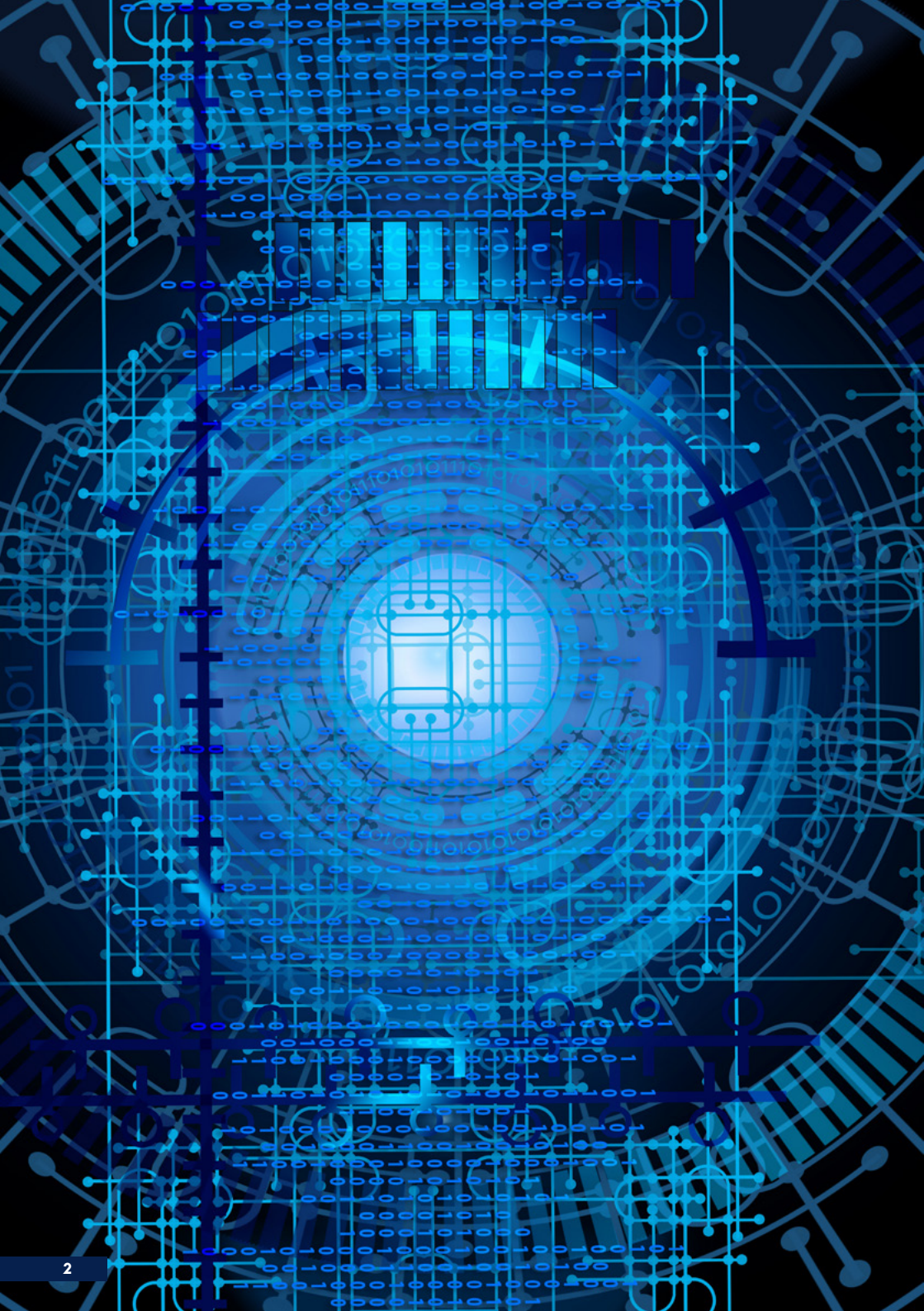
SEMICON Taiwan UK Delegation

September 2023

GREAT
BRITAIN & NORTHERN IRELAND



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Foreword

I am delighted to be leading the UK Delegation for SEMICON Taiwan 2023, showcasing the UK's capability across the semiconductor sector.

We have curated a selection of companies that showcase our strengths in design, software, equipment, and materials, representing just a fraction of the UK semiconductor sector offer.

Our participation in SEMICON Taiwan this year comes following the publication of the National Semiconductor Strategy in May. Recognising the significance of semiconductors to enable innovation and the technologies of tomorrow, the UK government has set out an ambitious vision to grow our already strong semiconductor sector.

We are partnering with our national innovation agency, Innovate UK, on our UK pavilion this year. Part of UK Research and Innovation (UKRI), they support business-led innovation, providing grants and opportunities for companies working in the semiconductor sector. They are bringing twelve high-growth, innovative companies to participate in SEMICON Taiwan, supporting them to find new international partners for research and collaboration.

The UK is a leader in compound semiconductors, R&D, and in IP and chip design. The approach of our National Semiconductor Strategy is focused on these strengths and developing them further. Compound semiconductors are vital in evolving technologies such as autonomous vehicles and future telecoms; they also enable innovation in green energy and are essential in achieving net zero targets.

While the UK is a global leader in these areas, the semiconductor supply chain is global in its nature. With Taiwan being a hub for semiconductor manufacturing, SEMICON Taiwan is a fantastic opportunity for both Taiwanese and UK companies to connect and explore possibilities for trade and collaboration.

We welcome the opportunity to discuss trade and investment opportunities, as well as scope for collaboration on R&D. We hope that you will enjoy our pavilion and have engaging conversations with our companies, and the Department for Business and Trade and UKRI welcome any questions or insight on your trade, investment or R&D collaboration needs.

Professor Julia Sutliffe
Chief Scientific Adviser at the Department for Business and Trade

UK Semiconductor Landscape

New £1 billion strategy for UK's Semiconductor Sector.

A new 20-year plan to secure the world-leading strengths of the UK's semiconductor industry been unveiled by the government.

The National Semiconductor Strategy sets out how up to £1 billion of government investment will boost the UK's strengths and skills in design, R&D and compound semiconductors, while helping to grow domestic chip firms across the UK.

Working in tandem with industry, investment made by the government will drive research, innovation and commercialisation through the sector - helping to deliver products from lab to market.

It comes as the Prime Minister was at the G7 leaders' Summit in Japan for discussions on strengthening our tech collaboration with like-minded economies and strengthening supply chains for critical technology like semiconductors.

Semiconductors are vitally important for the modern world we live in, being an essential component for the functioning of almost every electronic device we use. From phones and computers to ventilators and power stations, nearly every piece of technology in the world depends on them.

Over a trillion semiconductors are manufactured each year, with the global semiconductor market forecast to reach a total market size of $1 trillion by 2030.

Semiconductors also underpin future technologies, such as artificial intelligence, quantum and 6G.

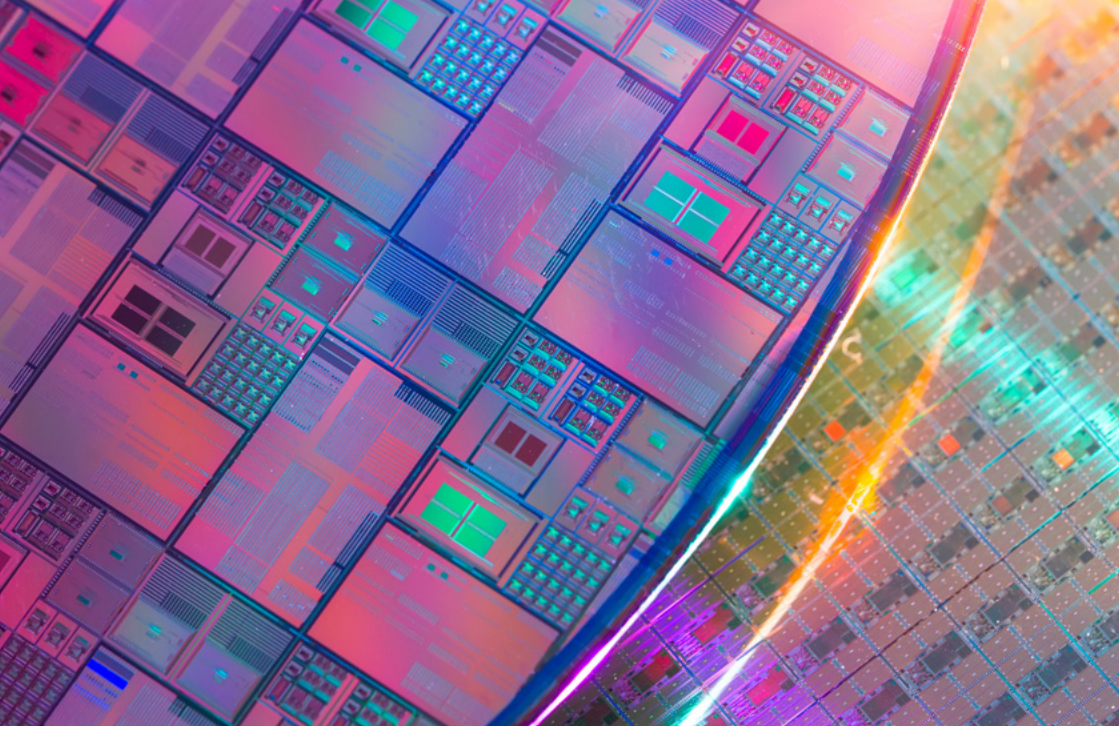
The strategy focuses on the UK's particular areas of strategic advantage in the semiconductors sector – semiconductor design, cutting-edge compound semiconductors, and our world-leading R&D ecosystem - supported by UK universities from Cambridge to Cardiff and Manchester to Edinburgh demonstrating global leadership in this space.

Compound semiconductors do things silicon chips can't, with use cases in evolving technologies such as autonomous driving and future telecoms. Their creation requires expertise in advanced materials, an area of UK science leadership.

To support the growth of the sector in the UK, the government will invest up to £200 million over the years 2023-2025 to improve industry access to infrastructure, power more research and development and facilitate greater international cooperation.

Taking a strategic approach to investment over the next decade, the government will invest up to £1 billion in a range of measures to secure the UK's advantage in this globally important sector and meet 3 key objectives:

- growing the domestic sector



- mitigating the risk of supply chain disruptions
- protecting our national security

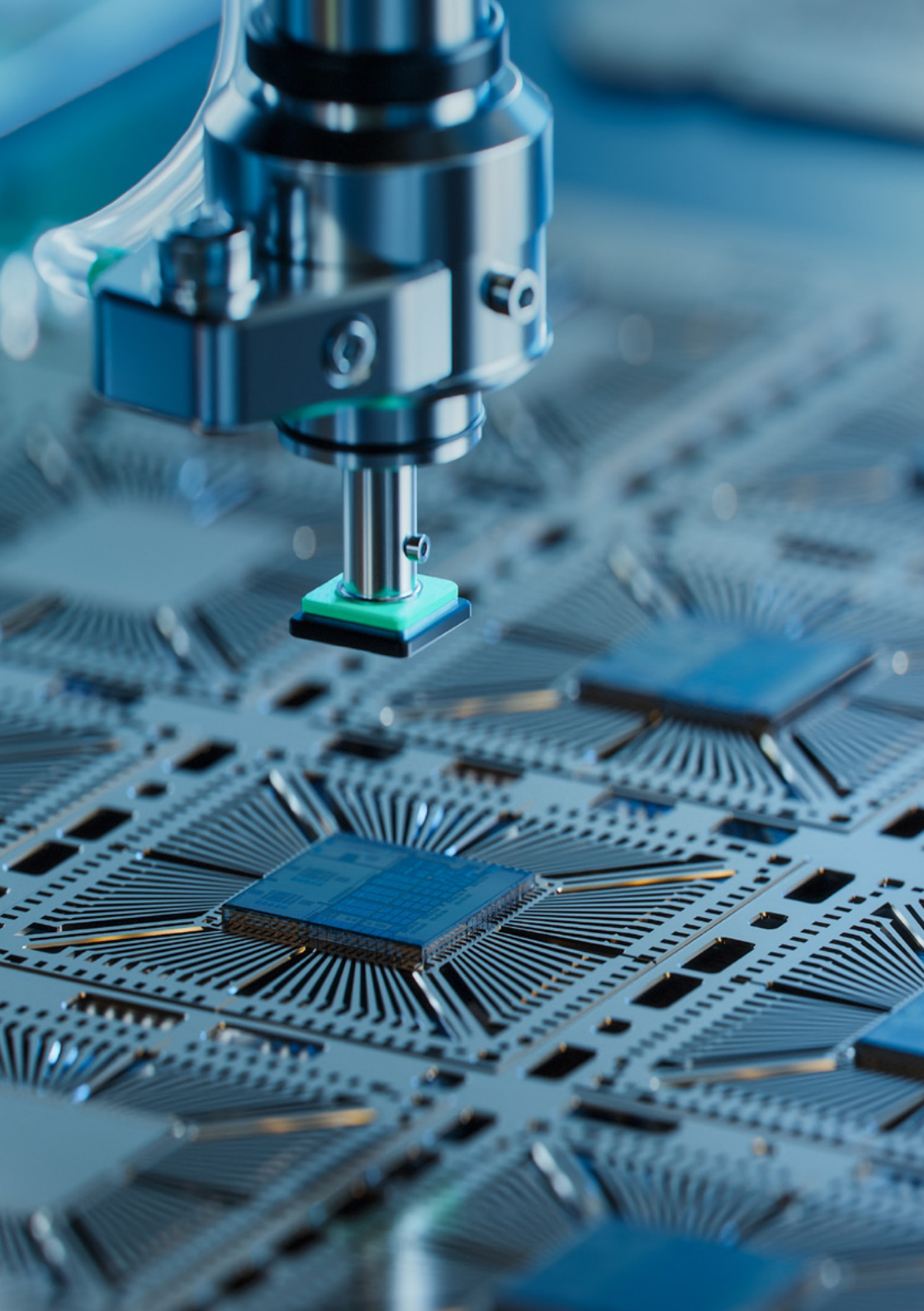
The strategy builds on the consistent support the government has provided for the semiconductor industry, having provided £539 million in grants for research and £214 million directly to SMEs in the sector across the last 10 years, as well as funding 450 PhD students since 2017.

The government will focus on growing the UK's unique and already world-leading strengths in compound semiconductors, research and development, intellectual property and design by investing up to £200 million over the years 2023-2025, and up to £1 billion in the next decade. This funding will be used to improve the talent pipeline and will make it easier for British firms to access things like prototyping, tools and business support.

These efforts will include investment in a new National Semiconductor Infrastructure Initiative to unlock the potential of British chip firms in these key areas. It will look at whether better access to prototyping facilities for chip firms is needed to tackle barriers to innovation and grow the industry. It will also explore opportunities to make specialist software tools more available for start-ups. The Department for Science, Innovation and Technology commissioned research[1] that will look at the best way to establish the Infrastructure Initiative. This will report its findings in the autumn.

Furthermore, the government will announce plans by the autumn on support for investment in the semiconductor manufacturing sector, particularly where they are critical to the UK tech ecosystem or the UK's national security.

1 https://www.gov.uk/government/news/government-explores-national-initiatives-to-boost-the-british-semiconductor-industry



Prime Minister Rishi Sunak said:

"Semiconductors underpin the devices we use every day and will be crucial to advancing the technologies of tomorrow."

"By increasing the capabilities and resilience of our world-leading semiconductor industry, we will grow our economy, create new jobs and stay at the forefront of new technological breakthroughs."

UK Research and Innovation

CATAPULT
Compound Semiconductor Applications

UK Research and Innovation

Seizing the opportunity of a thriving UK semiconductor industry.

How Innovate UK and Compound Semiconductor Applications (CSA) Catapult are leading initiatives to drive growth, create jobs and foster innovation to support the government's semiconductor strategy

The role of the Compound Semiconductor Applications Catapult

- Established and funded by Innovate UK, the CSA Catapult is the UK's authority on compound semiconductor applications and commercialisation. It focuses on the development of the most advanced semiconductors, compound semiconductors, and how they can be used in the next generation of technologies.
- From its base in Newport, Wales, the CSA Catapult's mission is to deliver long-term benefits to the UK economy. It does this by accelerating growth in industries where compound semiconductors create a competitive advantage and enables new products or end markets.
- The CSA Catapult is working towards its goals by implementing a range of initiatives as outlined in the strategy. These include bringing together supply chains, creating jobs, and providing training to scientists and engineers who will lead the way in developing future technologies.
- The CSA Catapult[1] is set to expand its operations across the UK, establishing physical locations in Bristol, Scotland, and the North-East. This expansion will allow the organisation to collaborate with companies and universities in these regions, leveraging their expertise to drive innovation and economic growth.
- Given its expertise in compound semiconductor technology and applications, the CSA Catapult is well-suited to spearhead the development of prototype silicon fabrication and scale-up of compound semiconductors in the UK.
Building the semiconductor for the UK and beyond

1 https://csa.catapult.org.uk/csacatapult/

Building the semiconductor for the UK and beyond

- The UK recognises that no one country has all the answers and therefore is keen to bring together complementary strengths through global collaboration.
- The strategy is correct to highlight the importance of forming long-term international partnerships to safeguard supply chains against possible disruption, but it is also important for growing the sector and the economy.
- The opportunity for a thriving UK semiconductor industry is there for the taking. There are significant opportunities for growth and innovation across the industry with the potential for huge economic benefits by supporting companies and growing jobs and skills across the UK and creating global opportunities.

Our commitment to the semiconductor strategy

Semiconductors are one of the five key areas within the digital and technologies domain that Innovate UK is investing in. Funding will deliver on developing new technologies and building the talent and skills pipeline to go alongside this. This investment is in addition to our responsive activities, transformative technologies work, and ongoing programmes such as Commercialising quantum technologies[2], Digital Security by Design[3] and Driving the electric revolution[4].

- To enable a fast start in response to the government's semiconductor strategy, Innovate UK has already funded a new £18 million semiconductor innovation programme this year. By working with industry and academia ahead of the strategy launch, we are well-placed to deliver on new government commitments.
- Innovate UK is also building strong international partnerships such as with the Department of Industrial Technology of the Ministry of Economic Affairs and ITRI in Taiwan and supporting more innovative UK businesses to build global collaborations including through our Global Business Innovation Programme

2 https://www.ukri.org/what-we-do/our-main-funds-and-areas-of-support/browse-our-areas-of-investment-and-support/commercialising-quantum-technologies-challenge/

3 https://www.dsbd.tech

4 https://www.ukri.org/what-we-do/our-main-funds-and-areas-of-support/browse-our-areas-of-investment-and-support/driving-the-electric-revolution/

UK Design and IP Strengths

The UK is strong across semiconductor design and IP and has a number of dedicated design houses, with over 110 companies. IP providers who are headquartered in the UK, such as Arm and Imagination Technologies, hold a strategic global position. This helps the UK to drive the proliferation of UK standards and values to meet wider objectives, such as cyber security.

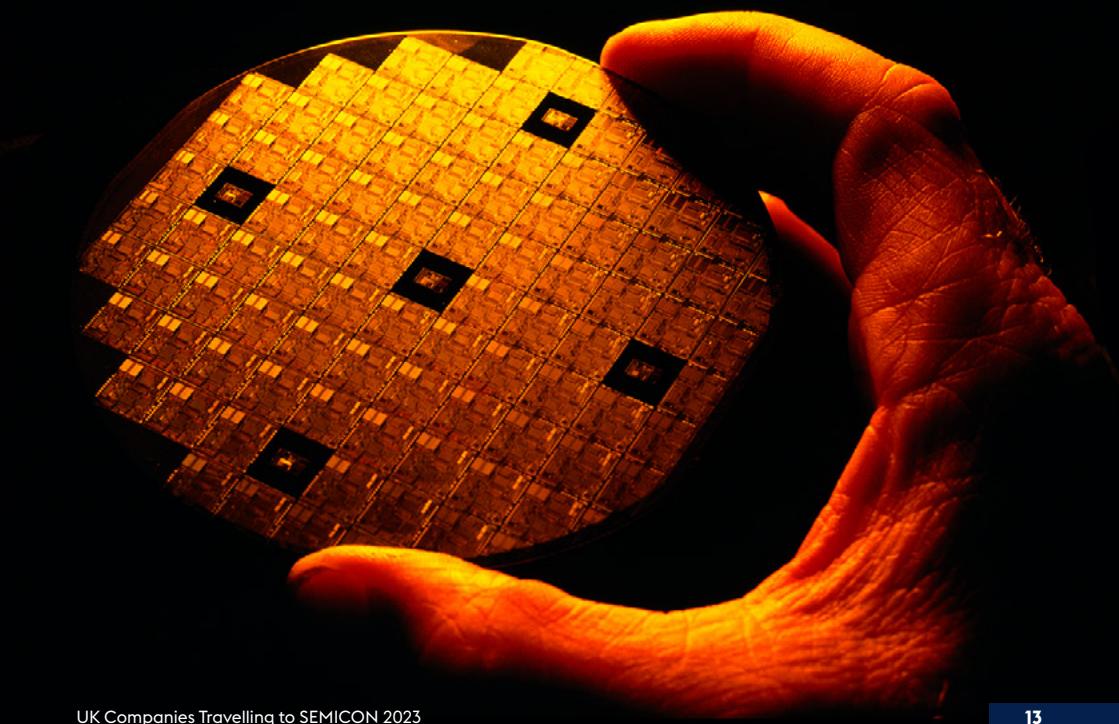
We see high international interest and investment into the UK. Our talent is sought-after and we have exceptional R&D clusters in Cambridge and Bristol. The UK is also an attractive place to list. Canadian IP company Alphawave has relocated to London and completed an IPO on the London Stock Exchange in 2021. In October 2022, Sondrel Holdings, a fabless semiconductor company focused on the design of application specific integrated circuits chose to list on London's (AIM) market.

Internationally leading companies also have a UK presence in semiconductor design. Apple has an office in St Albans focused on semiconductor design, Intel has a team in Swindon focusing on Graphics Processing Unit development and Infineon, a large German semiconductor company, has an R&D office in Bristol. Meanwhile, we have home-grown unicorns such as Graphcore, who are based in Bristol and are at the cutting edge of AI-enabling hardware. The UK has leadership in wider emerging technologies critical to prosperity and economic growth, as well as security needs.

Design is estimated to have a 29.8% share of total value add within the semiconductor value chain. It is second only to the manufacturing of semiconductors at 38.4%. The presence of world-leading companies in the UK within this high-value aspect of the industry is a real area of opportunity for future UK economic growth.

UK Companies Travelling to SEMICON 2023

The British Office in Taipei is pleased to welcome its first ever UK presence to SEMICON 2023. This consists of two delegations, supported by the **Department for Business and Trade** and **Innovate UK**, and comprises 17 leading UK companies.



Department for Business and Trade

We are the department for economic growth.
We support businesses to invest, grow and export, creating jobs and opportunities across the country.

We are delighted to present our delegation for SEMICON Taiwan, which represents a cross-section of great UK semiconductor companies in manufacturing, equipment and materials, and design and IP.

If you have any questions about these companies, please do not hesitate to use the contact details provided or speak to us at the **UK Pavilion.**

Clas-SiC Wafer Fab Ltd, UK

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Chief Executive Office

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https://clas-sic.com/

Meet the Company

From concept to prototype to manufacture in Silicon Carbide

- Clas-SiC Wafer Fab is the UK's first dedicated, open, 150mm, pure-play foundry to manufacture Silicon Carbide power devices, providing a fast, confident and cost-effective route to market.
- Clas-SiC combines the best & most experienced talent in the industry, along with state-of-the-art Silicon Carbide tools & processing
- Clas-SiC offering provides fast prototyping cycle times for SiC wafer fabrication to accelerate R&D and time to market for new device designs supporting Net Zero through reliability proven process design kits and a library of "off the shelf" Process Module IP
- Designers using our 1200V MOSFET PDK are able to employ their full innovation to customise the active area of their devices. We provide a 1200 V termination scheme, along with all the processing details.
- To assist the designer, our PDK includes a Design Rule Manual and Design Rule Check deck.
- JBS/MPS SiC diode Flexible, Reliability Proven Design Kit & Process READY NOW
- `1200V SiC MOSFET Flexible, Reliability Proven Design Kit & Process READY NOW
- 1700V & 3300V SiC MOSFET Reference Designs Proven, Alpha Design Kits AVAILABLE NOW, reliability testing complete Sept 2023

Crypto Quantique

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Head of Sales – APAC

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https://www.cryptoquantique.com/

Meet the Company

Crypto Quantique is the first software and IP (Intellectual Property) company to create true end-to-end IoT security products that can be seamlessly integrated throughout the entire supply chain, from the design of the chip to connecting devices to the cloud. With strong traction in the market, including signed partnerships with large semiconductor companies including STMicroelectronics, Microchip, and Renesas, along with signed customers like large OEMs like Wurth Elektronik. Their products have won multiple industry awards for their unique design.

Crypto Quantique is unique in the fact we provide a silicon-proven IP design, named QDID, which acts as a root of trust for IoT devices in the form of a physical unclonable function, also known a PUF. Along with this IP we provide a software platform to provision, onboard and manage devices at scale, with or without a QDID on the device.

With a proven track record of success, Crypto Quantique is well-positioned to become a leading player in the IoT security market. The company's ability to provide end-to-end security solutions that are seamlessly integrated throughout the entire supply chain sets it apart from competitors and gives it a significant competitive advantage. As the demand for IoT devices continues to grow, the need for comprehensive security solutions will become increasingly critical. This, along with developing worldwide legislation will leave Crypto Quantique at the forefront of this move to a secure future for IoT.

EpiValence Ltd

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Commercial Director

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Meet the Company

EpiValence Ltd – Building Chemical Bonds

EpiValence offer a wide range of ALD/CVD precursors.

We are a chemical manufacturer for high-tech industries with over 200 compounds of 45 elements from the Periodic table with a focus on ALD/ CVD precursors.

Our team have many years' experience of supplying and supporting the Semiconductor industry, knowing the requirements and expectations required to meet the customer's needs.

With state of the art multipurpose and pyrophoric laboratories, pilot plant and Technical Development Area for larger volume scale up. EpiValence can support requirements from grams to kilograms and beyond whether for development or production.

Our offer includes but not exclusively:

- Metal alkoxides
- Metal alkylamides
- Metal diketonates
- Metal alkyls

Other functionalised derivatives EpiValence provide:

- In house R&D Technical support – molecule design, proof of concept and scale up
- Broad range of capabilities and equipment – inc. dedicated production equipment
- Robust quality and management system
- Batch control, change control and traceability
- Full analytical suite – ICP, NMR and others
- Bubbler management – filling, emptying, cleaning and repair
- Collaboration and confidentiality to our customers
- Global distribute – experts in IATA and ADR regulations

Our core beliefs are to develop robust, repeatable and scalable processes to deliver consistently high quality products to meet the needs and expectations of our customers now and in the future.

Infinitesima

Contact

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https://www.infinitesima.com/

Meet the Company

Founded by CTO, Andrew Humphris, Infinitesima is an Oxfordshire based supplier of in-line and lab based probe metrology tools for advanced semiconductor manufacturing.

With the transition to 3D device designs and inflections such as hybrid bonding, the Semiconductor Industry needs new metrology tools to meet manufacturing demands. Our key product, the Metron3D system is a fully automated, sub-nanometer, high-speed 3D imaging system, operating at production throughputs of up to 170 wafers per hour.

High-speed imaging is enabled through Rapid Probe Microscope (RPM) technology, increasing imaging speed by up to 100x compared to conventional AFM systems using a patented photo-thermal actuation of the probe tip. With imaging time measured in seconds, rather than minutes the system is installed in leading IC manufacturers to address metrology challenges for manufacturing next generation logic, DRAM and 3D NAND devices.

We have a fast-growing team of researchers and engineers that are focused on enhancing the capabilities of the RPM and supporting our customers in the application of our technology. Located south of Oxford at Abingdon Business Park, our 720m2 offices and facilities support the development, manufacture, test and demonstration of our products and technology.

IQE

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Vice President APAC Sales

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https://www.iqep.com/

Meet the Company

IQE plc is the leading global supplier of compound semiconductor epitaxial wafers and material solutions to the semiconductor industry. For over thirty years IQE has been at the forefront of compound semiconductor innovation enabling billions of devices to connect, sense, power and display - from the car you drive to the smartphone in your pocket.

As the world's only pure play epitaxy foundry with a global manufacturing footprint across three continents, IQE is uniquely positioned within the global semiconductor supply to support customers across the ecosystem.

We are market-led, creating solutions to address market challenges with the broadest portfolio of scalable materials platforms in the industry and demonstrated by a recognized heritage of scaling innovation to high volume manufacturing across GaAs, GaN, InP, GaSb and Group IV silicon and germanium semiconductor materials.

Connect
We live in an interconnected digital world where connectivity is no longer optional. IQE's connect products enable high performance wireless communication with the broadest range of RF epitaxial wafer products for wireless communication, radar, and RF heating applications across the radio frequency spectrum spanning 1MHz to 300 GHz.

Sense
The connected digital world has become intelligent, driven by the need for smart connected devices to be able to detect and communicate with the world around them. IQE is a pioneer in VCSEL epitaxy for 3D sensing and our next generation long wavelength materials are enabling new technologies in mobile, automotive and VR sensing. IQE's InP powers optical communication networks with a portfolio of telecoms and datacoms epitaxy, covering lasers, detectors and high-speed photodiodes, while our SWIR to LWIR infrared applications are aided by a full IR spectrum of materials (InP, InSb, GaSb, InAs) which are found in a wide variety of defense security and healthcare sensing applications

Power
Power is fundamental to the digital world and for everyday life in improving energy efficiency from industrial motor drives to the power supplies for high-performance appliances and consumer products. IQE supplied the 1st GaN HEMT 20 years ago and offers a range of power-control solutions including GaN-on-Si materials for 150 mm and 200 mm platforms and GaN-on-GaN materials for high-voltage devices.

Display
Current trends in consumer device display technology are driving the need for extremely small, highly efficient LEDs. IQE is engaged in multiple partnerships for microLED, leveraging the power of our technology portfolio to directly address the requirements for mobile devices, wearables, and extremely high-resolution displays.

KLA Corporation (SPTS)

Contact

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https://www.spts.com/

Please find at booth M0248

Meet the Company

KLA Corporation is a leading supplier of wafer processing, process control and yield management solutions for the semiconductor and related nanoelectronics industries. KLA's products and services are used by bare wafer, IC, reticle and other manufacturers of materials and equipment around the world, from research and development to final volume manufacturing. Headquartered in Milpitas (California), KLA operates from 19 global locations, with ~14,000 employees worldwide. In the year ending December 2022, KLA's revenues were USD10.5billion.

KLA products include plasma etch and deposition systems, manufactured by their SPTS Division, which has been based in Newport, South Wales (UK) for around 40 years. The company provides SPTS wafer processing solutions to researchers and device makers around the world involved in MEMS, advanced packaging, photonics, RF/wireless communications and power device manufacturing.

Technologies include deep reactive ion etching (DRIE) for silicon etching, and ICP etch processes for SiOx, SiC, SiN and compound semiconductors. Also manufactured at the UK facility are plasma deposition systems (PVD and PECVD) for deposition of metals and dielectrics used in many different semiconductor applications.

Over 98% of these products are exported from the UK to all the major semiconductor-manufacturing regions throughout Asia, North America and mainland Europe, supported by local Sales and Customer Service teams in Taiwan, USA, China, Singapore, Korea, Malaysia, France and Germany.

In 2022, KLA broke ground on a new 200,000sq.ft. R&D and manufacturing site in Newport to expand the production capacity of their UK operations. This is due to come online in early 2025.

Oxford Instruments

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Please find at booth I3127

Meet the Company

Oxford Instruments focusses on research and industrial applications. Key market segments include Semiconductor & Communications, Advanced Materials, Healthcare & Life Science, and Quantum Technology. Their portfolio includes core technologies in areas such as low temperature and high magnetic field environments; NMR; X-ray, electron, laser, and optical based metrology; AFM; raman microscopy, confocal microscopy, optical imaging; advanced growth, deposition and etching. Oxford Instruments Plasma Technology offers configurable process tools and leading-edge processes for the precise, controllable and repeatable engineering of micro- & nano-structures. They provide process solutions for the etching of nanometre sized features, nanolayer deposition and the controlled growth of nanostructures.

Innovate UK

Innovate UK, the UK's national innovation agency, is pleased to be visiting Taiwan with this strong delegation of exciting UK semiconductor businesses.

As part of Innovate UK's Global Business Innovation Programme, delivered by Innovate UK EDGE, the agency's resource that helps ambitious UK businesses developing cutting-edge technologies in key sectors to grow, scale and enter global markets, they are looking to explore the opportunities for working with Taiwan, to build innovation and R&D focused partnerships and collaborations.

Bay Photonics

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Chief Technology Office

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Meet the Company

Bay Photonics harnesses the power of light through their expertise in designing, packaging, assembling and testing cutting-edge semiconductor-based photonic devices. The company's portfolio includes state-of-the-art emitters, detectors, and photonic integrated circuits (PICs).

Bay Photonics has been a steadfast supporter of the UK semiconductor photonics development community since 2007, spanning various market sectors such as telecommunications, biomedical, space and remote sensing. With their wealth of experience and highly skilled personnel, the company excels in operating semi-manual workstations tailored for small batch sizes. These workstations are particularly ideal for pioneering process development.

Bay Photonics boasts access to state-of-the-art, fully automatic workstations employed by large volume commercial packaging houses, facilitating design optimisation for mass production, making the company the perfect partner for individuals or organisations ranging from TRL3 (proving feasibility/technology development) to TRL7 (demonstrating system prototypes in operational environments). A privately-owned company, Bay Photonics offers open access to its services for photonic device assembly and packaging.

Bay Photonic's cutting-edge technologies encompass the gamut of downstream semiconductor device processes. The company offers comprehensive support for die-singulation, die-attachment, wire-bonding, encapsulation (ensuring mechanical protection, electrical insulation, photonic connection and thermal control for the encapsulated die), final testing and assembly (integration of photonic integrated circuits into products such as sensors, transmitters and receivers). Recently the company has been focusing on fostering the burgeoning quantum technology revolution. Semiconductor-based photonics plays a pivotal role in enabling aspects of quantum technology.

The packaging of quantum photonics entails the intricate task of integrating and packaging photonic devices that generate and manipulate single photons, quantum states of light and quantum information. Even minor disturbances or temperature changes can lead to decoherence or degrade their performance, making Bay Photonics' expertise and precision indispensable in this exciting field.

Blueshift Memory

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CEng, Chief Marketing Officer

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www.blueshiftmemory.com

Meet the Company

Blueshift Memory has developed a proprietary new computer architecture design enabling up to 1000 times faster, energy-efficient memory access. Blueshift Memory is a semiconductor IP company which has developed a proprietary next-generation (non-Von Neumann) technology that optimises computer memory architecture for more efficient handling of large data sets and time-critical data. Based on the Cambridge Architecture™ the technology overcomes the constraints of the 'Von Neumann bottleneck' or Memory Wall, offering up to 1,000 times faster memory access, up to 50% reduction in energy consumption and giving protection from memory-centric cybersecurity attacks for data-intensive applications such as, high performance computing, AI, machine vision for AR/VR, 5G edge connectivity and the IoT.

The company's team and advisory board have led multiple successful startups and have significant experience in the semiconductor and supercomputing industries. Founder and CTO, Peter Marosan, developed a distributed computing solution and a recommendation AI engine, and has designed supercomputer hardware and Big Data HPC. Co-Founders are Theodore Omtzigt, who is a former Intel and NVIDIA principal engineer and Kitrick Sheets, who was lead engineer on the Cray Jaguar supercomputer. CMO Helen Duncan has 45 years of experience in the electronics and semiconductor industries, including design engineering and marketing for Plessey and Rohm Electronics.

The company is developing a prototype computer vision AI module incorporating its technology, which also integrates a customised Codasip RISC-V core. This module design demonstrates the improvements in memory bandwidth, latency and reduced energy consumption that Blueshift Memory's IP can offer to DRAM and other memory vendors, as well as to processor (CPU/GPU) vendors and end users like hyperscalers.

Blueshift Memory is seeking to forge new partnerships with DRAM and other memory vendors, with a view to integrating its IP in to next-generation products.

EMU Technologies (Europe) Ltd

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Meet the Company

EMU Technologies is a wafer handling equipment manufacturer, focused on supplying cost effective, reliable automated and manual wafer handling equipment to the global semiconductor industry.Established in 2005 EMU has successfully delivered over 1,000 wafer handling products to global customers. Products range from automated and manual wafer notch/flat aligners and transfer machines to automated wafer sorters and laser mark readers operating under full host (MES) control. Recent innovations include an including award-winning AI edge inspection machine which has potential to become an industry standard. The company has grown by expanding its international footprint, has products installed in the majority of European fabs and has a proven, successful track record of sales in the USA and Singapore. EMU was selected by Wolfspeed USA as supplier of choice for automated substrate handling and ID reading.Traditionally products have been utilised by silicon wafer fabs, however, in recent years there has been a significant uptake of EMU technologies by compound semiconductor manufacturers.

EMU collaborates with over 60 compound semiconductor, silicon and emerging materials manufacturers, providing standard and customised automation solutions, which often involves adopting new technologies to cope with the handling and detection of novel substrate materials such as GaAs, SiC, GaN, InP, Glass.

The company's recent move to a new facility with dedicated clean manufacturing, design and rapid prototyping and source inspection areas has ensured the continuation of first-class service delivery to customers as industry requirements progress.EMU's three product categories are:

- Standard market-ready products - a competitively priced, high quality, reliable suite of wafer handling products that are compliant with semiconductor manufacturers' requirements
- Macro AI inspection products -commercialised, with ongoing customer support to fully exploit the AI algorithm's capabilities
- Micro AI inspection products - at the R&D/ prototyping stage, with many of the key elements of the product developed, with micro inspection available as a lab product or on EMU's existing automation platform.

With a project planned to develop and commercialise a new, low-cost front-end robot, to meet the future requirements of silicon and compound semiconductor manufacturers, EMU is seeking a collaboration with a Taiwanese partner with equipment that can satisfying the following key areas:

- high throughput wafer sorter
- front end module for process and metrology
- core automation element of the next generation AI micro inspection station

KuasaSemi Ltd

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Director & Co-founder

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Meet the Company

KuasaSemi Ltd specialises in advanced semiconductor design solutions, with a focus on wide-bandgap technologies. The company's state-of-the-art software and comprehensive support enables engineers and designers to unlock the full potential of semiconductor design and drive transformative innovation.

Founded by a family of power electronics and software engineers, KuasaSemi Ltd is the first and only UK based TCAD company. The company is developing and commercialising software to aid in the design of emerging wide-bandgap (WBG) semiconductor devices. These devices are at the forefront of power electronics used in electrified transport and are a core building block of the world's electrical grid infrastructure.

The TCAD software helps semiconductor design engineers optimise device performance, reliability and yield by predicting device behaviour under different conditions. With its modern intuitive interface, users can effortlessly create semiconductor designs that seamlessly connect to every detail of the process.

KuasaSemi's TCAD software can simulate the behaviour of semiconductor devices at different levels of abstraction, thereby providing a comprehensive understanding of their physical behaviours. This is a great benefit at the design stage, helping to identify and solve problems early in the development process and reduce the risk of costly and time-consuming redesigns. The TCAD tool has a focus on emerging materials such as Silicon Carbide (SiC) and Gallium Nitride (GaN).

Additional benefits of KuasaSemi's TCAD tool include; reducing the time and cost required for product development, by enabling designers to explore and optimise designs before fabrication; and helping semiconductor manufacturers improve the yield and performance of their devices, leading to higher-quality products and increased profitability.

KuasaSemi's TCAD tool will also support the development of new technologies and devices, opening-up new markets and opportunities for innovation in the semiconductor industry.

Microbritt

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Meet the Company

Microbritt is a micro-manufacturing service company that manufactures novel, bespoke, microscale products using a patented micromachining method “micromilling” for companies serving the defence, semiconductors, automotive, photonics and healthcare industries.

A spinout company from Newcastle University, Microbritt was formed following years of research funded by ESPRC to exploit a novel micromachining “micromilling” method established by adapting a subtractive CNC micromilling technology for use with brittle materials.

The technology is akin to 3D printing but subtractive down to microscale which allows complex shapes to be formed in brittle materials such as silicon, glass and graphite.

Microbritt can fabricate from scratch, or during the post processing making it an attractive technology to foundries manufacturing high value silicon/glass wafers.

Microbitt’s micromilling technology offers significant advantages:

- Geometries can be formed which cannot, or are difficult to form, using conventional micro-manufacturing processes. Allowing novel designs to be realised
- No chipping or rough edges which are common issues with conventional chemical etching and allowing for defect-free geometries and high-quality microscale production.
- Overcomes impossible post-processing of microscale chips and enables machining through multiple layer types (stacks) - reducing time.
- Rapid and easily reconfigurable technology which does not require tooling (photomasks), multiple instruments, and multiple process steps which supports rapid processing.
- Less energy intensive, no harsh chemical production reducing the carbon footprint.
- Hole drilling of manufactured microchips, taper-free, with no burring which can be used on sensitive layers where laser processing may cause damage due to heat or reflections. Large holes which can be produced with wafer thicknesses to 10 mm – used for vapor cell technologies.

Microbritt’s notable manufacturing partners include IMEC, Fraunhofer IMM and INEX Microtechnology. Processed Si wafers manufactured in Taiwan are also received which require the company’s unique capabilities. Microbritt is keen to collaborate directly with Taiwanese foundries to complement their exiting activities.

Microbritt is currently developing an AI system to automate wafer processing to allow higher throughput and is seeking collaboration partners.

Paragraf

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Meet the Company

Paragraf is the first company in the world to mass produce graphene-based electronic devices using standard semiconductor processes.

From a Cambridge University spinout startup in 2017, Paragraf has grown to employ a team of over 130 experts and holds over 100 patents. The company has experienced rapid growth culminating in the opening of its graphene device foundry in 2023, enabling high volume product manufacturing. Paragraf has continued to strengthen its position and expand its footprint into the USA with the recent acquisition of graphene biosensor leader Cardea Bio.

The company's patented contamination-free deposition technology delivers game-changing opportunities for the commercialisation of graphene by enabling the manufacture of high-purity 2D graphene sheets at scale.

Utilising unique, silicon-compatible, wafer-scale processes, Paragraf can seamlessly integrate graphene into ready to use products that can be quickly deployed by customers and partners to support the advancement and performance of existing, new and emerging technologies.

Products include:

- High-performance magnetic sensors for current sensing and position sensing which deliver higher sensitivity and superior noise tolerance in application areas such as automotive, automation and consumer
- Biosensors which deliver faster time to result, lower test costs and reduce sample preparation in industries such as agri-tech and healthcare

Paragraf is working with technology leaders to bring the benefits of graphene and other 3D materials to leading edge applications such as solid-state devices.

The company is committed to materially transforming electronics through the development of high-purity graphene products that will facilitate massive improvements in the performance of technologies across all aspects of life.

Pragmatic Semiconductor Ltd

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Meet the Company

Headquartered in Cambridge (UK), Pragmatic has developed the world's fastest and most sustainable semiconductor manufacturing process. Pragmatic operates a 200mm and 300mm production-line in the UK and has developed a modular, small-footprint (600m2) modular production-line that can be installed and operated anywhere in the world.

Pragmatic's ultra-low-cost, flexible integrated circuit technology makes it quick and easy to embed intelligence almost anywhere. With rapid cycle times (days) that substantially accelerate time to market, Pragmatic's foundry provides high-volume fabrication at a fraction of the cost of silicon, and with significantly lower environmental impact.

Example applications include radio frequency identification (RFID) and near field communications (NFC), allowing everyday objects to interact with their environment and be given unique digital identities. This brings game-changing benefits to the entire product lifecycle, including inventory reduction, traceability, counterfeit detection, proof of provenance, and customer interaction.

Pragmatic's technology is a key enabler for circular economy and supporting sustainability goals, preserving valuable resources by allowing organisations to effectively reduce, recycle and reuse products and materials.

Quantopticon Ltd.

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Meet the Company

Quantopticon specialises in cutting-edge simulation software products dedicated to modelling quantum photonics systems. The company's flagship product, Quantillion, is the world's first and only software platform for rapid and cost-effective design of quantum-photoni components, devices and integrated circuits.

Today, designing quantum-photonic components, devices and circuits is tremendously arduous, time-consuming and cost-intensive. Due to the lack of purpose-built software design tools to guide the process, quantum-photonic engineers must repeatedly build, test and iterate on physical prototypes, until they eventually meet the desired specifications.

Quantopticon has overcome this problem by creating a state-of-the-art design and optimisation platform for quantum-photonic hardware. Quantillion eliminates the need to carry out multiple trial-and-error experiments by replacing them with accurate and realistic simulations.

Developed in-house from first principles over the course of 20 years by world-leading multidisciplinary experts, Quantillion is a ground-breaking proprietary algorithm, uniquely capable of determining the optimal parameters and materials required to quickly and efficiently build high-quality, peak-performant components for photonic quantum computers, as well as terrestrial and satellite-borne quantum communication systems. The algorithm has been thoroughly validated and the results have been published in numerous articles in top peer-reviewed journals.

Popular simulation software packages, such as Lumerical and QuTiP, are being utilised to design quantum-photonic devices. However, these simulation engines employ physical models which are patchy and inadequate for this purpose. Quantillion overcomes these shortcomings by providing a complete and faithful picture of the underlying quantum-electromagnetic processes occurring within these devices, making it the only extant piece of software capable of predicting and optimising the performance of quantum-photonic devices. Operating at the physical layer of the design stack, the software suite is equipped with a library of quantum systems, photonic structure geometries and other user-selectable features, which empowers hardware engineers to identify the right parameters of their device first-time, simply by running a simulation.

Quantillion slashes component development costs by up to $250,000 and timelines by 24 weeks and accelerates time to market for commercial users. Fully taking fabrication tolerances into account, the software

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ensures consistent and reliable peak device performance, thus unlocking the path to high-volume manufacturing and relegating 'hero devices' to the past.

Alongside the European Space Agency, Quantopticon is currently designing single-photon sources with ultra-high purity and indistinguishability for the European network of quantum encryption satellites. These next-generation single-photon sources will close existing security loopholes in quantum communications and considerably increase data transmission rates along these channels.

Quantum Dice

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Meet the Company

Quantum Dice seeks to provide trusted and secure randomness, leveraging the unique properties of quantum systems along with its patented DISC protocol.

Quantum Dice aims to protect a connected future by harnessing the fundamental quantum properties of light to enable secure encryption. Leveraging its patented source-device independent self-certification (DISC) protocol, Quantum Dice is developing the world's first compact, high-speed and continuously self-certifying quantum random number generator.

The technology is suitable for a wide range of applications ranging from protecting terrestrial networks to providing quantum-secure entropy for satellite and IoT systems.

Founded in April 2020, Quantum Dice is an award-winning venture-backed spinout from Oxford University's world-renowned quantum optics laboratory where the architecture for the innovative quantum source of entropy was originally invented.

Quantum Dice offers a source-device independent, self-certifying random number generator, a device that leverages quantum processes to generate verifiably random keys. The patented DISC architecture assures the user a minimum amount of randomness that can be guaranteed even if the source of the device is maliciously influenced. The protocol considers imperfections of the source of randomness in the device; fluctuations are accounted for when assessing the amount of quantum randomness that can be extracted from the on-chip laser source. This allows for continuous assessment of the device's performance, preventing silent failure and protecting against external attacks.

Quantum Dice is active in the telecommunication, banking and space sectors but is seeking to exploit IoT opportunities by miniaturising the technology. The company is keen to collaborate with Taiwenese partners with expertise in advanced manufacturing processes for photonic integrated circuit fabrication using complementary CMOS.

Quantum Science

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Meet the Company

Quantum Science is a leading semiconductor innovation company that specialises in the development and commercialisation of quantum dots (QDs), nanomaterials, and technologies for infrared imaging and sensing applications.

The company's cutting-edge INFIQ® QD products and technologies have been successfully launched commercially at Merck Sigma and abcr and have been widely adopted by several leading short-wave infrared (SWIR) businesses.

The company's team consists of world-leading experts in QD synthesis and scale-up, nanocrystal and nanoparticle surface engineering, ink formulation, thin-film processing, and QD semiconductor device engineering.

Quantum Science develops colloidal stable nanocrystals called INFIQ® QDs. These tiny nanocrystals, typically ranging from 2-10 nm, demonstrate energy band tunability, enabling their energy levels to be fine-tuned through wet chemistry to efficiently absorb and emit light across the entire visible and infrared range. This provides an effective approach to design a wide range of infrared wavelengths for versatile infrared imaging and sensing applications. The technology can be solution processed and integrated with complementary metal-oxide-semiconductor monolithically, enabling high-performance infrared sensing and imaging at significantly lower costs (normally 10-1000 times lower) compared to conventional technologies such as InGaAs.

Quantum Science pushes the boundaries of innovation further by producing QD ink through surface engineering. The QD ink allows for single-layer deposition, as opposed to the traditional 16 layers of QD processing, greatly simplifying the manufacturing process and enhancing yield and efficiency.

In response to potential regulatory risks associated with the use of heavy-metal lead, Quantum Science develops SWIR lead-free QDs that meet the demands of large businesses and deliver market-leading performance.

The company benefits from a strong intellectual property portfolio and possesses full development capacity, from materials to QD devices. Quantum Science is equipped for QD synthesis, scale-up, surface functionalisation, and device fabrication, and collaborates with sensor design houses, foundries, and large semiconductor businesses to integrate its QD devices with ROIC (Readout Integrated Circuit) to produce SWIR QD sensors and cameras used in infrared imaging and sensing applications.

Taiwan's reputation for semiconductor manufacturing makes it an attractive partner for Quantum Science which is looking to accelerate the development of new products or services.

Quinas Technology

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Meet the Company

Quinas Technology is a spinout from Lancaster University which has been formed to exploit the patented memory technology, ULTRARAM™ that successfully combines the attributes of universal memory. The company is a beneficiary of Innovate UK's prestigious pre-accelerator ICURe programme for researchers seeking to commercialise technology.

The $165bn pa memory market is dominated by dynamic random-access memory (DRAM, $100bn) and NAND flash ($65bn). Flash is non-volatile, retaining data when unpowered, but is slow and has poor program/erase cycling endurance. In contrast, DRAM is fast with excellent endurance, but it is volatile, and requires data to be constantly refreshed. For decades there has been a quest for a memory that combines all these advantages without the disadvantages i.e. a memory that is fast and non-volatile, with high endurance and ultra-low switching energies otherwise known as 'universal memory'.

ULTRARAM™ combines the non-volatility of flash, with a performance that is expected to exceed that of DRAM.

The technology is a charge-based memory that is flash-like in its operation. The logic state of the memory (0 or 1) is determined by the presence or absence of charge on a floating gate and readout occurs by measuring the current through an underlying channel.
The novelty underpinning ULTRARAM™ is its use of a quantum-mechanical process called resonant tunnelling to control the movement of electrons in the device.

Unlike DRAM and flash, which are silicon based, ULTRARAM™ uses III-V compound semiconductors. This allows engineering of the memories' electrical properties to exploit the underlying physics to full effect, whilst also being capable of volume manufacture using established processes in the compound semiconductor and silicon industries.
The 6.1-angstrom family of semiconductors (GaSb, InAs and AlSb) are used to create a flash-like floating-gate memory. However, unlike flash, which uses a highly resistive oxide barrier to retain charge in the floating gate, ULTRARAM™ uses atomically thin layers of InAs/AlSb to create a triple-barrier resonant-tunnelling (TBRT) charge-confining structure. It is this mechanism that gives ULTRARAM™ its remarkable properties.

ULTRARAM™ has a retention time of >1,000 years, endurance >107 (with no degradation), switching energy 100x lower than DRAM and 1,000x lower than flash (at equivalent node) and when fully scaled is expected to switch 10x faster than DRAM.

Quinas Technology is seeking to secure collaborations and partnerships for R&D and manufacturing, specifically fabrication partners for test chips and standard /advanced packaging technologies such as chiplets.

Thermco Systems

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Meet the Company

Established in 1962 Thermco Systems is the original pioneer of diffusion furnaces and a market-leader in semiconductors serving over 400 global customers in R&D, automotive, communications, consumer electronics, power and data processing industries. From facilities in the UK, USA and China the company supplies a range of systems for current, emerging and new technologies. In-house design of all mechanical, electrical, electronic systems and software development ensures systems stay at the cutting edge of processing technology. Obsolescence and items affected by supply chain deficiencies are designed out ensuring true lifetime support. A new division, Thermco SiC coatings was established in 2022 to accommodate the growing demand in SiC coatings.

Thermco Systems offers unique solutions that support a wide range of substrate sizes up to 300mm and materials such as silicon, SiC, III-V and other novelmaterials:

Thermco has the largest installed base of horizontal diffusion furnaces in the world. With extensive experience and process know-how the company ensures efficient thermal processing systems design, offering maximum uptime, fast throughput and lowest cost of ownership. Solutions offer a full range of characterised atmospheric and LPCVD deposition processes, which can be adapted for use in new and emerging markets.

1. The EpiPro family of systems or epitaxial growth solutions CSD, offer high throughput volume processing of silicon and SiC wafers used primarily in the emerging power device sectors
2. T-Clean offers a full range of manual and fully automated systems to support semiconductor cleaning, chemical etching, lift off, electroless plating and RST drier processes and provides leading edge equipment for gas and chemical delivery, distribution and abatement systems for the storage and safe delivery of bulk chemicals and gases
3. Chemical Handling Equipment: gases, chemicals and other materials employed in the manufacturing process of semiconductors including the storage, delivery and recovery of the materials

The company is active in R & D and open for collaboration. Current projects include:

- Reducing QSS charge on the surface of the wafer and controlling native oxide growth
- Prototyping SiC coatings and high temperature thermal treatment, 2000C to 3000C, systems to control native oxide growth, GaN deposition and GaN diffusion

Department for Business and Trade

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