a RISC-V RV32I compliant processor core. All IP cores available through Lattice Propel Builder are compatible with the AMBA on-chip interconnect specification.

The **Lattice Propel SDK** enables software development to begin before final system hardware is available and includes industry-standard software development tools, software libraries, and development board support packages so developers can quickly and easily build, compile and debug their application software.

Commercially available 5G devices break 100 barrier

The Global mobile Suppliers Association (GSA) has reported that the number of commercially available 5G devices has continued to grow, and has broken through the 100 barrier for the first time, totalling 112 as of the end of May 2020.

In January 2020, the number of devices announced exceeded 200 for the first time and by end-May that figure had risen to 296 devices.

"Against the backdrop of an unprecedented disruption to normal life around the world, the growth in 5G has remained a constant feature," commented Joe Barrett, President of Global mobile Suppliers Association. "Whether it is new 5G smartphones or CPE devices for 5G fixed wireless access, the industry continues to deliver the devices people and businesses need in order to benefit from the 5G capacity boost that the 'new normal' is demanding.

"Based on vendors' previous statements, we might see more than 30 additional announced devices become commercially available before the end of June 2020. However, many device launch timetables were announced before COVID-19 had an impact on businesses worldwide and so GSA will be tracking and reporting regularly on these 5G device launch announcements."

By end of May 2020, GSA had identified:16 announced form factors; 84 vendors that had announced available or forthcoming 5G devices and 296 announced devices, including at least 112 that are commercially available).

In terms of spectrum bands, 72% of all announced 5G devices have been identified as supporting sub-6 GHz spectrum bands while 28.4% are understood to support mmWave spectrum. Just 22% of all announced devices are known to support both mmWave and sub-6 GHz spectrum bands.

Anglia enhances customised display options

DISTRIBUTOR RESPONDS TO MAJOR CHANGES IN HOW DISPLAYS ARE BEING INTEGRATED INTO DESIGNS. **NEIL TYLER** REPORTS

Anglia Components has announced a significant enhancement to its range of customised display options.

Part of the Anglia Inception custom and bespoke component design service it will now be possible for engineers to create, for example, new COVID-aware touchless user interfaces.

Commenting on the enhanced service, David Pearson, Technical Director of Anglia, said, "We are seeing a dramatic increase in the use of displays for both consumer and industrial electronics and due to the current COVID-19 situation, we're predicting further major change in how displays are integrated into designs."

According to Pearson, touch screens, which were previously a preferred user interface technology, are now seen as a potential source of infection and instruments are now being redesigned with a touchless interface using voice or gesture control or using 2-way communication from a control device such as a cell phone, tablet or dedicated unit.

Pearson continued, "At Anglia, we've been working increasingly on medical and other designs following the government's call to action, and we've seen how user interface design needs to change in this field."

Anglia is able to supply a variety of display options and these customised displays can be tailored to individual applications, allowing them to meet the demands of specific industries.

Customisation options include the addition of custom icons, characters or fonts, wide temperature range options, the addition of capacitive or resistive touch panels, optical bonded glass, negative mode operation and special viewing angles.

Anglia can also enhance display functionality with a range of built in driver IC and connector options for data, touch screen and backlight. In addition, a range of display types are also available including colour and mono TFT, graphic, character, VATN, OLED, AMOLED and Electronic Paper.

Development tools for RISC-V MCUs

IAR Systems and GigaDevice Semiconductor, a Flash memory and MCU provider, have announced the formation of a partnership to deliver development tools for GigaDevice's RISC-V based microcontrollers (MCUs).

IAR Systems is the developer of the C/C++ compiler and debugger tool-chain IAR Embedded Workbench while GigaDevice, a fabless company, supplies advanced memory technology and IC solutions and has developed a wide range of SPI NOR Flash, SPI NAND Flash, and MCUs for use in embedded, consumer, and mobile communications applications. In 2019, GigaDevice launched the world's first RISC-V-based general-purpose MCU products.

The collaboration comes in response to the rapid evolution of RISC-V technology and its ecosystem, increasing the need for professional development tools. IAR Systems' compiler and debugger technology will now be available to users of GigaDevice's RISC-V-based MCUs making it possible to create more powerful, easier-to-use, complete solutions based on RISC-V.

According to Thomas Andersson, Product Manager, IAR Systems. "The combination of GigaDevice's processor core and IAR Embedded Workbench adds great device power optimisation and development efficiency to the RISC-V community."

Government on track to give science a boost

BEIS CONFIRMS ALLOCATIONS FOR THE PUBLIC R&D BUDGET IN A MOVE WELCOMED BY CAMPAIGNING GROUP CASE. **NEIL TYLER** REPORTS

Earlier this year the government announced, in the March Spring Budget, plans to increase public R&D investment to £22 billion per year by 2024-25, exceeding the previous commitment to double science investment to £18bn.

Described as a landmark investment in what was the largest and fastest ever expansion of funding for basic research and innovation, the Department for Business, Energy and Industrial Strategy (BEIS) has now confirmed allocations of the R&D budget for the financial year 2020 to 2021. The department said that it would allocate £10.36 billion of funding to BEIS programmes and partner organisations.

This funding includes investment in world leading science and advanced mathematics, and in developing Net Zero energy technologies, automotive and aerospace sectors. It will also be used to secure talent and maintain the infrastructure needed to deliver world leading research, according to the UK government.

The Campaign for Science and Engineering (CaSE) welcomed the announcement, having long-called for increased R&D investment to unlock the scientific potential of the UK.

Commenting on the announcement, CaSE Assistant Director Daniel Rathbone said: "Following on from the announcement by the Chancellor in March of a significant increase in research spending in 2020/21, we now see that UKRI's budget will increase by a very welcome 20%. This will allow significantly increased investment in the UK's science base - supporting research that has the ability to drive economic growth and improve quality of life across the UK.

"The additional investment can also help protect and stabilise the delicate research ecosystem as it feels the effects of the Covid-19 pandemic. We look forward to seeing more detail from both the Government and UKRI about how it will be protected in the coming weeks."

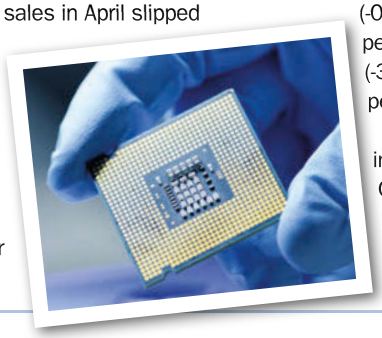
The latest BEIS research allocations represent a:

- **19%** increase in BEIS's total research budget from last year
- **20%** increase in UKRI budgets from last year
- **£1.6bn** increase in BEIS' total research budget from last year

Global semiconductor sales dip in April

Figures from the Semiconductor Industry Association (SIA) show worldwide sales of semiconductors totalled $34.4 billion for the month of April 2020, 1.2 percent less than in March, but 6.1 percent more than the April 2019 total of $32.4 billion.

"Global semiconductor sales in April slipped slightly compared to the previous month, which is in line with seasonal trends, but significantly outpaced sales from April 2019," said John Neuffer, SIA president and CEO. "The global semiconductor market through April has shown early signs of resilience to the economic turmoil caused by the COVID-19 pandemic, but significant uncertainty remains in the months ahead."



Regionally, month-to-month sales increased in China (2.1 percent), but decreased in Japan (-0.9 percent), the Americas (-1.1 percent), Asia Pacific/All Other (-3.1 percent), and Europe (-7.6 percent).

Sales increased year-to-year in the Americas (24.5 percent), China (4.4 percent), and Asia Pacific/All Other (3.3 percent), but fell in Japan (-0.1 percent) and Europe (-7.1 percent).

Bluetooth SIG and DiiA to collaborate

The Bluetooth Special Interest Group (SIG), and the DiiA, the global DALI alliance of companies from the lighting and sensor industries, have announced that they will be collaborating on accelerating the adoption of IoT-enabled commercial lighting systems.

The collaboration is intended to enable the deployment of certified DALI-2 devices and intelligent D4i luminaires, with qualified Bluetooth mesh intelligent lighting-control networks and brings together these complementary IoT standards for commercial lighting.

"Combining Bluetooth mesh with DALI is a natural choice for the commercial lighting industry," said Paul Drosihn, DiiA General Manager. "It enables sensor-rich lighting systems and will deliver powerful new IoT capabilities to building managers. This will include automated light-level and colour control, advanced luminaire performance monitoring including energy usage and predictive maintenance, as well as enhanced services such as asset tracking and indoor navigation."

IoT-enabled commercial lighting systems are comprised of two key components: IoT-enabled luminaires that include sensors and other devices, and an IoT-enabled lighting control system.

DALI-2, from the DiiA, provides an ecosystem of certified lighting devices including intelligent D4i luminaires, while Bluetooth mesh, from the Bluetooth SIG, is a leading IoT standard for intelligent wireless lighting-control networks.

Through this collaboration, companies from both organisations will be able to bring these two standards together by specifying a standard Bluetooth mesh interface for certified DALI-2 and D4i devices, enabling connectivity with qualified Bluetooth mesh lighting-control networks.

"Commercial building owners around the world are being asked to improve energy efficiency while also enhancing the occupant experience," said Mark Powell, CEO of the Bluetooth SIG. "The IoT-enabled intelligent lighting systems this collaboration enables promise to deliver the exact solution these building owners need."

Arm unveils new suite of mobile IP

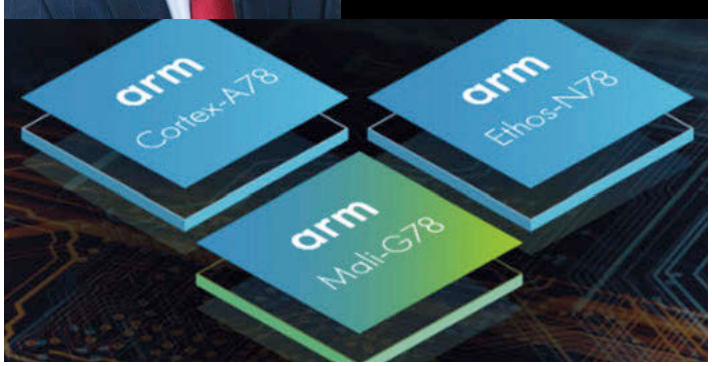
NEW PROCESSORS HAVE BEEN UNVEILED BY ARM TO SPECIFICALLY ADDRESS THE NEEDS OF SMARTPHONES. **NEIL TYLER** REPORTS

Arm has unveiled a number of new processors that have been specifically designed for smartphones. The new devices which include the: Cortex-X1 CPU, Cortex-A78 CPU, Mali-G78 GPU and Ethos-N78 neural network processor (NPU) are intended to deliver improved levels of performance and much greater efficiency.

Commenting Paul Williamson, vice president and general manager, Client Line of Business, Arm, said, "As we experience rapid societal changes in how we interact with and rely on technology to connect, aid, and support us we are increasingly living our lives on our smartphones and there is growing interest among users as to how we explore the limits of what is possible."

Acknowledging the impact of Covid-19 on the way in which live, work and interact with one another, Williamson said that, "The combination of these factors with the convergence of 5G and AI, are generating greater demand for more performance and efficiency.

"More performance and efficiency are only meaningful if your smartphone is optimised to deliver the best experiences on the applications that matter to you most."
Paul Williamson



"But more performance and efficiency are only meaningful if your smartphone is optimised to deliver the best experiences on the applications that matter to you most."

Along with these processors Arm has also launched a new engagement program called the Cortex-X Custom program, which is intended to give its partners more flexibility and scalability when it comes to increasing their application's performance.

The Custom Program allows for customisation and differentiation beyond the traditional roadmap of Arm Cortex products, according to the company.

The Cortex-X1 is the program's first CPU and is, according to Arm, its most powerful Cortex processor to date, bringing 30% peak performance improvements over the current Cortex-A77 CPU. It also offers 22% single-thread integer performance improvements over the Cortex-A78.

"This short high-performance burst is best for reactivity and responsiveness when using devices, enabling the highest performance ever for smartphones and large screen devices," according to Arm. "The Cortex-X1 offers 2x machine learning performance improvements over the Cortex-A77. This is part of our wider push for more local compute performance."

The Cortex-A78 CPU looks to deliver a combination of performance gains with more efficiency.

According to Arm, "The Cortex-A78 is our most efficient Cortex-A CPU ever designed for mobile device, providing double digit improvements for sustained performance." While it has the same architecture as the Cortex-A77 it has a modified micro-architecture to increase performance/W and performance/area and provides a sustained 20 per cent performance improvement over the Cortex-A77 within a 1W power budget.

Arm said that it has sought to maximise efficiency through reducing structures that have low performance and area, such as on the L1-I and L1-D caches. As a result, "We have optimised existing structures to consume less power, such as the brand prediction structures. This leads to 4% less power for performance and 5% less area."

At a cluster level

At a cluster level, the DynamIQ cluster of 4X Cortex-A77CPUs and 4X Cortex-A55 CPUs can be upgraded to 4x Cortex-A78 CPUs and 4X Cortex-A55 CPUs, to provide a 20 per cent sustained performance improvement in 15 per cent less space. By introducing the Cortex-X1, however, it is possible to boost peak performance by over 30 per cent.

The Cortex-X1 has been designed as a higher performance processor and, due to various microarchitecture upgrades, it has more resources compared to the Cortex-A78 - its decode bandwidth is increased by 25% to five instructions decoded per cycle, and MOP cache throughput has been increased by 33 % to 8 MOP/cycle. On Cortex-X1, the Neon engine gets two additional pipes, doubling its compute capacity over Cortex-A78, then Cortex-X1 supports 64kbyte L1 and up to 1Mbyte L2 cache.

Last year saw the release of the Mali-G77, now the new Mali-G78 - with Arm's Valhall architecture - is said to deliver a further 25% improvement in graphics performance.

The device supports up to 24 cores and these advances have been made possible via asynchronous top level, tiler enhancements, and improved fragment dependency tracking, according to Arm.

Arm also announced a new sub-tier of GPUs. The move, in response to demand from partners, sees the introduction of the Mali-G68 that, according to Arm, "Supports up to six cores and inherits all the latest Mali-G78 features."

To address expanding demand for machine learning (ML) the Ethos-N78 is a neural networking processor.

"Compared to the Ethos-N77 it is capable of delivering greater on-device ML capabilities but with up to 25% more performance efficiency," said the company. "The Ethos-N78 also offers unprecedented levels of configurability, with available configurations starting at 1Top/s on up to 10Top/s."

NAVIGATING **COVID-19**

As the impact of Covid-19 plays out how has the electronics industry responded and what could the post-pandemic future hold? By **Neil Tyler**

"It's almost Darwinian out there", according to one CEO who spoke to New Electronics and, with the impact of Covid-19 yet to be fully played out, it's likely that only those companies that are able to adapt to the changes brought about by the pandemic and the challenges of recession that will be the ones to survive.

Research conducted by ByteSnap Design in the UK last month, found that among electronics companies innovation, flexibility, operating as leanly as possible, while engaging in good financial management were seen as critical in terms of their survival.

According to the report, "With resilience, adaptability, cash, good leadership and a mix of customers, across a range of different industries, electronics firms should have good survival rates."

Whatever the future holds, the crisis has highlighted several issues, one being how dependent the electronics industry's supply chain is on Chinese manufacturers.

When the crisis struck China the initial reaction was, that while it would cause severe disruption to the global supply chain, business would be able to operate as normal. However, as Covid-19 went global, while the impact on the supply side eased as China's factories began to return to work, the shock to the demand side proved profound. The long term consequences, of which, are only now starting to play out.

The halting or slowing down of supply chains began in January, says Steve Rawlins, CEO, Anglia Components. "We first saw the effect in January when Chinese manufacturing started to close down. Anglia operates with a stock turn of one and holds inventory at a level of 50% of our annual sales – which is five-six times the level of the industry norm. We look to maintain a substantial buffer to insulate customers against inevitable but unpredictable disruptions, such as Covid-19, that can occur."

"The China shut down affected raw material supplies. Luckily we hold pretty good buffer stocks, so we weren't that badly affected," says William Heath, Commercial Director, OMC. "While suppliers are quoting longer lead times on materials, it's manageable; it is just making things harder for production planning. Lead times are long and everyone is being generally cautious."

"For RS Components, being a global business actually helped. Due to our initial response to the crisis in China we were able to apply what we'd learned when the crisis became global," explains Debbie Lentz, RS Components' President Global Supply Chain.

James Thew / stock.adobe.com

"As a distributor it's critical that we got up and running quickly and we deployed split shifts and social distancing to ensure our employees were kept safe."

According to Lentz, "Supply chain disruption meant that the company had to connect and work closely with suppliers. Production, once it re-started in China, was sporadic but as we hold stock at 12 different distribution centres around the world we were able to protect out supply chains – we used different source points, switching between the Far East and Europe when required."

According to Tyson Tuttle, CEO of Silicon Labs, "We had real supply chain worries when this hit China, there was an inability to transact but, as China began to unlock, communications started up again.

"As for Silicon Labs we are set up to work virtually, so as we monitored the situation in February and March and as the pandemic spread we had plans already in place to deal with it, i.e working from home, identifying essential employees and handling social distancing."

Tuttle makes the point that being exposed to the impact of the crisis via China meant that the company was relatively well prepared.

"As it went global we wanted to deal with the crisis proactively and navigate through it as effectively as possible. So as factories were hit and supplies affected we worked out how we would continue working using our network of design centres."

While, "everything just kept going," Tuttle concedes that for a lot of companies working remotely brought considerable challenges and they've had to learn how to be more productive in a virtual environment.

Surge in freight costs

One critical issue that severely impacted electronic supply chains was the jump in freight costs.

"The costs associated with air freight are up significantly," explains Lentz. "But a lot depends on the lane. From China to Europe and the US freight costs are very high, likewise from the UK to Japan, APAC and the US. A lot of freight goes in passenger planes so with airlines being grounded there's been a real and sizeable impact – it's a simple matter of supply and demand."

According to Jeff Schnabel, President CUI Devices, "The shut-down happened quickly and our ability to respond was limited. We had to work with partners and sub-components suppliers to get manufacturing up and running and it took 6-8 weeks to get back to 60-80 per cent normal capacity. We're back to normal today.

"In that time, costs have certainly gone up in terms of freight. We are seeing the big carriers implement restrictions on weight per company that they're willing to move, and while we have a specific partner, with whom we have a good rate, when it comes to finding other sources it's a lot more expensive. I would say it's the biggest cost impact by far, and it certainly affected lead times."

"Covid-19 has pitilessly exposed the fragility of the supply chain in our industry," Rawlins believes. "The simple fact is that there wasn't enough inventory in the system."

Supply chain disruption was a concern for a fifth of respondents to the ByteSnap survey and there were calls for the government to address design and manufacturing security, as well as a warning over the current reliance on Chinese imports.

According to Heath, "I think we'll see higher-level assembly starting to take place in the West, operations in which the most value is added. Component manufacture is unlikely to come back on any great scale, due to the sheer order of magnitude of difference in cost. Then there are components such as semiconductors for which a huge amount of manufacturing infrastructure would need to be built. Perhaps efforts will be made to source more widely, from other lower-cost countries rather than predominantly China, in order to spread the exposure."

"The simple truth is that it is almost impossible to know what the electronic industry will look like in the months ahead."
Mike Britchfield

"The costs associated with air freight are up significantly."
Debbie Lentz

Infection control efforts

Heath also makes the point that infection control measures will, "affect supplier productivity for some time to come and to a degree we will have to get used to this."

The fact that companies now have to adhere to new regulations and guidelines to better contain Covid-19, means that they have to take precautions to keep both employees and customers safe and better informed.

"What was initially seen as a quality of life issue i.e. working from home, is now a necessity, so at Silicon Labs we've been using Zoom and Teams," says Tuttle. "Our engineering and corporate systems are cloud based and we've been able to support our staff and customers by working remotely."

Digi-Key quickly implemented strict social distancing and workplace sanitisation measures, and began to evaluate additional ways to reduce contact, explains Ian Wallace, Director, EMEA Business Development.

"For example, over 8,000 plus totes travel through the receiving, picking and packing departments at Digi-Key every day and they were seen as a risk to employee health. The team developed a 4.5-metre ultraviolet sanitisation tunnel built into the curve of the conveyor belt that sanitises all totes that travel through the facility every day – drastically reducing potential virus contact for employees."

"We started taking our first steps in late February and by mid-March we had already imposed a 2m distancing rule to protect our staff," records Heath. "We're fortunate that our building has several entrances and a lot of facilities, so implementing social distancing wasn't disruptive.

We actually took steps progressively as things appeared to be getting more serious – we already had a pandemic policy from when we updated our business disaster recovery plan – but we never really expected to have to use it!"

According to Heath the company suspended face-to- face meetings with external parties and took other steps such as special handling and de-contamination of incoming goods.

"We segregated the whole company into smaller groups, so that if one person got sick, it would limit the spread. We also looked at how we could prevent cross-infection when goods and tools passed from one staff member to another."

While the Harwin factory in Portsmouth is spread out some additional measures were required to enable production to continue safely.

"We've added some additional spacing to accommodate social distancing rules and we put in place a one way system when walking around the business. Throughout the building we've sought to direct people walking around and made PPE available to all staff – we benefitted from a large shipment of masks from our Asian branch quite early on," explains the company's CEO, Damon de Laszlo.

Demand variations

While certain sectors are successfully riding the storm many others, in particular those supplying components to the automotive and consumer sectors, have seen demand collapse.

ByteSnap's research found that demand for IoT and medical products was growing, significantly, while for automotive and industrial levels of demand had fallen back precipitously with 60 per cent of those questioned saying it was down.

According to Heath, the impact of the pandemic remains difficult to evaluate, as OMC's products are manufactured to a lead time and are scheduled orders.

"We have seen a sudden move to hand-to-mouth ordering from customers, however, so if you look at something like average order value, then it looks like a dramatic impact, but really this is more an effect of our customers changing how they are ordering rather than how much they are ordering."

"Certain industry sectors have experienced very high demand for their products from the very beginning," explains Mike Britchfield, VP Sales, EMEA, Analog Devices. "Healthcare is the obvious use case, and we've had to ensure that these customers have been able to operate effectively within the limitations that the pandemic imposed.

"With the automotive industry, the pandemic has caused a significant drop in demand, but that could reflect that individuals are not only becoming more budget conscious with their spending but also that the latest models packed with the newest features might not be a priority."

Tuttle agrees. "I think the most challenged market is the automotive one. Not only are factories shut but traffic numbers have fallen significantly and people are just unwilling, or unable, to buy cars.

"We're predicting something like a 25-30 per cent drop in sales across 2020. But beyond that the sector has to now respond to the electric transition. That transformation is going to be costly at a time when revenues are down and many companies are seeking state support."

One sector that has reported strong growth has been communications.

"Communications is a core business for us, and we've seen increased demand, even more so as it appears that the trend towards working from home is going to require a more robust and effective communications infrastructure," suggests Britchfield.

"Perhaps efforts will be made to source more widely, from other lower-cost countries rather than predominantly China, in order to spread the exposure."
William Heath

"Anything to do with communications is on fire at the moment, whether that involves data centres, communications infrastructure or 5G."
Tyson Tuttle

"Wireless networks and overall connectivity are two areas where remote working is going to have a significant impact both now and in the not-so-distant future."

"Anything to do with communications is on fire at the moment," adds Tuttle, "whether that involves data centres, communications infrastructure or 5G."

The crisis is seen as accelerating the drive towards greater digitalisation across many different sectors, according to the CEOs interviewed.

From greater automation and teleworking to buildings needing to have advanced sensing and monitoring devices that can track movement and body temperature, many of the tools needed to succeed are already available but the actual impact of COVID-19 will certainly be hard to quantify.

"It will only be when people start returning to work, children head back to school, and fans are let back into concert venues or sports stadia, that we will know the role that the electronics industry will have to play in the post-pandemic world," says Britchfield.

"The simple truth, however, is that it's almost impossible to know what the world will look like in the months ahead."

ByteSnap's survey found that 86% of those surveyed said that they believed the UK, rather optimistically, would be back to normal within a year. However, a sizeable number expect a severe recession in 2020-21, with 36 per cent expecting a drop in demand.

In truth, we are still months away from beginning to see the real impact that the pandemic will have had on the electronics industry, and even then, analysis will be relatively limited.

Only when all this is over will we start to 'tentatively' see how the industry has really performed.

#ENGINEERINGHEROES

Celebrating engineering's role in fighting the Covid-19 pandemic

The way engineering and manufacturing have stepped up during the Covid-19 pandemic to address shortages of medical and protective equipment has been truly inspiring. #EngineeringHeroes celebrates and honours the stories of people, companies and technologies that have made up UK engineering's massive contribution during this time

Left image: Konstantin Z/stock.adobe.com Middle image: Vadim/stock.adobe.com Right image: Ford of Britain

BACKED BY newelectronics

If you have a story you would like us to share or you wish to join the leading companies and organisations supporting the campaign please visit our website.

Join the campaign! www.engineeringheroes.co.uk

A MARKET RIPE FOR DISRUPTION

Neil Tyler talks to the founders of Panthronics and looks at how their technology is set to disrupt the NFC market

A fabless semiconductor company specialising in high performance wireless technology, Panthronics started life in 2014 and this Austrian start-up is looking to seriously disrupt the NFC market.

Headed by Kambiz Hayat-Dawoodi, the CEO and Jakob Jongsma, the CTO, the company entered a NFC market that has been growing rapidly, driven by growing consumer adoption of contactless payments and ticketing, yet one which has been held back by incumbent manufacturers who have been constrained by products based on legacy technology which, according to Hayat-Dawoodi is, "no longer fit for purpose."

Both men have brought long years of experience to their respective positions having between them worked at ams, Infineon and Texas Instruments for over 30 years.

"We started working together back in the 1990s and from our experiences in this space we learned about the challenges and shortcomings of NFC and what needed to be done to address them," explains Hayat-Dawoodi.

"It's fair to say that we started the company, in part, because of the frustration we felt that innovation was difficult to push to market from inside larger companies."

The market opportunity is certainly huge with some analysts predicting that the NFC market could be worth $24 billion in the next couple of years. At the same time big players, like Apple and Huawei, are using NFC technology in their smartphones..

"When we started we simply wanted to bring an innovative technology to market but now we can see just how big the opportunity is for the company going forward," explains Hayat-Dawoodi.

In September 2019, Panthronics unveiled a new NFC controller platform to enable manufacturers of industrial devices, such as point-of-sale (PoS) terminals, to implement more robust NFC connectivity in a space-saving design.

"The device, the PTX100R, uses a radical new RF architecture that is able to produce significant improvements in both output power and sensitivity," explains Jongsma.

"We work closely with manufacturers and when it comes to PoS we're seeing many different form factors now coming into play. That, in turn, raises the question as to how you locate antennas while addressing sensitivity and interference issues," he explains. "When you look at legacy technology a lot of additional filtering is required. NFC readers tend to have to operate in challenging environments where noisy displays cause interference in the NFC antenna, which has to be mounted close to it. When it comes to mobile PoS equipment the space for the antenna is limited and the metal enclosure will often hamper the propagation of RF signals."

The PTX100R uses the company's patented DiRAC technology which enables the NFC reader to drive output power of up to 3W, directly to the antenna.

"That is more than double the output power capability of other NFC architectures," explains Jongsma, "and is achieved with a sensitivity of -80dB, which again is more than twice as good as the competition."

This means that PoS terminals and mobile PoS manufacturers can now achieve EMVCo 3.0 compliance (for contactless payments) with an antenna of just 900mm2, some four to five times smaller than the current norm.

"We've managed to remove a lot of components so a lot less heat is generated, and while the device is low power we've achieved that without compromising its efficiency," explains Jongsma.

Among the patented innovations implemented in the PTX100R are: a sine wave output driver that eliminates the need for EMI filters; ultra-precise wave shaping and true on-chip dynamic power control that exceeds the requirements of the new EMVCo 3.0 standard. The company's DiRAC technology also delivers increased dynamic range and direct sensing of antenna signals.

"All of which provide much greater margin for engineers when it comes to tackling increasingly challenging designs," Jongsma suggests.

PTX100W NFC charger IC

At a much reduced Embedded World, earlier this year, the company unveiled a new charger IC which was designed to substantially increase power output and significantly reduce wireless charging time


Kambiz Hayat-Dawoodi


Jakob Jongsma

for smaller devices such as earbuds and lifestyle-tracker wristbands.

The PTX100W NFC charger IC provides an output power at the charging device's antenna of >2.5W, which is more than twice as high as that produced by the next best NFC controller on the market, according to the company.

"That higher output power enables much faster charging, making it viable for manufacturers of consumer devices that only have space for a small antenna to eliminate the wired charging circuit from next-generation product designs," says Jongsma.

Increasingly, manufacturers developing mobile and wearable devices are looking to use wireless charging.

"It offers much greater convenience, more design flexibility and reliability benefits," suggests Hayat-Dawoodi. "Qi wireless charging, popular in smartphones, is unsuitable for smaller devices because it requires a large antenna and costly circuitry, so NFC wireless charging has much greater appeal. The antenna is smaller with high tolerance of antenna misalignment, and because of the NFC protocol's supports data communication with a host such as a smartphone."

Again, until the advent of the PTX100W the adoption of NFC for wireless charging was held back by the low output power provided by conventional NFC controller ICs.

"The PTX100W makes wireless charging via an NFC interface suitable for any device with a battery smaller than 500mAh and it's able to deliver output power thanks to its sine wave architecture," says Jongsma.

There is no EMC filter circuitry which means that OEMs can achieve antenna matching impedance some two times lower than that of a conventional solution, which has an EMC filter.

As a result the PTX100W NFC charger is able to drive much higher power through an NFC antenna than existing NFC ICs can, while significantly reducing the power losses introduced by external components.

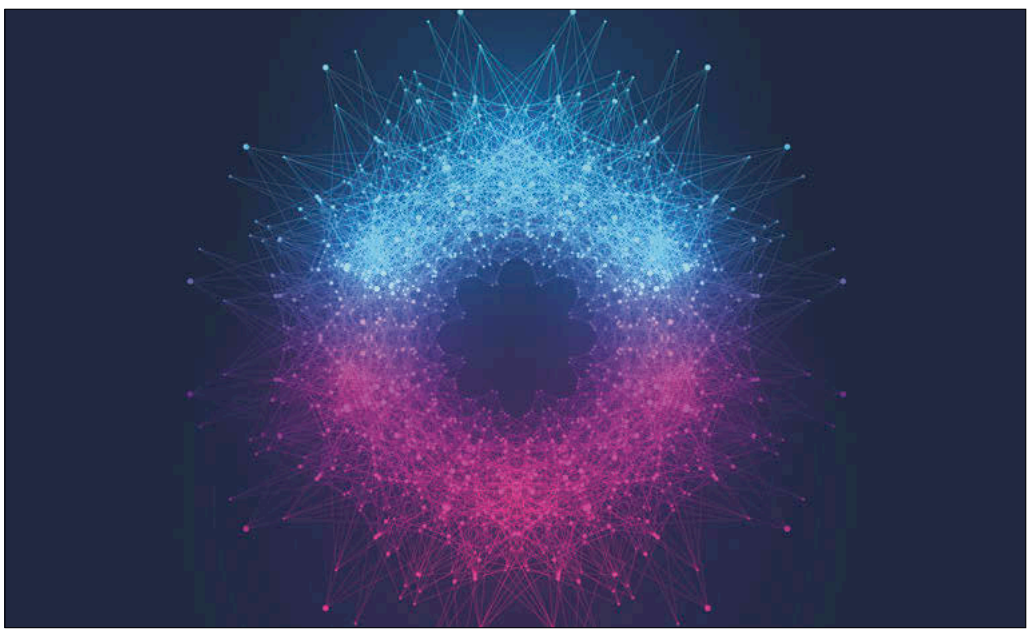
The PTX100W also supports NFC data communication while charging – data exchange operations are fully compliant with NFC Forum specifications.

"We're looking to work closely with other companies who lead in their particular fields," says Hayat-Dawoodi, "as we look to make inroads into various markets with this technology. We're looking for synergies. In the case of the consumer/wearables space, we recently developed a demonstration design of a wireless charging system for a device, based on the PTX100W and Renesas' Synergy S128 MCU."

According to Hayat-Dawoodi, Panthronics is now making NFC charging a realistic and practical option for new products and, together with its NFC reader, is well placed to really start disrupting this market.

PUSHING THE ENVELOPE

State-of-the-art wireless and computing technologies are demanding greater innovation when it comes to test & measurement, as **Sebastian Richter** explains



It seems that, today, advanced technology is increasingly spreading into every aspect of life. Wireless technologies are delivering essential services through our phones, every second of the day, and connecting the IoT and smart technologies we use to control our homes and monitor our health and fitness. We are also expecting 5G to have huge implications for consumer services, industrial controls, enterprise digital transformation, and improving road safety.

However, if we look only a little further into the future quantum computing could have an even more profound influence over every aspect of our lives.

These are important trends that present challenges on many levels. Of course, those that involve taking precision measurements and dealing with difficult noise and interference issues are especially interesting to companies working in the area of test and measurement.

Wireless coexistence

With our personal devices and IoT sensors all around us, we are in an environment saturated with LPWAN, Bluetooth, ZigBee, Wi-Fi, and cellular wireless connections. As this growing number of RF technologies reaches into every space of life around the globe, coexistence between the various systems becomes even more important and at the same time more difficult to ensure.

The ability for various systems to transmit and receive their signals without interference, even when they are active at the same time, can only be tested during development or during pre-compliance testing in a realistic test environment. That means that the test equipment must be designed for the transmission technologies concerned.

Wireless transmissions need to be tested over the air interface and it is important to test under realistic conditions. At Rohde & Schwarz, for example, we have placed a great emphasis on this, and have developed wireless testers that are capable of testing cellular and non-cellular signals simultaneously, including Bluetooth LE.

On the other hand, with conducted transmissions, an instrument such as an oscilloscope needs to recognise all of the transmission technologies concerned and decode them in real time. It is convenient if the user can see at a glance which event in the signal led to a faulty bus protocol transfer.

However, the test setup can noticeably influence the result when making cable or PCB measurements. This influence can be removed using computational de-embedding. At Rohde & Schwarz, we have worked with leading semiconductor and cable manufacturers to develop a suitable algorithm for vector signal analysers. Moreover, our new high-performance oscilloscopes, the R&S RTP, provide real-time de-embedding, allowing the trigger system to directly access the de-embedded signal.

All trigger types are supported up to the maximum bandwidth of 16 GHz. For troubleshooting on signal lines, there is also an option for transmission and reflection measurements in the time domain.

Test and Measurement sensitivity

Another factor that presents major test and measurement challenges is the trend towards ever-lower supply voltages, and hence tighter voltage tolerances, for the latest integrated components.

While end users see the benefits in terms of smaller, lighter products and longer battery life, those of us concerned with testing need effective ways to reliably measure extremely low voltages. We also need to be able to measure nanoamp currents

in all operating modes and estimate the impact of power-saving modes in order to optimise devices with ultra-low power consumption.

Another issue is that fast digital signals and other disturbance sources can be coupled into the DC supply voltage network. Low-noise oscilloscopes with bandwidths in the GHz range are therefore required. They must also have high vertical input sensitivity in combination with a broadband 1:1 power rail probe, and a high update rate is needed to reliably capture rare events. R&S RTP oscilloscopes acquire up to 750,000 waveforms per second, allowing developers to quickly and accurately characterise power supplies.

Quantum computing is happening now

While 5G and the IoT continue to grab headlines, and while we begin to understand the impact of technologies such as AI, quantum computing is potentially even more disruptive.

With today's major computing and web giants in the game, as well as various younger, specialised companies, quantum computers are already in the cloud. You can sign up right now for an account and start dabbling. This has massive implications for the way we will live in a future that could be closer than any of us quite realises.

Our current state of the art computers (quantum computing articles are already calling them classical computers), although fantastic, remain essentially simple binary machines. In contrast, a quantum bit, or qubit, can have many more than two states. This allows quantum computers to work on complex problems and ultimately deliver results far more quickly and efficiently than a conventional computer.

Author details: Sebastian Richter is Vice President Market Segment Industry, Components, Research and Universities, Rohde & Schwarz

While quantum computers are not expected to replace today's computers, rather they will enable us to tackle challenges that have hitherto been impossible.

Putting quantum in the cloud will provide affordable access for scientific and commercial applications, just as you can rent AI applications in the cloud, right now, to do complex workloads and pay for the service according to the number of computer cycles used.

Cloud AI enables hospitals, for example, to identify genetic disorders in newborn babies within minutes for just a few pounds – rather than several days at the cost of half a million.

Cloud services like these are transforming healthcare, and cloud quantum computing could do the same in fields such as materials science, financial services, cryptography, and others. Simulating a caffeine molecule, for example, is incredibly difficult to do with a classical computer, demanding over 100 years of processing time. A quantum computer can complete the task in a matter of seconds.

Cryptographic calculations are likely to be another of the quantum computer's talents. Its ability to accelerate brute force decryption is breath-taking as much as it is a massive concern for privacy and security. A quantum computer could theoretically mine every token in the Bitcoin system almost instantaneously, for example, while our current computing is projected to take until 2140 to mine the last Bitcoin.

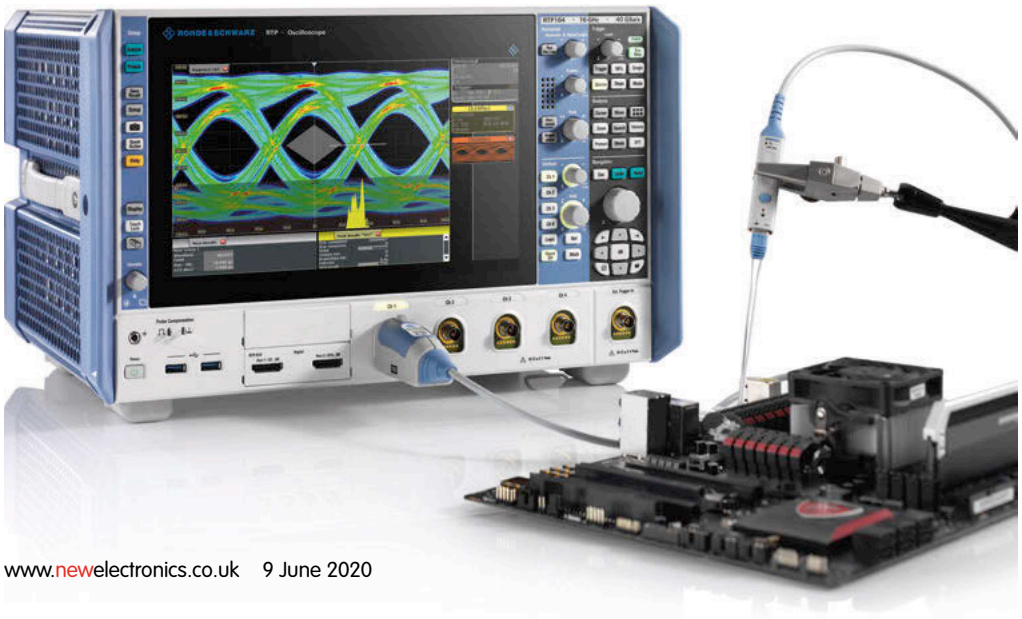
Low-noise design

A great deal of development must happen before all this becomes reality, and test & measurement specialists have a key role to play here.

Because of the nature of the technology, with each bit having multiple potential states, noise is a key concern. As the computer operates, the error rate increases and eventually reaches to a level that interferes with the results. Extending this effective operating time period, as well as increasing the number of qubits in the machine, have to be the major goals for builders of quantum computers right now.

Slowing the rising error rate is dependent on minimising sources of noise. The equipment is cryogenically cooled to near absolute zero, for example, to cut thermal noise to the lowest level possible. Also, extremely pure and clean RF sources are needed. At Rohde & Schwarz we are currently working with academic partners to meet the challenge using our ultra-low-noise R&S SGS100A RF sources.

To address this market companies in the test & measurement space have to support many different partners, but it is truly exciting to be working alongside the development of this potentially game-changing technology.



Below: The R&S RTP164 oscilloscope with the RT-2M160 probe

You're only as good as **the probe you use**

The quality of your signal is dependent on the probe you use, so how do you choose the right test probe for the job? **Sam Darwish** explains

Good testing requires good equipment, which includes probe selection.

Oscilloscopes are capable of displaying a wide variety of signals, usually as a plot of magnitude against time, and are used in a wide range of industries allowing engineers to 'look inside' a circuit or piece of equipment.

The first oscilloscopes were developed in the 1930s but from the 1980s onwards, digital storage oscilloscopes (DSOs) became more popular. They use a fast analogue-to-digital converter and memory chips to record and display a digital representation of a waveform. More flexible than traditional analogue oscilloscopes they were able to carry out many analyses automatically.

Modern DSOs, known as 'digitisers', do not have their own built-in display – rather they can be connected to a computer or other device that displays and analyses the waveform.

Mixed-signal oscilloscopes, or MSOs, combine all the capabilities of a DSO with some of the measurement capabilities of a logic analyser. They have the ability to combine both analogue and digital channels, allowing the user to accurately time-correlate both types of channels without using a separate logic analyser. They can be used to great effect when troubleshooting hybrid analogue/digital circuits such as control systems.

Oscilloscopes may have evolved in leaps and bounds over recent decades, but they are still reliant on the quality of the incoming signal. And the quality of that signal, which makes a physical and electrical connection between a test point or signal source and an oscilloscope's input terminal, is dependent of the quality of the probe.

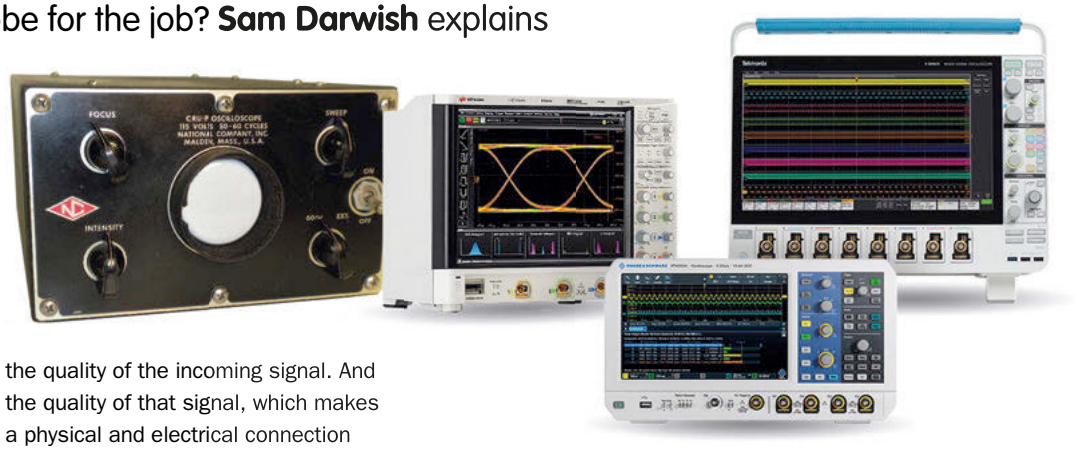


Figure 1: The changing face of oscilloscopes

In theory, simple wires, or 'fly leads', could be used to make this connection. In practice, the inherent inductance of simple wires makes them unsuitable for high frequencies. They may also pick up interference from local electrical noise emitters, making it much harder to detect low-level signals. To avoid these problems, oscilloscopes use a specially designed scope probe, typically connected via a coaxial cable. As longer cables will reduce a probe's bandwidth, there's also a trade-off to be made between physical convenience and accuracy.

The key types of probe

Probes fall into two broad types: active and passive. Passive probes are the most common. They have no transistors or amplifiers built in, so they don't need power and are usually more rugged and affordable. They are most often used for measuring high voltages.

Active probes have a small active amplifier built in near the tip. This means the input capacitance can be very low, which offers high input impedance on high frequencies and the best combination of resistive and capacitive loading. They are intended for use on high-impedance circuits where passive probes would generate too much source loading.

Most active probes are 'single-ended', which means they have a single tip that connects to the circuit. However, differential probes are also available, which have a positive and negative input plus a ground lead. As their name suggests, they measure the difference between two voltages at the inputs, and are used to examine signals that are referenced to each other rather than to earth ground.

Usually, probes measure the voltage at a particular point in a circuit. However, they can also sense current and convert it to a voltage that is then displayed on a scope.

Points to consider

To make a good connection, the probe must physically attach to the circuit with minimum impact on its operation, yet still transmit a usable signal. And since there are many different scope

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Sam Darwish, UK & I Sales Manager, Electro Rent

applications and circuits to be tested, it follows that there are many types of probe.

Choosing the right one for each job is essential and the general-purpose probe that comes with most scopes may not be the best choice every time.

The first step is to understand the signal to be tested. You need to select the attenuation ratio of the probe; for example 1:1, 10:1 or 100:1. Attenuation is used in order to best match the amplitude of the signal under test to the input range of the oscilloscope. Probes with higher attenuation allow you to extend the measurement range of the scope, while lower attenuation allows for lower-noise measurement.

The bandwidth of the probe refers to the range of frequencies it can work with, for example up to 100MHz. If frequencies exceed this level, you'll get unpredictable and probably unreliable results. It's usually best to go for a bandwidth at least five times greater than the signal frequency and ensure that it can be matched by the scope's bandwidth, too.

Rise time is the time that a probe takes to respond to the onset of a signal. If it's too long, the scope may not accurately measure sharp increases in amplitude. To be safe, make sure the rise time is three to five times faster than the pulse being measured.

To protect the probe, your scope and yourself, make sure you choose a probe with a higher maximum input voltage ('Vmax') than the test signal. The limits of passive probes can range up to thousands of volts, while many active probes can only handle tens of volts.

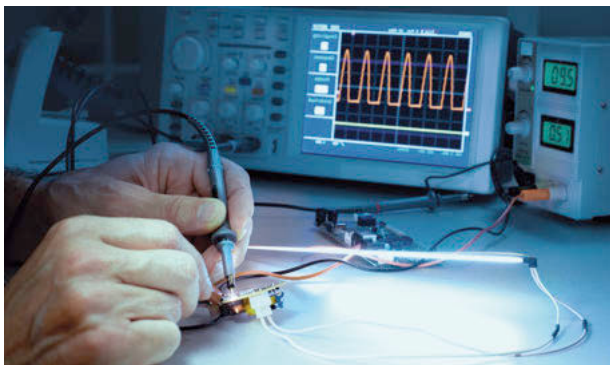


Figure 2: A probe in use

Finally, there's the question of source loading, or how much signal current the probe will draw from the circuit. As frequency increases, the capacitance of the probe's tip tends to increase, which increases loading. To minimise this, choose a probe with low tip capacitance.

You also need to consider the conditions in which the test will take place. What will the ambient temperature be, and how might that affect the signal? What other devices are operating nearby, and what electrical 'noise' might they induce in the test circuitry? Two of the most likely culprits in industrial settings are fluorescent lights and fan motors. Shielding on the probe usually cuts out most noise, but it can still be a problem for some low-level signals.

Probes in practice

Let's consider an example measurement and how we might choose the right probe when designing a 3.3V power supply. If noise is present, a general-purpose 10:1/10X probe is unlikely to be sensitive enough to see the small ripple voltage, plus it will be hard to get the scope to trigger from the periodic noise in the waveform. However, a low-attenuation passive probe, such as the 2X Tektronix TPP0502, will identify the ripple without having to use a differential probe.

Staying with power-conversion devices, there are other measurements that must be made in a 'floating' environment, where it isn't possible to refer to earth ground.

Examples include drain to source voltage (VDS) on a MOSFET, diode voltage on a freewheeling diode, inductor and transformer voltages or the voltage drop across ungrounded resistors.

While you could attempt to use two single-ended probes and calculate the difference, a better option is a differential probe matched to the measurement. Possible options include the Tektronix TDO1000 differential probe, or the TMDP0200 high-voltage differential probe.

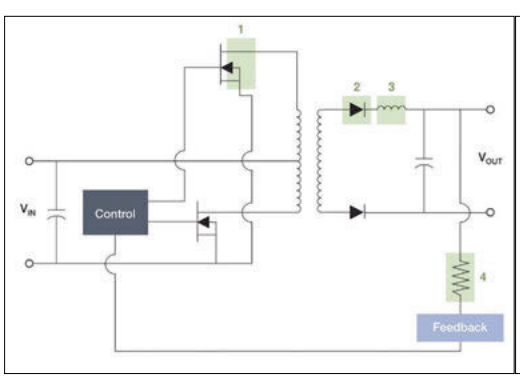
How to get the right probe every time

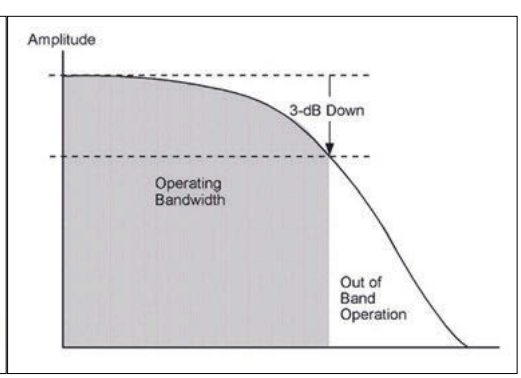
As you can see, choosing the right probe for your test is essential, and not always as simple as you might hope. When it comes to renting test equipment, look for a partner who will help you select and source the right probes for your application.

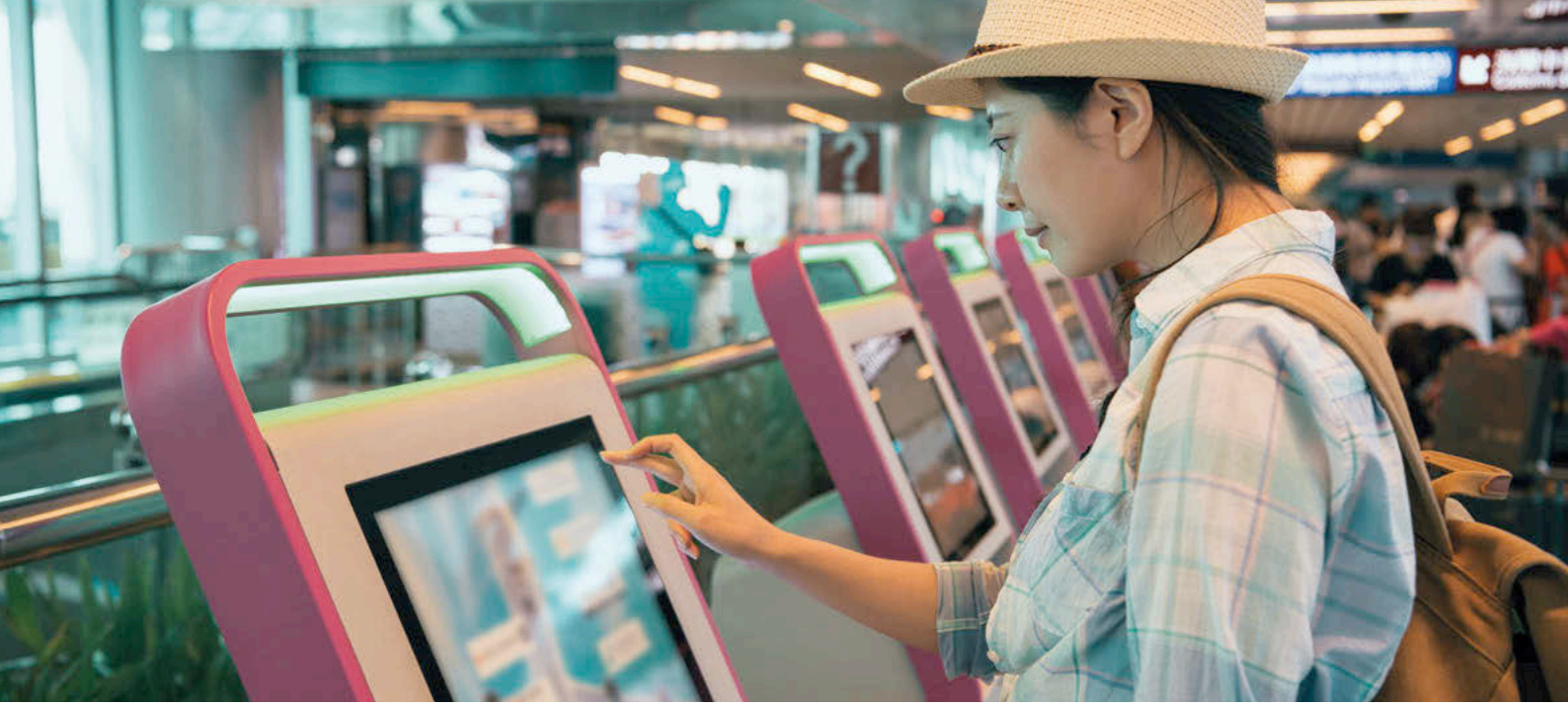
Electro Rent can source a wide range of probes from leading manufacturers and, crucially, we are able to offer the advice and guidance that make choosing the most appropriate equipment and accessories easier, so you know you always have the right equipment for the job. As a trusted partner, you will be able to experiment to get the perfect combination with no maintenance costs and far lower cost of ownership. The right solution should never out of reach, and testing able to keep pace with innovation.

Left below: A differential probe setup on a power converter

Below: Bandwidth limitations







Growing **hygiene** concerns

The Covid-19 pandemic has raised concerns that the virus could be transmitted via touchscreens. Can displays be made more secure or is there an alternative to hand? By **Neil Tyler**

How we interact with technology, through the interfaces we use, has changed radically with people becoming more comfortable using touchscreens whether in their private lives, professionally or when interacting with public services such as banks and public transport.

When it comes to displays capacitive and multi-touch resistive touchscreens have provided users with a host of new capabilities and options.

But is that about to change in light of the Covid-19 pandemic? How can we ensure that the touchscreens we use, especially in the public realm, are safe to use?

"Even before the current Covid-19 pandemic, there had been growing concern over the hygiene of public touchscreens. Reports showed that touchscreens used on some self-service kiosks in fast-food restaurants tested positive for E. coli bacteria, for example, and that has brought into question the hygiene of publicly used touchscreens," says Ian Crosby, Sales & Marketing Director, Zytronic.

The current medical crisis makes it clearer than ever that more must be done to ensure the use of touchscreens does not cause the spread of harmful bacteria and viruses.

"Despite concerns over the use of touchscreens, they can eliminate the need for face-to-face interaction with customers, helping maintain proper social distancing and helping contain Coronavirus and other infections," according to Crosby. "They are also more easily cleanable than physical buttons because they provide a smooth and continuous surface. They are simple and easy to clean properly; with regular cleaning, they can provide a much more hygienic alternative to conventional input methods on publicly used machines."

Despite these advantages, changes are needed to the way we approach public touch screen usage in order to provide the safest possible solution.

"There are several key steps Zytronic recommends, which can be taken to promote safety and hygiene in public touchscreens based on the problems currently found on public touchscreens," says Crosby. "Installing flush edge-to-edge interfaces will make cleaning and disinfection far easier, as bacteria tends to be found in the nooks and gaps of public machines and touchscreens. Regular cleaning and disinfection of publicly used touchscreens is essential to maintain proper hygiene.

"Speech contains, on average, the equivalent of 39 bits of information per second – whereas a touchscreen menu system is an order of magnitude slower."
Dave Betts

"Many touchscreen technologies, such as projected capacitive touch, can respond to the touch of a gloved hand or stylus. This means users can safely interact with touchscreens whilst minimising the chance of catching a virus or infection or spreading it themselves."

According to Crosby, specialist coatings for touchscreens are also available which can slow the spread of, or even kill, bacteria.

"In situations where fixed function keys are necessary, solutions such as the ZyBrid VK can be implemented, where the keys are part of a single, uninterrupted glass surface which allows for easy cleaning. Where tactility is needed, touchscreens are now available which implement machined features such as dimples, grooves and dials into the display. With these options, the glass remains unbroken and proves superior to moving buttons in terms of ease of cleaning."

PR Image Factory/Stock.adobe.com

Audio alternative

Health experts suggest that Covid-19 is here to stay for the foreseeable future, so are there alternatives to touchscreen kiosks because people may be wary of using them - will they really want to touch a screen that lots of other fingers have touched?

"Anti-bacterial touchscreens exist but this misses an important factor," explains Dave Betts, chief science officer at AudioTelligence, which specialises in blind audio signal separation. "The kiosk has to be perceived to be safe and hygienic by customers, as well as being genuinely safe and hygienic."

Could we remain socially isolated simply by talking to the kiosk, using a contactless payment system and then picking up our order from a service counter?

"The amount of physical contact would be minimised and the process made quicker. Speech contains, on average, the equivalent of 39 bits of information per second – whereas a touchscreen menu system is an order of magnitude slower. It is much quicker to say "two burgers with chips, one with cola" than go through the laborious process of finding the right buttons to press on a touchscreen," Betts suggests.

However, if you decide to use a voice activated system how do you overcome the problems of noise and impact of other people nearby?

Automatic speech recognition (ASR) has been around for many years and its reliability is improving, according to Betts. "It is most reliable on limited vocabulary systems. But that's fine as most kiosks only need a limited vocabulary. However, if you add in a noisy environment with lots of other people around, things are not so great."

Kiosks tend to be found in high street shops where several kiosks will be clustered together, which raises the question – how can you ensure that your order doesn't get mixed up with the person at the neighbouring kiosk?

"It's tempting to think that noise suppression is the answer. There have been some amazing advances in noise suppression in the last few years, fuelled by the artificial intelligence revolution. But these techniques share a common theme – they sound amazing if the signal was already clearly intelligible," explains Betts.

"Audio intelligibility is not the same as audio quality. If you take clean speech and add noise, the quality will sound worse and worse but the speech will still be utterly intelligible until, suddenly, it isn't. Generally, humans struggle if speech and noise are about the same level at the microphones." He continues, "Recently, Nvidia RTX was in the news with several online demos. Whenever you listen to a demo like these, you should ask yourself: "How easy was it to understand the noisy speech?" The answer will be "quite easy". Now if you could listen to what a microphone picks up in a noisy shopping mall, the situation will be different.

"It will be hard for someone to understand the raw speech – let alone an ASR system. And that's exactly where noise suppression falls down – it can't pull out the speech cleanly from such high noise levels."

Could beamforming hold the key? Perhaps, says Betts.

"It's surprisingly difficult to do well, however, unless you are willing to invest in a large number of expensive calibrated microphones and even then it's nowhere near good enough for a general high-volume kiosk."

Blind Source Separation

An alternative, according to Betts, is blind source separation (BSS).

"This technique simply needs between four and eight off-the-shelf microphones, with no calibration required. The array geometry is flexible, providing the array is between 5cm and 30cm across. Ideally there would be a clear 'line of sight' to the customer and, if space allows, a 2D array is preferable – but a linear array does also work."

"Despite concerns over the use of touchscreens, they can eliminate the need for face-to-face interaction with customers, helping maintain proper social distancing and helping contain Coronavirus and other infections."
Ian Crosby

BSS is able to separate the incoming audio back into its constituent sources automatically. So not only is the customer's voice brought out of the background noise, it is clearly distinguished from the voice of the person at the neighbouring kiosk.

"This is all done with data-driven machine learning. The system is continuously analysing the sound field and can pick out the speech of the person in front of the kiosk – adapting automatically to the lunchtime rush or the quiet of a 2am motorway pit-stop. Just like a human – but with no social distance required."

As the concepts behind BSS are mathematical, it can be implemented on any general computing device.

"The CPU cost is well within the capabilities of a modern Arm processor that supports single precision floating point. Then it needs memory – as BSS is a data-driven approach, it needs a frame store to keep all the audio it's analysing. For 16kHz and eight microphones, that frame store could be as much as 40MB – totally within the capabilities of a modern Arm processor. Optionally, a camera with face detection could help with ensuring the correct customer is selected," suggests Betts.

Then there's the ASR and speech-to-intent system. "Google managed to port its speech recognition system (currently English only) on to a pixel phone in less than 80Mb of memory. Similarly, specialist multilingual speech-to-intent systems for a limited vocabulary can be implemented in under 500Kb of memory, depending on the size of the vocabulary."

The Covid-19 pandemic has certainly highlighted the importance of good hygiene practice and strict implementation of health and safety procedures, and from traditional touchscreens to innovative audio solutions companies are looking to respond.

Faster FPGA verification

Launched in 2015, and used by about 20% of all VHDL FPGA designers, UVVM is one of the fastest growing verification methodologies in the EDA industry. By **Espen Tallaksen** and **Sunil Sahoo**

Today, design verification accounts for more than half of overall project time. Verification methodologies exist to alleviate this bottleneck, where a methodology will typically include a sequencer (a means of sending data to and controlling a device under test [DUT]), models (expressing how components should behave) and a scoreboard (a means of comparing the DUT's behaviour against the model's).

Some solutions have been around for decades. For example, the Universal Verification Methodology (UVM) has its roots in a language developed for verification purposes in 2001. However, UVM is based on the SystemVerilog language whereas about half of the FPGA design community codes in VHDL. For them, a VHDL based verification methodology is faster and more efficient.

It is even better news when it is free / open-source.

For instance, the open-source VHDL verification methodology (OS-VVM) which was launched in 2012, was named the number 1 verification library in 2018 and remains extremely popular. Also, its chief developer, Jim Lewis of Synthworks, works closely with the IEEE VHDL standards group.

A more recent addition to the industry is the Universal VHDL Verification Methodology (UVVM). It was launched in 2015 and has a growing following.

So, what's the score?

UVVM is a free methodology and library (*downloadable from www.github.com/uvvm*) for making structured VHDL-based testbenches. It comprises the following elements: a utility library, a VHDL verification component (VVC) framework and bus functional models (BFMs).

To demonstrate these, it is best to consider a verification scenario. Figure 1 shows the test bench for a simple interrupt controller (IRQC).

This test bench includes the DUT (i.e. the IRQC), which has a clock (clk), a reset (arst), a simple bus interface (SBI), a number (n) of interrupt sources (irq_source(n)) and the resulting interrupt to the CPU (irq2cpu). The test bench also has a clock generator and a test sequencer.

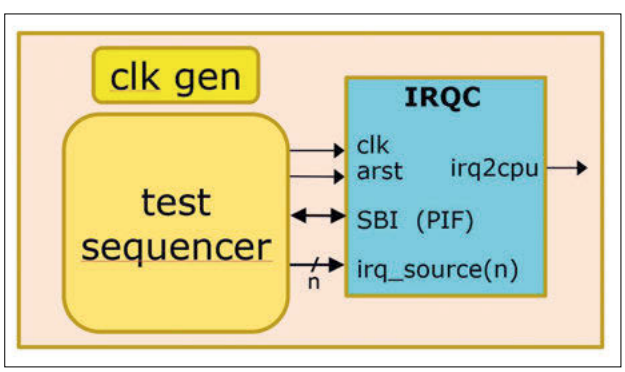


Figure 1: An IRQC testbench

In UVVM we create the clock generator by instantiating a concurrent procedure:
Clock_generator (clk, GC_CLK_PERIOD).

Then we create a test sequencer to control the simulation. The first thing it should do is send a message to let us know it has started and is not waiting for something. In code, we might have:
log(ID_LOG_HDR, "Started simulation of IRQC_TB").

Next, we need to check that the interrupt to the CPU is currently logic zero, if it's not then that's an error. Code for this might be:
check_value(irq2cpu, '0', "irq2cpu default inactive").

Then we should check signal stability, as we don't want the interrupt to the CPU to have spikes. It should be capable of going from a stable 0 to a stable 1:
check_stable(irq2cpu, now – v_reset_time).

In the IRQC we want to generate pulses. If we wanted to put a pulse onto source number 2 the code would be:
gen_pulse(irqc_source(2), '1', clk_period, "Set source 2 for clock period").

Another important test bench feature is to wait for values, but we don't want to forever. For example, if we've driven an interrupt source high, we expect the IRQC's output go active virtually straight away, so let's wait two 2 clock periods:
await_value(irq2cpu, '1', 0 ns, 2* C_CLK_PERIOD, "Interrupt expected immediately").

Also, most test benches need BFMs too; they're needed to access interfaces. We can therefore write a value (say AA) to the address of the interrupt trigger register thus…
sbi_write(C_ADDR_ITR, x"AA", "ITR : Set interrupts")

…and check that we can read it back with…
sbi_check(C_ADDR_IRR, x"AA", "IRR")

…reporting an error if we can't.

In UVVM we can check a read against an expected value and receive time-stamped messages. For example, the sequencer code to

check that a signal called 'dout' is 00 might be:

check_value(dout, x"00", "dout must be default inactive")

If all is OK, the message log might report:

60 ns irqc_tb check_value(slv x00)=> OK. dout must be default inactive.

Or, if it fails, we might receive:

ERROR:
192 ns. irqc_tb
value was: 'xFF'. expected 'x00'.
dout must be default inactive

The functions log (), check_value(), await_value() are just some of many in UVVM's utility library.

VVCs

Let's consider another BFM example. Data communications this time. Figure 2 shows a testbench for a UART.

The testbench has a simple bus interface (SBI), a RX and a TX, for which we need three BFMs, and a test sequencer, p_main. To exercise the interfaces of the UART module, we could for example use:

sbi_write(C_TX, x"B3")

…to initiate a UART serial data transfer out on TX, followed by…

uart_expect(x"B3")

…to check the data transmitted out on the TX serial output as initiated by the above sbi_write().

Similarly, we could use uart_transmit() to apply data (e.g. x2A) on the UART RX serial input followed by sbi_check() to verify that the correct data (x2A) was received and made available in the UART RX register.

As in the IRQC example, we can get time-stamped messages reporting success or otherwise.

But let's exercise this UART another way, this time using our VHDL verification components.

As before, we connect the DUT UART to the sequencer but this time via VVCs. This way the test sequencer doesn't talk to the UART directly. Rather, it distributes commands to the VVCs so, for example, whereas before we used:

sbi_write(C_TX, x"B3")

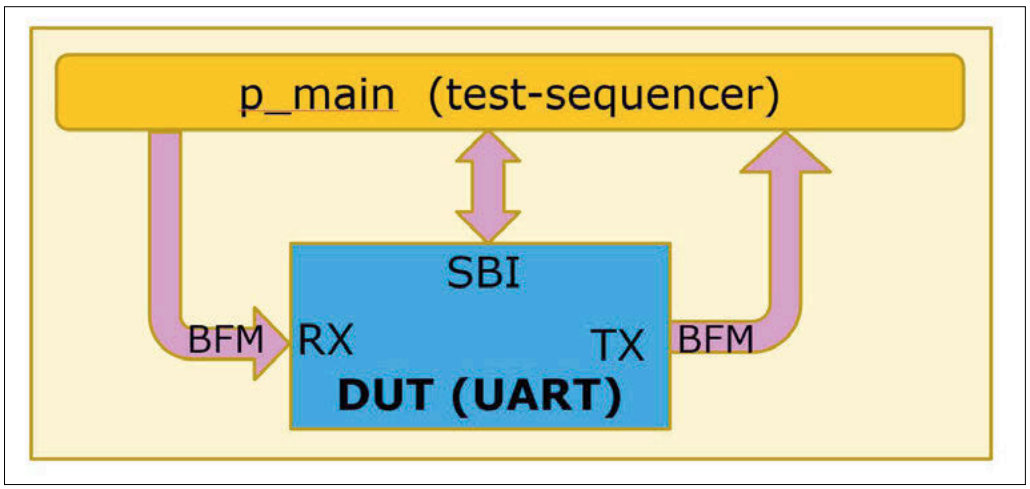


Figure 2: A UART testbench with BFMs

…now we use..

sbi_write(UART_VVCT,1,C_TX, x"B3").

The additional parameters convey that we are distributing the command to instance 1 of a UART_VVC.

The benefits of using VVCs are zero time reception of commands (which allows many commands to be written at the same time to multiple VVCs, thus initiating BFM execution on several interfaces simultaneously), queued transactions are possible plus we can do lots in parallel (property checks, for example).

Perhaps the biggest boost to productivity though is a better overview and reduced workload for the sequencer. As with UVVM's BFMs, the VVCs are open-source and free.

The VVCs in UVVM are unique when it comes to synchronising stimuli and the checking of modules within the FPGAs and the FPGA as a whole when we have multiple interfaces, as everything can be smoothly controlled using easily readable commands from a single test sequencer. The VVCs used in the module testbenches can be easily reused in a top-level testbench for the FPGA.

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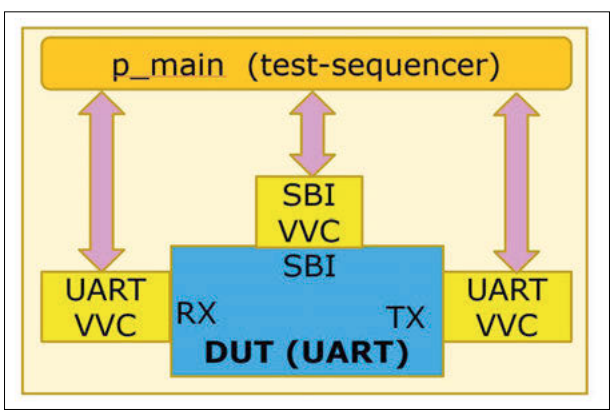

Figure 3: A UART testbench with VHDL verification components

What's not to like?

UVVM provides a good, almost Lego-like verification structure. It is easy to connect BFMs and VVCs, and scripting sequences of events is like writing pseudo code.

The fact that it is open source and is so well documented means UVVM, and other free methodologies and libraries (like OS-VVM) can be downloaded and added to your EDA tool box and you can start shaving hundreds or even thousands of hours off the verification time for large and complex designs.

On a final note, in 2018, the European Space Agency (ESA) initiated a project to extend UVVM in order to provide its suppliers with a means of improving their FPGA design quality, while at the same time reducing the verification cost and schedule. This has resulted in lots of new functionality being made available for the VHDL community, especially during late 2019 and early 2020.

The most important new features are Scoreboarding, Specification Coverage, Hierarchical VVCs, Error Injection and Transaction Information.

SUPPORTING MINIMALLY INVASIVE SURGERY

By revolutionising the electrical interfaces used in medical instruments, it will be possible to better support advances in MIS techniques. By **Philip Johnston**

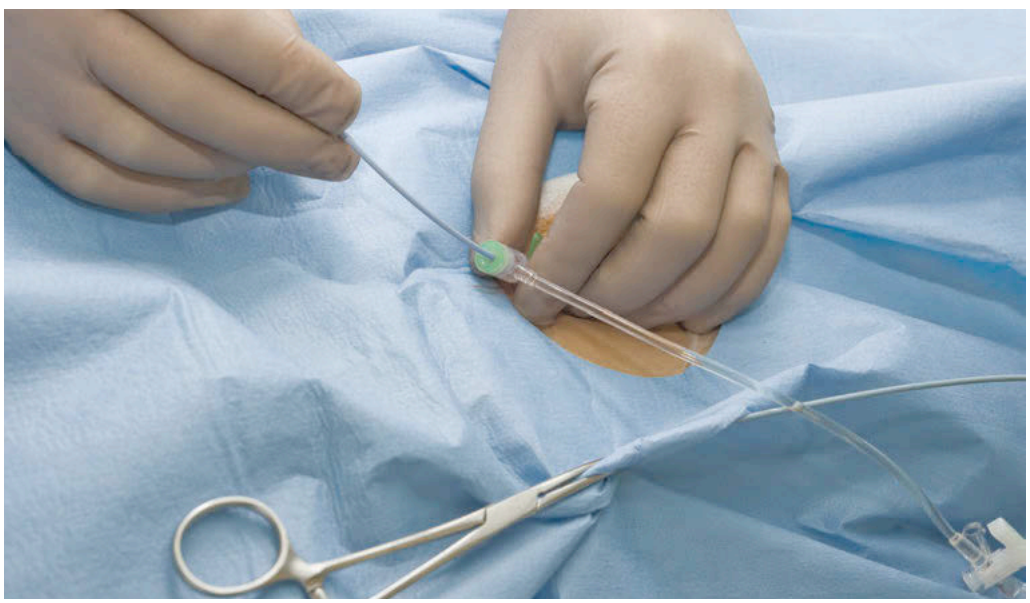

Figure 1: Minimally invasive surgery has improved patient recovery times Source: Bork/ Shutterstock.com

The ability to look inside a patient's body and determine the cause of illness without resulting in death or serious injury is a long held dream in medicine. Any kind of surgery is an invasive process which puts considerable stress on the body. In particular, the cardiovascular, respiratory, excretory and immune systems are put at risk and the body's ability to maintain homeostasis is compromised.

Therefore, if surgery is necessary, using minimally invasive surgery (MIS) techniques to limit the size and number of incisions made is a real benefit to the patient.

There are many advantages of MIS over traditional open surgery. The wounds caused by MIS procedures are smaller which helps shorten recovery times as well as leaving less noticeable scars. As patients recover more quickly, they can leave hospital sooner, freeing up hospital beds for other patients. For many patients using MIS results in them experiencing less pain and, as a result, needing less medication post-surgery.

Analyst firm Market & Markets predicts that by 2025, the global business for MIS-related equipment will be worth approximately $32.7 billion annually. The specialist fields where it is proving of particular value are in thoracic, orthopaedic, urological, vascular, gynaecological and neurological surgery, as well as interventional cardiology.

The pioneering work that led to modern-day MIS began back in the early 1980s, with the introduction of various types of electro-surgical instruments (catheters, endoscopes, laparoscopes, arthroscopes etc) being pivotal in its on-going technological progression. Now, it is estimated that over 90% of all surgical activity can be performed using MIS. These activities include appendectomy, tubal ligation, cholecystectomy, gastric bypass/banding, heart valve repair, myomectomy, hysterectomy, arthroscopy, prostatectomy, spinal fusion and bariatric procedures. In the future, surgeons will be able to make even greater use of MIS, as the supporting technology becomes increasingly sophisticated.

Compact form factors

Ongoing innovations in electro-surgical instruments will enable the incorporation of elevated levels of functionality and, consequently, these instruments will be more effective.

Opportunities will also open up for MIS to be applied to the treatment of a broader spectrum of health conditions and medical complaints.

However, to retain their 'non-invasive' properties, the surgical devices used for procedures must be in the most compact of form factors. This has far-reaching implications for the constituent electronics – not just in terms of the component parts (micro-sensors, micro-sensors, actuators, power management ICs, etc.) – but also for the wiring that delivers the data signals and power to them.

Traditionally, the wiring involved in these designs has not been much of a concern in terms of the space it takes up. Demands to shrink form factors yet simultaneously add more functional elements is placing exacting space constraints onto instrument designs.

The current approach to how medical devices are wired will need to change.

Until now, conventional electro-surgical instrument designs have relied on electrical interconnects that are based on microwire technology where wires usually need to be combined together into bundles around 600μm in diameter.

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Philip Johnston is CEO, Trackwise

Beyond their thickness, microwires have other shortfalls that medical engineers should be aware of, such as rigidity, as this makes them less easy to apply to enclosure formats that have unusual shapes.

As the density of the electronic content packed into modern electro-surgical instruments keeps increasing, the interfaces connecting everything together will need to evolve accordingly.

Flexible printed circuits (FPCs) are a viable option for supplanting microwires as they offer substantial space and weight savings while still supporting high degrees of signal integrity and prolonged operational reliability.

Because of these attributes, FPCs have already seen widespread uptake in an array of wearable and implantable medical devices used for the monitoring, regulation and assistance of vital physiological processes like pacemakers, hearing aids and blood glucose monitors.

Other advantages are their ability to be bent and shaped in order to fit the dimensions of the enclosure they are contained within. The composite structure of FPCs gives them considerable mechanical robustness, so they can operate effectively whilst in fact being significantly thinner.

By using an FPC, it is possible to implement conductive traces that are just 25µm wide. With a total interconnect thickness (including the accompanying electrical insulation and protective layers) that is less than 50µm, this solution is slightly thinner than the average human hair. Therefore, a single FPC can replace up to 12 microwires – not only curbing the space taken up, but reducing the complexity of the instrument's wiring assembly too. It should also be noted that there are additional cost savings to factor in: since multiple microwire interfaces can be replaced by a single FPC, a reduction in the bill-of-materials and in the outlay on product assembly is possible.

Manufacturing issues

Though FPCs present an attractive alternative to microwires, there is still one major obstacle to overcome if they are to be mass produced and designed into devices for MIS procedures.

Manufacturing techniques have put constraints on the FPC lengths that it is possible to manufacture. In most cases, most FPC manufacturers have only been able to support lengths of around 0.6 metres, with just a few companies capable of offering solutions of around 2 metres.

"FPCs are a viable option for supplanting microwires as they offer substantial space and weight savings while still supporting high degrees of signal integrity and prolonged operational reliability."
Philip Johnston

This has undoubtedly had a detrimental effect on their ability to address medical devices OEMs' design criteria.

To put it simply, there are a multitude of MIS application scenarios where longer wiring solutions are necessary. For example, catheters used in cardiac procedures will need to have a minimum length of 1.1m if clinical staff are to be able to use them correctly. Likewise, for procedures such as interventional neuroradiology, 2m wiring lengths are required.

Through its proprietary Improved Harness Technology (IHT), Trackwise is now in what can truly be described as a unique position in that it can manufacture multi-layer FPCs of any length. This manufacturing breakthrough gives OEMs serving the medical sector a lightweight, space-saving, length-unlimited alternative to current solutions.

Unlike conventional approaches to FPC production, IHT employs a fully patented dynamic process which is based on advanced roll-to-roll electro-lamination techniques.

By using these techniques, it is possible to create FPCs that can meet any length requirement, ensuring ongoing reliability and repeatability, while keeping the associated unit costs down. The planar nature of IHT interconnects allows them to be bonded within the structure they are mounted to, reducing the physical space that they occupy.

Thanks to IHT, Trackwise has the scope to produce FPCs of far longer lengths than are available from other sources – allowing medical OEMs to gain access to a cost-effective, high-volume supply of FPCs that are suitable for their specific application demands.

This is certain to be of value as the next generation of MIS instruments is designed and introduced.

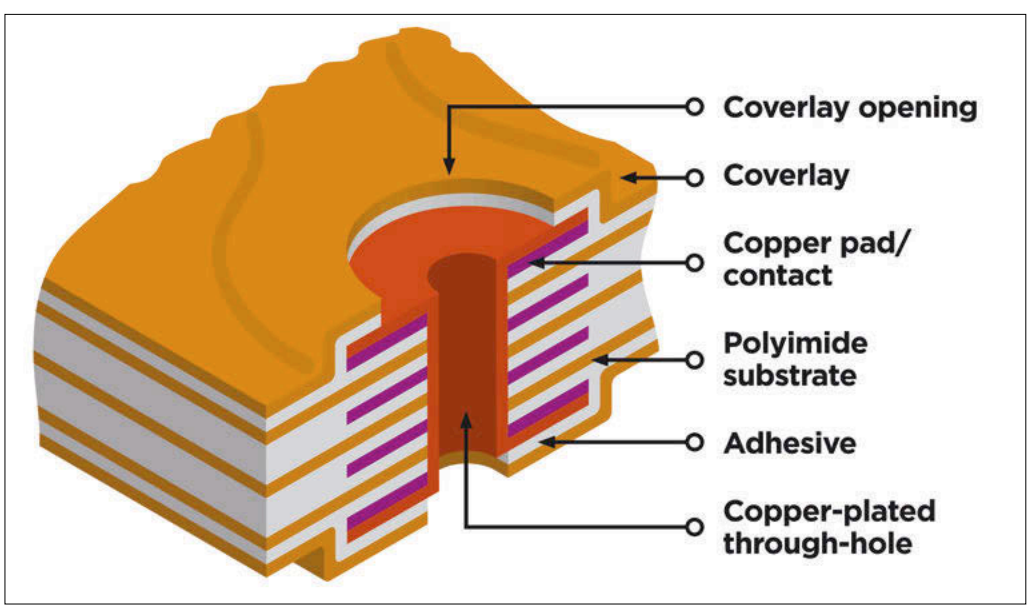

Figure 2: Example of an ultra-thin IHT interconnect
Source: Trackwise