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A year of seismic social and political change 1968 saw anti-Vietnam war protests in London; the assassinations of Robert Kennedy and Martin Luther King Jr; the creation of Intel Corporation; and a music scene still being set by the likes of the Beatles and the Rolling Stones.

1968 also saw the launch of New Electronics and, while in no way am I drawing comparisons with those other momentous events, the fact that we have been around for half a century and are able to celebrate our 50th anniversary, is no mean achievement.

The electronics industry and technology on which we have reported, have changed profoundly in those 50 years, and it’s been fascinating to look back through past issues of New Electronics. It’s certainly surprising to find how far back it is possible to go tracing the origins of some of the technologies, that today, are deemed to be ‘state of the art’.

The 1960s saw a period of great social change and advances in communications technologies. Along with the space race it saw the invention of the cash dispenser, the commercialisation of the computer for business, and the development of the computer mouse. The first computer video game was also invented.

In the 1970s Microsoft appeared, along with the first portable computer. It also saw the first documented Internet connection.

Turning to the 1980s, which has been described as the decade that heralded the computer age, the birth of the IBM PC signalled the start of today’s personal computer, while Apple’s Macintosh heralded much greater things to come. Oh, and the first digital cellular phones appeared.

Looking back at the 1990s, the creation of the World Wide Web, the Internet protocol, and language laid the foundations of the Internet as we know it today. It also saw the arrival of 2G mobile phones.

And what of today? Autonomous vehicles, robots, artificial intelligence, virtual and augmented reality, crypto-currencies, the Internet of Things - much technology that was unavailable 10 years ago, let alone 50.

Across those 50 years, New Electronics has been there, reporting on new products, identifying new technologies and trends and interviewing leading industry figures.

As editor of New Electronics, I’d like to take the opportunity to thank our readers and advertisers, who have supported NE over the past 50 years, and I look forward to continuing to provide electronic designers with informative, practical and, on occasion, entertaining news, comment and articles.

And like the Rolling Stones, we intend being around for a few more years yet!

Neil Tyler, Editor (neil.tyler@markallengroup.com)
Only 50 years old?

50 is a big milestone, and I’m sure that everyone here at Mouser Electronics will join me in wishing New Electronics ‘happy birthday’ and congratulations on being the go-to source of information for UK design engineers for five decades. Mouser, in fact, is just a little older – we were founded in 1964 by Jerry Mouser, a Californian physics teacher who needed components for an electronics program at his high school. Since that time, of course, we’ve seen many changes: changes which are necessary to stay relevant in a world which is much more competitive today than it was back when Mouser and New Electronics both started out. That’s the challenge for any organisation of any longevity – to remain a vital part of the customers’ ecosystem.

As far as Europe is concerned, Mouser’s history goes back a little over 10 years. In 2008 the company opened its headquarters in Munich, and followed that with branch offices – now nine – all across the continent. At that time, my colleague, Mark Burr-Lonnon, now Senior Vice-President, EMEA, Asia and Global Service laid out our plans: “We are not trying to be all things to all men”, he explained. “Our mission is to support design engineers with the latest parts and technologies – readily available from stock and delivered within two-to-three days – so that they can differentiate their designs and gain a competitive advantage.”

In an interview with a leading German publication a couple of years back, Mouser’s CEO Glenn Smith reiterated: “We are the NPI - New Product Introduction – distributor.” What this means to customers it that it can take many months for some of our competitors who broadly occupy the ‘catalogue’ or ‘high service’ space to be able to supply a new part, whereas we make it easy for our manufacturing partner suppliers to get their new products into our portfolio as quickly as possible – ideally on same day as they are released by the manufacturer. And we are stringent about the parts we advertise: they must be new releases and the latest technology – otherwise although you will still be able to find them on our website, they won’t be heavily promoted. We also will not promote a part until we have freely-available stock in our warehouse, immediately ready for shipping.

As the old saying goes: ‘Jack of all trades, and master of none’. Electronic component distribution – we believe – is no different in this respect to any other activity, and it is certainly our experience at Mouser that the needs of the design engineer differ considerably from those of the buyer looking to support full production. We have structured our business specifically to support design-in activity from initial conceptualisation through to prototyping and initial low volume production ramp-up.

Our position on supporting design and development activity has not changed in well over a decade. However, how we achieve that has seen many developments. But first, let’s talk about the other ‘unchangeable’ – the availability of stock. Simply put, many distributors do not hold as much inventory as they used to do. From a fiscal point of view, to the accountants, this must seem like a great policy. For the customer, however, he may not know he needs a part until he learns about it – from the web, through magazines and other promotions, a colleague, perhaps. At that moment, he needs that part as soon as possible. He can’t wait around for a distributor to put in a stock request to a manufacturer. Worse, for development purposes, he may only need a small number of parts; most distributors don’t want to deal with such small orders.

At Mouser, by contrast, all our stock listed on our web site is immediately available for anyone to purchase. In as small a quantity as they like. In most parts of Europe, that means that an order placed by 5pm will be picked, packed & shipped the same next day and will arrive with majority of our customers throughout Europe in 2 days. And when we say anyone, we mean it. Mouser treats everyone the same.

OK, so much for ‘plus ca change, plus c’est la meme chose’, let’s now look at changes that Mouser is making to support changes in the market.

Infrastructure
A number of factors have come together to produce a vibrant market:

- The accelerating move to hybrid and electric vehicles plus Automotive in general
- The emergence of real IoT applications – Industry 4.0/factory automation; remote diagnostics; wearables; connected auto; smart grid/metering
- The realization of technologies such as GaN to deliver extreme performance
- Security issues
- The rise of the pro-maker sector

Mouser targets all industry sectors, supporting design activities from conceptual, through initial prototype and into low volume production. In Europe, the company has grown in excess of 30% year on year for many years: currently our run rate is above
With the so-called ‘democratisation of design’, it’s not only experienced electronics design engineers that are developing new electronic systems, other professions are taking advantage of the IoT to develop specific solutions inspired through their daily experience. So, for example, a nurse might envisage a patient-monitoring system that needs a complex sensor solution. An architect might come up with the most efficient home-automation product, or a machine operator might innovate a new way to record and communicate wear on the production line. Distributors need to support both electronics engineers and these emerging pro-makers.

We believe that distributors must become a knowledge center – perhaps the knowledge center – for their customers. Therefore, Mouser’s website now also includes white papers, trend articles, technical articles, videos, blogs, applications notes. Mouser works very hard to ensure we don’t bombard our customers with emails; we want only to deliver relevant information. However, with the GDPR regulations we have gained better visibility about our customers’ needs, so we can provide them with information that they find useful and interesting. We newly encourage customers to tell us what they like and don’t like.”

These are just a few of the ways we’ve been changing to remain relevant and an essential part of our customers’ design processes. We know that New Electronics will similarly remain focused on its goals – yet flexible and welcoming of change. New Electronics is a key media partner for Mouser and as such we plan to continue to support the excellent work of the publishing team with more articles and joint promotions as well as the EDS show which has proved very popular with UK design engineers. Congratulations to all at the Mark Allen Group for continually developing your support for our industry.

Electronic components require very careful design-in. It is not enough merely to provide the IC and datasheet and stand back: engineers need an increasingly-sophisticated range of software and hardware development tools if they are to fully benefit from the amazing advances in silicon integration, functionality and performance. This in turn means that distributors are now required to broaden the range of services they offer. We call this activity ‘supporting the Design Ecosystem’.

Our model at Mouser means that the Design Ecosystem approach is even more necessary than other component suppliers which focus mainly on production fulfillment. In contrast - although not exclusively - Mouser primarily services design engineers. Our goal is to enable design engineers to try out new semiconductor technologies which will differentiate their end equipment by delivering extra performance and increased functionality. Therefore, we understand that designers need the full technology ‘Ecosystem’ – device itself, software development system, development board, design ideas and documentation – so that they literally ‘have the tools to do their job’. Independent surveys have said, for example, that Mouser offers the widest and deepest stocks of available-to-buy devkits anywhere.

Knowledge Centre

With the so-called ‘democratisation of design’, it’s not only experienced electronics design engineers that are developing new electronic systems, other professions are taking advantage of the IoT to develop specific solutions inspired through their daily experience. So, for example, a nurse might envisage a patient-monitoring system that needs a complex sensor solution. An architect might come up with the most efficient home-automation product, or a machine operator might innovate a new way to record and communicate wear on the production line. Distributors need to support both electronics engineers and these emerging pro-makers.

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Mouser works very hard to ensure we don’t bombard our customers with emails; we want only to deliver relevant information. Yet, of course in the light of recent political scandals there have been ever-stronger calls for personal information to be kept secure, and we are just seeing the implementation of new European GDPR data protection regulations. While many companies will view this as ‘more bureaucratic red tape’, Mouser believes that the steps that it has had to take to comply with the new laws have brought a closer understanding of customer needs. Previous ‘click box’ type permissions provided no information. With the GDPR regulations we have gained better visibility about our customers’ needs, so we can provide them with information that they find useful and interesting. We positively encourage customers to tell us what they like and don’t like.”
Even with beginnings separated by 16 years and more than 3,000 miles, the union of Analog Devices (ADI) and Linear Technology Corporation (LTC) reveals two companies that share remarkably similar paths to success.

Both roads led through many of the same types of challenges and milestones, from taking risks to delivering industry firsts, and to always working at the leading technological edge of the industry. And through it all, both companies maintained a solid focus on their customers.

**Risk-taking**

Started as a manufacturer of high-performance operational amplifiers, ADI reached $5.7 million in sales after just three years. While many would be content with that level of achievement, ADI’s founders were focused on the future. In 1969 ADI acquired Pastoriza Research, a manufacturer of circuit boards and modules that converted analog signals to digital. That set the course toward developing innovations to bridge the world around us to the burgeoning digital world to come.

While ADI would parlay its success into other bold investments, the very establishment of LTC seemed to fly in the face of conventional thinking. Founded in 1981, Linear Technology focused on analog technology while much of the world was embracing the start of the digital age. Yet the vision and courage of the organization’s leaders helped LTC become one of the most prosperous and respected companies in the analog industry.

**Together at the leading edge.**

**Together leading the industry.**

From the PC revolution and the birth of the CD layer, to industrial control and robotics, cellular communications, and automotive electronics, ADI and LTC have been at the forefront of new technologies and innovations. And in 2017, they came together as one company to take the industry even further.

With a shared culture of innovation and a passion for problem-solving, each company also brought complementary strengths to the newly combined organization. ADI is the industry’s biggest supplier of data converters, while Linear Technology has traditionally focused on power management. Together, the new organization is an industrial powerhouse that is able to offer a complete signal chain product portfolio to its customers—including expertise in RF, sensing, measuring, interpreting and other key capabilities that take silicon to software to cloud.

As the world accelerates toward greater digitization, solving the problems of tomorrow comes at the intersection of the physical and digital worlds. ADI continuously creates unmatched technologies that are taking digital to the next level, helping customers solve the toughest obstacles, and supporting them to create safer automobiles, faster networks, greener energy, better healthcare, and smarter buildings and machines. With over 4,700 patents and a workforce of 15,000 problem solvers, combined with know-how all along the signal chain, security and cloud, ADI is positioned to solve the most difficult and complex challenges across emerging disruptive markets. Through the achievements, innovations, and pioneering leadership of the past fifty years, ADI has evolved into the company ideally positioned to build the solutions of tomorrow and advance customers through the next 50 years and beyond.
Company Milestones
The successful run of both companies produced notable accomplishments along the way. Here are just a few from each organization:

Analog Devices
1967 – Analog Dialogue, the first issue of what would become the longest-running in-house publication in the electronics industry
1971 – AD506, first laser-trimmed linear IC FET-input operational amplifier
1973 – AD7520, First CMOS DAC
1978 – AD571, first monolithic ADC
1988 – World’s first complementary bipolar (CB) process, along with BICMOS, combines logic and high performance analog on a single chip
1991 – First MEMS ADXL50 accelerometer making airbags safety systems more reliable and cost-effective
2000s – Virtually every cell phone call made anywhere in the world passes through an ADI chipset inside network base stations
2010 – The AD5791, the world’s first 1 ppm 20-bit DAC, achieving a new level of precision, and once again raising the bar in converter technology and solutions
2013 – ADC precision broke yet another record as the AD7176 24-bit Sigma-Delta converter became the first device that could resolve 60 parts per billion – accurately
2014 – The acquisition of Hittite Microwave Corporation greatly strengthens ADI’s innovation capability across RF, microwave, and millimeter wave applications.
2015 – The Future Turns 50 as ADI celebrates five decades.
2017 - 1 + 1 > 2: ADI and LTC unite to become a new industry leader

Linear Technology
1986 – LT1070 – First 5A single chip easy-to-use switching regulator
1989 – First CMOS low power RS485 chip (LTC485)
1992 – Hot Swap™ family
1993 – Burst Mode® DC/DC converters
1999 – High efficiency, multiphase synchronous switching regulators
2001 – Power over Ethernet (PoE) controllers
2005 – First high speed 16-Bit ADC with 100dB SFDR
2008 – First precision battery monitor device for hybrid/electric vehicles
2010 – The AD5791, the world’s first 1 ppm 20-bit DAC, achieving a new level of precision, and once again raising the bar in converter technology and solutions
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2017 - 1 + 1 > 2: ADI and LTC unite to become a new industry leader
Fifty years is a long time to look back on, and when it comes to identifying those technologies that have made a real impact on our lives, the debate as to what should be included can be intense.

So many new technologies have appeared and the pace of change continues to accelerate. One thing that is clear though, is just how different society has become, due – in no small part – to the technologies that have appeared since New Electronics was first published in the summer of 1968.

Fifty years ago, we were seeing the first really significant advances in communications technology, and the US and USSR were locked into the ‘space race’, to see who could get a man to the moon first.

In the UK, arguments were raging over the delays and cost of two major technological projects: Concorde, and the ocean liner, the QE2. Plus ca change!

Likewise, concerns were growing over the competitive threat posed by Japan, especially in terms of technology. Fast forward 50 years and similar worries are now being expressed about China and other emerging economies.

The 1960s was the decade in which the computer was commercialised for the first time and the first computer video game invented.

Over the subsequent 50 years, new technologies and companies have appeared and then faded, historic names have come and gone.

Although open to debate, it could be true to say that the world we live in today was invented in the 1980s. It saw the start of the computer age when many of the most popular consumer products, that are still around today, first appeared.

MS-DOS appeared, so too, did Apple’s Macintosh. The CD-ROM, disposable cameras, and the first 3D video game...called ‘Robot’ all made their first appearance in the decade of Thatcher, Reagan, and the collapse of Communism.

Since the 1990s and the turn of the century, innovation has accelerated at an unprecedented rate and given rise to all manner of devices that, until a few years ago, were often deemed ‘science fiction’.

No sector of the economy has avoided the impact of technology - and that’s not going to change.

We are now living in a modern, increasingly connected society. A brave new world, but one that brings with it fresh challenges. Technology can improve our lives, but, in the case of robotics, we need to consider both ethical and societal issues as we look to introduce them into all aspects of our lives.

As technology becomes more pervasive, calls are being made for national and international efforts to promote better global governance of technology development, and, with the growth in cybercrime, the issue of security is set to have an impact on every aspect of our lives.

The impact of technology

Looking at the technologies that have had most impact on the way we live over the past 50 years, those that spring to mind include: the Internet and the rise of the Internet of Things (IoT); space exploration; genetic engineering; the mobile phone, robots and artificial intelligence.

The first real robot appeared back in 1954 when industrial robots appeared. Built by George Devol, the ‘Unimate’ was the first material handling robot employed in industrial production work.

A few years later, the Massachusetts Institute of Technology (MIT) founded its Artificial Intelligence Laboratory as it looked to research into how we could mechanically mimic human minds as well as hands.

Fifty years on and hundreds of thousands or robots now assemble...
products better, faster, and often, more cheaply than manual workers.

New advanced software is helping us to work, play and travel more easily than ever before, and in San Francisco, IBM’s Project Debater was recently able to listen and argue with a human, in what is being described as a ‘ground breaking display of artificial intelligence.’

IBM has a pretty good track record when it comes to displays of technology. The Watson supercomputer was able to win the Jeopardy games show back in 2011, and years before that, Deep Blue stunned the chess world with the defeat of Garry Kasparov.

As for having an impact on the way we live, cellular phones would surely have to be top of any list. The first time the concept of a mobile phone was mooted was way back in 1947. The first call was made in 1973 in Manhattan, outside the Hilton hotel. Carried out by a Motorola researcher, Martin Cooper, it was to herald a profound change in the way people interacted with one another and with the world around them.

Nearly fifty years on, and the mobile phone is ubiquitous. Almost everyone has one. Look around. Texting, listening to music, shopping or simply surfing the Internet, the mobile phone has completely changed the world and made it a ‘smaller’ place.

Communication has become more affordable and cheaper and every user has access to vast amounts of knowledge.

But at what cost? Is the mobile phone now our preferred companion? Do we no longer need company, as long as we have our phones?

Back in 1968, the US was racing to place a man on the moon. It won! While we’ve yet to return, we’re now looking to send a manned exhibition to Mars.

In terms of conquering space, while we haven’t come as far as expected, a manned expedition to the moon is planned. The space race provided the foundation for the development of hundreds of enabling technologies, including integrated computer circuits.

IBM’s role in recasting the desktop computer from hobbyist’s gadget to office automation tool in 1983 - followed by Apple’s Macintosh a year later - helped to universalise computing and actually made the computer ‘cool’. Computers were no longer the size of a small car, and could be used to play games, send messages and help us worker harder and more productively.

But, looming over all of this surely is the Internet, which has brought the greatest transformation to all our lives in the past half century.

The Net’s strength and weakness is that it’s the world’s largest library, but it’s also a global news channel, a social club, research archive, and shopping service. It’s a home for political debate, for good or ill. But crucially, it has been the most affordable mass medium ever devised.

As with any technology it has positive and negative impacts on society. More people now believe that it is a mix of ‘good and bad’, caused in no small measure by the activities of behemoths Facebook and YouTube.

Technology is moving at an ever-increasing pace and when it comes to the Internet, perhaps Mao Tse-tung’s misquoted comment about the French Revolution, that it was too early to say anything about its impact, could be equally true of the Internet.

For many, the technology that we use and take for granted today would have been unimaginable when New Electronics first appeared.

So, here’s to the next 50 years!
Congratulations to New Electronics on your 50th Anniversary and thank you for being part of our journey.

anglia

www.anglia.com
Anglia continues to outgrow the market as it celebrates 45 years

Anglia Components shows no sign of slowing down in its 45th year, having outgrown the market by a factor of five over the last ten years. Anglia’s turnover grew 52.4% between 2006 and 2016, while the market grew just 9.4% in the same period based on ecsn figures. Founded by Anglia President Bill Ingram in 1972, Anglia is now the UK’s largest privately owned component distributor with an on-target turnover of £60.8 million in 2017. Steve Rawlins, CEO of Anglia, discusses what makes the company special to its customers and the staff who work with them.

Q. What lies behind Anglia Components extraordinary growth over the last ten years?
A. We have stuck with our core business model, which hasn’t changed over Anglia’s history. We have always been privately owned, retained a UK warehouse and maintained one of the highest inventory levels in the business. Exceptional service and technical support set Anglia apart, providing the basis for stable and strong customer relationships. With no outside investors, we have more freedom to make long term decisions, and to partner with our customers to create success for them – which is also success for us. We have outgrown the market for the last ten years and are confident that we can maintain that growth to reach £100 million by the time we’re 50.

Q. What makes Anglia different from a customer perspective?
A. Anglia offers the accessibility of High Service Distribution, effective FAE support and competitive volume pricing. You can design with us for small quantities, and then move to volume at a sensible price.

We’ve just introduced more price breaks and smaller pack quantities to support customers in the design and prototype phases of a project. We’ve also hired more FAEs.

When we design with you, we recommend components that are not only technically suitable but also likely to be available for the life of the project, on a realistic basis, without high MOQs. For the volume production phase, Anglia holds higher stock levels in proportion to our business than most. This inventory is held in the UK and priced competitively, with flexible shipment options tailored to your needs.

Q. What does Anglia offer customers in the design and prototype phases?
A. Anglia is committed to supporting customers through all the phases of a project’s life from initial design through prototype to volume production. Customers looking to order low volumes for design and prototype phases can now access stock items on commodity Surface Mount parts in small quantities supplied in cut tape format. Up to ten breaks can now be shown for each part, giving customers much greater choice and complete transparency of pricing. With small pack quantities, our support in the early phases is now as comprehensive and flexible as our support during volume production.

Q. How are you developing Anglia Live?
A. Anglia Live has seen steady growth and we’re continually enhancing and improving it to broaden its appeal. Up to ten breaks can now be shown for each part. Other enhancements include improvements to loading speed and streamlining navigation. Vertical market sections have been added covering IoT, Industrial, Lighting and other applications.

Q. Finally, how does Anglia support customers with the component shortages that are currently impacting the industry?
This is a real issue and is becoming more widespread: chip resistors are the latest class of components to be affected. We are constantly looking at ways to help our customers and ensure that they are aware of the current market conditions. We foresaw that a shortage in chip resistors was coming about 6 months ago and invested heavily in inventory in order to protect our customers. When the supply chain tightens, we focus on supporting regular customers with scheduled orders – customers that work with us get the best support. At the moment we won’t supply brokers with shortage parts even if invited to ‘name our price’! I would strongly advise our customers to get their orders in or take on inventory now whilst stock is still available.

“We have stuck with our core business model, which hasn’t changed over Anglia’s history.”
Steve Rawlins

CELEBRATING 50 YEARS OF INNOVATION
The Ages of the FPGA

Since their introduction, FPGA devices have progressed through several distinct phases of development. Each phase was driven by both process technology opportunity and application demand. These driving pressures caused observable changes in the device characteristics and tools. These Ages of FPGAs, are:

- The Age of Invention
- The Age of Expansion
- The Age of Accumulation
- The Age of System

The Age of Invention: 1984-1992

The first FPGA, the Xilinx® XC2064, contained only 64 logic blocks, each of which held two 3-input Look-Up Tables (LUTs) and one register. By today’s counting, this would be about 64 logic cells - less than 1000 gates. Despite its small capacity, the XC2064 die was very large and the 2.5-micron process technology was barely able to yield the device.

Die size and cost per function were crushingly vital. The XC2064 had only 64 flip-flops but cost hundreds of dollars because its die was so large. Yield is super-linear for large die so a 5% die-size increase would double costs and could have dropped yield to zero. Cost-containment was not a question of mere optimization; it was a question of corporate survival.

As a result of cost pressures, FPGA architects turned to architectural and process innovations to maximize FPGA design efficiency. Although SRAM-based FPGAs were re-programmable, on-chip SRAM dominated the FPGA’s die area. Antifuse-based FPGAs eliminated the on-chip area penalty for SRAM storage (at the loss of re-programmability). In 1990, the largest capacity FPGA was the Actel 1280, which was antifuse-based. Quicklogic and Crosspoint followed Actel and developed FPGAs based on the antifuse. In search of efficiency, architectures spanned the space from complex LUT structures to NAND gates, down to individual transistors.

During the Age of Invention, FPGAs were much smaller than the applications that users wanted to put into them. As a result, multiple-FPGA systems became popular and automated, and multi-chip partitioning software became an important component of an FPGA design suite. Radically different FPGA architectures precluded universal design tools, so FPGA vendors took on the added burden of EDA development for their own devices.


FPGA startup companies were fabless, and typically could not obtain leading-edge silicon technology through the early 1990s. As a result, FPGAs began the Age of Expansion lagging the IC-process curve. Later in the decade, IC foundries realized that FPGA vendors took on the added burden of EDA development for their own devices.

Area was not as precious as it had been in the Age of Invention. Area could now be traded off against performance, features, and ease of use. Larger FPGA-based designs required synthesis tools with automatic placement and routing. By the end of the 1990s, automated synthesis, placement, and routing were required steps in the design process.

Most importantly, the easiest way to double the capacity and halve the cost for on-chip FPGA logic was to target the next process technology node so there was tremendous value in early access to new nodes. SRAM-based FPGAs realized a significant product advantage during this time because they were first to adopt each new node. Antifuse-based FPGAs lost their competitive edge.


By the start of the new millennium, FPGAs were common components in digital systems. Capacity and design size grew rapidly and FPGAs had found a huge market in data communications. The dot-com bust of the early 2000s created a desperate need for lower cost, which eliminated many “casual” ASIC users.

FPGAs were now larger than the typical problem size and increased capacity alone was insufficient to...
A dynamic technology
From the very first FPGAs in 1984, these astonishing devices have increased in capacity by more than 10,000x and increased in speed by 100x, with cost and energy consumption per unit function decreasing by more than 10,000x. By 2020, over 50 billion devices and machines will be connected, and they must meet the growing demands of end users, at the same time process an exponentially growing amount of data, whilst consuming the lowest possible power. This article looks at the journey the FPGAs have taken over the last 30+ years and how the most dynamic processing technology in the industry is enabling rapid innovation, offering adaptable, intelligent computing to shape the next generation of systems.

Ivo Bolsens
Xilinx Inc., CTO and Senior Vice-President.

CELEBRATING 50 YEARS OF INNOVATION

The Age of SoC: 2008 - 2017
Embracing the system design issues, FPGAs increasingly incorporated system blocks such as high-speed transceivers, memories, large amounts of DSP processing units and complete processor subsystems. They further incorporated important security features like bitstream encryption and authentication. In addition, system functions for powerful mixed signal processing and control functions for system temperature and power monitoring and management are often available. These features were first introduced by the Zynq® - 7000 SoC product family and further extended by the Zynq® UltraScale™ MPSoCs and Zynq® UltraScale+™ RFSoCs. During this period, a major step towards improving programming efficiency was introduced. Thanks to the introduction of High Level Synthesis (HLS), the traditional programming environment based on HW design languages such as VHDL and Verilog was extended by software-like flows using OpenCL™, C, C++.

The Age of Compute: 2018 -
As the merits of progressing Moore’s Law are slowing down, traditional computing systems face serious challenges in terms of improving performance, energy efficiency and cost. Moreover, requirements of real time performance, privacy and communication bandwidth, driven by emerging fields such as autonomous cars and 5G, create the need for more powerful and efficient computing capabilities at the edge. In this context, domain-specific computing is emerging which uses a customizable architecture and programming environment tailored to a particular application domain. Whereas faster compute hardware is essential to improve, other aspects such as efficient memory access, interconnect bandwidth, deterministic behavior and low latency can be of equal importance.

The adaptable compute acceleration platform (ACAP) will assume a central role in the implementation of future computing systems in the cloud and the edge infrastructure. It provides a parallel and heterogeneous programmable platform that can be customized to optimally meet the performance requirements of different application domains.

Programmability and adaptability have shown to be of fundamental value. Efficient customization of logic functions, of memory access, of connectivity for data movement, and of compute parallelism, will all be required to accelerate the workloads of the future. This technology is here to stay and will continue to evolve.

1984 - 2020
The Age of Compute

The Age of Compute: 2018 -
The Age of SoC
2008 - 2017
The Age of Accumulation
2000 - 2007
The Age of Acceleration

The growth of FPGA LUTs and interconnect wires over time. Wire length is measured in millions of transistor pitches.
The idea of the learning curve dominates the electronics industry. But it is also one where a small change in technique quickly scales into a disruptive competitive advantage. By Chris Edwards

If there is one thing that has controlled the growth of the electronics industry over the past half century, it is the semiconductor-manufacturing learning curve. It has driven Moore’s Law to the point where even though the ‘natural’ scaling proposed by IBM researcher Robert Dennard in the early days of silicon technology have broken down, the learning curve still keeps going.

It has been going so long, the learning curve looks like a demonstration of inevitability. The industry just keeps delivering the improvements that keep everything ticking along nicely. But the graph is also a demonstration of survivor bias in much the same way stock indices imply betting on shares is a guaranteed winner. The index rises because it continually adjusts. What’s missing is the number of shares that plummeted to zero when the companies that issued them failed to keep up.

Events 50 years provide a key example of how small but influential changes can lead to dramatic shifts in leadership even if the overall market stays on a seemingly unstoppable course. A number of advances came together that would see the strand of metal-oxide-semiconductor field-effect transistor (MOSFET) technology finally take off and sweep the older bipolar technology to the side. MOSFETs showed promise but they had major problems.

Initially on secondment from Italy-based SGS, when he arrived at Fairchild to work on their MOSFET development Federico Faggin recalled: “Metal-gate technology, which was the technology of the day, was not a good technology. It was slow and unreliable, and not living up to the theoretical promise of MOS devices.”

The concepts behind the MOS transistor date back almost a century to patents filed by New York-based inventor Julius Lilienfeld, though he never had the opportunity to demonstrate them experimentally and died in 1964 just as his ideas were being put into action. His patents described the idea of modulating conductivity in a channel using an electric field. Even as late as 1962, researchers insisted in speeches in conference such as Wescon the MOSFET could never be practical because the metal-insulator interfaces led to the formation of electron traps that made the devices perform poorly.
IN 1971
Intel unveils the first microcomputer-on-a-chip

IN 1972
The 8008, an early byte-oriented microprocessor from Intel, appears

A LOOK BACK OVER 50 YEARS

In 1964, not long after General Microelectronics engineers had developed a number of key techniques, Fairchild said its team had succeeded in making the first enhancement-mode, p-channel MOSFET. Just a month later, RCA followed up with a complementary version, the depletion-mode, n-channel version.

A short internal marketing war broke out at Fairchild over the naming of the technology. The company’s specialists, Frank Wanlass and CT “Tom” Sah, wanted to name the device ‘MOST’. Gordon Moore disliked the name and, although Sah managed to squeeze it into a paper in IEEE Transactions on Electron Devices, the term MOSFET stuck. RCA’s preferred moniker of insulated-gate field-effect transistor (IGFET) was a non-starter in the industry.

A decade later, RCA showed the capabilities of Wanlass’s idea of using complementary MOSFET to reduce power consumption with its CDP1802 microprocessor. But it would take time for CMOS to become mainstream. The RCA processor went into space. But through the 1970s and 1980s, CMOS on Earth was largely restricted to simple devices such as wristwatches because the need to double each transistor also doubled production cost. But the MOSFET train by then had become practically unstoppable thanks largely to the work that started at Fairchild.

Although a number of efforts proceeded in parallel, including Dennard’s use of an n-channel MOSFET as the control gate for the first DRAM, Fairchild’s efforts arguably had the greatest lasting impact, the biggest being the decision to take the metal out of MOS. It’s only during the last decade that metal has gone back into the gate stack and that move met significant resistance. Industry veterans were sceptical the new generation of metal gates would work because they could remember how bad things were with the original aluminium-based technology.

Faggin did not invent the concept of the non-metallic MOS gate. It was fellow Fairchild engineer, Tom Klein, who worked out that replacing the existing aluminium gate material with conductive polysilicon would lead to a much-wanted reduction in threshold voltage. Faggin came up with an etch process for that polysilicon and also helped develop the use of polysilicon not just as a gate material, but a cheap way to link together neighbouring transistors. Into the early 1970s, this was called “Freddy’s Etch”. But, by that time, Faggin, like many of his Fairchild colleagues, had departed for the venture capital-funded Intel.
Faggin claimed he had inadvertently helped Fairchild’s competitors. Gordon Moore and Andy Grove along with Faggin’s manager encouraged him to give a presentation on the technology at the International Solid State Circuits Conference and so publicly disclose some of the techniques. But, after many departed Fairchild for Intel, the then larger company chose to focus on its traditional bipolar technology. Intel, in contrast, was almost fully committed to the new polysilicon-based MOSFET.

During the 1970s and 1980s, Japanese suppliers took advantage of the survivor-bias effect by pooling resources on the development of key technologies such as memory. This quickly led to the then memory-dominated Intel stumbling over its heavy investment in 256Kbyte DRAMs. But, having been selected as the core for the IBM Personal Computer, investments from the computer giant helped stabilise the chipmaker and propel it towards market dominance. A second injection of cash helped Intel over a second slump – the bursting of the home-computer bubble in the mid-1980s.

By the end of the 1980s, manufacturers had finally embraced the lower power CMOS. Problems with power density that threatened further integration forced their hand. Other problems loomed as the CMOS wave swept away another group of industry laggards.

For a long time, people believed 1µm would prove a fundamental scaling limit. In practice, another more subtle problem emerged: the inability to move past three layers of metal for interconnect. This threatened further integration. You could make the transistors but not wire them up into anything useful.

The chemical solution to the problem seemed unthinkable: rubbing the delicate wafer with a roughened pad and a corrosive slurry.

Wilf Corrigan, then head of LSI Logic and who had been the chief of Fairchild in the 1970s, said at the end of the 1990s, chemical mechanical polishing effectively reset the leadership of the industry. He argued Japanese suppliers distrusted the technology. But the US manufacturers embraced the technology and were, as a result, able to design much more complex microprocessors than their more cautious competitors.

By the end of the 1990s, many of the chipmakers had learned the lesson of collaboration taught by the Japanese. Some abandoned manufacturing altogether in the face of increasing cost and signed up with foundries. Faggin had played a pivotal role in the early history of the foundry business when he set up Zilog. But Texas Instruments alumnus Morris Chang provided the ability for much smaller companies to challenge the giants with the formation of the independent foundry TSMC in 1987.

The result in recent years has been a matching of capabilities. Although Intel has proved capable of introducing technologies such as high-k, metal-gate production and finFETs more quickly than others, the foundries have proved able to put together their own versions quickly enough to accommodate customers who want to challenge Intel. The problem that faces companies designing CMOS integrated circuits now is the rapidly escalating cost. Only those with the deepest pockets are able to stay on the learning curve.
A lot of innovation happened in the past 50 years, and its pace is only quickening. In 1968, digital systems were in their infancy. Silicon and systems weren’t that complex and featured a small number of logic gates. Most devices and end systems were closed as well, so the need to think about security was limited.

Today billions of gates are packed on to a chip, the systems are complex, machine learning is being done on edge nodes and device security is featured in the news constantly. How did we get here? Relentless innovation.

The rise of ubiquitous computing
Arm emerged as a pioneer in IP design in early 1990s, starting with a unique low-power, small-footprint microprocessor architecture that silicon vendors could license and around which they could build their own special functionality. In the ensuing years, Arm not only evolved the microprocessor architecture but added security and system IP, subsystems, tools and software to enable system-level solutions.

Companies embraced Arm technology because it was trusted, fully verified and widely used to support the mobile-computing revolution. Arm is an established, trusted standard for SoC design that relieves customers of the design implementation and verification steps that make design costly and risky.

Today, Arm invests in each CPU upwards of 97 person-years and 1,600 CPU years of testing (even using ML algorithms to speed the process) with over 156 GB of data generated per nightly run. Arm invests at this level because hardware is not like software – you can’t patch silicon bugs in the field.

Arm continues to push boundaries of what can be done in silicon. Who would have thought that a device containing a tiny Arm Cortex-M CPU would be capable of complex digital signal processing, being able to perform keyword spotting from an audio stream, or other machine learning algorithms? Arm remains committed to removing barriers to creating custom SoCs, now you can even access the Cortex-M0 or Cortex-M3 CPUs, example systems and Arm’s broad ecosystem for $0 upfront through Arm DesignStart. Arm also have a variety of validated IoT SoC solutions, which include built-in security and can be customized.

Today, our industry is poised to deliver 1 trillion connected devices in the near future in the Internet of Things (IoT), transforming how we work and play. But at the same time, more attackers realize the potential gains that can be made in IoT. Even the most difficult non-invasive techniques now require only inexpensive equipment and limited amount of time, making them cost effective.

Security has been part of the Arm portfolio for quite some time, covering all types of attacks. It started almost 20 years ago with our SecurCore family of tamper-resistant CPUs, which are found in billions of smartcards out there, and since then we have added a lot of foundational security capabilities. Recently, Arm extended its physical security portfolio to support the broad IoT market with the Cortex-M35P processor equipped with by tamper resistance and TrustZone for software isolation, along with a suite of security IP beyond the processor to guard against side-channel attacks.

Arm’s dedication to the constant and collaborative work around effective security extends to the Platform Security Architecture (PSA) program we announced in 2017 (a three-stage process that provides a common and holistic framework to approach IoT security) and secure identity for cellular IoT, announced in early 2018.

Conclusion
The electronics industry has evolved massively over the past 50 years, and both Arm and the Arm ecosystem of over 1,600 software, tools and service providers have been instrumental to this. More is yet to come. We can’t revert to the old framework of closed systems. If we want electronics in the next 50 years to transform our lives, buildings and cities, then we need smarter connected devices built with trusted IP and reusable software that have a common, consistent approach to security.
ELC

- ELC 570 series
- Locking system with snap hooks
- IP67
- For medical applications
Circular connectors are the natural choice for applications needing a reliable connection, as David Phillips binder UK, explains

Firstly, let me wish New Electronics a very happy and successful 50th anniversary. There aren’t too many publications serving our industry that have been around for so long and everyone associated with New Electronics over the years can be immensely proud of its longevity in a rapidly changing publishing World. It has always done a great job reporting and providing information on the electronics industry and all of us at binder UK hope we can keep reading “NE” for many years to come.

Although a little older (binder was established in 1960) we share a 50th anniversary with New Electronics for it was back in 1968 that we made our first circular connector. Originally developed in the 1930’s for the aircraft industry, circular connectors have since become the natural choice for applications that need a reliable connection in “difficult” environments.

As everyone knows, interconnection in all its forms, is a vital and fundamental part of any electronic product or system. To satisfy the incredibly wide variety of applications that require connectors, our industry has developed a range of different formats and evolved performance and environmental standards that make selection easier for the user and specifier.

The company founder, Franz Binder, chose to concentrate exclusively on the circular connector format because he rightly saw its importance within key industrial sectors and today’s increasing move towards applications such as the “Smart” factory – the so-called industrial Internet of Things - continues to prove him right. Electronics technology has found its way into applications not necessarily foreseen 50 years ago and today it has never been more important to reliably provide the means to transmit power, signal and high-speed data.

binder occupies an enviable position at the professional end of the interconnection marketplace with products specified across a number of industry sectors including automation, measurement and control, medical, geophysical, food and beverage and renewable energy.

Each of these sectors make different demands on the connector manufacturer and we, along with other connector manufacturers, respond to their needs with developments such as new variants, new materials and new performance levels. A particularly good example is the food and beverage sector where the need to meet stringent hygiene requirements for machinery, systems and components is paramount. Here, binder’s latest models use high-quality materials such as stainless steel and special plastics with very smooth contours to prevent dirt adhesion. In addition, a high protection class (IP68 and IP69K) is provided to meet the requirements of high pressure cleaning and the often aggressive chemicals widely used across the industry.

Marcus Binder, the son of the founder, is now in charge of the company. He says “In a family run business it is essential to maintain traditional values while ensuring continuous development and product innovation.”
Established in 1985, Components Bureau provide a range of passive, opto and wound component solutions for the lighting, power supply and transportation markets.

In keeping with their business strategy, the company is expanding their offering to include a range of wireless solutions, adding Chinese manufacturers Bivocom and High Flying to their portfolio.

Bivocom is a leading provider of industrial wireless transmission terminals. The manufacturer offers high quality NB-IOT, 4G/3G/2G industrial modems, DTU, Gateway, Router, Android IPC and LoRa modules, which are widely used within smart grid, smart city, oil and gas, irrigation, intelligent transportation, kiosk and vending, mining, weather station and industrial automation applications.

High-Flying specialise in wireless communication, supplying products from system chips and IOT WiFi modules to Bluetooth modules.

Commenting on the new product range, Business Development Manager at Components Bureau, Darren Silver said: ‘We are excited to be the first UK representative for these two great manufacturers, we feel their products are a great addition to our portfolio as we look to expand into new markets.’

To find out more about the range of products available from Components Bureau, call +44 (0) 1480 412233, email info@componentsbureau.com, or visit www.componentsbureau.com.
Fischer Connectors continues to push the boundaries of technological innovation that fulfills customers’ needs for connectivity miniaturization, high-speed data transmission, sealing and ruggedness. The brand-new product line, the Fischer Freedom™ Series, has been developed to maximise efficiency, usability and performance, facilitate integration and optimise cable management.

The first product in this series, the Fischer LP360™, is a breakthrough low-profile connector. No key code means 360° mating freedom for optimized cable management. Membrane-sealed contacts ensure a fully cleanable connector (both plug and receptacle). Low profile allows for easy integration in any environment.

This breakthrough solution is ideal for a large variety of applications, primarily for portable and wearable applications, in such markets as defense & security, medical, and industrial & civil engineering – to name just a few.

Company Milestones
- 1954 W W Fischer founded in Morges, Switzerland
- 1960’s International patent filed for its push-pull locking system in 1962. 1964 developed the world’s first hermetic connector
- 1988 UK subsidiary set up
- 2010’s Continuous technological innovation sees launch of the Fischer Rugged Flash Drive, the robust Fischer UltiMate™, the miniaturized Fischer MiniMax™ and ultra-resistant Fischer FiberOptic series.
- June 2018 Launch of breakthrough technology in the brand-new Fischer Freedom™ Series and Fischer LP360™ connector

About Fischer Connectors:
A pioneer in high-reliability and rugged connector technology, Fischer Connectors has kept the spirit of innovation alive for more than 60 years, reimagining connectivity, and delivering breakthrough technologies, high-quality products and highly responsive customer service.

Fischer helps its customers produce innovative and reliable applications by designing, manufacturing and distributing high-performance, rugged connectivity solutions that withstand the most demanding environments.

With its HQ in Saint-Prex, Switzerland, where its R&D Center and manufacturing facilities are also located, Fischer has cable assembly sites in EMEA, the United States and Asia. The Group also includes local subsidiaries and a wide network of distributors and agents all over the world.
In 1962 Dr Nick Holonyak and his team of researchers at General Electric created the first practical visible spectrum LED. Six years later, Hewlett Packard integrated LEDs into early hand-held calculators. It was in the 80s that the use of LEDs really soared in the industrial sector, as specialist companies took this core technology and applied it to a vast range of applications. One such company, who pioneered the adoption of LEDs in a range of sectors, continues to move from strength to strength all these years later. Founded in the mid-80s as the Fibre-Data Group, OMC is one of the longest-established specialist manufacturers of optoelectronics in Europe, headquartered in Cornwall, UK. Accredited to ISO 9001:2008, ISO 14001:2004 and OHSAS 18001:2007 and winners of the UK National Electronic Component Award for Innovation, OMC is a pioneer in the development, manufacture and application of cutting-edge LED and fibre-optic technologies for a wide range of industries and companies worldwide, and places a major focus on research and development, engineering and innovation. The company has four key manufacturing divisions: Fibre Optics; LED Backlights and Optical Mouldings; Discrete Optoelectronic Components; and Semiconductor (LED) Lighting, and its commitment to the highest standards of quality, performance and engineering support is widely recognised within the industry.

Last year, the company completed the move into a new purpose-built manufacturing facility, reflecting an increase in demand for its bespoke and off-the-shelf opto-electronic products. The company - known for its optoelectronics expertise as ‘the problem solvers’ - has grown at between 10-15% year-on-year, with significant expansion in two areas, custom backlighting for LCD displays, and fibre optic cable assemblies and transmitter/receivers for use in industrial applications. The new facility has enabled the company to continue this growth and develop new solutions with dedicated development and production areas, plus a separate department set aside for the specialist tests it needs to perform in order to deliver tightly matched, high-reliability optoelectronic systems.

For Ledtech, one of the world’s largest capacity LED manufacturers, 2018 is a significant year. Unlike New Electronics, the company is still working towards its first half century, having been founded in Taiwan in 1977, yet earlier this year it announced the opening of a European facility in the UK. The addition of a direct facility adds a range of value-added manufacturing services, design-in support, volume availability and security of supply on a wide range of opto parts including discrete LEDs, LED displays, lighting components and luminaires. Additionally, later this year, the company will install a full LED production line in the UK facility.

Ledtech’s solid-state lighting products and components are used by some of the best respected names in the industry and most innovative SMEs alike. Ledtech addresses sectors with products specifically designed to fit the particular requirements of each application. Key markets include commercial, consumer, industrial, office, retail, business & finance, transportation, signage, instrumentation, healthcare, vending & gaming machines, hotels, restaurants & leisure and public spaces. Ledtech products meet international standards and lead the way in performance.

Comments Frank Liu, Founder, Group Chairman and CEO, Ledtech Electronics Corporation: “We constantly invest in people, technology and research & development to ensure that we can offer the solutions our customers need. The opening of our UK facility in Redruth, Cornwall, UK means that we now have design centres in Europe, Asia, and the USA, available to develop custom solutions for applications that require a specialised approach.”

Added William Heath, Director of Ledtech UK: “Whether our customers require a discrete LED, display, lighting component or luminaire we manufacture a vast range of standard devices – and if you need something custom-made, we are fully equipped to design a bespoke solution to suit your application. Ledtech UK can now offer the technical, engineering and commercial support to back up our leading, innovative product range.”
In Britain, the microelectronics industry has - like all forms of British industry - been subject to Government involvement lurching from hands-on to arms-length and covering most stages in between. Equally broader economic forces have also had their impact. By Dick Selwood

Taking a look at the industry’s development we’ll seek to draw together the threads of the past 50 years, using every ten years as a milestone.

1978: Now the chips are down

1978 marked the beginning of British Government interest in microelectronics. The sweeping intervention in technology that was Harold Wilson’s “white hot heat of technology” was not even a glowing ember, but a number of results from the 1975 Industries Act were encouraging technology. Scotland and Wales had Development Agencies (SDA and WDA) with the charter of improving their economies. Importantly, there was the National Enterprise Board (NEB), which was initially set up to extend public ownership of industry, but very quickly became a source of funds for industrial investment. It was also tasked with encouraging industrial cooperation, including mergers and as a third, less welcome role, it became a home for lame ducks, such as Ferranti, Sinclair Radionics, British Leyland and Rolls Royce. It was in this context that the BBC in March screened a programme, ‘Now the Chips are Down’, which highlighted the way in which the US was forging ahead in microelectronics and suggested that Britain was lagging behind.

Prime Minister James ‘Jim’ Callaghan watched it and apparently demanded to know what the NEB planned to do about it. They were able to put in front of him a proposal from a Briton and two Americans for a new semiconductor company, that would have design and manufacturing in the UK and the US. The company would initially make memory chips (a 64K DRAM and a 16K SRAM) and then a revolutionary microprocessor. All this for a mere investment of £50 million. The application was accepted and INMOS began a short and complicated life.

The WDA and SDA assumed that wafer fabrication was the secret to Silicon Valley’s success and embarked on luring companies to set up fabs in their countries. What seemed to escape most people was that Silicon Valley depended on active venture capitalists (VCs) prepared to take risks and accepting that a number of their investments would fail. These did not exist in the UK.

1988: Mixed results

By 1988 INMOS was no more. After five tumultuous years as a political football, the NEB sold its 75% stake in 1984, at a profit, to Thorn-EMI, a company with interests in consumer electronics, music, defence and retail. In 1989 Thorn passed control to Franco-Italian SGS-Thomson.

The inward investment programme, particularly that of the SDA, was charging ahead, with Motorola, NEC and others receiving financial support for building fabs in an area that became known as Silicon Glen.

A major failure was the Alvey Programme which closed in 1988. Launched by the UK Government in 1983 as a response to the Japanese 5th Generation Computer project, it was intended to look at areas including VLSI, AI, software engineering, man-machine interfacing and language processing, and architectures for parallel processing.

While it made some steps forward in getting better collaboration in R&D, the costs were high. It was reported that £200m of public money and a further £150m from industry was spent. Where it failed, according
Brian Oakley, who headed the project, was translating the R&D into commercial success.

He said that British industry didn’t spend enough on commercialisation and marketing.

Japan’s microelectronics industry was by now a world presence, backed as Oakley had recognised, by cheap money and the Japanese Ministry of International Trade and Industry. When their products, particularly memory devices, entered the market, US companies claimed that they must be dumping. It emerged that Japanese companies were getting more working die per wafer than their US rivals, and US companies discovered that when they transferred production to new, overseas fabs, they too saw an increase in yields.

The EU also established a programme to improve European competitiveness. The first of the family of ESPRIT programmes also began in 1983 and continued until 1998. The UK Government’s support for this and other EU programmes ranged from lukewarm to almost total denial.

A first sign of a major change in manufacturing was the opening in 1987 of TSMC, the first pure-play foundry.

1998: Bubble close to bursting

Perhaps the most important technology event in the UK in 1998 was the flotation of Advanced RISC Machines or ARM. A spinoff from Acorn Computers, by this time part-owned by Olivetti, ARM was very unusual in that it concentrated on Intellectual Property (IP), an Instruction Set Architecture, which it licensed to developers to build their own processors, either stand-alone or as part of an SoC. The architecture families it developed became the de facto standard for much embedded computing, and ARM became the world’s largest supplier of IP.

The inward investment approach, however, was faltering: Fujitsu closed a fab in County Durham, Siemens another in Northumberland (just 15 months after the Queen had opened it), Motorola merged two plants and shed staff, while a promised major investment by LG in Newport was never started.

This was against a tumultuous technical world background. The dotcom bubble was beginning its steepest inflation, and the concerns over the Y2K problem, of computers having problems at midnight on December 31st 1999, were growing.

When the dotcom bubble burst in 2002, there were dire predictions about the future of the Internet and those companies building chips for communications saw their markets shrink and share prices hammered.

While the broader semiconductor industry also declined, by 2008 things were beginning to pull back towards normal only for the world financial crisis to hit.

Inventories were run down, capital projects were put on hold, and general gloom spread across the industry. IDMs were increasingly abandoning fab ownership and using foundries.

It wasn’t helpful that Freescale and NXP had both been acquired by venture capital companies and loaded with debt.

2018 Mixed signals

The world is seeing an explosion in confidence and all the forecasts are for serious semiconductor growth today and new fabs are under construction around the world. It can be argued that the move to foundries has gone too far and there are regularly questions over the dominance of TSMC, which has well over half the world’s foundry business.

In the UK uncertainty over BREXIT is surely the most important factor in considering investment, but in parallel with that the last few years has seen significant start-up growth.

Both Bristol and Cambridge have continued to grow and companies like XMOS, Ultrahaptics, UltraSoC and Graphcore are successfully taking on the rest of the world, backed by British VCs.

Both ARM and Imagination Technologies have both been sold to overseas owners, although the British Prime Minister, Theresa May, was able to pronounce, to some incredulity, that the purchase of ARM by a Japanese holding company was a vote of confidence in Britain.

However, with all the ups and downs, the chip business has, for the last fifty years, been an exciting industry to work in, and while the swash-buckling sixties and seventies have been replaced by a much more corporate, and risk-averse approach, the future still holds much for the thousands of companies and millions of people employed in this dynamic industry.
It’s not just New Electronics celebrating 50 years this year, in July Intel also hits this milestone and the company is taking the opportunity to honour its heritage and look to the future. It’s a future that will be built on the technologies it invents, delivering experiences once thought to be impossible.

Fifty years ago, Robert Noyce and Gordon Moore founded Intel with the vision to ponder what might be possible. To imagine, to question and to do wonderful things in pursuit of a better future. Noyce issued an inspiring challenge: “don’t be encumbered by history, go off and do something wonderful.” Little did he know how passionately this challenge would be pursued, resulting in the Intel of today that invents at the boundaries of technology to make amazing experiences possible.

Harnessing the capability of the cloud, the ubiquity of the Internet of Things, the latest advances in memory and programmable solutions and the promise of always-on 5G connectivity, Intel is disrupting industries and solving global challenges.

Through milestone after milestone of cutting edge innovation, the fifty years have not been without their challenges. In 1975 a fire broke out in the moulding room of the company’s first production facility outside of the US, in Penang. It was probably the result of a faulty light but despite everything except the cafeteria burning to the ground, at an estimated $2.5m of damage, the recovery efforts were one of Intel’s greatest manufacturing triumphs. Next came the turbulent 80s when Intel underwent the worst recession in its history, but this prompted company leaders to refocus operations that would leave it stronger. Its resurgence in 1987 would prove to be the beginning of 11 years of record-setting revenues, clearly indicating it was the undisputed industry leader in its field.

So, this year – officially July 18th 2018 - Intel has a lot to honour, but all year long the company will bring together its people, its partners and communities to celebrate a bright future for Intel today and a better world for tomorrow. And of course, with sincerest congratulations to New Electronics too for reaching this milestone and wishing you continued success in the future.
1986 saw the entrance into the UK & Irish market of Jauch Quartz via the distributor, Logic Electronics. At the time, Logic were distributing various components for multiple manufacturers and the opportunity arose to begin trading with Jauch, a well-respected manufacturer of Frequency control and Battery products. The relationship advanced rapidly, and Jauch opted to purchase 40% of Logic Electronics in 1990. In 1995 the current MD of Jauch Quartz UK, Nicholas Ribton, went to Germany to work at the companies’ HQ; subsequently returning to Logic as Sales Manager and being a key interface between the two companies, enabling their continuing development.

In 1998, Logic secured agreements with NIC Components and Jianghai Capacitor to service the UK & Irish market, relationships that are still very much active today in Jauch Quartz UK Components Division. In 2007, the Directors of Logic Electronics sold the remainder of the business to Jauch which satisfied the strategy to establish global Jauch sales presence. Nicholas Ribton was appointed as Managing Director in 2009 and new staff were employed strategically, in the subsequent years, from Manufacturing and European distribution backgrounds. The UK & Irish turnover has also increased considerably from around £1.5M in 2008 up to a £6M forecast for 2018.

**Company Milestones**

- **1986** – Jauch Quartz enters UK & Irish market
- **1990** – Jauch Quartz buys a share of Logic Electronics
- **1998** – Logic Electronics signs Jianghai and NIC
- **2007** – Jauch Quartz completes the purchase of Logic Electronics
- **2017** – Jauch Quartz UK moves to bespoke new premises

In the 1980’s most Electronic products communicated via a physical link. In 2018 we have a crystal range specifically for RF communication.

The company has since gone through a series of operational improvements that has seen us increase warehouse capacity 4 times since our inception. In 2017, a significant investment was then made on a bespoke new building in Frimley, Surrey. The facility, at 900m2, is 3x larger than our previous premises and caters for our new custom Magnetics partner – Superworld Electronics.

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**Jauch Quartz goes global with Digi-Key Electronics**

Jauch Quartz, one of the leading specialists for quartz crystals, crystal oscillators and battery technology, is proud to announce that we have entered into a worldwide distribution agreement with Digi-Key Electronics, a global electronic components distributor.

“...a major focus of Jauch Quartz business growth strategy was to team up with a leading distribution channel partner. We are delighted to join forces with Digi-Key, one of the fastest growing distributors of electronic components in the world. Digi-Key’s leadership and market reach will bring our high technology products to a wide range of customers across numerous markets,” said Paul Benson, Strategic Business Manager, Jauch Quartz. “The combination of our innovation, including state-of-the-art wireless dedicated solutions, and Digi-Key’s expertise with assisting engineers through the entire design process will help customers develop and deliver solutions that enhance the value and performance of their products and help take them to market rapidly.”

“We’re excited to partner with Jauch Quartz and offer their leading-edge products to our global Engineering community,” said David Stein, Vice President, Global Supplier Management at Digi-Key. “Our worldwide customers will find great value in Jauch Quartz’ experience, quality products, and industry expertise.”

For more information about Jauch Quartz and to see their entire product listing, please visit their Supplier Center page on the Digi-Key website https://www.digikey.com/en/supplier-centers/jauch

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**About Digi-Key Electronics**

Digi-Key Electronics, headquartered in Thief River Falls, Minn., USA, is an authorized global distributor of electronic components, offering more than 1.5 million products, with over 1.8 million in stock and available for immediate shipment. From over 750 quality approved manufacturers, Digi-Key also offers a wide variety of online resources such as EDA and design tools, datasheets, reference designs, instructional articles and videos, multimedia libraries, and much more. Technical support is available 24/7 via email, phone and webchat. Additional information and access to Digi-Key’s broad product offering can be found by visiting www.digikey.com.

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**About Jauch Quartz GmbH**

The Jauch Group is one of the leading specialists for quartz crystals, crystal oscillators and battery technology. Established in 1954, we are a European market leader in the frequency control products industry, most recently with innovative MEMS timing and RF specific devices. We underline our claim to leadership with our knowledge in technical knowledge, high application and certification expertise, alongside in-house advanced test environments with high availability and fast delivery of products. Our competent staff at our subsidiaries Jauch Quartz France, Jauch Quartz United Kingdom, and Jauch Quartz America are available to assist with pioneering technology solutions.

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Just over 70 years ago, Léon Mouttet, an innovative engineer and entrepreneur, founded LEMO in Morges, Switzerland, as a manufacturer of specialist electrical contacts. The business quickly evolved, and it wasn’t long before it offered complete electrical connectors.

1957 saw the invention of the first ever push-pull coupling system for electrical connectors. A revolutionary product, it provided a user-friendly alternative to the traditional screw or bayonet coupling systems.

Its success led to the business expanding into the American and German markets in the 1960s, and into the UK and Japan a decade later.

The expansion of the nuclear power industry presented unique challenges. The hazardous conditions of the industry required many of the processes to be controlled, monitored and maintained remotely. Connectors specifically designed for use in remote-handling applications were developed.

The early 1980’s saw the company introduce the first generation of plastic push-pull connectors specifically designed for the medical market.

Next came the HDTV revolution in the early 1990s and the subsequent development of a broadcast range of specialist hybrid fibre optic push-pull connectors.

By the mid-1990s, LEMO had further expanded its global footprint and introduced a dedicated range of rugged, light weight and high-density connectors specifically designed for the motor-sport market.

The arrival of the 2000’s saw the business expand into Asia with the opening of a Chinese subsidiary. In parallel, changes in the communication technology saw LEMO enter the defence market, albeit with adapted motor sport connectors that were leading the industry from a packaging density perspective which made them a highly desirable addition to this market sector.

Today, LEMO has 20 subsidiaries operating across the globe and plans further ranges of industry specific push-pull connectors in support of the evolution of hi-tech markets.
Celebrating five decades

Just like New Electronics, Pickering Electronics, the manufacturer of high-quality reed relays, is also celebrating its 50th anniversary this year. Pickering Electronics was founded in 1968 by the late John Moore. Five decades later its future is looking bright, with sales in 2017 up by 30% on the previous year.

“Fifty years of designing, manufacturing and distributing reed relays means that we have a very good understanding of the product we are selling and consider ourselves to be the leaders in reed relay technology,” said Graham Dale, technical director at Pickering Electronics.

“Since 1968, we have gradually evolved our reed relays from very large, relatively crude parts to the small, ultra-reliable parts we have today. Production methods and quality systems have improved a great deal over that time, and costs reduced.

“When I started designing reed relays in the late 1970s some were saying that these electromechanical devices would have a limited lifetime. Instead, the market for high-quality reed relays has increased into areas that were inconceivable in those days.”

In 1983 Pickering Electronics established SoftCenter® technology and former-less coil construction, setting it apart from other reed relay manufacturers. SoftCenter protects the sensitive glass/metal seal of the reed switch capsule, thereby increasing contact resistance stability and improving the life expectation of the relay. Former-less coil construction maximises magnetic drive and increases packing density.

The Pickering Group now comprises two privately owned companies: Pickering Electronics, a specialist in reed relay design and manufacture, and Pickering Interfaces, which since 1988 has been designing and manufacturing modular signal switching and simulation for electronic test and verification systems. Pickering employs over 380 people worldwide, with manufacturing facilities in the UK and Czech Republic.

So happy birthday New Electronics, and happy birthday Pickering!

The Industry’s Smallest Through-Hole Reed Relay is Here!

Introducing the New Series 124 4mm²™

- Stacking on 4 mm x 4 mm pitch, providing the highest available packing density
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- Very fast operate times making these ideal for high speed test systems
- Choice of 3 or 5 Volt coils
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An example of packing density showing a high density module populated with a total of 606 Series 124 4mm²™ relays.

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Two years ago James Bates took over as Managing Director of Rapid. It has been a time of significant change at the Colchester-based company, repositioning itself from a broadline electronic components distributor to one that is engaged in focusing on individual sectors and developing a service-led approach.

“Identifying and focusing on our strengths, we revealed our new customer proposition – ‘Helping you make it’ – giving customers everything they need to design and manufacture innovative products, services, solutions and technologies. This includes high service levels and innovative online solutions as well as components, consumables and equipment.”

One of the areas Rapid is developing is in the field of EV charging. “Our partnership with installation specialist ICEE and manufacturer Schneider Electric has helped to create a seamless, one-point of contact supply chain for the customer looking to install an EV charging network,” says Bates.

Rapid has introduced several bespoke product modification services, made significant investments in staff and has doubled its Business Development Team, created a new Quotations team and made several senior management appointments. A new educational challenge, Airgineers, continues the company’s tradition of engaging in STEM initiatives. A fully responsive website will also go live soon.

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CELEBRATING 50 YEARS OF INNOVATION
Rapid’s Milestone
Rapid celebrates its 40th anniversary in 2019. From trading in a room above a garage, it is now one of the UK’s leading distributors of electronic components. “Rapid’s substantial growth has not altered the key focus of the business”, says James Bates (above): “We are committed to supporting the products we stock and the customers we serve.”

Company Milestones
1979
Founded in Eynsford, Kent
2006
Launched ecommerce website
2014
Stocked 100,000 products for the first time
2017
Shortlisted as Distributor of the Year at Elektra Awards

www.rapidonline.com
Rapid Electronics part of the CONRAD Group
Better tools, better process, better software

For more than 35 years, Green Hills Software has been developing the technologies which underpin the safety-critical systems of today.

Over the past 35 years, Green Hills Software has established a strong leadership position across a broad spectrum of embedded software developers, specifiers and partners. It remains dedicated to delivering success to customers and partners through a comprehensive offering of world-class software solutions and industry-leading, safety- and security-certification experts and services.

Founder and chief executive officer, Dan O’Dowd, continues to lead the company’s innovation and growth. Fiscal strength and self-sufficiency have always been part of the ethos, enabling Green Hills to continually invest in technology innovation. The company attributes over 35 years of stability and growth to forming strong long-term relationships with customers and partners, remaining focused on delivering leading technology innovation and the technical knowledge and longevity of its executive team and staff.

Historical product milestones
Green Hills Software’s culture of stretching the limits of technological feasibility has resulted in groundbreaking solutions that improve the efficiency and capability of software developers and their electronic products. Examples include the first embedded 32-bit compiler (Green Hills Compiler in 1983); the first embedded graphical integrated Development Environment (MULTI in 1993); the first commercial, partitioning real-time operating system (INTEGRITY in 1997); the first backwards-in-time debugger (TimeMachine in 2003) and gigabyte-class trace probe (SuperTrace Probe in 2003).

Excellence in compilers and the MULTI debugger technology continue to be foundational components in Green Hills Software’s solutions. Their innovative design is focused on quickly resolving one or more difficult debugging problems that plague the users of other embedded software debuggers every day. Many days or even weeks can be lost trying to identify the bugs. This whole process can be dramatically reduced using the right tools. For example, the TimeMachine debugger enables developers to step and run forward and backwards through their code, more easily tracking down the root cause of bugs—even if they occurred long before the problem manifested itself. With TimeMachine, developers can more readily explore processor execution and, as a result, find and fix bugs faster.

Safe and secure real-time operating systems must be designed and not retrofitted. The only way to build a high-reliability operating system is to plan it from the start. The INTEGRITY RTOS was architected and developed to be used as a platform for systems

“Developing software that cannot be hacked and does not fail is not a dream—it’s a reality.”
Dan O’Dowd, founder and CEO, Green Hills Software.
that have to be independently validated against the highest levels of security and functional safety. INTEGRITY helps developers manage the growing software complexity execution within embedded systems.

Furthermore, Green Hills has built an experienced certification services team that not only achieves excellence in certifying its own products but also helps customers to certify their systems. Organisations have been relying on Green Hills to reduce certification time-to-market and costs for over fifteen years.

First certified in 2002 to RTCA/DO-178B Level A (avionics), the INTEGRITY-178 RTOS has made over 60+ compliant deliveries and in 2008 became the first and only operating system to be certified by NIAP (National Information Assurance Partnership comprised of NSA & NIST) to EAL 6+, High Robustness, the highest level of security ever achieved for any software product. In 2006, the INTEGRITY RTOS was certified to IEC 61508 (industrial) and more recently to EN 50128 (railway) and ISO 26262 (automotive). Also, the MULTI IDE meets the highest standards of functional safety, including IEC 61508:2010, EN 50128:2011 and ISO 26262:2011.

The MULTI satisfies both SIL 4 (Safety Integrity Level) and ASIL D (Automotive Safety Integrity Level) and is certified by TÜV NORD and exida.

The security of embedded products has been a specialisation for Green Hills Software for more than 25 years, long before the emergence of the IoT. In the last couple of years, the lack of security in embedded devices has made headline news. Cars, medical devices, industrial systems, infrastructure, personal devices and much more are part of the IoT. Each and every device should be architected secure, making it impenetrable to a hacker. This is an achievable goal.

Security is achieved through the selection of the right products, technical expertise and a rigorous development and quality process. The need for security in every product should be assessed, and the system designed to provide total protection from deliberate attempts to exploit it, as well as providing the separation architecture necessary to constrain software bugs within. For example, the INTEGRITY operating system provides multiple independent levels of security on a single or multicore processor.

To address the security market beyond the embedded device to manufacturing and operations, INTEGRITY Security Services (ISS), a wholly owned subsidiary, was formed to provide an end-to-end security product portfolio, from FIPS 140-2 certified cryptographic modules and secure boot solutions for the onboard protection of software, data, and network communications to large-scale public key management systems.

Looking into the future
Green Hills Software has the proven expertise to create the critical technology needed to produce reliable, bug-free, and high-performance software. Developers trust Green Hills to provide them with tools and methodology required to write and debug software used in our continually evolving world of technology.
Back in the 1960s, microwave technology was a very specialist niche, used mostly for military radar and communications applications. In the decades since then, it has become – if not entirely mainstream – the key enabling technology for successive generations of cellular communications as well as automotive radars and satellite TV.

A major change over the past 50 years has been the gradual replacement of vacuum tube devices such as the magnetron, klystron and travelling wave tube (TWT) with more efficient, reliable and compact solid-state equivalents. This began in the 1960s, when gallium arsenide (GaAs) transferred electron devices, commonly called Gunn diodes, were developed to provide a solid-state solution for the low-power generation of microwave energy. Although named after the British-American physicist J B Gunn, who observed the oscillations in 1962, the effect was actually predicted a year earlier by the British engineers Brian Ridley and Tom Watkins of Mullard Laboratories and Cyril Hilsum of the Services Electronics Research Laboratory (SERL) at Baldock, who wrote theoretical papers on the effect in 1961.

SERL later became part of the Royal Signals and Radar Establishment (RSRE) at Malvern, now QinetiQ, which was a major sponsor of Government-funded industrial research projects into solid-state microwave in the 60s, 70s and early 80s.

Gunn diode oscillators were used in a variety of military and civilian applications, including target-seeking radars in missiles like Sea Dart and Sea Wolf, airborne radars like the Foxhunter radar deployed on the Tornado, and - at the other end of the cost scale - direction-sensing Doppler radar modules for automatic door openers, temporary traffic light sensors, and police speed radars.

Indium phosphide (InP) was also used for Gunn diodes, and though capable of generating higher power levels there were concerns about reliability, and they were not widely adopted.

However, reflection amplifiers using InP Gunn diodes did go into service in a military radar application in the early 1980s.

**Monolithic ICs**
The dominance of compound semiconductors in microwave truly began with the development of the GaAs MESFET. The late Jim Turner, working at Plessey Research Caswell, published the world’s first experimental results in 1966, and followed this with a paper on the first commercial e-beam fabricated GaAs MESFETs in 1970. He went on to develop, along with his colleague Ray Pengelly, the world’s first GaAs monolithic microwave integrated circuit (MMIC), publishing the results in 1976.

While MMICs developed rapidly in both capability and complexity,
discrete FETs continued to be important too, especially for high power applications. Towards the end of the 1980s, high electron mobility transistors (HEMT) were developed for low-noise applications such as satellite TV receivers, followed by pseudomorphic HEMTs (pHEMT), which offered superior gain and noise performance characteristics. pHEMT technology was also incorporated into MMICs.

For power devices the GaAs heterojunction transistor (HBT) were developed, which still dominate the market for cellular handset PAs, and later on silicon germanium (SiGe) and gallium nitride (GaN) devices. GaN devices currently dominate the RF power transistor market, first coming to the fore in 2008 in systems for the detection of improvised explosive devices (IED).

**Phased array radar**

The MMIC’s compact nature, and its potential to lower unit costs, finally provided radar system designers with the opportunity to realise the first phased array radars in the early 1980s. These radars require a large matrix of transmit/receive modules, each with independent phase and gain control, that can move the main beam in two or three dimensions without physically moving the antenna.

The 996 radar was one of the first phased array radars to go into service with the Royal Navy, made possible by GaAs FET transmit/receive modules. Around the same time, a true 3D radar concept project was being developed. The Multifunction Electronically Scanned Adaptive Radar (MESAR) was an experimental phased array radar that used a solid state active array and a digital beamformer, together with programmable waveform generation and signal processing. The MESAR programme began in 1982, and was the forerunner of a new generation of intelligent radar systems, including the SAMPSON radar deployed on the Type 45 destroyer.

**Circuit technologies**

In the 1960s the predominant circuit technology was waveguide. Much of the design process, though based on electromagnetic theory, was empirical - a design manual of the time stated that “a good set of needle files is a prerequisite for a microwave design engineer”.

Microstrip technology gradually started to be adopted, initially on an alumina substrate as seen in the Texas Instruments 8-10GHz noise source from 1968, but later on flexible metal-clad PTFE substrates as well as the cheaper FR4 for lower frequencies. Today, laminate materials dominate the microwave PCB market.

Low-temperature co-fired ceramic (LTCC) technology was introduced in the late 1990s, and offered the...
advantage of combining the circuit and its packaging into one structure, being particularly suitable for multi-chip modules. Still in use, it nevertheless failed to fulfil its initial hype.

**Computerised design**

Computerised Optimisation of Microwave Passive and Active Circuits (COMPACT) was the first successful microwave design package, commercialised by Compact Software in 1973. COMPACT ran on a time-sharing basis on mainframe computers, and rapidly became an industry standard, particularly in the defence industry.

COMPACT was followed in 1981 by the company’s third-generation program SuperCOMPACT, which enjoyed a similar monopoly until the launch in 1983 of Touchstone by a new company – EEsof. Touchstone was the first microwave EDA program that was able to run on a desktop computer, the newly-available IBM PC. Other companies followed up in quick succession. Hewlett-Packard launched its Microwave Design System (MDS), which eventually took over EEsof and merged their products into the Advanced Design System (ADS) – still being marketed today by Keysight Technologies. Ansoft (now part of ANSYS) was founded in 1984, and specialised in 2D and 3D electromagnetic modelling, a field later joined by CST Computer Systems Technology. A later entrant to the EDA market, AWR, is now a division of National Instruments.

**Commodity GaAs**

Though defence remained the dominant microwave sector in the 1980s, interest was growing in commercial spin-offs. Early designs for direct broadcast satellite (DBS) systems began to emerge, and some prototype automotive radars were also trialled. DBS provided the first true high-volume application for GaAs HEMTs with the launch of the Astra 1A satellite in December 1988. Sky Broadcasting launched its commercial service on four channels on Astra, while rival British Satellite Broadcasting (BSB) transmitted over the Marcopolo satellite.

The microwave low-noise blocks (LNB) that formed the first RF stage after the Sky dish or the novel BSB ‘squarial’ utilised four GaAs transistors, with a target price of £1.00 each for devices that had previously cost orders of magnitude more. Sky and BSB eventually merged, and the market expanded rapidly. The age of commodity GaAs had arrived, coincidentally just in time to save the microwave industry from the inevitable slump in the defence market following the end of the Cold War.

**GSM to 5G**

Although early analogue (1G) cellular phones were available in the 1980s, the mobile phone revolution really took off when GSM was introduced in the early 1990s. Subscriber numbers grew exponentially, exceeding even the most ambitious forecasts. Demands on the RF front end components drove continuous technology improvements, with dual-band, tri-band and quad-band devices being required to cover different frequency designations around the world.

3G and 4G LTE increased the design challenges further, with stringent linearity requirements an high peak-to-average power ratios on the MMIC power amplifiers.

5G will push the requirements of microwave technology still further, but will offer a step change in data rates. It will make use of mmWave frequencies where wide operating bands can be made available.
Having started my own career in 1980 fabricating PCBs on the south coast, Wilson Process Systems was formally established a year later offering that exact same service alone with several other thousand companies throughout the UK in the 80s. Today only a few hundred companies remain offering prototype & small production batches. For many, the rise of imported PCBs from Europe followed by China through the 90s and into 2000s put many PCB fabricators out of business. For some, diversification was the only option which WPS took with both hands. The early 90s saw the opportunity to start populating PCBs as certain customers saw this as a natural progression. With the introduction of automated assembly early on, WPS soon established an ethos of automation which remains today. From initial photo-mech and plating processes manufacturing bare PCBs (when health & safety was at its infancy) through to today’s offering of 200K placements an hour via its fleet of Universal surface mount equipment, WPS has seen numerous technical innovations covering PCB related production in its 37 years servicing the industry. Even with the wholesale migration out to the Far East, WPS has still managed to maintain its competitiveness within the volume industrial sector whilst still appealing to the small batch customers.

Today Wilson Process employs approximately 100 staff over 2 sites within the seaside town of Hastings. With over 30,000 sq ft of manufacturing space dedicated to automated through-hole, high capacity surface mount plus over 60 hand assembly operatives, WPS prides itself as a true supplier partner offering a competitive manufacturing resource focused on industrial, commercial and medical sectors within the contract electronics market.