



POWER ELECTRONICSUK



CAPABILITY DIRECTORY 2014

A collaboration between industry, academia and the public sector:

- Working towards a sustainable supply of quality, industry-prepared graduates
- Attracting young people to degree study and professional careers in electronics
- Connecting employers with young talent in schools and universities



If you wish to join this initiative, please contact us to find out more about sponsoring :

- Our Summer Schools for school pupils
- University students through our Scholarship Scheme



FOR FURTHER INFORMATION

Email : info@ukesf.org
Website : www.ukesf.org



UK Electronics Skills Foundation

Why was UKESF set up?

- To address the threat of diminishing skills capability in the UK electronics sector
- To secure a sustainable supply of quality and industry-prepared graduates

How does UKESF work?

- Raising awareness in schools of the value of electronics to society and the economy
- Attracting school students to degrees and careers in Electronic Engineering
- Facilitating relationships between companies and university students
- Securing employment for graduates

Who is involved?

- Founder and Industry Partners establishing UKESF and providing strategic direction
- Industry sponsors

Why should employers engage with UKESF?

- To help ensure a prosperous future for the electronics industry
- To support a programme that attracts more young people to electronics
- To make early connections with young talent for future employment in the sector

MICHAEL FALLON

Minister of State for Business and Enterprise

Electronics technologies underpin the world economy and the UK ranks 4th in the EU with electronics exports worth nearly £23bn. An important subset of this, and one where the UK has particular strengths, is power electronics - the extension of solid-state electronics away from handling communications and data and into the field of efficiently handling power. The direct global market for power electronics is estimated at £135bn and growing 10% per year and covers a breadth of application that few other industries can match.

The UK power electronics sector has grown over the last decade and can continue to do so. With the UK's historical involvement with power conversion a significant number of world class universities are researching the field and more than 40 are involved in the power electronics area alone.

In 2011 the Department for Business Innovation and Skills, in partnership with the industry, published 'Power Electronics: A Strategy for Success'. Drawing on the thinking of business, government and universities it is an integrated strategy for the power electronics industry and establishes a foundation for growth in the sector highlighting the opportunities that could be gained from business and academia working better together.

This guide highlights the industry's key companies. Many of them offer access to intellectual property that can cut time to market and independent design services that can be accessed easily by business. It also illustrates the research activities of our world class UK universities, many of which have an excellent track record for collaborating with design and manufacturing business both in the UK and throughout the world.

In addition, the UK is a leading destination for foreign direct investment into the European Union, with a growing proportion coming in the technology sectors and power electronics is an area with significant future potential. The government is providing support in this area through UK Trade and Investment who have a proven track record of helping companies who are interested in the UK as an investment location.

I strongly encourage you to make use of the contacts that we have provided and to seize the commercial opportunities that are available.



STEVE BURGIN

Chairman, PowerElectronicsUK / President, Alstom UK

As you are hopefully aware, the National Strategy for Power Electronics was launched by Mark Prisk, Minister of State for Business & Enterprise, in October 2011. Since then, it has been my pleasure to chair the PowerElectronicsUK Forum and, on behalf of this group, I would like to thank you for your participation in this Directory and in the collection of the supporting data.

With respect to PowerElectronicsUK, significant progress has been made in a number of areas:

1. The core of a National Forum has now been established with a work plan agreed.
2. Power Electronics now features explicitly in strategy papers from key delivery agencies; EPSRC, TSB and UKTI and we are working with those agencies to develop intervention steps in support of the industry.
3. Several Awards have already been announced by the Technology Strategy Board and we believe these are all in exciting areas with significant market potential
4. EPSRC have announced an £18m call for a Virtual Centre of Excellence in Power Electronics .



While we are making progress, we are not resting on our laurels. I have been working behind the scenes with Government to discuss ways that Government, Industry and Academia can work in partnership to support our Mission to **ensure the UK is recognised as a world leader in power electronics, creating jobs, and attracting investment.**

Our immediate intentions from here are to:

- Continue to raise the profile of Power Electronics in the UK
- Develop an Industrial Executive Group
- Drive forward the Action Plan

We welcome the opportunity to work with you in support of our mission; please see the PowerElectronicsUK web-site for an overview of current activity.

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Power Electronics in the Automotive Environment

Dr John Reeve - Chief Engineer (Electric Drives), Ricardo UK

Power electronics are already present in almost every system on modern cars helping to improve functionality, economy and safety. In fact, modern vehicles simply could not function without power electronics. However, the increasing electrification of the powertrain is pushing the installed power electronic capacity up by an order of magnitude well into the hundreds of kilowatts. The standard 12V DC bus is also being rapidly supplemented by ever higher voltages – 48V for mild hybrids, 400V and beyond for full hybrids and electric vehicles.

The development of power electronic devices to support this accelerating electrification of the automobile is largely more evolutionary than revolutionary in nature. While we all look ahead to new semiconductor technologies, for example, a great deal of progress is being made in pushing current technologies ever further especially in the areas of packaging, thermal management and durability. We must also not forget the strides being made in passive component technology also being driven by automotive requirements.

Automotive applications present a uniquely challenging set of requirements for power electronics – they need to be small, light, reliable, safe, high performing, refined and of course cheap. They also often operate in extremely harsh environments of heat, cold, wet, vibration and shock and keep doing so for the lifetime of the vehicle. The price, performance and reliability metrics now routinely achieved are enviable and it is clear that the increased pace of development and innovation required for automotive applications can also drive significant benefits for all sectors.



Power Semiconductor Devices

Paul Taylor - © Dynex Semiconductor Ltd 2012

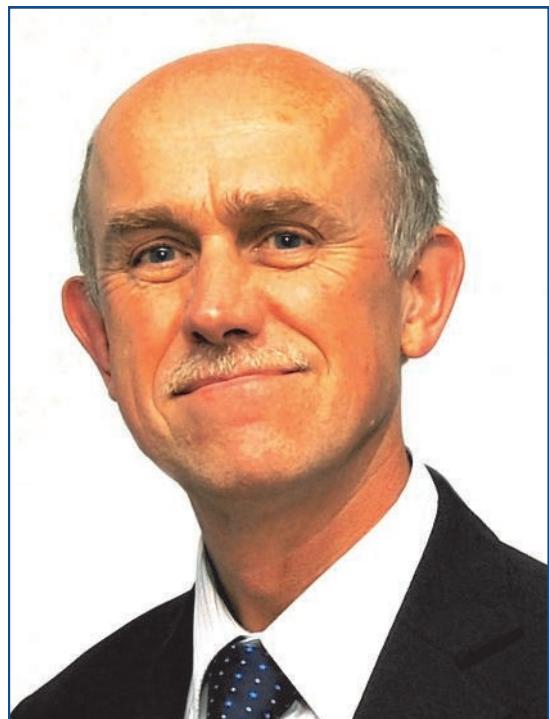
Power semiconductor devices are at the very heart of all power electronic systems, and the UK is at the forefront of the technologies that enable the manufacture of these special electronics devices.

Although there is significant development work on the use of new wide band gap materials, such as SiC, GaN and diamond, most power devices are based on silicon. There are many classes of such devices, including diodes, MOSFETs, thyristors, and transistors, but it is mainly Insulated Gate Bipolar Transistors "IGBTs" that are driving the efficient electronic energy management essential to the future low carbon economy.

Take for example the ultra high power electric grid systems that manage the power being delivered by renewable energy sources such as wind, solar, and wave. These use high power voltage source converters with IGBT modules as the prime control device.

IGBT modules are available in a wide range of voltages from 1.2kV to 6.5kV and are able to control several hundred to several thousand amps. But a typical IGBT module used in the power grid application is a 3.3kV switch, capable of controlling more than 1,500A. That module would typically contain 36 large area silicon chips, comprising some diodes and some IGBTs, and all have to operate together reliably to control these high power levels. The module that interconnects these chips is a multi-material structure containing advanced AlN insulators mounted on AlSiC composite base plates, and contained within a plastic housing.

IGBT modules are now a well established and reliable power device, yet there are still technology advances in the pipeline that will improve their energy efficiency and performance in the future: coupled with advances in the new wide band gap materials, silicon power devices offer a powerful future for our future energy demands.



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COMPANY OVERVIEW

42 Technology is a product development consultancy with a broad skill base in electronics, software physics, fluidics and mechanical design. In addition we maintain a network of experts and academic partners to enable us to apply the right skill set to all of our development projects. We have a strong background in the development of real-time embedded systems and associated high-precision analogue and power electronics. These skills are an essential component of our multidisciplinary approach to optimising the design of the complex systems we develop.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

42 Technology offers consultancy focused on innovative new product development. This ranges from feasibility and strategy studies, through proof-of-principle and early prototypes to pre-production prototypes and transfer to manufacture. We offer system, mechanical, electronics and software design services, normally as integrated parts of an overall programme of work but separately if required. We most frequently work in developing: industrial products, medical diagnostics, fluid and paper handling systems and consumer goods but can apply our expertise in most areas.

ABB LIMITED



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COMPANY OVERVIEW

ABB (www.abb.com) is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 135,000 people. In the ABB Ltd, UK markets and engineers ABB Power Electronic products and solutions into a wide field of industrial and utility applications.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

- HVDC
- HVAC
- Power Converters,
- Frequency Converters
- Rectifiers
- Excitation
- Static Reactive Power Compensators
- MV and LV Variable Speed Drives
- Electric Vehicle DC fast battery chargers and AC slow chargers
- Solar Power Converters

ABB Power electronics are employed in virtually all industrial and utility market sectors but also including transport and domestic applications.

AIXTRON LIMITED



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COMPANY OVERVIEW

AIXTRON is a leading provider of deposition equipment to the semiconductor industry. The Company's technology solutions are used by a diverse range of customers worldwide to build advanced components for electronic and opto-electronic applications based on compound, silicon, or organic semiconductor materials, as well as Carbon Nanotubes (CNT) and other nanomaterials. Such components are used in flat panel display applications, solid state lighting, organic semiconductor devices such as OLED, OPV, and OTFTs, for functional polymer thin films, energy harvesting and storage, fibre optic communication systems, wireless and mobile telephony applications, optical and electronic storage devices, computing, signalling and lighting, as well as a range of other leading-edge technologies.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

AIXTRON's product portfolio for compound semiconductors includes:

- MOCVD Equipment (Metal Organic Chemical Vapour Phase Deposition) for deposition of GaAs, InP and GaN based materials for electronic and optoelectronic applications
- OVPD® Equipment for OLED display, OLED lighting, and organic semiconductor solutions,
- PVPD(TM) Equipment for carrier-gas enhanced vapour phase in-situ polymerization for functional films,
- ALD Equipment (Atomic Layer Deposition) for Logic, DRAM, NVM, Flash and MIM applications,
- CVD and PECVD systems for the deposition of Carbon Nanotubes and Nano-fibres and combinations thereof for advanced hybrid structures.

AIXTRON's UK operations specialise as a Technology Centre for MOCVD Equipment based on Close Coupled Showerhead® technology. This area of expertise is core to the groups' high volume, state of the art MOCVD production systems. Demand for such systems are driven by the increasing adoption of LEDs for lighting applications, GaN power electronics and other technologies. Lab-scale MOCVD systems are also designed and manufactured in the UK, which are destined for leading compound semiconductor research customers around the world. Additionally, the Nanoinstruments team specialises in the design, development and manufacture of CVD systems for the deposition of CNT and graphene.



BM300T CNT/Graphene deposition System



CRIUS 2XL Production MOCVD System



CCS R&D MOCVD System

ALSTOM GRID



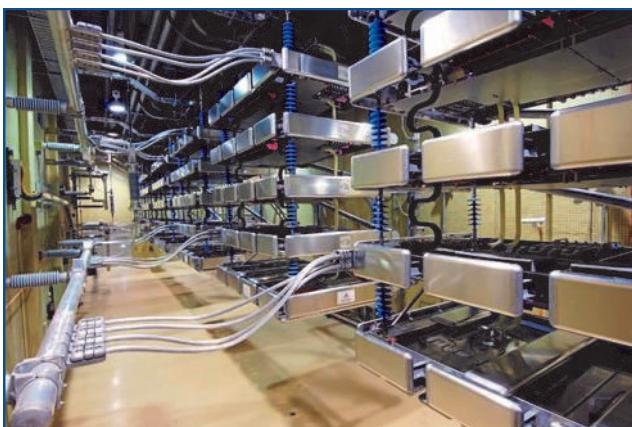
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COMPANY OVERVIEW

Alstom Grid has engineering, research and development, manufacturing and services facilities within its UK operations. The company provides the technologies to connect both conventional power generation and renewable energy generation onto the national grid. Using advanced power electronic technology for high voltage direct current transmission, grids can be connected together over very long distances to improve access to remote sources of generation. Power electronic technologies can also be used for electro-intensive industries such as metallurgy, railways, oil and gas and other applications. Advanced digital control and protection systems for sub-stations or complete grids can be provided. These solutions help to manage the grid systems of today and will operate the supergrid system for the future. Alstom Grid is able to combine its products, equipment and solutions to offer full turn-key projects to its customers. This includes a full service facility from network consulting, on-site installation, testing and commissioning to training and spare parts.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

From its main base in Stafford, Alstom Grid provides a range of products and services. The largest power transformer facility in the UK can manufacture units up to 800kV voltage class for AC substations, generator transformers, shunt reactors and phase shifting transformers. This facility is the world core competence centre for HVDC converter transformers. The Sub-station Project unit builds AC transmission sub-stations up to 400kV for the UK market. The unit also is responsible for the design of off-shore AC platforms to connect to wind farms for near shore and far off-shore applications. The Power Electronic unit is the world-wide core competence centre for HVDC systems. The unit can offer full turn-key solutions for projects up to 800kV DC and power ratings up to 7200MW. The Sub-station Automation Systems unit designs and manufactures digital control and protection equipment for substations and transmission systems. The Service unit provides a support facility for customer maintenance including holding of spare parts. Within the Service unit, the Technical Institute provides a full range of training programmes related to Alstom Grid's products and services.



AMANTYS LIMITED



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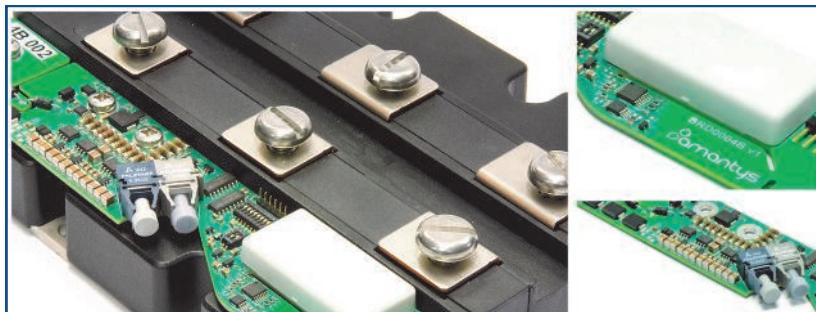
COMPANY OVERVIEW

Amantys is a leading independent design and manufacturing company of innovative medium and high voltage power electronics switching products. We combine advanced digital control techniques with power system designs to monitor and control the switching of power devices – “power simplified, by design”. Amantys is headquartered in Cambridge, UK where a multi-disciplined team of engineers develop innovative products and solutions for power electronics switching. Our products are designed for operation in a wide variety of medium and high voltage switching applications.

- Electricity transmission and distribution; HVDC
- Motor drives
- Locomotive traction
- Renewable energy generation
- Uninterruptible power supplies
- Hybrid and electric vehicles

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Amantys has a vision to redefine power electronics with the introduction of Intelligent Power Switching, applying digital control techniques to the core of power electronics. We have launched our first products with the introduction of the Amantys Power Drive, a family of gate drives that control IGBT modules at voltage ratings of 1200 Volts and above from all the leading IGBT Module manufacturers, including ABB, Dynex, Fuji Electric, Hitachi, Infineon and Mitsubishi. In addition the company has now introduced “Amantys Power Insight” an integrated hardware and software solution enabling the gate drive to export critical performance parameters from the heart of IGBT switching to the host control system, or anywhere on the web. We are engaged today with customers delivering advanced products that improve efficiency, performance and reliability .



ANVIL SEMICONDUCTORS LIMITED



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COMPANY OVERVIEW

Anvil Semiconductors was established in August 2010 as a spin-out from the School of Engineering of the University of Warwick to exploit patented developments in Silicon Carbide (SiC) Power Semiconductor technology. Anvil is developing technology in two key areas :

- Fabricating SiC oxides at high temperatures enabling significant improvements in carrier mobility in MOSFET channels consequently reducing die size, parasitic capacitance and cost
- Producing electronic devices on 3C SiC wafers grown on Si seed crystals enabling low cost commercial SiC devices.

The founders, Dr. Peter Ward and Prof. Phil Mawby enjoy global recognition for their expertise in the fields of industrial R&D and manufacturing (Ward); and power devices, their modelling and applications (Mawby). They have published widely on these topics, and have excellent contacts with industry and other leading research institutions around the world.

Anvil has demonstrated early components and is looking to work with system designers to carry out trials in real applications. Its business plan is to be a fabless manufacturer of 3C-SiC devices to supply to the power semiconductor industry, and is currently looking for partners and suppliers to help in its endeavours to bring down the cost of silicon carbide components.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Anvil Semiconductors is based in Coventry and still has a close relationship with the University of Warwick through use of the Science City semiconductor research and development facility established at the University. This specialised laboratory includes a temperature and humidity controlled, semiconductor Class 1000 cleanroom, and the World's first SiC atmospheric pressure processing furnace to allow the development of the oxidation and annealing process solutions. Anvil has also invested in access to SiC epitaxy reactors and a device fabrication foundry to enable full device process development in production facilities.

API CAPACITORS LIMITED



*api*capacitors

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COMPANY OVERVIEW

API Capacitors is the UK's leading designer and manufacturer of high quality power capacitors for power electronic applications. Our extensive product range of filter, snubber and energy storage capacitors services the professional markets of traction, industrial drives, power conditioning and avionics, together with discharge capacitors for medical, plasma and pulsed power applications. The strength of the company lies in working alongside its customers, tailoring the product correctly to its specific application so it performs exactly as required with total reliability.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

API Capacitors design and manufacture DC, AC, Track Signalling, Snubber & Energy Storage capacitors that are not limited to a catalogue range. Current, voltage, size, mass and terminations are matched to the customer's requirement and application, a few of which are listed below. Long life and high reliability is achieved using ultra low defect density, high isotactic, metallised polypropylene dielectric film incorporating an extended working temperature range and controlled self-healing capability. Elements are wound on the latest precision edge controlled automatic winding machines. High conductivity copper is used for low resistance internal connections. Capacitors are finished in powder coated corrosion free metal or insulated cases and filled with an environmentally safe oil or dry leak free resin.

AVID TECHNOLOGY LIMITED



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COMPANY OVERVIEW

AVID Technology Limited design, manufacture and distribute technology products which reduce fuel consumption and emissions of heavy duty vehicles. AVID supplies Advanced Thermal Management components to vehicle manufacturers. These electric water pumps and cooling fans deliver high performance and efficiency through the use of brushless DC motors and integrated controllers which provide unrivalled control and diagnostics. AVID supplies its eFan Micro Hybrid system to heavy duty vehicle fleet operators in the bus, truck and off highway sectors. The eFan Micro Hybrid system reduces fuel consumption in a cost effective manner by reducing parasitic losses on the engine.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Fuel saving technology for heavy duty vehicles eFan Micro Hybrid System for fleet operators Advanced Thermal Management components for vehicle manufacturers Electric water pumps Electric cooling fans High performance alternators Control systems

CAMSEMI



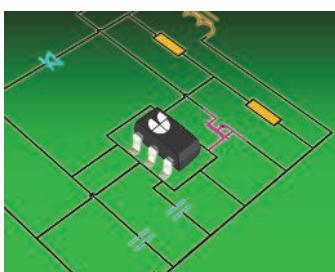
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COMPANY OVERVIEW

CamSemi is a privately-held, fabless power management IC company. Its mission is to help customers find more 'cost-efficient' ways to design and manufacture energy-efficient power conversion products in Networking, Mobile Consumer and Solid State Lighting applications.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

CamSemi offers IC products for "Offline" or "AC:DC" power conversion based upon two major topologies - Resonant Discontinuous Forward Converter for replacement of traditional linear power supplies; and - Primary Side Sensing flyback solutions aimed at adapters and chargers which require tight voltage and current regulation and some of which incorporate the company's PowerBrane® UHV technologies. Launched products include: C2470 RDFC controllers; C2140, 50 and 60 PSS controllers; and C3120 LED driver ICs.



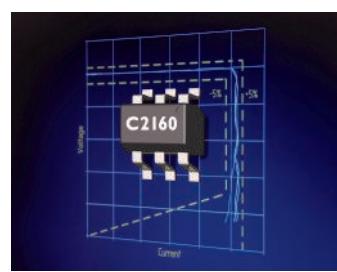
CamSemi offers low cost,
low component count
solutions



CamSemi enables low
cost, 5 star-rated chargers
for mobiles and other
applications

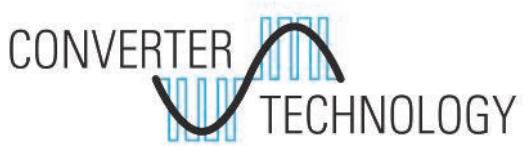


CamSemi
C3120 LED
driver ICs



CamSemi PSS controllers
deliver 'best in class' CC and
CV

CONVERTOR TECHNOLOGY LIMITED



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COMPANY OVERVIEW

Converter Technology is a dynamic electronics design consultancy with a proven track record in electronic power system designs. We provide expert design services to an international client base including small start-ups and large multi-national organisations. Our designs can be found in products in a variety of areas including telecoms, automotive, marine, consumer and industrial markets. Within these markets we have designed LED Drivers, mains AC/DC converters, battery chargers, fault tolerant systems, energy harvesting circuits and power factor correction systems.

We can support design activities from early stage specification definition all the way through to prototype design and manufacture. Our advanced in house power design lab provides the capability for detailed technical testing including conducted EMI, high and low ambient temperatures, thermal imaging, regulation, efficiency and control loop measurement. We use industry leading CAD tools such as Solidworks for 3D design/integration, Mentor Graphics software for schematic entry/PCB design and Cadence PSpice for circuit simulation.

Converter Technology's mission is to enable our customers to use leading edge power conversion technologies, to de-risk their product development and to maximise system level energy efficiency of the resulting products.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Converter Technology offers four key services to its clients:-

Custom Power System Development. This is our most commonly used service and is the best way to get to the optimal design for your product. We will be involved from day one and help with forming the initial specification based on our experience in the cost/performance trade-off of different system architectures and converter topologies. We manage the full design process to produce and test a number of prototype units. We also work closely with your engineering team to ensure our design works well in the final product.

Design Test and Review. Some customers prefer to keep the design activity in-house and in these cases we are happy to offer our services in a design test and review capacity. We will provide an independent expert view on your design based on schematic review and prototype test.

Emergency Technical Support. Even if we haven't been involved with any aspect of your design or test program, we can still offer assistance if you find you have a problem just before product launch or even if you have units already in the field. In a number of cases now we have been instrumental in helping high profile clients to rapidly resolve design issues and get their product to market.

Technical Training. If you prefer to build your engineering capability in house then we can provide technical training services to ensure your engineers are up to date with the latest technology and design techniques. Training can be delivered face to face or online.

CORETEST TECHNOLOGIES LIMITED



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COMPANY OVERVIEW

CoreTest Technologies is a supplier of semiconductor test equipment. Our prime market is UK and Europe and we distribute to the Far East, Asia and USA via our global sales and service channels. Equipment is supplied by our partners who are among the best in the world. CoreTest also designs and manufactures custom equipment for specific customer applications. We and our partners use industry leading CAD tools for 3D, PCB design and simulation (mechanical, thermal and electrical). Suppliers are ISO9001 certified.

Single test socket to complete test cells and hardware required to handle and test devices can be provided. Device technologies including power, digital, optical, sensors, mixed signal, analog, RF. Markets we operate in include semiconductor manufacturing, medical, aerospace, defence, PCBA test and EMS providers. Our customers include European manufacturers, international IDMs and global ATE providers. More than 60 installations have been completed in the Philippines, Japan and China.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

CREA Test Systems for Power semiconductors as wafer, discrete or module. Test systems will perform static and dynamic tests tailored for the DUT and can test from low power to high power devices at 3kV at 12,000A. Device adaptors include hot plates with interlocks for safety.

Test sockets and fixtures from EQUIPTEST for all device types including transistors and power devices. Sockets for power devices up to 40A with kelvin contacts.

Portable Bench Top Temperature Forcing System, FLEX-TC will force from -55C to +250C whilst operating from electrical power only. The system is quiet, fast and accurate. It is used for characterisation, production and as an active heatsink.

ATOM IC Pick & Place handler will dock to a test head or operate on a bench top. It will pick parts from a tray and place tested parts into pass or fail trays. Setup and tooling is simple and low cost.

TEST SOLUTIONS EUROPE supply Manipulators, Docking and Signal Towers for all testers and peripheral equipment. Designed and manufactured in UK and distributed worldwide.

PROTRONIX supply custom automated process equipment – Handlers, Tape & Reel Loaders, Device Sorters, Assembly Equipment, Burn-In etc.

GEOTEST PXI based ATE for semiconductor test. Our TS-900 systems and SQS (Semiconductor Quick Start) bundles use the GX5295 32 channel digital i/o cards and cards. Cards for other test functions from Geotest and PXI card suppliers are available.



DANFOSS LIMITED



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COMPANY OVERVIEW

Danfoss VLT® Drives have been mass producing frequency converters for over 40 years and operate in 120 countries world wide. Danfoss specialises in developing variable speed drive solutions for a wide variety of applications in dedicated business areas (water and waste water, chemical, heating & ventilation, refrigeration, food & beverage and general industry).

Danfoss Solar Inverters develops, manufactures and sells a comprehensive range of grid-connected photovoltaic inverters for residential, commercial and large scale solar energy applications. The product range also includes solutions for monitoring the solar system in order to achieve optimal energy output and return on investment.

Danfoss is dedicated to developing and manufacturing advanced energy saving products that improve quality of life while contributing to a safer and cleaner environment. We recognise the importance of identifying opportunities for renewable sources of power generation and are committed to the long term sustainability of the environment.

All our products comply with the RoHS directive. All our factories have ISO 14001 certification and all new product series are designed according to the EU Directive WEEE. Danfoss has signed the ICC Business Charter for Sustainable Development and the UN Global Compact. Meeting these standards, in conjunction with our own Environmental policy, ensures that Danfoss constantly adheres to its environmental and social responsibilities.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Danfoss Drives offer a complete range of frequency converters (available in power size 0.18kW to 1.4MW), soft starters and accessories; designed to reduce energy consumption, maximise efficiency and save money.

The VLT® AutomationDrive is an ideal and reliable choice in any industrial application. The built in modular open-technology platform and configurable, user-friendly interface make it exceptionally adaptable and programmable; a truly intelligent plug-and-play product.

With numerous powerful standard and optional features, our VLT® HVAC Drive is the perfect choice for heating, ventilation, air conditioning and refrigeration applications. Compatible with most BMS control systems; ensuring reduced installation costs, comfortable control of the building environment and simple updating of the system.

The VLT® AQUA Drive is the ultimate innovative solution for water, wastewater and irrigation management. Easy to install, commission, operate and maintain; making it the perfect match for pumps and blowers in modern systems.

Our VLT® Automation, HVAC and AQUA Drives are available in low harmonic versions, enabling the end user to actively eliminate harmonic distortion in the power supply. The Danfoss VLT® Low Harmonic Drive continuously regulates the network and load conditions without affecting the connected motor and meets the toughest harmonic standards.

The VLT® Advanced Active Filter can compensate harmonic distortion for individual loads or can be installed as a stand alone solution at the point of common coupling to address several loads simultaneously for group compensation.

Danfoss Drives offer a power quality consultancy service, part of which is a survey to measure the effectiveness of the power within your chosen application/system followed by recommendations of remedial action required to improve the power quality. Such a survey, in conjunction with our Harmonic Distortion Calculation software (MCT31), will dramatically save energy and reduce total cost of ownership.

DIODES ZETEX LIMITED



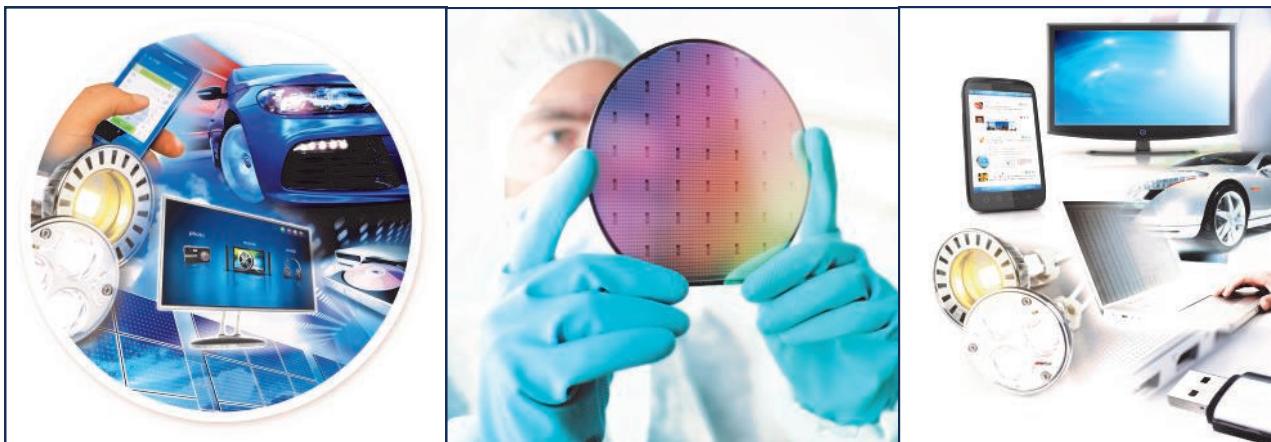
Contact:	Jon Shillito
Phone:	0161 622 4444
Email:	jon_shillito@eu.diodes.com
Website:	www.diodes.com
Address:	Stockfield Road, Oldham, Lancs, OL9 9LL

COMPANY OVERVIEW

Diodes Zetex Ltd is a wholly owned subsidiary of Diodes Inc. It is responsible for sales of all the company semiconductor products in EMEA. Additionally, located in the UK is a wafer fabrication facility, warehouse, development, engineering & support staff. The wafer fab manufactures both MOS and bipolar technologies for transistors, protection devices and integrated circuits.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Power and analog electronic device solutions for the efficient management, protection and switching of electrical power in consumer, communications, computer, lighting, automotive and renewable energy markets. Product development of bipolar and MOSFET transistors, schottky and SBR rectifier diodes, standard linear i.c.s, protection and load switches, power supply controllers, motor control pre-drivers, digital satellite signal receiver power management, LED drivers. Development and manufacture of in-house wafer fabrication technologies.



DYNEX SEMICONDUCTOR LIMITED



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COMPANY OVERVIEW

Dynex Semiconductor Ltd is the only operating business of Dynex Power Inc , a public company listed on the Toronto Venture Stock exchange. The business was originally founded in 1956 and has used the prior trade names of: AEI Semiconductors Ltd (AEI); Marconi Electronic Devices Ltd (MEDL) ; GEC-Plessey Semiconductors Ltd (GPS) . Dynex designs and manufactures high power bipolar semiconductors, high power insulated gate bipolar transistor (IGBT) modules, high power electronic assemblies and radiation hard silicon-on-sapphire integrated circuits (SOS IC's). The company's power products are used worldwide in power electronic applications including electric power transmission and distribution, renewable and distributed energy, marine and rail traction motor drives, aerospace, electric vehicles, industrial automation and controls and power supplies. Our IC products are used in demanding applications in the aerospace industry. Dynex Semiconductor Ltd is its only operating business and is based in Lincoln, England in a 14,000m² purpose built facility housing the fully integrated silicon fabrication, assembly and test, sales, design and development operations. In 2008 Zhuzhou CSR Times Electric Co., Ltd acquired 75% of Dynex Power Inc. The UK business continues to operate under the Dynex brand and in addition to the products manufactured in the UK Dynex also sells power semiconductor devices worldwide , manufactured in China under the Dynex brand. In 2010 Dynex won the Queen's award for enterprise: this international trade award recognises substantial growth in overseas earnings and commercial success, sustained over a 3 year period. Also in 2010 CSR Times Electric established an R&D centre at Dynex specialising in the development of high power semiconductor devices for a wide range of power electronic applications, then in 2012 Dynex expanded their office buildings to accommodate this growing centre of excellence.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Dynex Semiconductor Ltd delivers solutions for its customers' power electronic system requirements. The company is a recognised high power semiconductor specialist that designs and manufactures high voltage IGBT modules, bipolar power discrete, and power subassemblies. It is part of the CSR Corporation giving access to high volume manufacturing capability based in China. **High voltage bipolar discrete** : Dynex's bipolar products are phase control thyristors (SCR), high power rectifier diodes, gate turn-off (GTO) thyristors and associated diodes, and pulse power thyristors. Dynex phase control thyristors feature the latest ion implant (i2) technology which produces marked reductions in conduction losses. The voltage range extends from 1,200V to 8,500V, average current ratings from 500A to nearly 7,000A and silicon diameter up to 150 mm. They are well suited to most power conversion applications. Dynex rectifier diode voltages extend to 6,000V and current to 11,000A and are particularly suitable for IGBT inverter front-end rectifiers, very high current applications such as aluminium smelting and trackside rectification. Dynex is committed to the continued production of GTO's up to 6,500V. This range of devices is suitable for applications in main line and light rail traction drives and auxiliary converters. **IGBT Modules** : Built using its proprietary and in house manufactured high voltage chips, Dynex offers a selected range of high power IGBT and complementary diode modules. The product family includes modules with voltage ratings from 1,200V to 6,500V and current ratings from 100A to 3,600A. Dynex manufactures and assembles IGBT and diode chips at its recently upgraded wafer fabrication plant in Lincoln. **Power Assemblies** : The power assembly group design and manufacture a range of systems which meet specific customer requirements for electrical, thermal and mechanical performance. The long experience of providing systems which utilise the Dynex semiconductor range and the unique understanding of applications, enables the group to provide optimum power assembly solutions, which can include protection and control electronics. Air cooled and liquid cooled assemblies, heat sinks and clamping arrangements have been designed for thyristor, GTO, diode and IGBT systems.



IGBT Module



Power Assembly

E2V TECHNOLOGIES



Contact:	Andy Bennett
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Website:	www.e2v.com
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COMPANY OVERVIEW

Our people design, develop and manufacture inspirational high technology engineering solutions for the most exacting requirements of global systems companies. We deliver solutions, sub-systems and components, to these advanced systems companies, for their specialist applications within medical & science, aerospace & defence, and commercial & industrial markets.

For the year ended 31 March 2012, we achieved sales of £235m and are listed on the London Stock Exchange. We have approximately 1650 employees in European, US and Asia Pac design, development and manufacturing facilities. Sales and technical support are provided by four global sales and support territory bases to a total of more than 50 countries. As a result of our track record of innovation and technological breakthroughs, e2v continues to be involved in many high-profile ground breaking programmes, including: Airbus A380 Boeing 757, 767, 747, 777, and in the new 787 European Space Agency Gaia mission to map our galaxy US Patriot air and missile defence system Eurofighter Typhoon Hubble space telescope upgrade project. Our success is built on long established relationships with industry partners: for example with Freescale Semiconductor, to develop and supply extended reliability versions of their microprocessors. The combination of our in-house technical capability, (which has resulted in nearly 200 patent families being granted to the e2v group), and links with technical authorities and universities, ensures that we can bring together the right level of expertise for a diverse range of technical challenges. Contact us now and challenge us to help solve your technology problem.....

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

We offer: RF power solutions for: defence electronic countermeasures, radiotherapy cancer treatment machines, Radar systems, Stellar satellite communications amplifiers, Industrial heating, Cargo screening, ProWave Industrial processing systems, missile control safety & arming devices and digital television transmitters. High performance imaging solutions including CCD & CMOS sensors and cameras, for space and earth observation imaging, science and life science imaging, machine vision, ophthalmology and dental x-ray systems and fire, rescue & security thermal imaging. Hi-rel semiconductor solutions for aerospace & defence programmes requiring: lifecycle management, hi-rel microprocessors, high speed data converters, high reliability ICs with lifetime continuity of supply, assembly & test services and MRAMs.



EATON ELECTRIC LIMITED



Powering Business Worldwide

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COMPANY OVERVIEW

Eaton Corporation is a diversified power management company with more than 100 years of experience providing energy-efficient solutions that help our customers effectively manage electrical, hydraulic and mechanical power. With 2011 sales of \$16.0 billion, Eaton is a global technology leader in electrical components and systems for power quality, distribution and control; hydraulics components, systems and services for industrial and mobile equipment; aerospace fuel, hydraulics and pneumatic systems for commercial and military use; and truck and automotive drivetrain and powertrain systems for performance, fuel economy and safety. Eaton has approximately 73,000 employees and sells products to customers in more than 150 countries.

Eaton's electrical sector is a global leader in power distribution, power quality, control and industrial automation products and services. Eaton's global electrical product lines, including Cutler-Hammer®, Moeller®, Powerware®, Holec®, MEM®, Santak®, and MGE Office Protection Systems™ provide customer-driven PowerChain Management® solutions to serve the power system needs of the data center, industrial, institutional, government, utility, commercial, residential, and OEM markets worldwide.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Eaton's Electrical business in the United Kingdom is built on over 100 years of experience with such market leading brands as MEM®, Powerware, MGE Office protection systems, Moeller, Cutler-Hammer and Eaton.

Industrial Automation & Control

Automation Control & Visualization – Safety Logic, HMI, PLC, Industrial PC, Modular I/O, Control relays, Relays, Switching, Protecting & Driving Motors – Contactors, Motor Protection Relays, Motor Protective Circuit Breakers, Motor Starter Combinations, Soft Starters, Frequency Inverters, Distributed Drives Systems, Command & Control – Command & Indication, Position Switches, Sensors, Switches & Disconnectors, Panel Wiring Solutions

Power Quality

Eaton's power quality portfolio encompasses a comprehensive offering of power management solutions from a single-source provider. This includes uninterruptible power supplies (UPSs), surge protective devices, switchgear, power distribution units (PDUs), remote monitoring, meters, software, connectivity, enclosures and services.

With all our products, Eaton strives for continued success in leveraging technical innovation to develop next-generation solutions. Our power quality portfolio was designed to fulfill specific customer requirements, complement a new or pre-existing solution, and to deliver a comprehensive solution.

Power Distribution & Monitoring

Medium Voltage Switchgear – Primary Switchgear, secondary Switchgear, Ring Main Units, Medium Voltage Automation Systems. Low Voltage Switchgear – Main Distribution, Sub Distribution, Final Distribution, Busbar Trunking, Transformers, Motor Control Centres, Power Integration Services – Power Protection, Power Monitoring, Power Systems Control, Protective Relays, Metering & Monitoring Solutions – Energy Monitoring Systems, Power and Energy Meters, Networking Hardware

Circuit Protection

Miniature Circuit Breakers, Residual Current Circuit (Operated) Breakers, Moulded Case Circuit Breakers, Air Circuit Breakers, Medium Voltage Vacuum Breakers, Arc Fault Protection Systems, Hydraulic-Magnetic Circuit Breakers, Motor Protective Circuit Breakers, Surge Protection Devices, Solar Switches, Automatic Transfer Switches



EDWARDS LIMITED



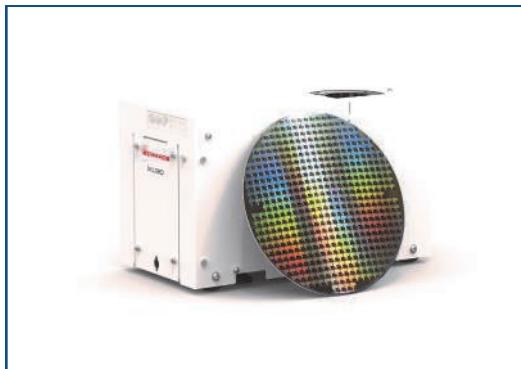
Contact:	Dr James Haylock
Phone:	01323 525304
Email:	jim.haylock@edwardsvacuum.com
Website:	www.edwardsvacuum.com
Address:	Marshall Road, Eastbourne, East Sussex, BN22 9BA

COMPANY OVERVIEW

Edwards is in the business of vacuum science: we create the pure manufacturing environments that deliver real-world product solutions. So much depends on vacuum technology: from the microchips that drive smartphones, computers and cars, through LED displays to aircraft turbine blades, UK-based Edwards makes their existence possible through the cutting-edge innovation and technology leadership that our business is founded upon. Edwards systems are at the heart of important work such as drug discovery, and with inventions such as the industry-changing dry pump, ours is a continuing commitment to explore the possibilities of vacuum processes. Semiconductors are the cornerstones of modern electronics, and therefore touch our lives every day. The microchips found in everything from computers and smartphones to washing machines and traffic lights are made possible by the vacuum processes in which Edwards specialises. As the established market leader in the supply of systems for this sector, we have led the way in developing products that allow semiconductors to be made better, faster, more cost-effectively, and with less waste. With a presence at every major semiconductor Fab in the world, we offer technical expertise and ongoing support for our process-specific or custom designed systems. Edwards takes a leading environmental role through abatement systems for industry that prevent the emission of harmful greenhouse gases, and which give us an overall negative carbon footprint*. Around 3000 employees worldwide share the Edwards vision: that of dedication, invention, and the highest standards of manufacturing and service. *Greenhouse Gas Protocol - Scope 3 Indirect Emissions

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

The hubs for power electronics capability within Edwards are at the Global Technology Centre in Burgess Hill and at the electronics manufacturing site in Eastbourne. The diverse range of vacuum pumping technologies available from Edwards, demands drives that supply anything from a few watts to tens of kilowatts and operate at speeds up to 90,000 rpm. These tightly integrated drive applications require compact size, rugged construction, environmental protection and typically liquid cooling. Our engineers use their understanding of our products to specify requirements and work with a range of suppliers, to source motors and power electronics. Where application requirements make it difficult to source solutions from partner companies, our design teams step in. These design teams integrate many disciplines, including embedded software; power electronics; mechanical design and production engineering, to create bespoke solutions. Co-location of the design teams within the manufacturing site ensures that the resulting designs are optimised for production.



EMERSON CONTROL TECHNIQUES



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COMPANY OVERVIEW

Control Techniques is a UK division of Emerson, a global \$24bn engineering business which today employs more than 125,000 people around the World. Control Techniques is a world leader in the design, manufacture, sales, application and support of electrical drive products and converters for renewable energy sources, notably PV/solar converters. Engineering and design is centred at the companies global headquarters in Newtown, Mid Wales, with satellite design groups in China, India, Romania and USA. Manufacturing is centred on the Mid Wales facility with satellite production in China, Romania and USA. System Engineering is undertaken in a global network of Drive and Application Centres which provide local engineering, sales and technical support to customers. The companies product range covers drive systems and power converters from a few 100W through to multi MW. Products customised to different applications and market sectors are produced in order to provide optimised solutions. The company has a worldwide

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Motor Drive, Automation products, PV (Solar) converters



ERA TECHNOLOGY



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COMPANY OVERVIEW

ERA Technology provides specialist engineering technical consultancy to owners and operators of large-value capital assets and systems; helping clients to reduce risk, improve operational performance and comply with functional safety and regulatory requirements. ERA has built an enviable reputation for technical excellence in the delivery of its services. From its establishment in 1920 as a research association to today's international consultancy business, its aim has been to be the consultant of choice for its clients.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

AccessERA – Access to specialist expertise via the Information Centre, Technical Reports and Publications, Training Courses and Conferences

Condition Assessment – Optimise the performance and life of high value static, rotating and electrical assets

Electromagnetic Compatibility (EMC) – EMC Management, modelling and measurements to support reliability

Engineering Design and Performance – Assessment of electrical and mechanical components, systems and materials; Third party verification

Environmental and Regulatory Compliance – Understand how multiple, changing obligations can affect your business

Forensic Engineering – Failure investigation to establish root cause; Expert witness support

Power Systems Services – Design, quality assessment and protection studies; Electrical Power Systems Analysis Software (ERACS)

Safety Assessment – Independent assessment to assure system safety

Safety Engineering – Safety planning, risk management and safety cases

Software Assurance – Independent assurance of software intensive systems and procurement support



EXCEPTION PCB SOLUTIONS



Contact:	Mike Devine
Phone:	0791 7506850
Email:	mike.devine@exceptionpcb.com
Website:	www.exceptionpcbsolutions.com
Address:	Alexandra Way, Ashchurch Business Centre, Tewkesbury, GL20 8 NB

COMPANY OVERVIEW

Understanding the requirements and applying the 'right fit' technology and 'supply chain solution' is essential in your selection of a PCB vendor. At eXception we have the global network of best in class supply chain partners supported by our own award winning hi-technology facility in the UK.

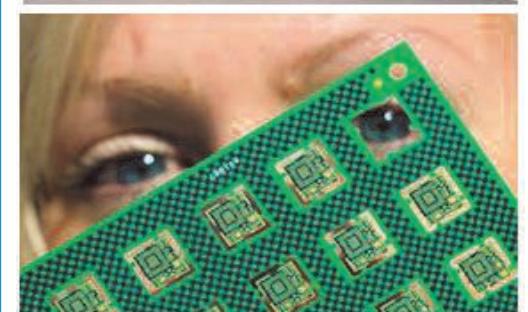
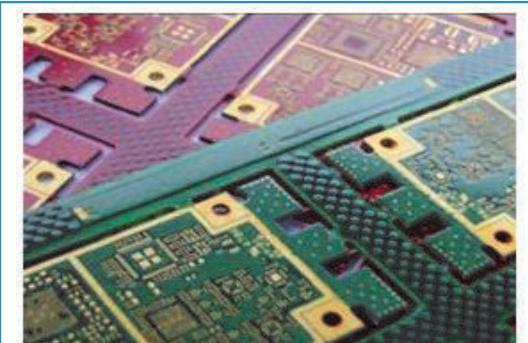
PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Consultancy Services

eXception prides itself on adding value at the early stages of product development. We provide a comprehensive range of first-class design, support and manufacturing services to the electronics industry. Our depth of skill and industry expertise enables us to quickly understand your business, providing honest practical advice and solutions throughout the entire product life-cycle (design to manufacture), this helps the reduction of design times and improve manufacturing efficiency. Having a multi-talented bilingual and flexible 24hr engineering team that applies best in class technology and electronic manufacturing practices ensures a clear route to market with the overall aim in achieving lowest total cost.

Services and Capabilities Offered

- Schematic Capture (Mentor Graphics DxDesigner)
- PCB Layout (Mentor Graphics Expedition & Cadence Allegro PCB suites)
- Signal/Power/Thermal PCB Analysis ~ (Mentor Graphics Hyperlinx)
- Optimized Design to Fabrication (The future of DFM!)
- Mechanical Design
- Impedance Modelling (using Polar Speedstack)
- 24hr Technical Support
- Onsite/Offsite Representation
- Design for Volume (DFV)
- Multilayer build/Stack-up Generation
- RF / Digital Design
- SLA Modelling



FAIRFORD ELECTRONICS LIMITED



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COMPANY OVERVIEW

Fairford is a UK based motor control innovator; designer and manufacturer, and works in industrial and commercial markets worldwide. More than 80% of our annual sales are exported. In 1982 Fairford became the first company to design and produce a fully digital three phase soft starter with automatic Energy Optimising. Fairford was granted patents in the USA, Japan, Australia and Europe. Since then, by specialising exclusively in this one area, Fairford has been able to lead the market through innovative design and engineering excellence. We continually innovate, adding new features with increasingly more effective solutions to suit all sizes and complexity of applications. We've written history - and we'll continue to do so.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Fairford focuses on energy saving motor controls and soft starts in both low and medium voltage applications. We work with Original Equipment Manufacturers, Brand Label Customers and distributors worldwide. We design and manufacture bespoke motor control solutions, but also supply our own product range via a global network of distributors.

GAN SYSTEMS



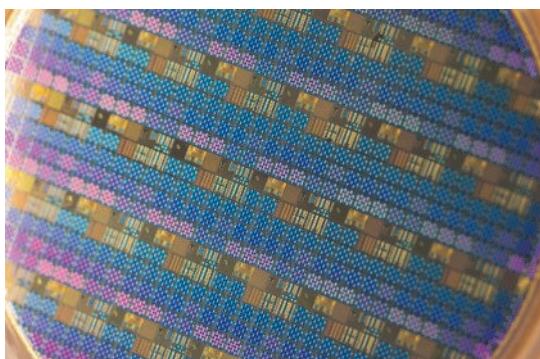
Contact:	Geoff Haynes
Phone:	07768 316704
Email:	ghaynes@gansystems.com
Website:	www.gansystems.com
Address:	Littleton House Cottage, Blandford Forum, Dorset, DT11 9NB

COMPANY OVERVIEW

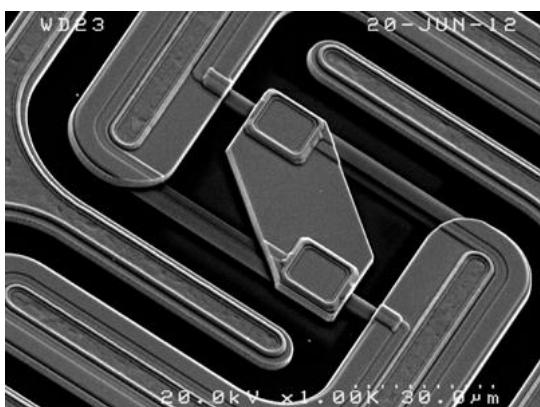
GaN Systems designs and produces power switch components that benefit from the company's novel design methodology and the high performance high power attributes of GaN semiconductor processes. The UK company serves the technical and commercial requirements of the company's customers and partners in Europe.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Electronic power switch components and modules. Product definition, application support, reference designs and demonstrators.



Gallium nitride wafer featuring GaN Systems 200, 650 and 1,200 Volt power switching transistors and test structures



Scanning Electron Microscope image of a section of a 1,200 Volt gallium nitride power transistor from GaN Systems.



GaN Systems CEO, Girvan Patterson, displays a gallium nitride wafer featuring the company's 200, 650 and 1,200 Volt power switching transistors.

GE ENERGY POWER CONVERSION UK LIMITED



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Website:	www.ge-energy.com/electrifyingchange
Address:	Boughton Road, Rugby, CV21 1BU

COMPANY OVERVIEW

GE's Power Conversion business applies the science and systems of power conversion to help drive the electric transformation of the world's energy infrastructure. Designing and delivering advanced motor, drive and control technologies that evolve today's industrial processes for a cleaner, more productive future. It serves specialized sectors such as energy, marine, industry and all related services.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Energy: Utilizing rotating machines, converters and automation systems to the energy market including oil & gas, power generation and renewable industries.

Marine: Advanced technologies in power generation and distribution, electric propulsion, power management, vessel automation, dynamic positioning and control systems to offshore, merchant and naval marine markets.

Industry: Combining motors, generators, variable speed drives and automation & process control to the metals, mining, material handling, test bench and other process industries.

Service: Our related services include spares, 24/7 technical support and intervention, long term support contracts, remote diagnostic solutions and a comprehensive range of trainings



GOODRICH POWER SYSTEMS



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Website:	www.goodrich.com/Goodrich
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COMPANY OVERVIEW

Goodrich Corporation is a leading global supplier of high reliability equipment and systems to the civil and defence markets – for both rotorcraft and passenger aircraft. Typical customers are OE airframers like Boeing, Airbus, Bombardier, Embraer, Dassault – and major sub-contractors like BAE Systems. Future civil airliner designs – leading on from the Boeing 787 “More Electric Aircraft” concept – will incorporate significant amounts of power electronics into new technology aircraft equipment.

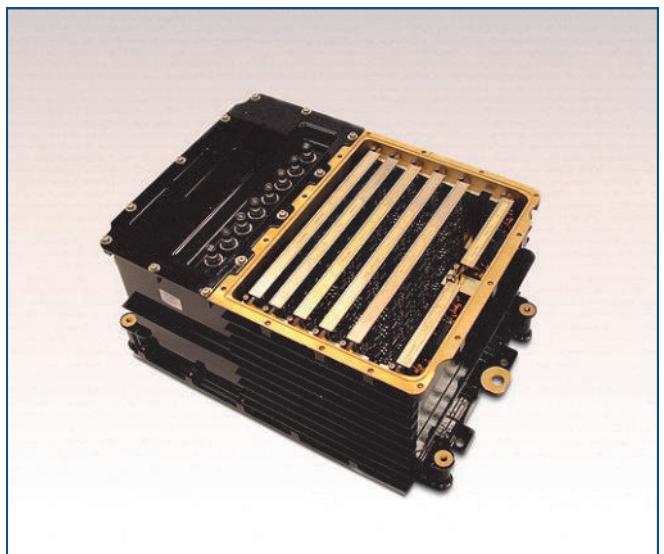
PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Goodrich UK supplies high performance electrical power systems for main engine and auxiliary supply, and other safety critical applications.

The “Engine Electric Start” concept for civil airliners is at the heart of More Electric Aircraft developments. The main engine generator is back-driven as a motor to start the engine – replacing conventional compressed air technology. The future power electronic components, modules and equipment to realise this application are distinctly different from other aerospace and industrial technologies. Large turbofan engines on civil airliners require ~100kW or more of motoring power to be backdriven through the generator to start them.



Electronic Power Control



Electronic Power Distribution

IMEX SYSTEMS LIMITED

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Email:	wdgray@imex.co.uk
Website:	www.imex.co.uk
Address:	Coatbridge Business Centre, Coatbridge, ML5 3RB

COMPANY OVERVIEW

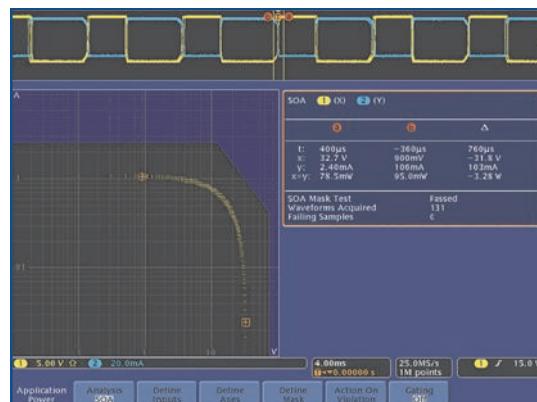
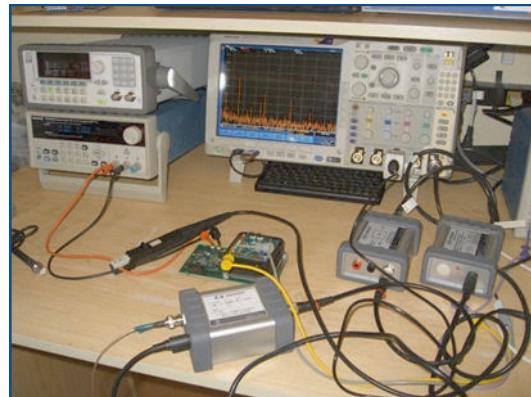
We supply oscilloscopes, software and probing solutions for SMPS development. Used to determine switching losses, turn on/off times. We also supply battery powered portable oscilloscopes with isolated channels for use in remote locations e.g. wind turbine maintenance. etc.. We can provide Wind & Solar Power training systems. AC & DC Power Sources used in system development.

We have supplied equipment over the past 20 years to most of the companies in Scotland/NE England who design power systems . We have also been involved with Universities, both in teaching laboratories and in research projects relating to power electronics.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

- Supplier of Test Instrumentation for Power Electronics Design.
- Teaching laboratory Instrumentation

This shows the set up for analysing new generation of wireless chargers using a unique Tektronix Mixed domain Oscilloscope, which in addition to analogue and control logic signals can also show RF spectrum.



Switching loss and safe operating area calculations from Switched Mode Power Supplies under development.

INDIUM CORPORATION



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COMPANY OVERVIEW

Indium Corporation is a developer, manufacturer and marketer of advanced materials, primarily focussed at joining and bonding applications for the electronics industry. Our specialities for power electronics are die-attach solders, fluxes and thermal interface materials, using the elements Pb, Sn, In, Cu, Ag and Au.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Die-Attach solder preforms packaged in tape and reel; Fluxes and flux coated materials; Thermal Interface materials; product and process advice on alloy selection and reliability.

INDUSTRIAL CAPACITORS (WREXHAM) LIMITED



Contact:	David Thomson
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Website:	www.icwltd.co.uk
Address:	7Miners Road, Llay Industrial Estate, Wrexham, LL12 0pj

COMPANY OVERVIEW

Working from our dedicated facility, we have designed and manufactured metallised plastic film capacitors for power electronics since 1974.

We supply the industrial, military and professional markets throughout the world and have gained a reputation for service which is second to none. We have extensive problem solving experience, short lead times and produce many specialised capacitors for difficult applications alongside our standard ranges. Our products offer working voltages of between 63Vdc and 2000Vdc and up to 660Vac. The range of capacitances offered extends from 10nF to 2000uF in a single winding. Windings can be combined to produce significantly higher capacitances.

Our focussed and experienced R&D team ensure we remain at the forefront of technology, allowing us to address new markets and improve performance for existing customers.

A continuous investment programme has resulted in us utilising the very latest in winding technology which, in tandem with modern testing facilities, ensures quality of the highest order. The company has for many years been approved to ISO 9001. Design innovation and manufacturing flexibility are at the heart of our success.

We maintain sufficient stocks of raw materials to allow us to quickly react to changes in demands from our customers while still offering short lead times, reasonable minimum order quantities and competitive pricing.

ICW also produces the highly regarded ClarityCap™ brand of audio grade capacitors. For further information relating to these products please either contact us or visit our dedicated website at www.claritycap.co.uk

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Film capacitors for power electronics EMC filtering capacitors Custom capacitors Short lead times Realistic minimum order quantities.

INSETO



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Address:	Unit 25, Focus Way, Andover, Hants, SP10 5NY

COMPANY OVERVIEW

Inseto is a specialist ISO Accredited technical distributor, providing advanced technology for research & industry throughout the UK, Ireland and Scandinavia. The Company provides equipment, assembly materials and consumable products for Power, Semiconductor or Microelectronic related research and production; these products include:

- Equipment from bench top furnaces, through plasma etch and cleaning, wafer inspection, mounting, dicing and scribing, wafer or device probing, die and wire bond, materials testing, vacuum soldering, to component test and inspection.
- Assembly materials and related machine consumable products include: 2&3D Metallised Substrates, Thick Film Materials, Precision Machined Ceramics, Glass & Ceramic Sealed Packages, Wire Bond Materials and consumables from dicing to test, as well as Adhesives for encapsulation, sealing & bonding.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Equipment, assembly materials and consumable products for Power, Semiconductor or Microelectronic related research and production.

INTERNATIONAL RECTIFIER

International
IR Rectifier

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COMPANY OVERVIEW

International Rectifier is a world leader in power management technology. IR's digital, analog and mixed signal ICs, advanced circuit devices, integrated power systems and components enable high performance computing and reduce energy waste from motors, the world's single largest consumer of electricity. Leading manufacturers of computers, energy efficient appliances, lighting, automobiles, satellites, aircraft and defense systems rely on IR's power management benchmarks to power their next generation products.

With headquarters in El Segundo, California, International Rectifier maintains operations in 20 countries throughout North America, Europe, Japan and Asia. International Rectifier's stock is listed on the New York Stock Exchange under the ticker symbol IRF. The company's website is located at www.irf.com.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Some of iR's flagship products include

GaNpowIR® power devices - iMOTION™ integrated design platform - CHiL digital controller - PowIRstage® devices, - SupIRBuck® DirectFET® Power MOSFETs ..and an expanding family of low-voltage and high-voltage ICs.



IXYS UK LIMITED



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COMPANY OVERVIEW

Located in Chippenham, IXYS UK Westcode Ltd is a wholly owned subsidiary IXYS Corporation (NASDAQ:IXYS) an international power and IC semiconductor company. Within the group IXYS UK Westcode Ltd specialises in the development and manufacturing of very high power semiconductor devices using pressure contact packaging. Power semiconductors have been in continuous production on the Chippenham site since the mid 1920's when the company was owned by Westinghouse Brake and signal company Ltd and has been part of the global IXYS Corporation since 2002. Today the focus of manufacture is very high power thyristors and rectifiers, as well has high technology products like IGBTs (Insulated gate Bipolar transistors) and power semiconductor sub-assemblies. IXYS UK Westcode Ltd continues to supply high technology components for a wide range of applications such as wind and solar energy, welding, AC and DC motor drives for oil, marine and water treatment facilities, uninterruptible power supplies, motor soft starters, transportation, induction heating, mining equipment and many other industrial applications. Around 90% of the products manufactured in Chippenham are exported, with a customer base across Europe, Asia & the Americas.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

IXYS UK Westcode limited manufactures pressure contact semiconductors with individual die sizes of 19mm to 100mm. As well as pressure contact IGBTs and high power isolated base thyristor/diode modules: Rectifier diodes from 400A to 10kA with voltages from 200V to 6kV Fast & soft recovery diodes from 100A to 2.5kA with voltages from 200V to 6kV Phase control thyristors from 100A to 7kA with voltages from 200V to 6.5kV Medium voltage thyristors from 350A to 3.5kA with voltages from 3.6kV to 6.5kV Fast turn-off & distributed gate thyristors from 100A to 4kA with voltages from 800V to 4.5kV Gate turn-off thyristors from 500A to 4kA with voltages from 1.4kV to 4.5kV Pressure contact IGBTs from 160A to 2400A with voltage ratings 2.5kV & 4.5kV Isolated base modules (Dual & single) from 320A to 1200A with voltage ratings 1.2kV to 3.6kV IXYS UK Westcode limited also supplies & manufactures mechanical parts required for the operation of power semiconductor devices such as: Heat sinks, coolers, clamps, snubbers, gate trigger and protection circuits as well as complete sub-assemblies incorporating the semiconductor and the aforementioned mechanical parts.

JOHN G PECK LIMITED



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COMPANY OVERVIEW

Established in 1983, JGPL specialises in the field of power electronics, promoting a wide range of power semiconductors and associated products from a handful of world leading manufacturers including Mitsubishi Electric, Eldre, Powerex, Sic Safco and ABB. JGPL is uniquely placed to provide a key service to companies working in power electronic applications.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

JGPL's portfolio includes :

- IGBTs and IPMs
- Diodes and thyristors
- Custom power modules
- Laminated busbars
- Electrolytic capacitors
- Current and voltage sensors
- Hybrid drivers and power supplies
- Thermal interface materials

JOHN P KUMMER LIMITED



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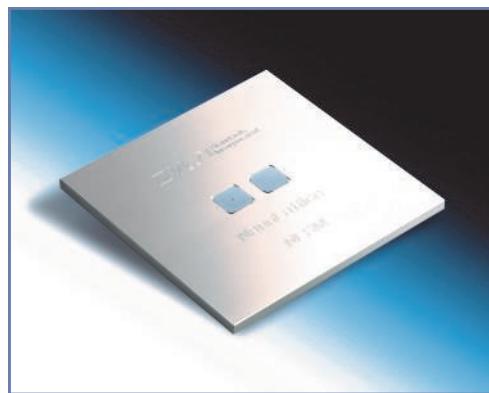
COMPANY OVERVIEW

We are a specialist supplier of advanced epoxy adhesives which are aimed at high temperature electronics and related applications. We have a packaging laboratory from where we can supply Epoxies in Premixed Frozen Form.

We have been established since 1989 and have been supplying equipment and materials to the microelectronics and related industries since then. In recent years we have become a specialist supplier of advanced epoxy adhesives for use in the microelectronics, medical, optical and other related high technology industries. We have a packaging laboratory from where we can supply epoxies in premixed frozen form. We are certified to BS EN ISO9001:2008 for all our activities.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

- EPO-TEK Advanced High Temperature Epoxies in 2K and Frozen Syringe form. Equipment for Failure Analysis of Electronic Components and Assemblies.
- EPO-TEK Advanced High Temperature Epoxies in 2 component and frozen syringe form.
- Metrology, Inspection and Test equipment for the semiconductor industries
- Calibration samples for metrology tools
- Equipment for Sample Preparation and investigation during failure analysis
- Specialist Process Tools for coating and surface preparation.



KYOCERA FINECERAMICS



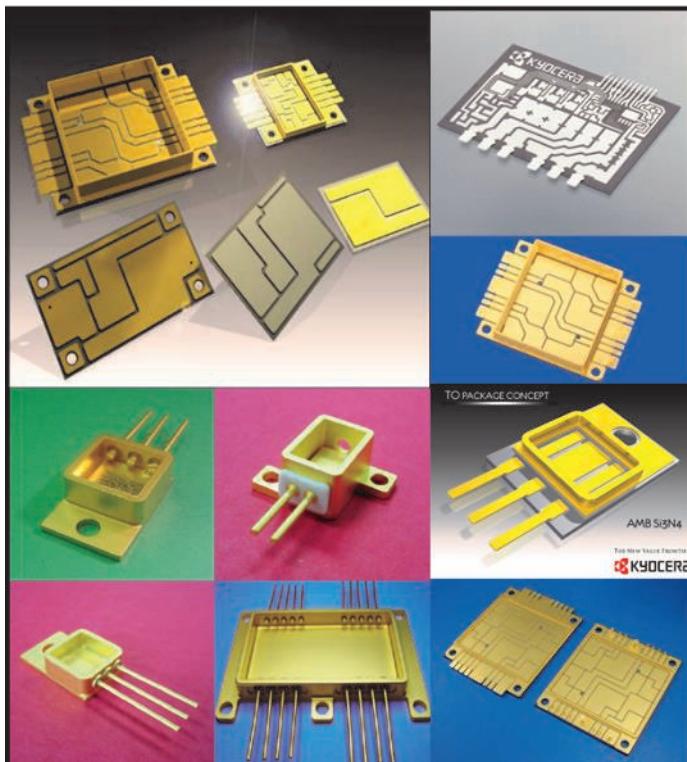
Contact:	Andrew Rimmer
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Address:	Prospect House, Archipeligo, Lyon Way, Fimley, Surrey, GU16 7ER

COMPANY OVERVIEW

Kyocera Fineceramics Limited is a wholly owned subsidiary of Kyocera Corporation of Japan. Kyocera is a global leader in both ceramic and organic packaging solutions for a wide range of electronic applications with 4 dedicated R&D facilities focussed on developing new materials and techniques to solve the challenges presented by the new generations of SiC and III-V materials. With total control over the materials development, manufacturing, simulation and subsequent verification, Kyocera is an ideal partner for programmes where high level support and top quality

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Kyocera Fineceramics Limited can offer full technical and commercial support from its UK office for electronics packaging and assembly services.



A full range of ceramic eyelet packaging is available for high reliability, high power applications including diodes, rectifiers, motor controllers and DC converters. Applications include undersea cables, downhole drilling, satellite and commercial avionics.

Copper core alloy 52 and copper zirconium pins are available together with copper tungsten, kovar, steel and copper bases and frames.

For more integrated applications, silicon nitride AMB modules are proving to be highly reliable and adaptable solutions with single and multi-layer options. Tabbed and pinned interconnections are available as required and brazed walls allow hermetic modules to be developed.

MAHLE POWERTRAIN



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COMPANY OVERVIEW

MAHLE Powertrain is the engineering services division of MAHLE GmbH, specialising in the design, analysis, development, calibration, testing and manufacture of high efficiency, IC engines. With R&D centres in Northampton, Stuttgart, Detroit, São Paulo and Shanghai, MAHLE Powertrain supports OEMs on a truly global basis. MAHLE's advanced downsizing demonstrator engine is now a recognised industry benchmark for highly optimised gasoline engine performance. MAHLE's new twin cylinder, 4-stroke, 30 kW range extender engine is currently being installed in an electric demo vehicle. Both programmes, managed entirely by MAHLE Powertrain, are expected to make significant advances in low carbon transport technologies.



PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

- Fundamental research
- Engine concept design
- Engine simulation
- Thermodynamic analysis
- Engine development
- Combustion system development
- Engine prototyping
- Aluminium casting
- Engine build
- Engine testing
- Engine calibration
- Demonstrator vehicle build
- Vehicle testing
- Vehicle calibration
- Engine manufacture



MANUFACTURING TECHNOLOGY CENTRE



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COMPANY OVERVIEW

The Manufacturing Technology Centre (MTC) represents one of the largest public sector investments in UK manufacturing, with principal expertise centred around assembly, fabrication and joining technologies. An initial £40 million has been committed to fund the construction of the facility and procure a range of state of the art equipment and machinery for research and development in manufacturing processes. Our key selling point is the capacity to place technology onto a member company's shop floor that has been proved to the point that minimal disruption of existing production will occur. We provide a unique environment bringing the country's leading academics, engineers and industry professionals under one roof to develop and demonstrate new technologies on an industrial scale. This allows our member companies to develop new manufacturing processes in a safe, neutral industrial setting, whilst reducing the associated financial risks. The MTC is also a member of the High Value Manufacturing Catapult Centre. Funded by the Technology Strategy Board (TSB), Catapults are centres of excellence that bridge the gap between business, academia, research and government. They are a powerful new element in the UK economy, helping businesses develop relevant and exciting ideas in receptive and invigorating environments. The High Value Manufacturing Catapult Centre is the first such to open for business, and across the seven member institutions embraces all forms of manufacture using metals and composites, in addition to process manufacturing technologies and bio-processing.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

The MTC specialises in research and development services for a range of manufacturing processes that are particularly important to the high value manufacturing sector: electronics manufacturing; net shape manufacturing; intelligent automation; advanced tooling and fixturing; computerised engineering (modelling and simulation) and high integrity fabrication (HIF). Specifically in electronics manufacturing the MTC hosts a £2m investment in printed circuit board assembly and process characterisation equipment, housed in a dedicated, controlled climate room with ESD protection. The equipment is available for process and equipment trials and can be operated in full production mode. The MTC also offers to electronics manufacturers expertise in automation, machine vision, non-destructive testing, and ICT for production organisation and control. The MTC provides a flexible approach to working with both large and small companies and offers a tailored service designed to meet the needs of individual companies which ranges from consultancy support for specific problems to a long-term relationship for programme based projects through membership of MTC. To support member activities the MTC provides foresight of availability of, and assists with access to, public funding



MARTIN'S ELECTRONIC DEVICES AND INSTRUMENTS (MEDI)



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Address:	18B Alkham road, Stoke Newington, London, N16 7AA

COMPANY OVERVIEW

MEDI is an R&D house involved in the design and development of power electronic projects since 1987. Our expertise is in customized projects involving high current / high voltage handling. Energy saving Voltage Optimizer technology for reducing carbon footprint was nominated for the Green Product of the Year 2011 award by EPD magazine, UK. MEDI is the authorised Design Partner of Microchip, USA.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Research and Development (R&D) in Power Electronics, R.F, embedded software. Ready solutions available for Energy saving Voltage Optimizer using IGBT PWM technology, intelligent motor control with soft starter, wide range of inverter and solar chargers.



250KVA 3-phase voltage optimizer. This is used for energy saving. 15% to 20% energy can be saved with this product. This is an IGBT based AC to AC PWM type voltage regulator controlled with DSP. Energy is saved by optimizing and phase balancing the 3-phase voltage

MCLAREN ELECTRONIC SYSTEMS LIMITED (MESL)



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COMPANY OVERVIEW

McLaren Electronic Systems Ltd (MESL) has been supplying advanced electronic systems into professional motorsport for over two decades. The company is the official electronic control unit (ECU) supplier to the FIA Formula One World Championship, NASCAR Sprint Cup and IZOD IndyCar series.

Automotive OEMs are increasingly approaching MESL for electronic systems, ranging from high performance motorsport ECUs with data acquisition for development activities, through to low-cost, purpose developed electronic modules for production cars. Model-based applications developed in Simulink / Stateflow can be targeted at development or production units, providing a seamless, low risk migration path into production.

The company has a dedicated team to develop high voltage, high current power electronics for automotive applications. Skills span the entire spectrum from electronic hardware and software development through to full validation to automotive standards for production road vehicles. All design, development and low volume manufacturing activities are handled at MESL's headquarters in the McLaren Technology Centre, Woking, Surrey. The company is partnered with an established UK based electronic manufacturing firm for high volume production and is able to offer high quality electronic systems into price sensitive applications.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

- **Inverters** for high bandwidth control of electric motors in hybrid and electric vehicles.
- **DC/DC converters** to supply low voltage auxiliary supplies from a high voltage DC bus.
- **Combined inverters & DC/DC converters.**
- **Bespoke and off-the shelf solutions.**
- **Electronic control units** with support for customer applications, e.g. for managing hybrid/E.V. system functions
- **Data acquisition** systems supporting logging rates up to 400kHz and customer applications.
- **Simulink / Stateflow** graphical development environment for customer applications.
- **Wireless telemetry systems** for reliable, high rate transmission of data.
- **Low to high volume** applications supported.
- **Advanced data viewing and analysis** PC software, as used in Formula One.
- **Fast turnaround** – motorsport timescales.
- **High quality, high reliability** electronics, supporting mission critical applications.
- Validation to **automotive standards**.
- **ISO 26262 / IEC 61508** safety certification to ASIL-D / SIL-3.
- Support for **J1939, OBD-II** standards for automotive compliance in global markets.
- **CAN, FlexRay, Ethernet, ARCNET** communications.



MENTOR GRAPHICS

Mechanical Analysis Division



Mechanical Analysis

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COMPANY OVERVIEW

Thermal Design Software for Electronics Cooling Applications Mentor Graphics - Mechanical Analysis leads the market in electronics thermal design software. FloTHERM®, FloTHERM® PCB, FloTHERM® XT and FloEFD™ help to predict airflow, temperature and heat transfer in components, boards and complete systems, found in the automotive, aerospace, consumer, computing, and telecom industries.

These software solutions are complemented by our thermal characterization and testing solutions. Thermal Characterization and Testing In the specialized field of thermal testing for semi-conductor devices, Mentor Graphics offers T3Ster®, enabling thermal characterization of semi-conductor device packages including digital ICs, stacked dies, and MCMs, and power electronics devices, including MOSFETs and IGBTs which can be tested at high power.

Together with T3Ster, TeraLED® enables the full thermal, photometric and radiometric characterization of power and HBLEDs. The range is completed by DynTIM®, that provides a cutting-edge solution for measuring thermal performance of thermal interface materials (TIMs). With DynTIM® the thermal conductivity of greases, pastes, phase-change materials, adhesives and solid samples can be measured with high accuracy.



MicRed Power Tester 1500A

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

FloTHERM®, FloTHERM® PCB, FloTHERM® XT and FloEFD™, T3Ster®, TeraLED®, DynTIM®, Power Tester 1500A

ML ELECTRONICS LIMITED



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COMPANY OVERVIEW

ML Electronics is a specialist electronic product development consultancy and manufacturer specialising in high technology products for markets as diverse as medical, automotive, aerospace, defence and consumer electronics. We have assisted many clients with new product development, from initial concept, through development and into production, either in our own dedicated manufacturing facility, or with off-shore partners for high-volume products. Previous projects have included the following:

- Wireless domestic utility metering
- Ethernet over Power modules
- Inspiratory muscle trainer
- Theatre-based plasma surgical cutting and coagulation tool
- Wireless physiological monitoring system for assisted living
- Power electronics and control systems for low carbon vehicles
- Vehicle monitoring and control
- Driver authorisation systems for specialist vehicles
- Automotive LED lighting systems
- iPhone™ and iPad™ apps



PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

ML Electronics are ISO9000 and ISO13485 certified and are approved Apple developers.



Engineering Services

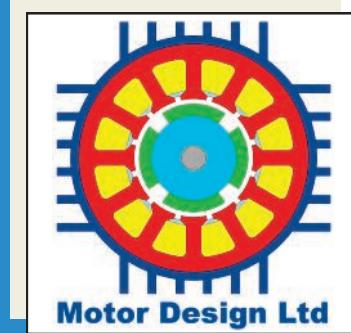
- Market & Technology Research
- Technology Roadmap & Strategy
- Technical Consultancy
- Product Development
- Industrial Design & 3D Modelling
- Project Recovery



Manufacturing Services

- Component Sourcing, Purchasing & Kitting
- Rapid Prototypes (PCB and 3D models)
- Build to Print (Customer or MLE design)
- Special to Type Test Equipment (STTE)
- Test Rigs and Calibration Equipment
- Obsolescence and End of Life Management

MOTOR DESIGN LIMITED



Contact:	Dave Staton
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Website:	www.motor-design.com
Address:	4 Scotland Street, Ellesmere, Shropshire, SY12 0EG

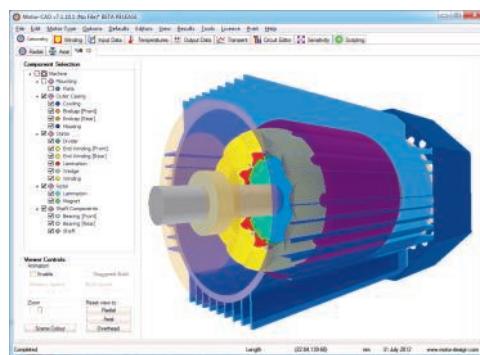
COMPANY OVERVIEW

Motor Design Ltd (MDL) have been developing electric motor and drive simulation software since 1999. It is a world leader in the development of advanced software design tools for thermal analysis of electrical machines. It is a supplier of software to most sectors designing electric motors and generators such as automotive, aerospace, servo, renewables, industrial, etc. It has several hundred customers throughout the world including many prestigious names such as ABB, BAE Systems, Bosch, BMW, Daimler, Ford, Goodrich, QinetiQ, Rolls Royce, Siemens, etc.

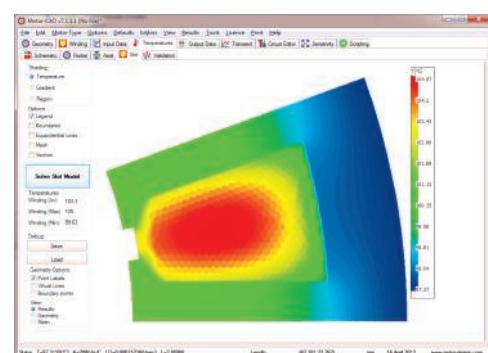
The main software package that MDL develop is called Motor-CAD. This is a package dedicated to thermal analysis of electric motors and generators and includes a large variety of cooling methods. The package is based on analytical lumped circuit analysis so is very fast to calculate and so is very suited to thermal performance prediction for motors that have a highly complex transient duty cycle loads.

MDL also market SPEED electric motor design software, FLUX finite element software and PORTUNUS system simulation software. They have developed heat transfer and flow network libraries for the PORTUNUS software. These simplify power electronics cooling design and analysis as PORTUNUS also has a Power Electronics library and library of Infineon power devices for which conduction and switching devices are fully characterised.

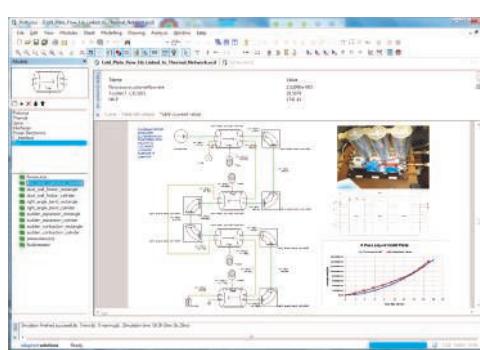
MDL also supply design consultancy and machine design training services.



Motor-CAD cross-section viewer



Temperature rise with a slot as calculated by Motor-CAD



Flow network analysis of liquid cooled heat-sink in PORTUNUS

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

- Motor-CAD software for optimisation of electric motor and generator cooling systems
- SPEED software for electric motor design
- FLUX electromagnetic and thermal finite element software
- PORTUNUS system simulation software for mechatronic system design and electronics cooling
- Electric motor and drive consulting
- Electric motor and drive training

MOTT MACDONALD



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COMPANY OVERVIEW

Mott MacDonald's £1 billion consultancy business spans 140 countries with over 14,000 staff working in all sectors from transport, energy, buildings, water and the environment to health and education, industry and communications. Our breadth of skills, sectors, services and global reach makes us one of the world's top players in delivering management, engineering and development solutions for public and private sector customers from 30 centres throughout the UK and offices over 100 countries across Europe, Asia and the Pacific, the Middle East, Africa and the Americas.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

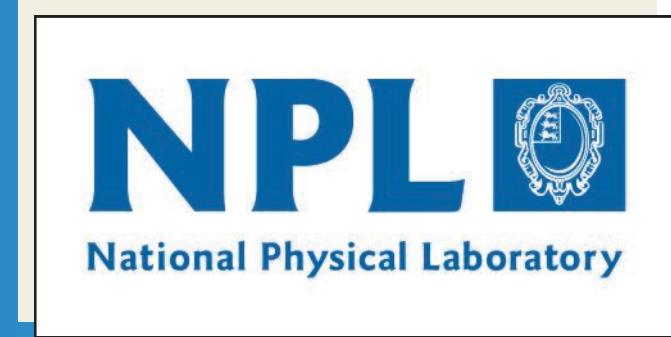
Helping clients turn project ideas into reality is where we excel. From preparing the business case to the delivery of the completed project and planning maintenance, we cover the entire project cycle. Our team combines engineers, planners, financial analysts, environmental and safety specialists, as well as atmospheric and wind modellers. This integration of key skills enables us to provide a seamless service to our regulator, utility, developer, investor, lender, original equipment manufacturer and contractor clients.

In the Power Electronics market we are deeply involved in High Voltage DC (HVDC) Transmission businesses supporting various developers and utilities in the transmission system development covering full spectrum of tasks including studies, detailed design, engineering, project management, construction support of subsea cable, offshore substations, onshore substations, foundation / civil works, construction, contractual arrangements, construction cost and timetable assumptions, agreements, permitting, environmental and safety impact, supplier and operation and maintenance issues for projects from 1 MW to 10 GW. Full service capabilities in energy sector environmental, social and health impact assessment and management. Some of the recent projects where we have worked include UK-Norway HVDC transmission link, France-UK HVDC link re-commissioning, Java-Bali HVDC link, England – Scotland HVDC West Coast Interconnector.



Representation of Mott MacDonald's multi-sector diversity

NATIONAL PHYSICAL LABORATORY



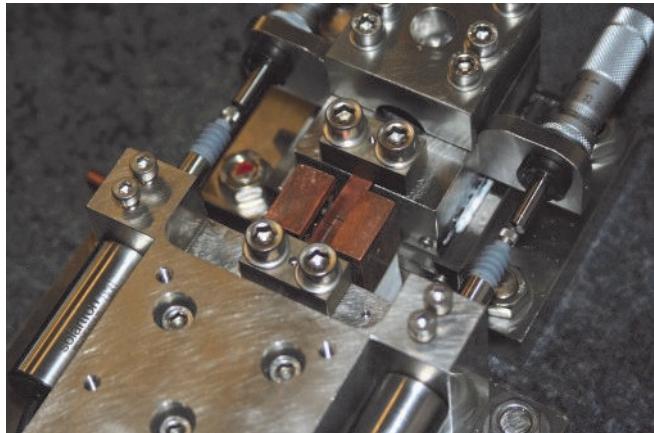
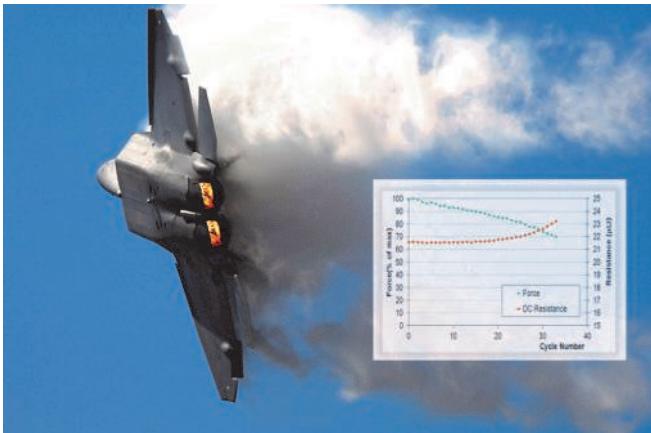
Contact:	Chris Hunt
Phone:	02089437027
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Website:	www.npl.co.uk/ei
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COMPANY OVERVIEW

NPL materials division mission is to develop the science around materials metrology for a wide range of systems. This includes the new families of SMART, nano, functional materials as well as refining techniques in traditional high performance metallurgical, composite and plastic materials.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

NPL activities in power electronics is in the study and characterisation of interconnect materials. Materials properties are key physical properties that are needed, and the time dependent behaviour needs to be characterised. NPL has built metrology techniques that can measure the stress strain and fatigue properties at joint scale geometries. We study the effect of microstructure and its evolution driven by thermal and stress processes as well as the development of interfacial zones that can significantly influence the behaviour of the whole joint. To this end NPL has built a range of miniature test instruments to evaluate the mechanical properties.



NIDEC SR DRIVES LIMITED



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COMPANY OVERVIEW

Nidec SR Drives Ltd is a leading engineering and technology provider in the field of advanced electrical machines and drive systems, with a particular but not exclusive focus on switched reluctance technology. The company pioneered the development, application and commercialisation of switched reluctance technology under its SR Drive® trademark and is now the world leader in this domain. Our SR Drive® systems deliver superior performance and efficiencies without the use of permanent magnets or rare-earth materials. The company undertakes research, development, prototyping and licensing of switched reluctance and other advanced electrical drive systems across a wide spectrum of applications and ratings, ranging from few watts to several megawatts. Applications include but are not limited to traction, industrial and mining, appliance & consumer, motion control, automotive and aerospace. Nidec SR Drives Ltd has always approached design from a “complete system” perspective, considering not only the electrical machine and its electronic controls, but also the overall application in which they will operate. This allows us to tailor the design to closely meet our customers’ performance and cost targets, and ensures that the potential benefits of an advanced electronically-controlled drive are explored and utilised to the fullest possible extent. The company therefore has diverse in-house engineering design, modelling, development and testing capabilities that cover the entire spectrum of modern drive system requirements. Our comprehensive expertise includes electromagnetic, mechanical and thermal design, power electronics, digital and analogue signal processing, embedded software, communications interfaces, feedback control systems, product safety and agency approvals. This know-how is backed up by extensive CAD tools, laboratory and prototyping facilities, together with in-house prototyping, low volume manufacture and testing capabilities.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Electromagnetic, mechanical and thermal design of switched reluctance and hybrid permanent magnet motors/generators. Design, development, prototyping and testing of power electronics and switched mode power conversion equipment (inverters, rectifiers, DC-to-DC converters, switched-mode power supplies etc.) from watts to megawatts, and using all types of semiconductor devices including MOSFETs, IGBTs, thyristors and GTO’s. Packaging and thermal design of power electronic systems. Analogue and digital signal-level electronics of all kinds, including programmable logic, embedded microprocessors and DSP. Extensive computer-aided design, modelling, simulation and dynamic performance prediction facilities at both component and system level, and often including aspects of the customer’s overall application. Design, development and analysis of motor control algorithms and feedback control systems. Peripheral electronic system design, including power supplies, EMC, communications protocols, etc. Product safety and agency approvals. Comprehensive laboratory and 4-quadrant dynamometer testing facilities for systems up to 300kW. In-house prototyping and low-volume production of motors and controls, supported by the extensive world-wide high volume manufacturing capabilities of Nidec Corporation.

NORFOLK CAPACITORS LIMITED



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COMPANY OVERVIEW

NCL is the UK's leading designer and manufacturer of high quality, technically advanced capacitors for power electronic applications. The extensive product range of filter, snubber and energy storage capacitors services the professional markets of traction, industrial drives, power conditioning and avionics, together with discharge capacitors for medical, plasma and pulsed power applications. The strength of the company lies in working alongside its customers, tailoring the product correctly to its specific application so it performs exactly as required with total reliability. "Manufacturing power capacitors for over 25 years"

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

DC Filter Capacitors Low inductance DC link capacitors for IGBT inverters, DC link capacitors for GTO inverters and choppers; surge and spike suppression. AC Filter Capacitors Single and three-phase filter capacitors for specialised power factor correction and harmonic reduction. Snubber Capacitors Low inductance AC and DC types for thyristors, GTOs and IGCTs. Special snubbers for high power IGBTs. Energy Storage Capacitors Low inductance, high peak current designs for medium and high voltage discharge. Track Circuit Capacitors Switched, variable capacitance polypropylene units and polycarbonate equivalents, all hermetically sealed. Custom Design Capacitors Most capacitors are made to order so in each category many aspects of the design and manufacture can be easily modified to fit a precise application.

NXP SEMICONDUCTORS



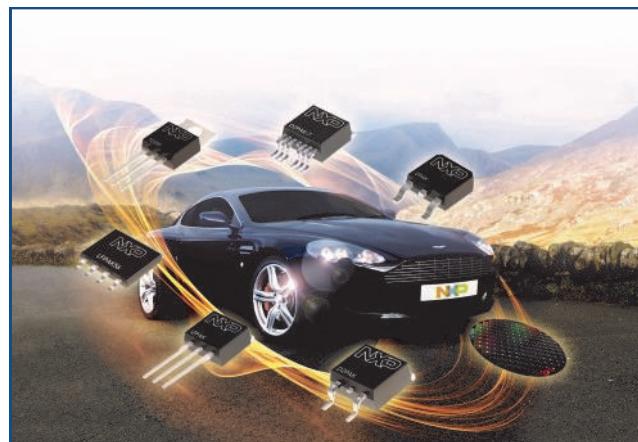
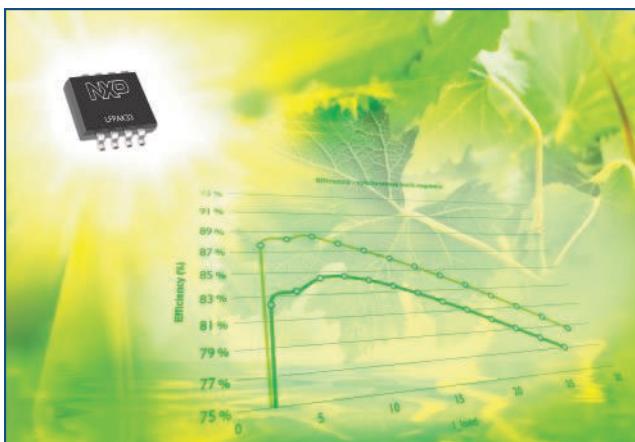
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COMPANY OVERVIEW

NXP Semiconductors UK operation is primarily concerned with the design, development, manufacturing and marketing of power semiconductor products for a wide variety of applications. The UK operation is the headquarters for NXP's power semiconductor product line and is responsible for research & development, product design, quality, test & measurement, marketing, HR, finance and manufacturing. The UK site includes a wafer fab dedicated to the production of power semiconductor devices. Products are sold to a wide variety of customers worldwide.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Low voltage power MOSFET products for the automotive, computing, communications and industrial sectors. Products are available in a wide variety of packages and at several voltage grades up to 200V.



ON-SYSTEMS LIMITED



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COMPANY OVERVIEW

Focused entirely on power conversion, on-systems' experienced team work with you to ensure your power conversion requirements are delivered on time and on budget.

We use a combination of COTS modules and in-house adapted design capabilities.

Our comprehensive range of standard high quality AC-DC and DC-DC converters range from PCB mounted units of a few watts, to large system units of several kW. These standard modules can significantly shorten development time, and help ensure that the most cost effective, reliable, low risk, compliant power converters are selected from the outset of a program.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

on-systems offers the following products and services;

- Fully compliant COTS products. Our 'off the shelf' products are designed and qualified to meet the requirements of heavy industry, rail, broadcast and the military markets.
- Adapted design. Although many applications can be satisfied using our range of standard modules, we can work with you from initial design to deliver a fully compliant bespoke product that meets your specific requirements.
- Engineering and design service. Our in house development team uses a comprehensive range of software products to model your design upfront. This capability ensures that the optimum design can be identified early on in a program to significantly reduce the total design effort and cost.

Our products and designs can be found in a myriad of environments, including; satellite communication systems, radios, sub-sea battery chargers, rugged vehicle systems, trackside power, train cab control systems, off air repeaters, and above decks ships power.



COBRA 230M



BOA100



PYTHON 120

OXFORD INSTRUMENTS PLASMA TECHNOLOGY



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COMPANY OVERVIEW

Oxford Instruments Plasma Technology provides a range of high performance, flexible tools to semiconductor processing customers involved in research and development, and production. We offer a range of tools for the fabrication of power semiconductor devices applicable for silicon and emerging wide band gap technologies.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Oxford Instruments Plasma Technology provides a range of high performance and flexible tools to semiconductor processing customers involved in research and development, and production. These include tools for the fabrication of power semiconductor devices based on silicon technologies and emerging wide band gap technologies based on GaN or SiC. Oxford Instruments is an established supplier of production equipment to high power silicon device manufacturers of IGBTs and IGBTs. Oxford Instruments has a strong background in GaN processing being a major production supplier to the HBLED industry and is applying this knowledge to enable wide band gap power semiconductor device research and production.

Oxford Instruments offers a number of processing techniques including Reactive Ion Etching (RIE), Plasma Enhanced Chemical Vapour Deposition (PECVD) and Atomic Layer Deposition (ALD). These processing techniques are suitable for etching and depositing; mask layers, high breakdown voltage isolation layers, surface passivation, gate dielectrics and contacts. Etch processes for Si, SiC, GaN, Si₃N₄, SiO₂, Al₂O₃, HfO₂ and metals. Deposition processes are available for Al₂O₃, diamond-like-carbon (DLC), Si₃N₄, SiO₂, HfO₂. A full list of materials is available on Oxford Instruments' website.



PANDA EUROPE



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COMPANY OVERVIEW

Panda Europe is a technical market consultancy focussing on electronics interconnection technologies with special expertise in semiconductor packaging and assembly. The company undertakes design, development and research projects for a varied level of businesses, small to large, on a global basis. Other work covers due diligence analysis, market analysis and technical reporting covering the science and engineering aspects of emerging technology.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Technology design and development consulting in Semiconductor chip packaging, electronic interconnect, and related electronic systems design.

PARKER SSDE



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COMPANY OVERVIEW

An industry leading manufacturer of AC variable speed drives, DC drives, servo drives and servo motors. Engineering drives solutions and systems that give peace of mind to our worldwide customer base through improved energy saving, increased productivity and manufacturing efficiency.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

An industry leading manufacturer of AC variable speed drives, DC drives, and drive systems. Key market strengths are in providing solutions for Mobile, industrial and energy applications

PLESSEY SEMICONDUCTORS



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COMPANY OVERVIEW

Plessey is an innovative globally recognised semiconductor research, design and manufacturing company with 165 staff (over 30% with PhD/degree level qualifications). We exploit our state-of-the-art UK production facilities and extensive IP portfolio to develop an international semiconductor business with significant market potential within innovative sensors (EPIC) and High Brightness (HB) LED technologies. Plessey is lead by a management team with over 250 years of combined industry experience and a Board of Directors and advisory team made up of leading, accredited academics and businessmen well respected globally in their professions.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Plessey Semiconductors is a privately held UK based international company and is a leading expert in the development and manufacture of semiconductor products used in sensing, measurement and controls applications. Plessey's products are found in a wide range of markets including communications, medical, defence, aerospace and automotive. Plessey has a strong heritage in electronics innovation, a proven expertise in advanced design and manufacture of semiconductor products, together with international brand recognition. Plessey has recently brought to market an innovative high sensitivity electric potential sensor (EPIC) with broad applications from electrophysiology like ECG, EMG and EOG, to movement sensing and human machine interfacing. Following the acquisition of Gallium Nitride (GaN) on Silicon technology from the University of Cambridge, Plessey is now developing this technology into a High Bright Light Emitting Diode (HB LED) product for the rapidly growing solid state lighting market, and aims to become one of the first commercial players to successfully manufacture HB LEDs on silicon wafers. To this end Plessey is putting in place a dedicated GaN processing line in its Plymouth facility, which subsequently Plessey intends to expand into the provision of GaN technology for power applications.

PPA ENERGY



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COMPANY OVERVIEW

PPA Energy is one of the UK's leading energy and management consultants. PPA Energy's team comprises a group of highly experienced professionals specialising in technoeconomic and management and innovation consultancy services for the energy sector, with particular emphasis on the power sector, smart energy networks and their operation, control economics and regulation.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Research, Innovation and demonstration of power electronics in distribution and transmission power systems with a strong focus on Smart networks including :

- High-voltage onshore and offshore transmission networks
- Active sensors and Network Visualization for distribution networks
- Active fault level management
- Zefal Network Friendly generation
- Soft open and Zefal hybrid soft close points
- Equalization networks
- DC and Superconducting networks
- Intermittent generation and system balancing,
- Smarter, faster fault management
- Capacity enhancement of existing assets,
- Active loss management

The strength of PPA Energy is our ability to combine strategic, financial/economic and technical advice as an integrated consultancy service to public and private sector clients in the power sector.

Collaboration projects.

We are active participants in structuring and managing a wide variety of collaborative research programmes

in the UK including

EU FP7, TSB Smart, Ofgem: IFI, LNCF, RIIO, TSB KTP etc, EPRSC Flexnet and Hubnet, UHVNet with some 14 Universities and Research Facilities.



PULSE POWER AND MEASUREMENT



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COMPANY OVERVIEW

Pulse Power & Measurement Ltd (known as PPM) is a privately owned business registered in the UK at Companies House, Cardiff. Company Registration No. 2963819 PPM's primary business activity is the design, manufacture, marketing and support of "RF-over-Fibre" technology products.

PPM was founded in 1994 as a distributor of Pulse Power Systems, Power Electronics Components & EMC Test Equipment. PPM moved into design and manufacture in 1995 with the acquisition of Electro Optic Developments RF-over-Fibre business, and has significantly broadened the original product range of Electromagnetically Shielded Fibre optic systems. Today, PPM designs and manufactures a wide range of "RF over Fibre" electronic systems, which allow RF electrical signals to be transmitted over fibre optic cables. This provides signal transmission over long distances, without loss, in addition to signal integrity and security. PPM now has over 16 years of experience in developing and manufacturing a wide range of world-class RF and RF over fibre products.

Market areas for the RF and "RF-over-fibre" product lines include Communications and Broadcast, Industrial OEM's, Military & Government Agencies, National Labs and Research Establishments.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

PPM has focused its business on specific market areas in order to provide better service to our customers.

Communications - PPM's ViaLite range of inter-facility fibre optic links transport RF & Data signals in RF communication systems, satellite ground stations, broadcast facilities, Internet service providers, GPS antenna applications and other communication gateways. The product has been designed for high reliability and provides the user with confidence that the product will be supported over the long lifetimes required in the communications sector.

Test & Instrumentation - The point2point and Sentinel/Sentry fibre optic link ranges provide a means of transporting RF and Digital signals in the presence of intense electromagnetic fields. These products in conjunction with our RF Sensors & Probes serve the needs of the EMC, EMP, Lightning Test and Tempest communities. The point2point product range also brings new capabilities to timing and monitoring applications within the High Energy Physics arena.

Special Projects & Military Systems - PPM employs its core expertise skills of RF & Opto-electronics in the design, development and manufacture of custom systems. These systems vary from modifications and integration of our standard product range to complete custom design and development projects. Applications are diverse, and include both field deployable military and commercial projects. PPM excels at the rapid development and on-time delivery of products designed to meet a customer's specific requirement and is well versed in responding to urgent operational requirements. We provide a specialist service and long term logistic support to our customers which has enabled us to win a number of major contracts and UK MOD orders for equipment such as the company's ultra-wide-dynamic-range analogue fibre-optic-links for remotely located RF Antenna's.

PPM Power - Is a specialist distributor for high power components, design tools and test equipment. Products such as high power IGBT modules and die, thyristors, IGCTs, various technologies for high power resistor, cold plates, and other passive components are available.

PPM Power also offer a range of DC power supplies from 100mW to 250kW for OEM, subsea and test applications. Power Electronics Software and Real Time Electronics digital emulations equipment used in power electronics equipment is a key part of our product offering.

Quality Assurance - Our ISO9000:2008 Quality Management System has been refined for flexibility and efficiency, and to produce a high quality, high reliability and diverse product range. Our applications engineers work closely with customers to understand the system requirements and to specify the correct product for each application.

RAM INNOVATIONS LIMITED



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COMPANY OVERVIEW

Based in Deeside, North Wales (UK), RAM Innovations was established to provide services & products to the semiconductor & electronics industries.

Our purpose built 1000 sq. metre development facility is comprehensively equipped with die & component placement/bonding, metallographic & chemical laboratories, along with sophisticated state-of-the-art manufacturing equipment for laser direct imaging, lamination, sequential build-up embedding, & CNC machining .

Our wet chemistry development area houses our metallisation , metal plating, & chemical milling capability.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Flexible product and/or process development to customers requirements.

RAM Innovations can support your development needs through a range of scenarios, from one off samples, to long term (3 years+) highly structured development programs involving your own specific materials & equipment suppliers. Our core specialities are:-

- Semiconductor package development
- High complexity HDI printed circuits in composite constructions
- Converging technologies (PCB, semiconductor packaging, photovoltaic's, printable electronics, embedded components, optoelectronics)
- Manufacturing solutions
- Multi partner collaborations (customer, materials & equipment manufacturers, academia)

We can give you:-

- Comprehensive reporting of all aspects of development, including blind leads & "dead ends"
- Proof-of-concept samples & test vehicles
- Marketing & engineering samples
- Detailed processing requirements & machine specifications/parameters
- Technology training of your own employees
- Hosting facilities for collaborator meetings

RAYTHEON UK



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COMPANY OVERVIEW

The headquarters for Power and control electronics is based in Glenrothes where we design develop and manufacture advanced power conversion products and electronic control systems.

The Glenrothes facility's design and manufacturing capability included semiconductor fabrication, substrate and microcircuit manufacture, printed circuit board assembly and unit building a complete production resource for high quality electronic subsystems.

The facilities at Glenrothes are geared to supply into the high performance end of the electronic systems market place concentrating on complex mission critical components and subsystems for the aerospace and defence industries.

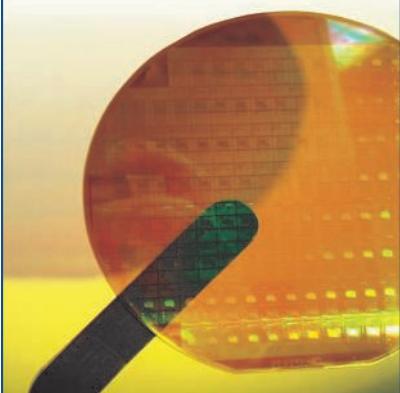
The commercial markets where Power and Control products can be found include transportation (railway ATP and automotive safety) communications, energy management and oil and gas exploration.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Power and control electronic systems from Raytheon include power management and distribution systems, missile guidance and control systems, AC-DC, DC-DC power supplies, motor control systems, power modules, hybrid microcircuits and semiconductors.

The latest addition to our Power and Control portfolio is the development of High Temperature Silicon Carbide (HiTSiC). Our semiconductor division already provides foundry services for semiconductor clients building discrete components in Silicon Carbide (SiC). Raytheon are now active in the development of manufacturing techniques to build complex mixed signal devices in SiC, with the aim of being able to provide custom ASIC devices suitable for operation in harsh environments.

SEMICONDUCTORS



WEAPON SYSTEMS



POWER PRODUCTS & SOLUTIONS



RDVS



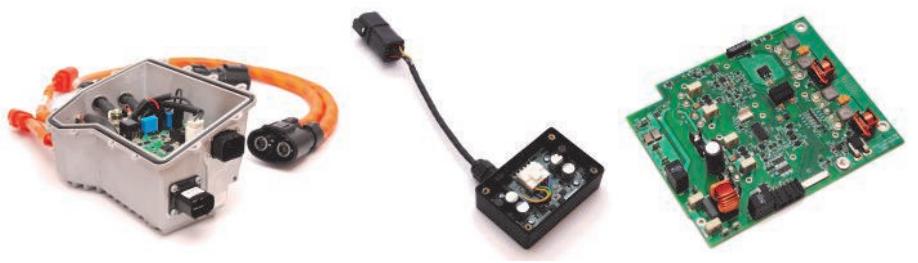
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COMPANY OVERVIEW

RDVS provides services and components, both low and high voltage, for a broad range of vehicles. RDVS Services is a leading provider of electrical and electronic engineering services to OEMs and Tier 1 clients. We work closely with our clients, engineer to engineer, to ensure that the right problem is solved. Our design and engineering services include: Vehicle integration & system design, Testing verification & validation, Electronic component design, Mechanical component design, Embedded software, Prototyping, and Manufacturing. RDVS Components provides innovative electrical and electronic components that optimise the performance of vehicle systems. Built on our proven state-of-the-art technology platforms, our components are configured and customised to meet the requirements of specific architectures. Our components are organised into the following categories, covering many elements of different vehicle systems: Battery Electronics, High Voltage Vehicle Components, Body Electronics, Low Voltage Transmission Components, Off Board Systems, and Testing Products. As part of our High Voltage vehicle components, we have experience in designing: Coil Economisers, Isolation Monitors, Pre-charge Control Modules, DC/DC Converters, Power Distribution Units, Heating, Ventilation and Air Conditioning (HVAC) Controls, Contractor Controls, Voltage Sensors, and Current Sensors.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

- Vehicle integration & system design
- Testing verification & validation
- Electronic component design
- Mechanical component design
- Embedded software
- Prototyping
- Manufacturing



Power Distribution Unit

A Coil Economiser

An HV PCB

RDVS was established in 2004 to provide electrical and electronic design consultancy and prototyping services to all aspects of the automotive sector. Using our many years of experience in the industry, the company provides support for manufacturers at every stage of the product design and development process, from pre-study to product launch. We deliver innovative whole system solutions offering world class quality and value, and have successfully integrated our designs into several OEM electric vehicles. RDVS is also a leading supplier of components for electric, hybrid and fuel cell vehicles, providing high voltage power distribution units, CAN interfaces / gateways and high voltage controllers for several OEM projects. The components we specialise in range from those with standard specifications to bespoke electronic component design including manufacturing services. The company has successfully delivered consultancy projects varying in scope from military vehicle, niche sports car and race car electrical system designs to the design and supply of complete high and low voltage systems for electric cars. We are practical problem solvers with a track record of success, recognised by the industry, having supplied services and components to vehicle, battery and fuel cell manufacturers.

RICARDO UK LIMITED



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COMPANY OVERVIEW

Ricardo is a global, world-class, multi-industry consultancy for engineering, technology, project innovation and strategy. Through our advanced and well-equipped technical facilities in Europe, North America and Asia we serve a wide and balanced customer base including the market-leading brands across a range of industrial sectors, as well as government agencies and national and international regulatory authorities. We employ over 1600 professional engineers, consultants and staff.

Since Ricardo was founded nearly a century ago, the company has been renowned for its track record of highly successful research-led product innovation and development expertise. With our internally funded research activity and proven ability to attract the best of international scientific and engineering talent, Ricardo has been able to maintain its technical edge, which has provided us – and our customers – with crucial first mover advantage in highly competitive markets.

Ricardo's deep technical knowledge and wide experience is particularly apparent in the transportation sectors that we serve, which range from passenger cars and motorcycles, to commercial, agricultural and off-highway vehicles, railway locomotive power and marine propulsion systems. Key areas of expertise include low-carbon gasoline, diesel, hybrid and fuel cell powertrain technologies; the latest driveline and transmission systems; control electronics and software development; vehicle systems integration, and the engineering of the latest concepts in wind energy and tidal power systems.

Guided by our corporate values of respect, integrity, creativity & innovation and passion, we enable our customers to achieve sustainable growth and commercial success.

Creativity in collaborative working is in the Ricardo DNA; it is no coincidence that time and again, big name clients across multiple industries return to Ricardo for successful project delivery, and record their appreciation of the seamless way that Ricardo people integrate into project teams.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Hybrid and electric vehicle product development for all markets and applications:

- Design and development of electrical & electronic components including vehicle control units, electrical machines, power converters, high voltage harnesses and full vehicle, system and component EMC development
- Strategic studies related to legislation, business drivers and technology including lifecycle cost, total cost of ownership and strategic procurement, and concept demonstration of advanced technologies
- Complete systems design, integration, vehicle build and productionization of parallel, power-split and series configurations as well as all-electric solutions
- Architecture definition and comprehensive vehicle modelling, system specification & design, safety analysis and implementation of safety critical control systems, and control algorithm development to achieve sophisticated functionality and fuel economy objectives
- Hybrid & Electric driveline and transmission design, development and prototype manufacture
- Engine design, calibration and optimisation for hybrid applications
- Components and systems development and integration, testing and validation
- Vehicle level integration and optimization, homologation and industrialisation support
- Battery pack and charging station design, engineering, development and testing, including rapid prototype battery management systems
- Robust programme management and bespoke development and validation processes
- Flexible and collaborative approach, delivering high value, high quality solutions to time and within budget, while meeting customer expectations for training and technology transfer

RIELLO UPS LIMITED



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COMPANY OVERVIEW

Riello UPS Ltd is the UK subsidiary of Riello UPS S.p.A, Europe's leading manufacturer of uninterruptible power supplies and standby power systems from 400VA to 6MVA. The company is part of the Riello Elettronica Group, with subsidiary businesses and support offices worldwide. The UK subsidiary of Riello UPS RPS (S.p.A) was formally known as Riello Galatrek Ltd; the name was changed in January 2006 to reflect the growth of the Riello UPS brand within the European market place and the strategic success of Riello UPS RPS (S.p.A). Centrally located within easy access of the UK's major transport routes in Wrexham, North Wales, Riello UPS Ltd operates from one of the largest industrial estates in Europe. In March 2009, Riello UPS Ltd moved into newer premises of 27,500 Sq ft in order to accommodate the continuing expansion of the business and develop state of the art training facilities. The company operates certified management systems including ISO 9001 Quality, ISO 14001 Environment, OHSAS 18001 Health and Safety and is SAFEContractor Certified.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Riello UPS Ltd is the UK subsidiary of Riello UPS S.p.A, Europe's leading manufacturer of uninterruptible power supplies and standby power systems from 400VA to 6MVA. The company is part of the Riello Elettronica Group, with subsidiary businesses and support offices worldwide. The Riello UPS brand stands for reliability, innovation and customer service; winning numerous awards that recognise commitments to Product Line Leadership and Customer Value Enhancement. In 2007, Riello UPS were proud to become official sponsor to the Ducati Corse MotoGP team. Thanks to its focus on customer service, investments and experience, Riello UPS has become a market leader in Europe and one of the World's top five UPS manufacturers. The Riello UPS product range includes solutions for powering the smallest desktop PCs or the latest super computers used within the most advanced data centre operations. Riello UPS power solutions can be found within banks, hospitals, airports and almost anywhere a continuous electrical supply is critical. Recent high profile customers have included OpenHosting, Advantage Interactive, Cable & Wireless, the University of Edinburgh Super Computer, Grattan Logistics and a variety of Public Sector agencies, to name but a few. By adopting a consultative approach and 'service' ethic, Riello UPS Ltd enable our customers to achieve the ultimate in power protection for their business. We combine cutting-edge technology with our comprehensive and un-equalled range of service options to offer real value. From electrical installation and commissioning, to on-going maintenance and product training, we cover all the bases to achieve cost-effective power continuity solutions that take our customers from where they are today, to where they want to be in the future. For further information about Riello UPS Ltd, products and services, please visit our main website www.riello-ups.co.uk or our publicity centre www.riello-upspr.co.uk.



ROCKWELL AUTOMATION LIMITED

Rockwell Automation

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COMPANY OVERVIEW

Rockwell Automation Ltd is part of a global organisation with a turnover of \$5 billion, headquartered in Milwaukee, USA. The UK operation has a sales force of over 100 professional Account Managers, Application Engineers and Technical Specialists. Additional customer support is provided by product and industry experts, a training centre delivering tailored courses to our customers and partners plus a 24 hour technical support team. Rockwell Automation provides an extensive portfolio of control and power electronic products and services. The product offerings include, LV control equipment, Variable Speed Drives, Medium Voltage Drives, Programmable Controllers, SCADA and MES. With a focus on sustainability and life-time costs, Rockwell Automation provides a range of added value services that include Asset Management, Condition Monitoring and on-site support services. Coupled with this, Rockwell Automation has a system engineering capability combined with extensive domain experience of the manufacturing sector. In particular Rockwell Automation has dedicated resources assigned to Rail, Water and Energy industries within the UK market. Our UK headquarters, based in Milton Keynes, houses one of the most advanced customer demonstration facilities in the country - the Solutions Centre and Business Solutions Suite. Here visitors can see the latest Allen-Bradley and Rockwell Software products in simulated industrial situations. Also within the facility is a demonstration of totally integrated applications that can be tailored to a range of industries or processes.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Rockwell Automation Ltd provides specialist capabilities in power electronics and systems. The SMC range of electronic soft starters provide controlled current and torque during the starting period of typical industrial electric motors. Ranging in powers from 0.4kW through to 8MW in voltages up to and including 15kV, the SMC is one of the most comprehensive ranges of soft starters available. PowerFlex variable speed drives are available from 0.2kW through to 24MW in all popular voltages (according to rating) from 110V through to 6,600V. Several ranges of drives are available depending upon the required level of functionality and a key feature is the easy integration into networked systems. Our systems engineering division is able to provide full solutions capability for power electronic applications by providing simple or complex systems for either integration with existing controls or if required full turnkey operation.



ROLLS-ROYCE PLC



Rolls-Royce

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COMPANY OVERVIEW

As a world-leading provider of power systems and services for use on land, at sea and in the air, we have established a strong position in global markets - civil aerospace, defence aerospace, marine and energy and nuclear. In 2011, we performed well in difficult market conditions and continued to invest for future growth, including £908 million in R&D. We have an £62.2bn order book, underlying revenue has grown to £11.3 billion and underlying profit has increased 21 per cent to £1.2 billion. This success is due to the extraordinary team of over 40,000 people that work for Rolls-Royce around the world. Our business operates in four global market sectors: Civil Aerospace – The civil aerospace business is a major manufacturer of aero engines for all sectors of the airliner and corporate jet market. We power more than 30 types of commercial aircraft and over 13,000 engines are in service with customers around the world. Defence Aerospace – We are the world's second largest provider of defence aero-engine products and services with 160 customers in over 100 countries. Our engines power aircraft in all sectors: transport, combat, reconnaissance, training, helicopters, and unmanned aerial vehicles. Marine – Rolls-Royce has a world-leading range of capabilities in the marine market, encompassing vessel design, the integration of complex systems and the supply and support of power and propulsion equipment. We are leaders in mission-critical systems for offshore oil and gas, merchant and naval vessels. Our marine business serves more than 4,000 customers and has equipment installed on over 30,000 vessels, including those of 70 navies. Energy – Our energy business supplies customers with gas turbines, compressors, reciprocating engines, and related services to support the efficient production of oil and gas, and power generation around the world. We are establishing a strong position in the civil nuclear sector for the provision of mission-critical equipment, systems and engineering services.



PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Rolls-Royce is recognised as a high value business being a world leader in power systems; these operate within a wide range of sectors and applications. The focus of the electrical divisions within Rolls-Royce is to provide systems which complement this core business in all the sectors. The electrical capability of the UK is around the design and integration of novel electrical systems. Within aerospace Rolls-Royce provide systems integration and development for both defence and civil applications from the watt range to the hundreds of kilowatt range. In the marine sector Rolls-Royce provides the integration of large electrical systems up the MVA range for various applications such as lifting equipment through to variable speed propulsion systems for large vessels.



SCHNEIDER ELECTRIC UK



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COMPANY OVERVIEW

As a global specialist in energy management with operations in more than 100 countries, Schneider Electric offers integrated solutions across multiple market segments, including leadership positions in Utilities & Infrastructures, Industries & Machine Manufacturers, Non-residential Buildings, Data Centres & Networks and in Residential.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Schneider Electric has unique positions to provide you with innovative integrated solutions making energy safer, more reliable, more efficient and more productive. Combining leading edge new businesses- building automation and security, installation systems and control, power monitoring and control, critical power and cooling services- to our historical strengths of power and control, we provide you with comprehensive unique answers for residential, building, energy and infrastructure and data and networks markets.

We have developed a unique worldwide capability to provide these solutions and transform the way people power & control their environment. Our solutions help customers reduce costs, stay connected at all times and tap into an ultra pure, secure and uninterrupted power supply.

Automation & control

Variable speed drives, soft starters Programmable automation controller, safety controllers, HMI, Control & signalling devices, sensors, enclosures, contactor & control relays.

Electric distribution

Control & command, Consumer unit, Din style enclosures, Industrial plugs and sockets, EV link charging solution, Industrial cable management, Low voltage equipments, Low voltage protection, Low voltage switchboards, Low voltage switchgear and Feeders pillars, Metering and monitoring, OEM low voltage protection, Power factor correction.

MV distribution and Energy Automation

Medium voltage components, Medium voltage equipments and systems, Medium voltage Prefabricated substations, Medium voltage network control& supervision, Medium voltage protection relays, MV secondary distribution products.

Installation systems & control

Cable management systems, Installation materials, Lighting Control & automation, Voice data image and Wiring accessories.

Building Management

Intelligent building management, energy services, Security, Lighting control, Maintenance services.

Critical Power and cooling services

Smart UPS and cooling solutions for home/home office, small/medium business and large corporations.

SEMEFAB



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COMPANY OVERVIEW

Founded in 1986, Semefab is a silicon wafer foundry manufacturing power devices, integrated circuits and Micro Electro-Mechanical Systems (MEMS) based in Glenrothes, Scotland. In addition to its fabrication capability, Semefab operates its own test floor supporting both wafer level test and package test. As well as producing a wide range of Power Electronics devices, Semefab supports a process portfolio including MEMS, CMOS, Bipolar, Opto-CMOS, and small signal discrete technologies. Semefab supplies processed wafers, probed die and packaged devices to the market. As a global foundry, Semefab exports >75% of its fabricated product and ships more than 200 million die per year.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Semefab operates 3 wafer fabs manufacturing both 150mm and 100mm wafers for its own range of products and for a wide range of customer specific products with feature sizes down to 0.8um. Installed capacity is for 50K 100mm wafers plus 50K 150mm wafers per annum. The facility is fully ISO9001 and ISO14001 accredited.

In terms of Power Electronics Semefab's expertise lies in the areas of:

- Power Bipolar Transistors in the range of 100-1200V and 1-50A.
- Fast Recovery Diodes in the range 300-1200V and 10-100A with Tr_r in the range of 35ns.
- Power Mosfets both Lateral and Vertical and IGBT up to 3.3KeV.
- RF Mosfets.

Semefab also fabricates precision analogue ICs, JFET transistors, photo diodes, mixed signal ASICs and a range of MEMS devices such as pressure sensors, gas sensors, flow sensors and liquid viscosity sensors.

Semefab's team are experts at inducting existing customer's process flows and subsequent optimisation within their equipment set. Equally, the team is very experienced in conducting full process development.

Semefab is an experienced and established foundry accustomed to developing, optimising and inducting customer specific solutions in a cost effective manner.

SEVCON



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COMPANY OVERVIEW

Sevcon manufactures high quality motor controllers and system components which impact on the way people travel, work and live. We offer a diverse range of products on electrically powered vehicles from fork lift trucks to high performance sports cars, which are constructed to perform reliably in the most severe conditions. Priding ourselves on our products with a dedication to design and development, we are constantly evolving to meet the needs of our customers and partners. Sevcon operates worldwide from our headquarters in Gateshead, UK, and from subsidiaries in France, Japan, Korea, and the USA.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

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SGA TECHNOLOGIES LIMITED



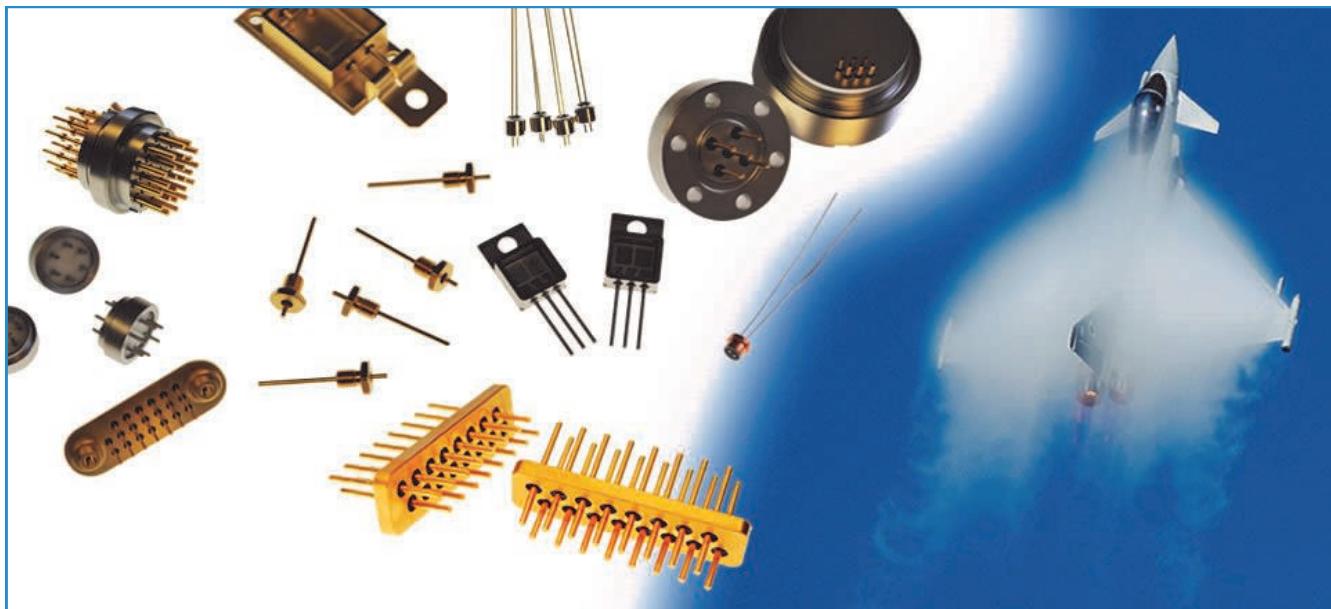
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COMPANY OVERVIEW

SGA Technologies Ltd have been designing and manufacturing high quality hermetic components and offering specialist plating services since 1969. In March 2004 SGA Technologies Ltd acquired the glass to metal sealing business of Wesley Coe formerly based in Cambridge. In April 2006 SGA Technologies Ltd acquired Micrometics Ltd a Haverhill based business which produced high quality hermetic products, which included high specification connectors and bulkhead seals. The two acquisitions have consolidated SGA Technologies position as a dominant force within the UK for glass to metal seals and hermetic products. The company is a privately owned business with Chris Brown taking over the role of Managing Director in May 2007 after a management buyout. The growth has been funded principally by the company policy of retaining profits, and by a programme of continuous investment in people and equipment. The company currently operates across 3 sites and employees over 70 staff. Since 1988, the Company has held the ISO 9001 certification, which confirms that our quality management system meets internationally recognised standards. "Our commitment is to use our design and engineering skills to create components that perform better, last longer and reduce costs for

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Single & multi pin feedthrough's, hermetic packaging, ignitor seals, optoelectronic components, RF seals & packages, high pressure seals, other value add processes and specialist plating services.



SHARP LABORATORIES OF EUROPE



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COMPANY OVERVIEW

Sharp Laboratories of Europe was founded to contribute new ideas and technology to Sharp products and to support our major European customers. We are a UK company, wholly owned by Sharp of Japan. Our funding to do research and development comes from Sharp and in return we provide technology that can be used in Sharp products. So far our technology has gone into mobile phones, smart cards, personal computers, laptops and displays for cars. We are now expanding our R&D activities into Energy, Health, Lighting, Solar and power electronics.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Sharp laboratories has a broad range of expertise from electronics, displays, lighting, energy, displays and health.

SIEMENS



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COMPANY OVERVIEW

The Drive Technologies division of Siemens is the world's leader in products, end-to-end systems, applications and services for the entire drive train. With high-performance controllers, drives and simulation software, we help customers in a wide range of industries including renewable power generation, automotive and aerospace, improve their productivity, flexibility and efficiency in the UK. We also supply end-to-end solutions for electric and mechanical drive applications and large gears for raw material extraction and processing, for renewable energy production or for ships and trains.

We continuously enhance our portfolio, aiming to provide intelligent solutions for boosting energy efficiency. With regenerative inverters and energy-saving motors, together with sophisticated energy management systems, we help our customers significantly reduce their energy consumption, also contributing to the protection of our environment.

Our award winning manufacturing facility in Congleton, Cheshire, designs, manufactures and delivers energy efficient inverters to customers in the UK and around the world for use in a variety of applications. Our state of the art mechanical drives assembly and service centre in Leeds has an enviable reputation and supplies customers both in the UK and abroad.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

As a leading supplier for the entire powertrain, Siemens Drive Technologies has an enviable portfolio of high quality products and systems, integrated applications and industry expertise, all supported by an end to end service offering. This integrated portfolio is designed to improve productivity and energy efficiency to enable our customers to stay ahead of the game.

With our drives range, Siemens offers the ideal basis for innovative and future-proof solutions: a comprehensive system family that covers all output and performance classes.

Our high efficiency motors with a wide variety of performance classes and designs will meet motor requirements from 0.06 kW to 100 MW.

The technology is supported by design, commissioning and engineering software tools, including an energy savings calculator.

SILVACO EUROPE LIMITED



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COMPANY OVERVIEW

Silvaco is a leading provider of TCAD, circuit simulation, and IC CAD software tools. Silvaco's tools are used by fabs for developing semiconductor processes, and design houses for developing analog, mixed-signal, and RF integrated circuits. The company provides a complete PDK-based design flow with interfaces to third-party design platforms. Silvaco has a worldwide presence with local offices in all key industrial regions in the world. Europe, Middle East and Africa operations are headquartered in Cambridgeshire.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Silvaco offers a complete integrated design flow for Silicon, Gallium Nitride (GaN) and Silicon Carbide (SiC) power devices. TCAD tools are used to explore structural variations, optimizing designs through process and device simulation. SPICE model parameters for compact models can be extracted from measurements or TCAD-simulated data and used in circuit simulation. Silvaco's enabling technologies for wide bandgap semiconductors include extended precision numerics, 2D/3D process/device simulation, and new compact models for power devices.

SUPPLY DESIGN LIMITED

SUPPLYDESIGN

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COMPANY OVERVIEW

Supply Design specialises in high-efficiency, high-reliability power supplies and battery chargers. Established in 2001, we have a reputation for delivering high quality power solutions for our customers and partners.

World-leading Efficiency

Supply Design has produced the first single-stage, three-phase to DC power electronics topology with power factor correction (PFC) and galvanic isolation. The converter cuts power losses by up to 60%, creating a ground breaking new standard for DC power conversion.

The elegant low component count design can be tailored to reduce weight, size and cost and/or increase reliability. The design has been proven with a multi-national A&D partner and has won Shell Springboard and SMART awards for the technology's energy saving potential.

Call us. Supply Design is actively looking for strategic partners to take advantage of commercial opportunities and to create market leading products.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Our new Harmony Power range of three-phase converters starts with a 1.5kW 28VDC PSU which boasts an efficiency of 94% and power factor of 0.99 in a compact enclosure. We are currently developing a modular system based on 5kW blocks that will be scalable to 60kW. This solution is suitable for power supply, front-end, rectifier, UPS and battery chargers applications in Aerospace, Defence, High-end Industrial, Telecoms, DC Data centres and Electric Vehicle Charger markets.

Modular System Specifications – for release in 2013:

Efficiency:	48VDC variant >96%
	400VDC variant > 97%
Power Factor:	> 0.99 from 25% to 100% load
Power output:	5kW per module, parallelable to 60kW
High power density:	15kW per 1u 19in chassis
AC Frequency:	45 to 440Hz
THD:	< 3%
Holdup:	> 20ms
Phase load balance:	<0.1%
Galvanic isolation	
Programmable output voltage and current	



Our team will be delighted to discuss your detailed requirements. Custom configurations, including multiple output solutions, available on request.

TEXAS INSTRUMENTS UK LIMITED



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COMPANY OVERVIEW

TI UK Ltd comprises of both a fab and design centre. The fab focusses on the production of high power devices for the automotive and industrial markets. The design centre comprises 3 different teams : Power Management focusing on integrated power solutions , Audio focussing on high performance audio products and High speed signal path focussing on high speed convertor products.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Product portfolio include the following : For power management : Standard power management devices (linear and switching) through to highly integrated power management devices for mobile applications. For audio : highly integrated audio codes for mobile applications. For high speed signal path : GBPS ADC convertor products.

TMD TECHNOLOGIES LIMITED

TMD

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COMPANY OVERVIEW



TMD Technologies Limited (TMD) is among the world's leading manufacturers of microwave amplifiers, tubes, high voltage power supplies, and transmitters for Radar, EW, Communications, EMC RF testing, and other applications.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Microwave power amplifiers, transmitters and travelling wave tubes (TWTs). Air traffic control transmitters and complete radar system upgrades. Travelling wave tubes (TWTs). Specialist high voltage power supplies.



TRW CONEKT

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powered by **TRW**

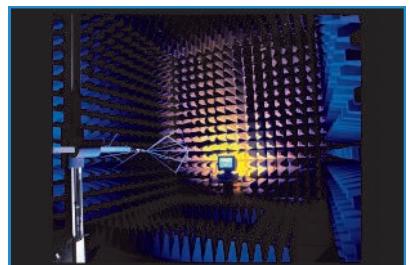
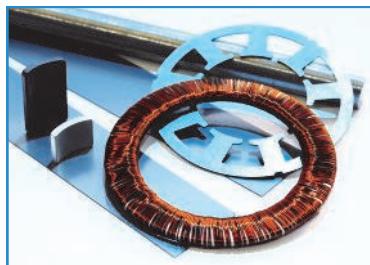
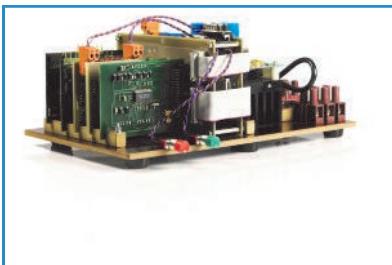
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COMPANY OVERVIEW

TRW Conekt is a consultancy and engineering test services business that generates new ideas and applies science and technology to product development, manufacture and validation. With an established engineering heritage, the range of services offered by Conekt enables us to support our clients through a knowledge-led approach to technology innovation and product development. By combining the skills of our specialist engineers with our in-house UKAS accredited test facility, Conekt is uniquely positioned to offer a complete engineering service from concept design and development through prototype and validation testing to low volume manufacture and systems integration. Conekt's experienced engineering teams work closely with our clients to define project requirements, taking account of the skills and knowledge of both partners, whether for a part of or the entire product development pipeline. By working across a range of industries, including aerospace, automotive, defence, energy and healthcare, Conekt is able to provide solutions to a diverse range of engineering problems.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Conekt is able to optimise the design and power electronic control of low-cost, high performance electromagnetic devices using our world class simulation tool set. This includes 2 and 3 dimensional finite element based electro-magnetic simulation (including long-stroke and rotational motion, drive circuits, external forces, eddy-currents, non-linear material properties) and system-level simulation. By combining expertise in magnetic design, magnetic materials, electronics, control and sensing, we are able to meet the most challenging customer requirements. Conekt is also a centre of expertise for the characterisation, selection, specification and quality control of magnetic materials used in passive components, transformers and electromagnetic devices. Conekt's expertise in new product development and applications engineering is supported by our state-of-the-art product validation facilities in Solihull, UK. With external ISO 17025 accreditations by UKAS (accredited testing laboratory No. 0332,) our experienced test equipment design engineers are available to support UKAS and non-UKAS testing on or offsite. Services offered by Conekt include: Electro-magnetic simulation, analysis and optimisation of motors, generators, actuators, inductors and transformers; Power electronics and control system development; Prototype electromechanical system build and test; Design innovation to solve demanding actuation and sensing challenges; Measurement of magnetic properties; Selection and specification of magnetic materials; Materials and mechanical testing; Failure investigation and reliability analysis; Environmental - climatics and vibration testing; EMC testing; Instrumentation, test rig design and manufacture; Prototype design and manufacture.



TURBO POWER SYSTEMS LIMITED



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COMPANY OVERVIEW

Turbo Power Systems is a company that designs and manufactures high performance electric motors and generators, drives and power electronics. Structured into two divisions, Electrical Machines and Power Electronics, our design and manufacturing plants are based near Heathrow, London and Gateshead, North East England respectively. With our origins going back over 40 years we have highly talented and experienced staff throughout all of the disciplines required in a customised, advanced technology business such as ours. Listed on the London and Toronto stock exchanges, we are a company which is commercially and technically continually striving to deliver market leading solutions that exceed our customer's expectations. Both of our facilities are accredited to ISO9001 Quality Assurance and have significant investment relating to quality control. The Gateshead site also has AS9100 aerospace accreditation. Our Power Electronics division is experienced in the management and delivery of customised power electronic projects from development concept stage to in service product support.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Turbo Power Systems innovative electrical machines and power electronics utilise our patented technologies and highly-qualified engineers to provide custom solutions for the Energy, industrial, Transport and Defence markets. The Electrical Machines division designs and manufactures high performance permanent magnet motors and generators operating in the range 10,000 to 70,000rpm, up to 1.2MW, offering custom designed, high efficiency products in areas such as: high speed motors for air and gas compression; submersible motors for the oil and gas industry; integrated generators for distributed generation, energy recovery and power delivery systems and providing tailored solutions to meet the most challenging requirements. Due to the high electrical frequencies resulting from operation at high speeds, most applications require the use of an inverter to allow the machine to be connected to the supply or the load. These inverters and drives are designed and manufactured by the Power Electronics Division and are ideally matched to the characteristics of the machine. This approach ensures that the customer can rely on a single supplier to provide a truly optimised solution with maximum functionality, reliability and efficiency at the lowest cost (very close matching between the electric machine and the electronics design are critical to the success of a high speed application). The Power Electronics division also specialises in the design and manufacture of a wide range of power electronics products from 3kW up to several MW's and for many different applications in our chosen markets including: grid connect and islanded inverters for solar, tidal, wave and wind power applications; variable frequency drives for industrial and aerospace applications; specialist high voltage power supplies; power converters for distributed generation systems; rugged power converters for the rail industry including systems supplied from the third rail (3-phase inverter, single-phase utility, low voltage power supplies and battery chargers, bulk regulated DC -DC supplies), at seat single phase supply from battery inputs, alternator supplied battery chargers and LVPS systems, and DC motor choppers.



ULTRA ELECTRONICS LIMITED - PMES

Ultra
ELECTRONICS

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COMPANY OVERVIEW

Ultra Electronics PMES is an operating business of Ultra Electronics Limited, an internationally successful defence, security, transport and energy company with a long, consistent track record of development and growth.

PMES provides innovative, high-technology power conversion and control solutions, underwater measurement ranges and high integrity sensors for a variety of defence applications.

PMES is considered a leader in their fields of expertise and has a world wide customer base. Like many successful businesses, PMES has evolved over recent years to meet the differing needs of its markets and customers for not only existing product ranges but also new and innovative products and services.

This evolution has positioned PMES to further exploit its strategic growth potential predicted within its markets. To this end PMES moved to the purpose built new facility in Rugeley, Staffordshire in February 2009.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Products supplied by PMES include a range of inverters and converters, solid-state frequency converters, variable speed drives, transformer rectifiers, transformers and bespoke power supplies as well as specialist control consoles.

PMES also offers a range of power-dense motors and motor drives which use commercially available components while delivering military levels of performance; applications include hybrid electric propulsion and gas turbine electric start systems.

PMES also supplies aircraft ground service systems which provide the electrical power necessary to support aircraft while they are on-board ships.

PMES's capabilities cover the definition, design, integration, simulation, modelling and analysis of electrical power systems.

Alongside our significant design and manufacture capability we also have extensive experience and expertise in the relevant disciplines of Project and Risk Management, Requirements Management, Safety Management, Sub-Contract Management and Through Life Support Management throughout the whole CADMID lifecycle.

PMES offer systems and sub-systems which provide value for money at initial acquisition and offer significantly reduced through life costs compared to the alternatives



VACON DRIVES UK LIMITED



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COMPANY OVERVIEW

Founded in 1993, Vacon has R&D and production units in Finland, the USA, China and Italy, and sales offices in 27 countries. In 2011 Vacon had revenues of EUR 380 million and globally employed 1500 people. The shares of Vacon Plc (VAC1V) are quoted on the main list of the Helsinki stock exchange. Vacon Drives UK Limited was formed on 1 June 1999 and was started by 4 dedicated and driven people of whom 3 were previously working within the UK AC drives industry. They had over 50 years of experience in drives sales and engineering. Since those early days the company and its business has continued to flourish to today being one of the top AC drive suppliers with a strong pedigree of global brand and OEMs in its customer portfolios. The company's slogan 'Driven by Drives' and the Vacon brand form the basis of everything Vacon believe and interpret into the business. Vacon believe that customer support and service care is paramount to good customer relations. Vacon operate a genuine 24/7 support role and any customer can call Vacon Drives UK on its main telephone number and speak with a technical support engineer at any time. Since its formation, Vacon Drives UK has been based at Hinckley, Leicestershire, which provides excellent logistical coverage across the UK and Ireland. The premises in Hinckley carry extensive stock of new and service exchange units along with spare parts. There is an on-site fully equipped workshop for repair and load testing of drives, plus an application product display area. In addition there are facilities for customer training and conferences. Vacon openly encourage potential and existing customers to visit, join in and feel the Vacon spirit that has enabled the company to grow where it is today and which will continue to drive it forward into the future! E-mail sales@vacon.co.uk

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

Every ac motor deserves a vacon drive! Vacon is driven by a passion to design, manufacture and sell only the best AC drives on the planet. AC drives can be used to control electric motors or to help generate power from renewable sources. Vacon currently manufactures AC drives in Finland, China, Italy and the United States. Adapting products as close as possible to the customer gives flexible production and short delivery times. Vacon AC drives are sold in more than 100 countries. We have subsidiaries, business partners and service centers around the world. We increase our local presence systematically, ensuring good availability of products and service wherever you are.



WAREWORKS LIMITED



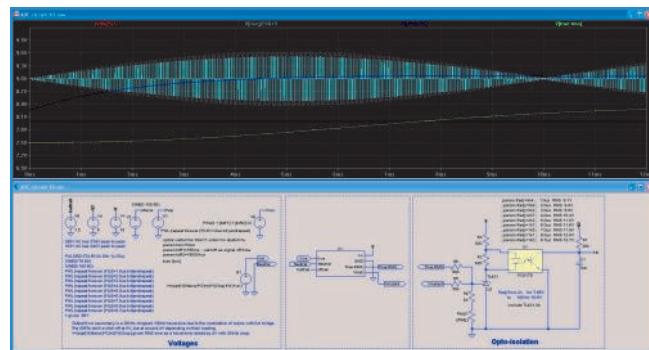
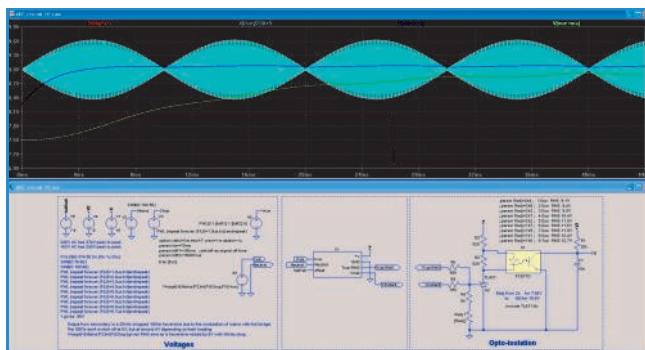
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COMPANY OVERVIEW

WareWorks Ltd are UK electronic design consultants based centrally in Manchester. * Electronic Design (hardware, firmware & software). * Turnkey Solutions (concept to manufacture). * Technical Services (approvals, reports, presentations, training, etc). WareWork's service ranges from advice on any aspects of the design process right through to turnkey solutions from initial concept through to finished product, including managing manufacture & distribution if required. We can work independently or with in-house design teams and/or other sub-contractors as appropriate. Our driving principle is that whether commercial or not-for-profit, all products must deliver Return On Investment (ROI), be it financial or otherwise. Understanding & specifying your requirements is normally free of charge.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

We are highly experienced in SMPS design, including offline. Ranging from W to kW & including specialist applications. All major topologies, MOSFETs, IGBTs, transformer design, natural & forced cooling, heat transfer, etc. Please contact us to discuss your application without obligation (we are always happy to undertake a binding non-disclosure agreement). With a combined career length spanning over 70 years our engineers have design experience across the board. We have worked on designs ranging from very low added value items with sales measured in millions right through to products where high demand is one a month with a price tag to match.



Simulation of an innovative switched-mode industrial welder currently under development at Wareworks Limited

X-FAB SEMICONDUCTOR FOUNDRIES AG



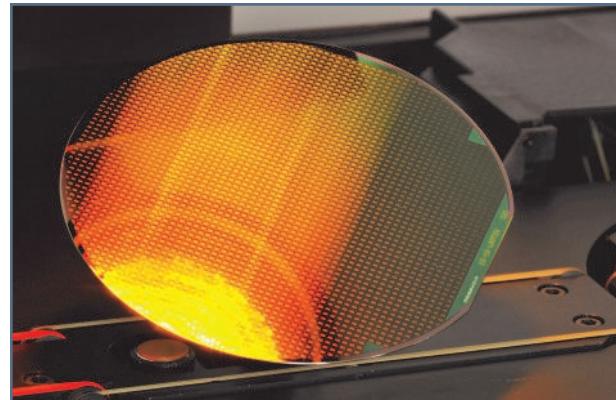
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COMPANY OVERVIEW

X-FAB Semiconductor Foundries AG, the analog/mixed-signal foundry group manufacturing silicon wafers for analog-digital integrated circuits, has a branch office in Plymouth. From there, a small team of engineers work within the global X-FAB organisation. The team consists of process development engineers, technical hotline engineers and sales managers. It is responsible for various development projects within the X-FAB group and covers process characterisation and technical consultancy tasks.

PRIMARY PRODUCT(S), SERVICE(S) OR SPECIALITIES OF THE UK OPERATIONS

The X-FAB UK team has a strong focus on R&D and technical support functions within the X-FAB group. It supports development projects covering high-voltage and optical capabilities, non-volatile memories and MEMS (micro-electro mechanical systems).

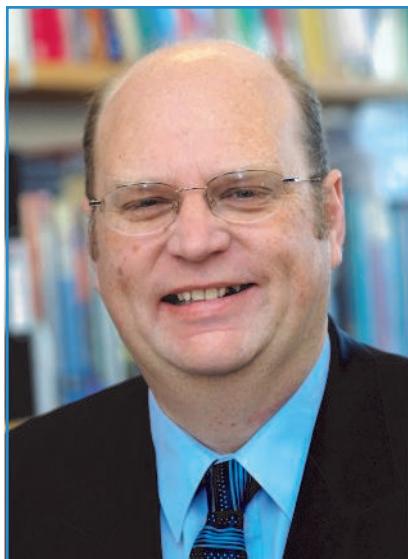


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UK University Sector

Phil Mawby - University Of Warwick



Power Electronics has strong representation in the UK academic community with world class research and teaching in this important discipline. The expertise among the academic community spans the whole spectrum of power applications, from lowest power energy savaging to the very highest power applications such as HVDC. It also covers the complete supply chain from power semiconductor devices and materials through to complete systems, and everything in-between. This community has strong links with industry, having collaborations with most of the important companies in the area in the UK, providing cutting-edge research to ensure UK industry remains at the leading edge and competitive internationally.

Semiconductor devices are the building blocks which allow many modern applications to exist, as well as making new applications a reality. These are exciting times, as wide-bandgap materials are offering the potential to transform the performance of many energy-processing applications. In the UK there are a number of universities with well recognised expertise in

the development of power semiconductor devices. Cambridge University is internationally recognised in many aspects of device design, particularly IGBT, Superjunction and power integrated circuit technologies, and has seen a number of successful spinout companies as a result. Cambridge semiconductors are a prime example of a company created from expertise rooted in strong academic research. Sheffield University has developed some unique device concepts, namely the Clustered IGBT (CIGBT) and is now pioneering concepts in the developing area of gallium nitride (GaN) HEMT devices. Warwick University is a leader in Silicon Carbide (SiC) device research, as well as device modelling and has recently created a spin-out company to exploit SiC devices (Anvil Semiconductors).

UK universities also have a world-class research in the area of component integration. This area is particularly relevant to industry as it can deliver significant system benefits. Several of the leading Universities have substantial experience in this area, including Nottingham, Warwick where new packaging solutions for hostile environments are being developed. This is complimented with a world-class modelling of the associated underpinning physical processes associated with package wear-out, for example at Newcastle and Greenwich. The modelling of electro-thermal processes based on different mission profiles is also of great importance, and ground-breaking area looking at efficient numerical approaches to this problem are being developed. Passive component design for highly integrated designs is another key area where Bristol, Manchester and Newcastle are making an impact.

Power electronics applications are too numerous to mention here but UK universities have an impressively strong portfolio of activities that cover all power ranges and industries. The UK academic sector provides key underpinning research and indeed boasts some of the largest university research groups in this area, for example Nottingham is probably the largest group in Europe focussed exclusively on power electronics, machines and drives. Other notable groups exist at Newcastle, Manchester, Strathclyde, Bristol, Sheffield and Imperial. All of which have strong ties with UK and overseas leading companies. In summary the UK has strength and academic strength and is helping to support a rapidly growing industrial base, which can compete on a world stage.

ASTON UNIVERSITY



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INTRODUCTION

The Power Engineering and Power Electronics Group at Aston University carries out power electronics research with an emphasis on applications in power networks. The group was established in 2011 and currently consists of 4 academic staff, 1 research fellow, 2 academic visitors and 5 PhD students and will be recruiting a new Lecturer/Senior Lecturer in power electronics in 2013; secured grant income over this period is approximately £1.1M. The group has extensive links to industry and undertakes undergraduate teaching (primarily foundation degree) to major Power Utility companies.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Our current/recent projects are primarily focused on the application of power electronics for grid and auto applications with an emphasis on prototyping and testing. The projects range from LV to HV applications and include multilevel converters. The group deals with all aspects of modelling, topology, design, manufacture, control and protection. Current projects (with industrial sponsorship) include:

- AC/AC Power electronic converter for smart grid low voltage (LV) networks, utilising SiC MOSFETs and BJTs
- Inverter connected automotive, second-life battery interface for network grid support
- Multi-level power converters for High Voltage DC (HVDC) applications
- Power systems grid intervention techniques including energy storage components with active filtering
- Power Electronics for active frequency response using DSM at LV .

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Equipment in our bespoke research laboratory includes LeCroy high-speed DSOs with differential voltage and current probes, the latest Agilent E5061B Network Analyser, various programmable Arbitrary function generators, DC power supplies and electronic loads, DSpace and OPAL-RT rapid-prototyping stations, surface-mount fabrication/rework and FPGA/DSP development systems. Simulation software includes full-versions of MATLAB/Simulink/PLECS, Micro-Cap Spice and PSCAD.

UNIVERSITY OF BRIGHTON



University of Brighton

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INTRODUCTION

The Electrical Engineering research group is part of the School of Computing, Engineering and Mathematics at the University of Brighton. The group comprises mostly of lecturers working in the fields of: Power Electronics, High Voltage Technology, Power Systems and Analogue Electronics. However, there is a wider network of lecturers and researchers also working in related areas.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

In recent years, the group has undertaken many collaboration opportunities with Industry and other Academia, including a range of European Union, KTP and SEEDA Innovation Voucher projects. The subject matter has included:

- Novel techniques for boosting energy usage efficiency for solar photovoltaic systems;
- Improvements in designs of high voltage power supplies;
- Simulation of Pantograph-Catenary systems and their active control mechanisms;
- Application of electronics and intelligent systems for reduction in diesel engine emissions;
- Characterisation of novel magnetic materials for electro-technical applications;
- Design and condition monitoring of vehicle ignition systems and their components;
- Condition monitoring of high power laser systems, through voltage-current monitoring;
- Modelling of renewable energy systems;
- Electronics and intelligent systems applied to improvement of bus travel for travellers.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

- A hybrid engine test-bed including power electronics development areas;
- Diesel and gasoline engine test-cells with appropriate electrical/electronic support;
- Amongst other strongly related Power and Automotive teaching activities, a thriving MSc Automotive Electronics course, including excellent links with Ricardo Consulting Engineers;
- MATLAB/Simulink – a large variety of toolboxes including SimPowerSystems;
- Multisim circuit simulator and associated software.
- Power Electronics and Machines laboratory, with some high voltage equipment

BRISTOL UNIVERSITY



University of
BRISTOL

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INTRODUCTION

The Bristol Power Electronics Innovation Centre (BPEIC) is an interdisciplinary forum for power electronics activities at the University of Bristol. It combines two main entities, the Electrical Energy Management Group (EEMG) and the Centre for Device Thermography and Reliability (CDTR), linked to additional expertise in statistical simulation of power electronic circuits in Engineering Mathematics and solar energy devices and energy storage in Electrical Engineering/Physics/Chemistry. Both the EEMG and the CDTR were judged to be internationally leading in the 2008 Research Assessment Exercise (RAE), with 64% of outputs graded 3* or 4* in the Bristol Electrical and Electronic Engineering submission and 55% in the Physics submission. Indicators for leadership are summarised below:

- Research portfolio of £5.5M, (EPSRC, NERC, TSB, EC FP7, EC ESA, EC EDA, US ONR, US DARPA, industry).
- 8 FTE academic staff pursuing research dedicated to power electronic systems. & 13 Research Fellows/Assistants, of which 70% are from the EC/UK, PLUS 26 PhDs, of which 75% are from the UK/EC, 25% international students to further diversity.
- Excellent track record of working with industry through direct funded research, TSB/EC/EDA/DARPA and other collaborative grants.
- Research undertaken with 30 UK and international industry partners, of which 12 are SMEs, and with 16 UK and international universities.
- An annual academic output (2011) of 30 papers in top IEEE, IET and AIP Journals, 35 papers at international conferences and patent applications.
- A further 10 FTE academic staff and associated researchers pursuing research into topics whose exploitation involves the use of power electronics.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Electrical Energy Management Group (Prof Phil Mellor) Research published in leading international IEEE / IET Transactions and at the major international conferences in Power Electronics, Electrical Drives, and 'Smart' Materials. Over 280 papers published in past ten years. Key expertise - power electronic conversion, electrical drives and management of electrical energy with a focus on the systems employed in aircraft, automobiles and micro-renewables. Highly-efficient / compact power converters and electrical drives; automotive power trains; aerospace generation and actuation, direct-drive wind generators, grid-tie inverters. Development of required supporting technologies for GaN and SiC power devices: novel gate drivers, switching-aid circuits, new circuit topologies, control methods, sensors, design for high frequency and high-temperature operation. High-performance passive component design: multi-physics design optimisation, thermal and loss analyses, new mixed-material structures, novel integrated magnetic components. Power electronic systems for the managing of energy at sub Watt levels for use in energy harvesting and HV supplies; novel circuit topologies, exploitation of non-linear behaviour. Coupled electromagnetic/thermal/electrical system modelling, multi-objective optimisation. Robust minimal sensor control methods, design for fault tolerance, low harmonic distortion inverter switching control. Centre for Device Thermography and Reliability (Prof Martin Kuball) with focus on semiconductor devices and components. The CDTR excels in thermal device management & device reliability research, and device simulation: Novel materials, such as GaN, diamond, GaN-on-Si, GaN-on-diamond for electronics, and integration such as GaN-diamond (power and RF electronics) on device/chip level. Internationally leading research in thermal management and thermal management analysis of power and RF electronic devices (sub-micron, nanosecond resolution). Internationally leading research in reliability and failure mechanisms of electronic devices. Development of new thermal and reliability testing methodologies (Raman thermography, transient trapping testing, interface trapping testing, and others). High power electronics packaging solutions (silver-diamond composites). Device simulation (electronic, thermal and stress).

The Bristol Power Electronic Innovation Centre has excellent facilities for a wide range of device and application research. The thermal and reliability testing facilities for wide bandgap electronics are unrivalled. The Energy Management group has comprehensive test facilities for testing drives and actuators at powers up to 1MVA. There are dedicated Medium Voltage and High Current laboratories. The university has recently made a number of related investments :

- £1M refurbishment of the West Wing of the Queens Engineering Building, in particular £0.25M to extend facilities of the EEMG.
- Provision of new clean room facilities, as part of a £5M refurbishment of the Physics facilities including specifically to the CDTR

CRANFIELD UNIVERSITY



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INTRODUCTION

Cranfield is a wholly postgraduate university specialising in science, technology and management. Our business is driven by industry needs and we work with some of the most recognised names in the business – Airbus, Boeing, GlaxoSmithKline, Rolls-Royce, Shell and BP to name but a few. We are unique in our ability to transform knowledge into ingenious solutions in aerospace, automotive, energy, environment and manufacturing. Underpinned by our demonstrated strengths to turn ideas rapidly from concept through to commercial exploitation by means prototype demonstration, assessment and evaluation, we forge close links with our business partners through collaborative research, consultancy and other value-added investments. With power electronics being central to providing future solutions in these sectors, Cranfield currently has a total of 20 academic and research staff and an annual research income of £2m directly related to power electronics research and teaching, and a further 140 staff with an annual income of £14m in multi-disciplinary research related to energy and power conversion.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Electrical machines and drives – Patented electrical machine technologies developed to pave the way for next generation electric drives to be exploited for electric vehicles (land, air and marine) and renewable energy systems (e.g. wind and wave). Our drive technologies essentially focus on developing cost-effective and sustainable supply chains for high performance, high efficiency and high reliability electric drives, in anticipation for increasingly challenging operational conditions against future uncertainty in sourcing critical raw materials. In particular, we research into high performance motors using new non-critical materials.

Power converters for renewable energy systems – This covers hardware topology optimisation of energy storage systems such as batteries with the converter, and software control of power flow, start-up and generation modes, and failure-safe operations. The research also extends to integration and connection of renewable energy systems to local smart-grids, as well as vehicle-to-grid architectures.

Intelligent power electronics – This covers a collection of technologies ranging from sensors to robust circuit design, and includes complex algorithms to detect component deterioration, data transmission and automated analysis, with consequent significant improvements in availability, reliability and safety.

Robust control and optimisation of power electronics in automotives – A portfolio of research activities in the areas of i) electric drivetrain integrations for electrical vehicles (EV) and Hybrid EVs, ii) robust control strategies and architectures for Hybrid EVs, iii) battery management and electrical systems for Hybrid EVs.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Our research facilities relevant to power electronics are wide-ranging in size and multi-disciplinary in nature, with many deployed in industrial scale demonstration:

- Dynamometer systems for motor drive tests and characterization - High speed eddy current dynamometer system (70,000rpm, 1kW), medium speed eddy current dynamometer system (6,000rpm, 5kW) and Chassis dynamometer 2-wheel drive (330kW).
- Renewable Energy Wave and Towing Tank - For hydrodynamic testing of marine structures and electric systems research into wave and tidal energy generation.
- On-campus smart grid - Cranfield's designed wind turbine test facility combining a 50kW vertical axis turbine and generator system with an 84kWh battery storage capability which is fed into the Cranfield campus grid and also to supply an electric vehicle charging station.
- dSPACE HIL midsize simulator and dSPACE rapid-prototyping power train controller.
- EPSRC Centre for Innovative Manufacturing in Through-life Engineering Services provides world-class capability and facilities to enable industry to deliver electronics products with outstanding availability, predictability and reliability with the lowest life cycle cost.
- Integrated Vehicle Health Management (IVHM) Centre offers a range of facilities in its Electronics lab, Prognostics lab, and Simulation lab.

DE MONTFORD UNIVERSITY



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INTRODUCTION

De Montfort University, Leicester, UK, has an expanding engineering department offering undergraduate (BEng), taught postgraduate (MSc) courses, and research.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Junction temperature is an important aspect of all electronic devices and in particular power devices and difficult to measure accurately. Facilities have been set-up to make infra-red (IR) thermal measurements of power transistors and devices under DC and RF power excitation. A novel proprietary method (patent GB0821112.0), using high emissivity micro-particles for more accurate measurement of spot temperatures on devices, has been developed. This method removes one of the major sources of error in IR temperature measurements, the surface emissivity.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

1. Quantum focus IR microscope (Infrascope II) for IR thermal measurement with a maximum spatial resolution 3 microns. The microscope has integrated DC and RF probing facilities and computer controlled micro-manipulator for assisting in placing IR micro-particle sensors.
2. Dedicated power electronics laboratory equipped with experimental DC, single and three phase power conversion systems.
3. Electro-thermal power device characterisation facilities for static and dynamic power devices measurements.
4. Back end fabrication facilities with class 100 clean areas.

UNIVERSITY OF EDINBURGH



THE UNIVERSITY
of EDINBURGH

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INTRODUCTION

The Institute for Energy Systems (IES) is a multi-disciplinary research institute comprising 13 academic staff, 26 research staff and approximately 40 PhD students. IES leads the EPSRC-funded Supergen Marine Energy Consortium, is a partner in the SuperGen FlexNet, AMPerES and Photovoltaics consortia, several Energy Technologies Institute and EU projects. It's current research grant portfolio is around £10 million, mainly centred around research into offshore renewable energy. Within the institute, there are 4 academics, 3 research staff and approximately 10 PhD students whose work is at least partially in the field of power electronics, mostly centred around power electronic interfaces for renewable energy systems.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Power electronics plays a critical role in renewable energy systems, conditioning the very variable output for suitable connection to the main utility network. In direct drive systems, it can also be used to optimise the energy output from the renewable energy device (wind turbine, wave energy converter). Current research includes projects in the following areas:

- Power electronic control of direct drive linear generators in wave power systems to optimise the power output from the wave energy converter.
- Power converter systems for interconnecting arrays of wave energy converters.
- High power dc-dc converters for HVDC systems interconnecting offshore wind power systems.
- The effect of VSC HVDC systems connecting offshore renewable energy systems to the Scottish electricity network.
- Micro-grids incorporating renewable energy systems for remote rural areas.
- Control of electromagnetic bearings for low speed generators for renewable energy systems

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

The Power Electronics and Machines research laboratories include motor drives and test facilities for systems up to approximately 30 kW.

A wide range of simulation software is available, including PSS/E, PSCAD, PLECS, Matlab/Simulink, Opera, dSPACE

The Power Systems and Machines teaching laboratory includes rotating machine sets and power electronic drives for undergraduate teaching

UNIVERSITY OF GLASGOW



**University
of Glasgow**

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INTRODUCTION

Power electronic research at the University of Glasgow currently focuses on microgeneration, smart microgrids and electric motor/generator power converter technologies. The University has had a long association with industrial research/collaboration through its SPEED (Scottish Power Electronics and Electric Drives) Laboratory, and this emphasis on industrial funded research continues to this day. Current research projects include RENEW NET, which is in collaboration with 5 other Scottish universities to support Scottish based industry develop the current and next generation electrical power systems for use in the renewable energy sector.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Power Electronic related activities at the University of Glasgow are currently focused in three areas: 1] Application and interface of thermoelectric (TEG) devices 2] Electric motor and generator power converter development 3] Maximum power converters and smart microgrids Thermoelectric generators (TEGs) are semiconductor devices which generate a voltage when the two junctions are maintained at different temperatures, exploiting the Seebeck effect. We are currently researching the use of TEGs in a number of applications from mW to kW to harvest energy from waste heat. A related activity is the development of high efficiency microcontroller based DC-DC converters which will be used to stabilise the power developed by the TEG arrays. Over the last 20 years the SPEED Laboratory has developed a range of flexible controllers and associated power electronic converters for use in a range of motor and generator technologies (permanent magnet ac, brushless dc, induction, switched reluctance and synchronous reluctance machines) for a range of applications (aerospace, automotive, domestic, industrial). Recent research activities have focused on permanent magnet and induction generator control in renewable energy applications. Future developments that have been proposed for Smart Grid technology include the control of small-scale distributed generation and storage devices and the control of energy consumption through the use of smart appliances. A software simulation package is being developed which will allow for the modelling of smart grids at the end user level. The package allows for the simulation of systems involving power electronic converters, electrical, heating and communication elements. Within this package, complete energy consumption models of domestic or business premises including smart grid control elements can be created and analysed.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Related research facilities include a number of electric motor and generator dynamometers up to 7.5kW, a range controllable power AC/DC power supplies and electronic loads. Also, we have skilled technician support for high quality power electronic converter design and build.

UNIVERSITY OF GREENWICH



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INTRODUCTION

The Computational Mechanics and Reliability Group (CMRG) is uniquely positioned to provide leadership in the underpinning technology of modelling and simulation for power electronics components and systems. With a team of 2 professors, 1 reader, and 6 research fellows we provide a strategically important research capability in simulation, modelling and reliability to support design and innovation in power electronics. CMRG has 15+ years experience in developing virtual prototyping technologies working with software providers, manufacturers and end-users. The group has received over £4M since 2006 from Government agencies and Industry both in the UK and internationally to support its research and enterprise activities in design, modelling and simulation for electronics manufacturing and reliability. Our work has received numerous awards (note: 70% of our work was rated in highest two categories for RAE-2008, with 30% as world leading). Group also received the Times Higher Education Award for Outstanding Engineering Research Team of the year in 2009.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

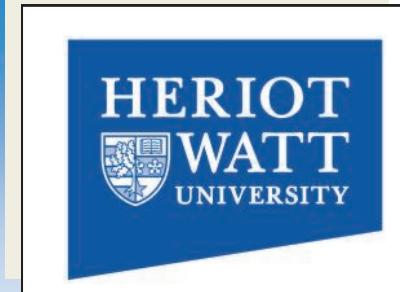
Relevant activities include:

- i) Design for integration and reliability: Multi-physics (electrical, thermal, mechanical) and multi-level (device, package, system) modelling methodologies are core research areas for the group. The group has extensive experience in developing process models for electronics manufacturing and packaging technologies, thermal management and electrical models for performance, and physics-of-failure models for reliability predictions. This includes the development of high fidelity models (finite element analysis) and reduced order model equivalents (compact models) for fast analysis.
- ii) Multi-objective optimisation and risk analysis: Multi-objective optimisation provides the ability for power electronics engineers to investigate the design space for devices, packaging and systems. Together with tools such as design of experiments and sensitivity analysis, multi-objective optimisation provides the ability of optimising two or more conflicting objectives (e.g. minimise junction temperature and costs) subject to certain constraints. In addition to this we have also been developing stochastic techniques for risk analysis, and hence design for robustness.
- iii) Prognostics and Health Management: The team has been developing methodologies for prognostics and health management for a number of years. This combines soft computing methodologies such as data mining to uncover patterns in large data sets, data-fusion combining data driven and model driven techniques for fault detection, parameter isolation as well as predicting the remaining useful life of the power electronics system. Our latest iEMRC project (RODENT) is developing damage mechanics models which will be embedded into a real-time prognostics framework for monitoring health and predicting future availability of power electronics modules when in the field.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

The group is based in the school of computing and mathematical sciences and has access to a number of commercial software tools as COMSOL, ANSYS, PSPICE, MATLAB, Optimus, PECS, and its own tools such as PHYSICA, ROMARA and POWERLIFE. In terms of hardware the group has a 96 processor high performance computing cluster and a hardware-in-loop facility based around the national instruments PXI systems for embedded system development. We also have access to reliability testing and failure analysis facilities including thermal cycling, HAST, SEM-EDX, etc

HERIOT-WATT UNIVERSITY



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INTRODUCTION

Traditionally at HW, Power Electronics research has focused upon optimisation of powering motor and vibration machines, adaptive control and neural-net controllers. Currently, significant work is conducted on powering sonar for marine autonomous vehicles and extensive work is required to ensure robust operation. Reliability of devices operating in harsh environment and being driven to, and beyond original specifications, is of major interest. Additionally, some work on conditioning power from PV units to supply a grid has been conducted, but now with new appointments in the key areas, this work is significantly being ramped-up. HW positions itself on the applications side of Power Electronics taking a holistic approach with the implementation of a system for long-term reliability and predictive reliability. The university has made good strategic multimillion £ investments recently by bringing the experts in PV, Power Electronics, Reliability Science which sets HW at the fore of leading PV activity centres, combining inorganic, organic PV and systems research in the UK. Some of the existing facilities which would enable this centre to take a leading role in combining relevant experts covering from basic renewable energy generation, grid integration and the reliability engineering with a view to generate a team the data for necessary validation and with a vision to develop the standalone dc power for remote non-grid population and also conducting innovative research to keep UK a step ahead in this scheme. Some of the prominent facilities are described below.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Traditionally at HW, Power Electronics research has focused upon optimisation of powering motor and vibration machines, adaptive control and neural-net controllers. Currently, significant work is conducted on powering sonar for marine autonomous vehicles and extensive work is required to ensure robust operation. Reliability of devices operating in harsh environment and being driven to, and beyond original specifications, is of major interest. Additionally, some work on conditioning power from PV units to supply a grid has been conducted, but now with new appointments in the key areas, this work is significantly being ramped-up. HW positions itself on the applications side of Power Electronics taking a holistic approach with the implementation of a system for long-term reliability and predictive reliability. The university has made good strategic multimillion £ investments recently by bringing the experts in PV, Power Electronics, Reliability Science which sets HW at the fore of leading PV activity centres, combining inorganic, organic PV and systems research in the UK. Some of the existing facilities which would enable this centre to take a leading role in combining relevant experts covering from basic renewable energy generation, grid integration and the reliability engineering with a view to generate a team the data for necessary validation and with a vision to develop the standalone dc power for remote non-grid population and also conducting innovative research to keep UK a step ahead in this scheme. Some of the prominent facilities are described below.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

HW has a number of facilities available for testing and benchmarking applications utilising Power Electronics. Four of the larger capital infrastructural pieces are:- The "Eco-Village" research facility consists of 10 Smart Homes, in 5 pairs of semi-detached due to be completed by 1st September 2012. A number of technologies are to be installed in each of these dwellings including a home energy monitor, an electric vehicle charging point and a fuel cell CHP unit. Additionally the housing development will have an integrated PV system installed adjacent to it. The High Voltage Lab is one of a few facilities remaining in the UK. It includes a 800 kV set for surge protection and lightening strike studies, 400 kV AC and 400 kV DC sets for insulation breakdown and other discharge studies. The facility is a purpose build lab of 200 m² divided into 5 Faraday cages with dedicated technical support. The Ocean Systems Laboratory is a multidisciplinary science and engineering research centre that innovates, applies and teaches world class advances in autonomous systems, sensor modelling/processing, and underwater acoustic system theory/design for offshore, marine science, renewable energy and security applications. A specialist water tank is available for testing and benchmarking autonomous electric marine vehicles. PV Cell/module Fabrication and Testing Facilities consists of multiple pieces of kit for the research and full development of PV units.

IMPERIAL COLLEGE LONDON



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INTRODUCTION

The power electronics activity at Imperial has been focussed on four broad sets of topics: transmission grid applications (such as HVDC converter stations); distribution grid applications (such as interfacing of distributed generation and micro grid formation); consumer electronics (such as LED lighting, wireless device charging) and energy harvesting (such as motion-driven generators for medical sensors). Thus, our activity spans applications from 1GW to 1µW. We consider semiconductor device physics for the modelling of devices in extreme settings, circuit topology innovation for modular converters, control system design for inverter interfaces and system modelling for interaction of power electronics and power networks. The power electronics work is conducted by 2 professors, 2 senior lecturers, 3 research fellows and 22 PhD students. We lead two of the large multi-university consortia on future technologies for power networks and have funding of over £2M in HVDC and distribution power electronics. Wireless charging, battery condition monitoring and energy harvesting are funded at about £1.5M

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Multi-level HVDC converter stations have overtaken PWM 2-level designs but now the emphasis is on (i) reduction of power losses and (ii) provision of fault current control/interruption. We are engaged with fundamental work on both topics and have patent applications jointly with our industrial partners. The converter station design has significant implications for how multi-terminal HVDC networks might be configured and controlled and we are active here also. We have a history of studying the stability of micro grids in which the generation sources are all inverters. We have developed approaches to modelling the small signal stability of droop-control inverters. Protection design for inverter-dominated networks is a challenge because of the reduced and complex fault current provided by inverters. We have experimentally verified fault-flow algorithms to aid such protection design. Reducing losses in grid power electronics hinges on using power electronics in close combination with traditional means. We have demonstrated a fast "wear-less" tap-change diverter to allow tap-change transformers to provide fast-acting voltage control for PV integration. We have demonstrated wireless power transfer for consumer electronics and achieved end-to-end efficiencies of over 75% over distances of 30cm. In combination with colleagues at Imperial we have demonstrated low-frequency motion-driven electrostatic generators as potential battery replacements for medical monitoring. We have developed models of the sub-system interactions that enable the optimal design parameters to be identify for maximising energy yield.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Our main facility is the Maurice Hancock Smart Energy Lab. This features back-to-back converters (two 90kVA pairs and seven 10kVA pairs) with rapid prototyping control platforms. The converters can be interconnected via network impedances to mimic distribution feeders and substations. A 16 kW PV array, a 100 kWh Lithium-Phosphate battery and passive load banks can also be introduced. Control systems designed in Simulink can be download to the test platform and a LabView data acquisition system collects results. The network can be subjected to various faults such as line-to-line short-circuits and asymmetric voltage dips to test transient response of controllers. A second set up in the same lab is built around an LC-ladder array modelling 4 DC cables of a multi-terminal HVDC system with 10 kVA inverters on each terminal providing interfaces to AC connections. The lab also has test rigs for wireless power transfer, vibration test amplifiers and general power electronic converter testing.

KINGS COLLEGE LONDON



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INTRODUCTION

Research team consists of 3 academics, 2 post-docs and 1 PhD student. We are working on interconnection materials for high temperature applications. These materials include solders and sintered materials. Current grant portfolio includes £650K EPSRC project on nanoparticle enhanced solder materials for high temperature interconnect and privately funded research into high melt point solders.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Investigation of methods for extending Pb-free solder applications beyond normal temperature ranges to 150-185 deg C. The team at King's is using composite solder materials to achieve these goals, adding nanoparticle enhancements to the solder to modify chemical and physical properties. Additionally, the team has started to look at sintered Ag and Cu nanoparticle materials with a view to replacing solder materials with sintered joints which can withstand 300 deg C temperatures and higher.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Solder characterization facilities (optical and electron microscopy, argon ion beam milling of samples, mechanical testing, temperature cycling). Nanoparticle characterization facilities (IR spectroscopy, nanoparticle sizers and zeta potential measurement).

LEEDS UNIVERSITY



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INTRODUCTION

The research in the area of Power Electronics and Drives at the University of Leeds has an international reputation built over several decades. The group currently comprises three full-time academics (Drs Corda, Zhang and Chong) and a new Chair is planned to be appointed to strengthen the activity. Increasingly. The group currently has ten research fellows and PhD students.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

One of our major research activities has been to develop multilevel converter-based FACTS devices including Synchronous Series Compensator (SSSC) (for line impedance variation), Static Compensator (STATCOM) (for reactive power and harmonic elimination control) and the combination of these two. Another strand of our work is on investigating the optimal structure for module-integrated PV and converter (MIPC) units. Our proposed MIPC is based on Cuk bidirectional and boost converters. This approach enables independent control of individual PV modules according to their isolation, giving substantially higher output power under conditions of panel mismatch and partial shading. We also work in the area of Switched Reluctance Machines for wave power power generation.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

A solar power laboratory has been established in Leeds for testing different types of PV devices under controlled light conditions. We have three motor-generator sets of different types for testing power electronic converters and their control algorithms. 7.5kW In-house built multilevel STATCOM and a 400 V stabilized dc power supply for testing converter circuits.

UNIVERSITY OF LEICESTER



**University of
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INTRODUCTION

The Power Electronics, Electrical Machines, Power Systems and HV Research Group has 5 academic staff, 2 research fellows and 8 research students. The group has an extensive research portfolio of £1.2m, including a combination of research and industrial grants, in such areas of high voltage and very high current power electronics, electrical machines and drives, and dielectric breakdown.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Power electronics projects include:

- 50kVA switched mode power supply for electrostatic dust precipitation in power stations.
- 1200 amp ultra-fast battery recharging system for commercial electric vehicles.
- Induction heating
- Pulsed power supply for lasers in nuclear fusion.
- High voltage ionisation power supply.
- A number of energy efficient drives projects from 800 watts to 60kW

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

The Group is proud to be accommodated in a large laboratory suite (comprising three dedicated laboratories) that has recently seen a £1M refurbishment. There are a wide range of laboratory resources and specialist equipment including:

- Large and small electrical machines and drives test facility with a 200kVA 3 phase supply
- 3000 amp pulsed power generator
- Large battery charge/discharge unit designed for fork-lift truck and submarine batteries
- Magnetic and electrostatic modelling and CAD facilities
- Equipment for the development of embedded generation systems, including: photovoltaic, wind power and variable speed generation and a large scale wind turbine simulator
- 50 kVAp PV array - equipment for the development of electronically controlled drives and generators
- High voltage testing equipment
- Space charge measurement using pulsed electroacoustic (PEA) techniques
- High sensitivity electrical treeing and electroluminescence equipment with application in electrical treeing detection
- Broadband dielectric spectroscopy

LIVERPOOL JOHN MOORES UNIVERSITY



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INTRODUCTION

The Electric Machines and Drives (EMD) research group was established in 1992 and has a 20-year long history of high quality research. It is led by Prof. Emil Levi (Fellow IEEE), who was awarded the Professorship in Electric Machines and Drives in 2000. The group currently includes one more academic, Dr Martin Jones, who became Reader in Power Electronics and Drives in 2011. Two new appointments at Lecturer level are currently in progress, so that the group will consist of four academics and eight PhD students in September 2012. The group has exceptionally developed research collaboration with overseas Universities and it regularly hosts overseas research fellows for typically three to six months research stays. This includes academics from the University of Seville, University of Malaga, University of Vigo (Spain) on yearly basis. Current research portfolio includes three major sources of funding, with the total value of approximately £ 530,000. The first project is financed by the EPSRC within auspices of a consortium project, "Vehicle Electrical Systems Integration", (EP/I038543/1, 01/10/2011-30/09/2015); the second source is the University of Malaya (Kuala Lumpur, Malaysia) within the auspices of two joint PhD student research projects, "Model-predictive control of multiphase and multi-motor drive systems" and "Variable-speed asymmetrical six-phase wind-energy generator systems", 2011-2014; the third income source is the Qatar National Research Fund, through the project "Advanced power electronic solutions for variable-speed multiphase ac motor drives", which includes Qatar University and Texas A&M University at Qatar as partners (NPRP 4-152-2-053 project; 01/04/2012 – 31/03/2015).

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

The past research activities have been predominantly related to modelling of parasitic phenomena in three-phase machine d-q models (main flux saturation, iron loss, stray load losses), development of improved vector control and direct torque control schemes for induction machines, optimal efficiency control of induction machines, application of fuzzy logic and artificial neural networks in drive control, speed sensor-less control of induction machines, self-excited induction generator operation for stand-alone applications, etc. The group's main research projects during the last ten years have been associated with the modelling, control, and implementation of multiphase (more than three phases) variable-speed drive and generation systems, including development and control of multiphase two-level and multilevel dc to ac power electronic converters. Perceived applications of multiphase machines and drives are related to the electric ship propulsion, locomotive traction, electric and hybrid electric vehicles, more electric aircraft concept, and industrial high-power drives. The other main research track was related to the multiple three-phase motor drive systems, supplied from a single inverter with a reduced switch count. Significant new research results have been obtained, including the solutions for multi-motor multiphase drive systems with single inverter supply (based on an opportune series connection of stator windings), PWM methods for single-frequency and multi-frequency output voltage generation with multiphase two-level inverters, PWM control of multiphase machines in open-end winding configuration, PWM control of multilevel multiphase inverters, etc. It is envisaged that the main research activities in near future will continue to be in the broad area of multiphase supply control for multiphase machines and high-performance control of multiphase drive and generation systems.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Infrastructure for research in the EMD area includes, in addition to the office space and computing facilities, a dedicated research laboratory. The laboratory is a specialised facility, equipped with multiphase machines and multiphase power electronic converters that enable experimental validation of a vast range of supply and machine control algorithms. The machinery is all with distributed stator winding (near-sinusoidal magneto-motive force distribution) and includes two five-phase induction machines, one five-phase synchronous reluctance machine, one symmetrical and one asymmetrical six-phase machine and a range of three-phase induction and permanent magnet synchronous machines. All are equipped with resolvers and encoder emulators for high performance application testing. The set of power electronic converters includes two six-phase three-level NPC voltage source inverters, one nine-phase two-level and two eight-phase two-level inverters, so that parallel projects can be executed at the same time. The main control platforms are a dedicated custom-built dSpace system and direct DSP programming tools. Further, there is an ABB's four-quadrant regenerative 15 kW module unit for interfacing of the generation system to the grid, a four-quadrant programmable ABB's 15 kW dc drive system for use as a load/prime mover in motoring/generation related research, an Omiran "Three-phase grid simulator system" (Type DM 7500/PAS), two high-quality dc power supplies Sorensen SGI 600/25, and a large number of high-quality precision measurement instruments (digital oscilloscopes, current and voltage probes, universal power analyser Voltech PM3000, MAGTROL torque meter, HP/Agilent dynamic signal analysers, etc.)

UNIVERSITY OF MANCHESTER

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INTRODUCTION

Power Electronics research is focused within the Power Conversion Group in the School of Electrical and Electronic Engineering. With over 60 academic staff, the School is one of the largest of its kind in the UK, and was ranked equal second for research quality in the 2008 Research Assessment Exercise. The Power Conversion Group comprises eight academic staff and a team of almost 40 research staff and students. The Group's current research grant portfolio amounts to £3.5M, two-thirds is from research council and UK / EU government sources, with the remainder being direct industrial funding. The Group hosts the Rolls-Royce University Technology Centre (UTC) in Electrical Systems, which focuses on more-electric technologies for aerospace, marine and land-based power generation and management systems.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

The research activities embrace power electronic converters, electrical motor drives and the integration and control of power electronics in energy conversion systems, underpinned throughout by a culture of thorough experimental validation at power levels up to 100 kW. The main application areas are aerospace, marine, and automotive systems, renewable power generation and electricity supply. The current research areas are: Converters: Advanced topologies, high frequency switching techniques, application of new device technologies such as SiC and GaN, high frequency magnetic components, thermal management and converter fabrication. Recent work has included 60 kW, power-dense SiC-based DC-DC converters for automotive applications and high-power-factor rectifiers for aerospace systems. Motor drives: System topologies (induction, permanent magnet and switched reluctance), modelling and analysis, high temperature systems, low temperature and superconducting systems, partial discharge effects, insulation systems, reliability and condition monitoring, sensor-less and advanced control techniques. System integration and energy storage / management: Operation, control and optimisation of 'finite energy' power-electronics-enabled systems typically for applications onboard ships vehicles and aircraft comprising multiple generators, energy storage devices, converters and motor drives, frequency-wild AC, DC or hybrid distribution architectures. Stability, power quality and energy use, and high fault tolerance. Large scale integration: Interconnection and control of converters for power generation, transmission and distribution: multi-terminal high-voltage DC systems, wind turbines, smart-grids and renewable energy.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

The Group's 400 sq m of recently refurbished laboratory space include: The Intelligent Electrical Power Networks Evaluation Facility (IEPNEF): a flexible 100 kW system for researching more-electric systems; including a hardware-in-the-loop, two-shaft, gas engine emulator driving fault-tolerant, engine-embedded generators, which supply multiple, programmable power electronic loads and a 1 MJ super-capacitor system through a DC network. Three cryogenic chambers for superconducting devices, machines and low temperature circuits. Two environmental chambers for temperature, humidity and low pressure testing. Six dynamometers, some rated up to 100 kW, 15,000 rpm, including re-configurable multi-phase induction and synchronous motor drives. A doubly-fed induction machine drive / generator system for condition monitoring research. A rig for examining interactions between mechanical drive-lines and generator / motor drives. A calorimeter for precision measurement of losses in motor drives and power electronics.

NEWCASTLE UNIVERSITY



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INTRODUCTION

With research activities ranging from power device fabrication through circuits, drives and control to electrical machines, Power Electronics at Newcastle University forms the largest, balanced set of expertise in the UK. 15 full time academics (5 professors, 1 reader, 3 senior lecturers, 6 lecturers) are working almost exclusively on Power Electronics solutions, supported by 14 members of research staff, 10 visiting members of staff, 3 dedicated technicians, 56 registered PhD and EngD students and 160 MSc students. We are holding the Dyson Research Centre on power electronics, the Advanced Drives Centre, and we are Competence Centre within the “European Centre of Power Electronics.” Our research is funded through the following routes: EPSRC: We receive regularly funding from EPSRC. Funding include four EPSRC Platform grants, two grants support research into the production of high efficient low cost power electronics and drives, whilst the other two have supported the development of Silicon Carbide (SiC) devices. Current EPSRC collaborative grants include the FRENS project on reliability in renewable energy (5 UK & 5 Chinese institutions) and the VESI project (10 UK and 20 industrial partners) on highly integrated power drive trains for EVs. EU (Framework 7): We are involved in European funded project under FP7. We are leading the activity on fault tolerant machines for aerospace applications in Actuation 2015; Elibama, where we are leading on traction battery testing technologies; Inomanship and Tefles we work on efficient energy management system of cargo ships. TSB: Over the last five years we have embarked upon four automotive Power Electronics projects; with partners including Leyland Trucks, Prodrive, Cummins and Sevcon, researching power dense power dc/dc converters, high voltage electric steering systems and novel switched reluctance traction drives. Industry: We currently have funding from Goodrich, Tata Steel, Qinetiq, Hoganas, Airbus, BAE Systems, Ztek, Raytheon UK, AEC and Rolls Royce. Levels of industrial funding vary from £5k to £1.3M per company.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

We are unique in the UK in having significant depth across the sector within a single team. Our research activities lie in the following four core areas: Power Electronic Devices: UK’s leading academic group in silicon carbide device design and fabrication to produce devices that operate at extremely high temperatures and show ultra high switching speeds; silicon power devices; smart materials and nano-fluids for heat-sinks which actively control thermal impedance; novel packaging for high temperature and high power density modules. Power Electronic Converters and Circuits: novel converter and generator topologies that increase efficiency and power factor; grid connection of renewable energy sources with focus on grid faults; multilevel converters; intelligent driver circuits for lifetime prediction of power devices. Energy Management and Control: new control strategies to reduce passive components in dc/dc converters; development of low-cost energy management systems for ultra-capacitors and Li-Ion capacitors; efficiency optimisation; sensorless control. Electric Drives and Machines: permanent magnet motors with reduced magnet materials; novel topologies for reluctance machine drives; new materials and construction methods to increase efficiency; optimisation of drives for very high torque or ultra high speed operation; fault tolerant drives.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Over the last five years we have spent £4M on our 500m² power electronics, drives and machines facilities, with a further £2.5M on two clean-rooms, suitable for power device fabrication and £4M on device characterisation laboratories. We believe this gives us the best equipped Power Electronics research facilities in the UK. £1M of the total has been spent on estate, providing state-of-the-art infrastructure for up to 100 researchers, in addition to the 15 academics. The remainder has been spent on research equipment and test rigs. Funding of this has comprised £3M from our RDA, £3M from SRIF3, £2.5M from industry and £200k from the EPSRC, with the remaining £1.8M coming from Newcastle University internal investment, in recognition of the importance and standing of this area, and its alignment with University research strategy. We have dedicated workshops and technicians for the construction of power electronic hardware, ranging from making silicon and SiC power devices to complete electrical machines and drives. Test facilities include dynamometers up to 500kW, speeds up to 100,000 r/min, environmental testing, heaters, chillers, advanced electronic measurement systems, on-wafer and device level electrical testing at temperatures up to 400°C.

NOTTINGHAM UNIVERSITY



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INTRODUCTION

The Power Electronics Machines and Control (PEMC) Group is a leading international centre with over 100 researchers engaged in Power Electronics based research. The current team has 10 academic staff (including 5 professors), 36 research fellows (including 4 senior research fellows and 1 principal research fellow) and 56 registered PhD students. The current grant portfolio is £19.3M with an annual research project spend of approximately £3.6M. The group undertakes pure and applied research spanning all aspects of power electronics and associated technologies. Comprehensive experimental facilities support the research activity. The Group has formal links with many national and international industry and university partners and houses the Cummins Innovation Centre in Electrical Machines and the GE Aviation Strategic Partnership in Advanced Electrical Systems.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Core technology expertise of the Group covers 4 main areas:

- Power Electronic Energy Conversion, Conditioning and Control
- Power Electronics Integration, Packaging and Thermal Management
- Motor Drives and Motor Control
- Electrical Machines.

The Group mission is to sustain an internationally renowned research portfolio spanning all key power electronic disciplines from power device and component technology to complete power conversion systems. The PEMC Group collaborates closely with the George Green Institute for Electromagnetic Research and with the Heat Transfer Group. Research activities cover basic technology (e.g. physics of failure research) to applied research (e.g. professionally engineered advanced technology demonstrator hardware for aerospace industries). The PEMC Group has very strong links with industry, both nationally and internationally, ranging from component suppliers to OEMs, where it applies its core technology expertise to application oriented research. Whilst the portfolio of application areas is not fixed and continually evolves to reflect to new opportunities, it is currently orientated towards the transport and energy sectors. Other significant industrial collaborations exist in Industrial Drive Systems and Pulsed Power Converters. The Group plays key roles at University level within the Energy Technologies Research Institute (ETRI) and the Aerospace Research Institute.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

The Group is justifiably proud of its experimental facilities and is renowned for its ability to conduct pure and applied research at realistic power levels (up to 1MW continuous). We have dedicated laboratory space of 1750m² and further specialist facilities for power device packaging research and for reliability studies, including environmental testing (temperature, humidity, altitude & vibration), power cycling and microstructural analysis. Dedicated electronic supplies provide emulation of variable frequency generation systems up to 270 kVA and we have dynamometers from 800 kW@1500 rpm to 49 kW @ 120,000 rpm. In addition to the group's main Research Laboratory (refurbished 2012) we also have exclusive use of a new laboratory, the Aerospace Research Centre (opened 2010) which houses many of our aerospace power electronics projects and use of additional space the Aerospace Technology Centre for higher TRL projects and industrial interaction. These two buildings are a result of a £9.5m investment in this research area by the University. Further facilities, opening in 2012 and part of a £6.5M investment in energy research, include a dedicated "smart grid" laboratory equipped with a flexible asynchronous ac and dc bus infrastructure, rated at 1MVA, that will support research into future electricity networks. All these facilities have up to date, extensive and broad based facilities for Power Electronics related research with an investment in equipment in the last two years of well over £1M. The facilities have been recognised as an EU Marie Curie Training Centre.

OXFORD UNIVERSITY



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INTRODUCTION

Power electronics research at Oxford University is focused in two world leading departments. The Department of Materials has an impressive track record in innovative passive devices, packaging and thermal management plus the underpinning science of materials reliability. The Department of Engineering Science's capability in heat transfer and cooling technology derived from its jet engine research has recently been used to develop new power electronic cooling technology with expertise in thermal management and the application of power electronics to electrical machine drive systems.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Passives Focused on high energy density capacitors using novel dielectric composites for compact high reliability load levelling and supercapacitors for energy storage applications. We also employ a similar approach for magnetic materials for inductors. Packaging and Interconnects die attach (large area, e.g. 100 – 150 mm die) and high temperature operation, (e.g. ambients of up to 250 degC), wire bonding (process optimisation and reliability of thick wire bonds for high current handling) and solder interconnects (Pb-free reliability and high temperature solders). Thermal Management Manufacture of novel CTE matched alloys, primarily aluminium/silicon for passive substrates, and novel designs incorporating active cooling such as direct jet impingement cooling. A variety of sophisticated spatially resolved thermal instrumentation techniques are available including:

- (i) thin film heat transfer sensors ,and
- (ii) liquid crystals.

Reliability physics of failures models built on stochastic and microstructure evolution data as a function of temperature, time and electrical stress to study reliability. We also characterise and model mechanical behaviour of materials such as creep behaviour of Pb-free solders as a function of temperature. **Electrical machines and drives** Focused on novel permanent magnet and switched reluctance topologies primarily for automotive applications. Recent and current programmes include:

- (i) yokeless and segmented armature (YASA) electrical machines - leading to the spin-out company Oxford YASA Motors;
- (ii) blending of control modes for improved system efficiency;
- (iii) control of power electronics for traction control in electric vehicles;
- (iv) converters for switched reluctance machines;
- (v) liquid cooling systems for inverters.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Thick and thin film processing supported with 6 inch Class 100 cleanroom facilities. Advanced materials characterisation facilities including testing under thermal, mechanical and electrical stress. Advanced modelling including FE and FD for mechanical, thermal and microstructure. Thermal analysis including spatially and time resolved analyses Prototype electrical machine engineering, test and manufacture.

UNIVERSITY OF SHEFFIELD



The
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INTRODUCTION

The University of Sheffield (UoS) has a world renowned vertically integrated, knowledge and capability base spanning the entire power electronics supply chain – from discrete and integrated components, integration of power electronics with control and applications in priority areas that feed into almost all aspects of the power electronics industry including electrical machines and drives. Much of its research is conducted in collaboration with industry world-wide, including strategic partnerships with the Rolls-Royce University Technology Centre (UTC) in Advanced Electrical Machines and Drives, the Rolls-Royce UTC in Control and Systems Engineering and the Sheffield Siemens Wind Power Research Centre (S²WP). Seven academic staff and nine Research Associates are directly involved in the PE research activity, with three new academic positions (to be recruited from March 2012). There are 26 full time PhD students working on power electronics research projects, and, on average, ~12 MSc and an equal number of undergraduate students undertake projects each year in this area. Moreover, a number of other staff members from across the Faculty of Engineering are associated with elements of power electronics projects. Current work is funded from a number of sources, including the EPSRC, TSB, EU, and direct industrial funding, to a total of around £5M, with over £21M being attracted over the last 10 years for work in the area.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

University of Sheffield provides design to manufacture capability for its industrial sponsors through world leading discrete and integrated component expertise and its strategic links world-wide. The aerospace sector, with its continual drive for high power density, ultra-high levels reliability and in-service health monitoring is a key end-user of the technology being researched at Sheffield with many active programmes. UoS has already delivered innovative power semiconductor device solutions in Silicon (Si) and wide band gap (WBG) materials such as Gallium Nitride (GaN) and Silicon Carbide (SiC). Complimenting this, the university is investigating next generation concepts such as the optical gate drivers and novel converter topologies. Presently, very high power density power conversion solutions utilising high value materials and manufacturing techniques to deliver advanced thermal management of passive/active components and power electronic converters for aerospace applications is actively pursued. Electric and hybrid-electric vehicles (EVs/HEVs) remain a complementary core at UoS to the aerospace applications, including discrete and Power IC technologies for electrification, sensorless and direct torque/power controls, novel converter topologies, switching techniques for machine drives in safety critical applications, and power quality and stability studies of “more electric” vehicular systems, including vehicle-to-grid (V2G) interfaces and bidirectional direct and contactless chargers. The power quality and stability assessment of V2G systems which exploits the synergy between the electro-mobility and renewable energy sources has led to a UoS focus on alternative energy interfaces, including photovoltaic systems and multi-phase converters for wind generators. Moreover, various topologies of multi-level converters for high power grid interfaces and aerospace applications, fault-tolerant converters and control techniques for EV traction drives and for embedded power generation are actively pursued. Furthermore, the industrial power electronics activity at UoS encompasses high efficiency power devices, power conversion, including resonant power converters for consumer electronic and lighting applications and high power, high frequency resonantly switched matrix converters for industrial applications and V2G interfaces. The integration of power electronics and advanced control strategies is a key to maximise energy efficiency and achieve optimum system performance. Research in the controls area at UoS includes development of platform technologies in power quality, parallel operation of inverters, power flow control, and integration of renewable energy into the smart grids, DC grids and micro-grids, synchronisation mechanisms and the development of technologies for energy storage systems, EV/HEVs and more-electric aircraft.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Significant infrastructure exists to support the high quality interlinked research activities. The UoS hosts an EPSRC III-V National Centre for proof-of-concept GaN power device fabrication. For Silicon and SiC, external links with state-of-the-art facilities world-wide are actively employed. Excellent facilities exist in-house for Technology CAD (with calibrated models) and testing of power devices/modules, gate drives and converters over a wide temperature/power/frequency range. In-house packaging facilities include wire bonder, laser welding equipment, solder and silver sintering assembly facilities, heated die presses and environmental chambers (including pressure and humidity control) and thermo-stream facilities for lifetime and physics of failure testing, as required. The UoS houses state-of-the-art power device characterisation facilities including parametric test facilities for static and dynamic testing at wafer/die/packaged device/module level. Furthermore, at the application level, high speed and high power dynamometers and spin-pit facilities, high power ac and dc power supplies, grid interface inverters, electronic loads, data acquisition and control systems and pre-compliance EMC test facilities are in place. Comprehensive mechanical workshop facilities are also available in-house.

UNIVERSITY OF STRATHCLYDE



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INTRODUCTION

The Institute for Energy and Environment, with 26 academic staff, 30 post-doctoral researchers and 140 PhD students, is the largest Institute/Centre in the Electronic and Electrical Engineering department. Its research groups provide complementary depth and breadth in electrical power and energy systems research. The Power Electronics, Drives, and Energy Conversion (PEDEC) group, leads power electronics research and comprises 5 academic staff, 8 post-doctoral researchers and 16 PhD students. The Institute's focus on energy systems research means that there is significant power electronics and related research over a range of power levels and applications across its research groups. The Institute plays a management role in HubNet, the EPSRC Energy Networks Hub. It is a key contributor to the EPSRC Supergen FLEXNET and HiDEF projects, and to the Transition Pathways project for low-carbon energy systems in the UK. It is PI on the EPSRC Energy Networks Grand Challenge 'Autonomic Power System' project and is a key partner on the Grand Challenge 'Top and Tail' project. The Institute holds an EPSRC Platform Grant on renewable energy generation and integration into power systems. Additionally, the Institute has an EPSRC grant portfolio in excess of £25million with projects covering a broad range of subject areas in which power electronics and their applications play a key enabling role.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

Activities include device-level research, with power systems level applications; the emerging area of power-electronic systems operation beyond device ratings; HVDC systems; pulse-power switching; fuel-cell sources has for battery/fuel-cell hybrid electric vehicle; and power electronics research for aerospace applications. The core research focus of the PEDEC group is summarised as:

- Power Electronics Circuits: Includes all power converter topologies and applications.
- Systems: Active power filters, grid connection interface, STATCOM and FACTS devices, wind turbine pitch drive systems & their battery UPS back-up.
- Devices: Modelling, packaging, experimental verification of transient behaviour. High-temperature SiC (350°C) and low-temperature (77K) MOSFETs.
- Control of Inverters for Generator Grid Interface: Research focuses on optimised control under transient and distorted grid conditions, and the study of interactions within multi-inverter systems and FACTS devices.
- HVDC Micro-Grid: Collection networks for distributed renewable sources, at transmission and distribution levels, and DC circuit breakers.
- Specialist Power Supplies: High-efficiency, high-power density, Megawatt-level, low-voltage power systems.
- Pulsed Power: Multi-pulse generation for diode flash X-ray diagnostics applied to hydrodynamics research.
- High-Temperature Silicon-Carbide: Design, processing, manufacture and packaging for high-temperature (350°C) SiC power electronics.
- Energy Networks: Battery charging, V2G interface, energy storage systems, on-board electrical power networks and propulsion systems, and smart grids.
- Renewable Energy: Wind turbine, wave and PV energy conversion systems, converter topologies and control.

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Research is supported by well-appointed simulation and design facilities (dSPACE, Matlab/Simulink, SABER, PSCAD), prototyping capability (power electronics hardware, electrical machines and actuators, and DSP/FPGA control), the Medium Voltage Power Electronics and the Energy Conversion laboratories, and Machine Drives research facilities, including embedded power electronics and control capability. The laboratories incorporate dedicated test areas, a cold table, a high-temperature furnace, environmental chamber, 100kW test bed, and a 110kVA micro-grid with hardware-in-the-loop and real-time simulation.

A fuel cell dynamics laboratory offers a monitoring facility for fuel cell performance and grid integration. Strathclyde University provides infrastructure to support research that is directly applicable to power electronics and the application of power electronics, including the Offshore Renewable Energy (ORE) Catapult Centre, the Strathclyde Technology and Innovation Centre (TIC), the Power Networks Demonstration Centre (PNDC), the Wind Energy Centre for Doctoral Training (CDT), the Rolls-Royce University Technology Centre (UTC) in Electrical Power Systems, the Centre for Advanced Condition Monitoring and RenewNet (a multi-university partnership initiative, to facilitate effective knowledge transfer enabling industry to work with academia to solve problems relating to renewable energy systems). Total investment exceeds £150million and is a key enabling element in power electronics research.

SWANSEA UNIVERSITY



Swansea University
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INTRODUCTION

The power electronics research group originates from one of the four departments that joined together to form School of Engineering, now College of Engineering, Swansea University. Swansea's College of Engineering is a cutting edge research environment with state of the art research laboratories. It pioneers technological progress in both traditional and emerging disciplines within the field of Engineering, working in partnership with major industrial companies and UK Research councils. All College's activities are driven and underpinned by world leading research, as recognized by the latest Research Assessment Exercise (RAE) in 2008, where the combined score of the College of Engineering ranks number 8 in the UK and number 1 in Wales. In addition, 73% of its research was rated as internationally leading or internationally excellent. At the present, Centre has 16 full time equivalent posts (7 Academics and 9 Research Associates) and 15 postgraduate research students (14 PhDs and 1 MPhil), making a total of 31 research active members. Current research (around £4,000,000.00 in value) is being supported by grants from the EPSRC, Royal Society, H.E.F.C.W., European Regional Development Fund, and for specific projects by EU Consortium grants (under FRAMEWORK and other initiatives) and industry.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

The Electronics System Design Centre has particular interests in power semiconductor electronics devices and technologies and power electronics. The Centre is best known for its research in ground-breaking Power IC technology, which combines power devices with low voltage control IC technology, the key technology for more energy efficient electronics. The Centre is a world leader in semiconductor device modelling, FEM and compact modelling especially in quantum transport (Non-Equilibrium Green's Functions) and ensemble Monte Carlo simulations of nanoscale transistors. The application of power electronics in embedded energy generation is also an area of rapid growth within the group. Other areas of particular interest include GaN devices and technology, MEMS and Energy Harvesting, PV Technology and Systems, Systems, Control and Software Engineering. List of selected publications: IET Ren. Power Gen., DOI: 10.1049/iet-rpg.2009.0090, IEEE Trans. Elect. Dev., DOI: 10.1109/TED.2008.927658, IET Elect. Lett., DOI: 10.1049/el:20070887, J. Appl. Phys., DOI: 10.1063/1.1530712, J. Appl. Phys., DOI:10.1063/1.3380826, doi:10.1109/TED.2004.829895, doi:10.1063/1.1765731

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

The centre's laboratories and facilities include a Design and Modelling Laboratory equipped with multi-licenses for the industrial standard SILVACO TCAD software, CADENCE design tool, PSPICE, MATLAB and COMSOL softwares; well equipped Device Characterization Laboratory and general purpose Power Electronics Laboratory; Advanced Device Characterization Laboratory equipped with electron microscopes, x-ray photoelectron spectroscopy, scanning probe microscopes and nanoscale four point probe. Researchers within the Centre have also access to the state of the art Engineering's Clean Room facility equipped with the latest semiconductor fabrication equipment including e-beam lithography (£25M ERDF investment) and Supercomputing Cluster.

UNIVERSITY OF WARWICK



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INTRODUCTION

The University of Warwick is one of the leading UK Universities which is internationally recognised in the field of power electronics. The Power Electronics Applications in Energy Research Group (PEATER) was founded in 2005 by Professor Philip Mawby to establish a world-class centre for research into power electronics, power semiconductor devices and applications in power systems and power conversion. It has now expanded to a team of 7 academics directly involved in the area of electrical power, of which 3 are full professors. These are supported by a team of 10 Research Fellows and over 20 PhD students.

The group also has active industrial and academic collaborations running in the fields of Aerospace, Semiconductor Research, Automotive, Power IC development and Renewable Energy with a current research grant portfolio in excess of £4m.

SYNOPSIS OF RELEVANT POWER ELECTRONICS ACTIVITIES

At Warwick, our core research expertise lies in the following areas:

- Power semiconductors – the group has a strong reputation in the power device area; this covers traditional silicon device technologies from power IC's through to high power IGBTs, diodes and thyristors.
- WBG materials – wide bandgap (WBG) materials include silicon carbide (SiC), gallium nitride (GaN) and diamond.
- Packaging – to exploit the benefits of advanced silicon designs and WBG devices, new packaging technologies are needed.
- Modelling – our expertise in this area is world class. We particularly focus on the electro-thermal interaction of devices with their environments.
- Reliability – understanding the details of the interaction between the complex mission profile and the wear-out of the device. The group has made significant progress towards developing a physics-based methodology to tackle the problem of condition monitoring .

KEY FACILITIES RELEVANT TO POWER ELECTRONICS

Operational since early 2010, the University houses a specialised laboratory which was a major investment through the Science Cities Initiative and includes a semiconductor Class 1000 cleanroom, with a suite of processing equipment which includes:

- High temperature furnace - a unique custom vertical design aimed at high quality Gate oxides on SiC in a new temperature regime up to 1500°C and implant annealing 100mm wafers in Argon up to 1800°C
- A metal contact formation furnace capable of 1000°C specifically for SiC processing
- Inductively coupled plasma dry etcher - low ion energy for good mask selectivity and minimum physical damage, but high rate etching
- Low pressure SiO₂ deposition - a TEOS based system which will deposit high quality field oxides to avoid the need to grow thick oxides on SiC
- A 1:1 stepper and associated coater/developer capable of 0.75 micron lithography
- An advanced stylus based physical film thickness monitor
- A Reichart analytical microscope with a high quality CCD camera and image processing software
- Extracted solvent and acid benches for wafer cleaning and other operations
- Additional facilities include a power module assembly laboratory which enables the long-term reliability assessments of modules, PE systems modelling, design and assembly capability as well as Hardware in the Loop (HIL) for emulating hardware.

SUPPORTING ORGANISATIONS

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BIS



Department
for Business
Innovation & Skills

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OVERVIEW

BIS – the Department for Business Innovation and Skills – was created to help ensure business success in an increasingly competitive world. BIS's role is to boost productivity and keep the UK competitive and an attractive place to do business, especially in challenging economic times, as well as to help companies succeed overseas and to bring foreign investment to the UK.

BIS focuses on raising and sustaining the UK's economic performance, nationally and in the regions, to create the jobs, wealth and ideas which support a healthy economy and social wellbeing. This is either worked on directly, or through those who have an interdependent interest in a successful business environment. These include consumers, employees, investors, small & medium-sized enterprises, large corporate businesses and representative bodies.

BIS is also the 'voice for business in Government', listening carefully to what these different groups have to say and weigh up the evidence behind their various views. The arguments made for business success are then effectively presented around the rest of Whitehall and Brussels. Collaborative work with other government departments and at Cabinet influences Government and European policy in a way which puts the UK's economic interests first.



EEE ACADEMY



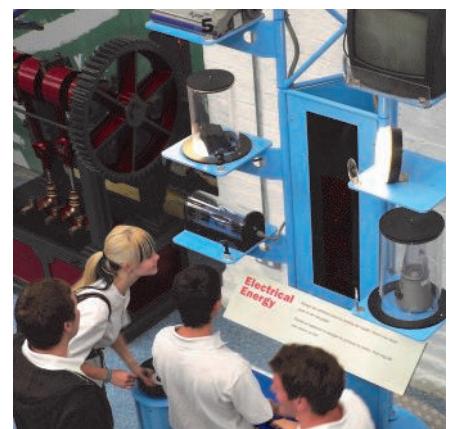
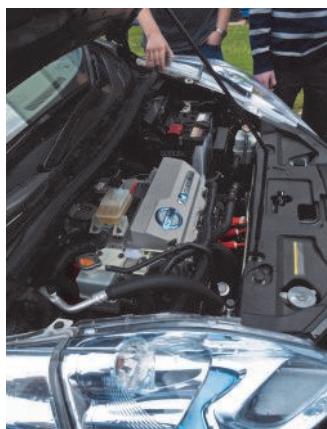
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OVERVIEW

ELECTRICAL ENGINEERING ENERGY (EEE) ACADEMY

Electrical Energy Engineering underpins much of our recent economic development through industries including Aerospace, Manufacturing, Building Technologies, Transportation, Industrial Automation and Renewable Energy. The sector is of critical national importance, but faces the difficulty of finding the skilled electrical engineers needed now and for the future to sustain its expanding operations. The aim of the E3 Academy is to encourage more young people to follow university courses directed towards electrical energy engineering. The industrial partners provide a scholarship package worth around £5000 per year to E3 scholars at selected UK universities. The Academy brings benefits that no individual company could achieve. For example, during the annual summer school E3 scholars see the exciting and rewarding careers available across the electrical energy sector, and are exposed to different company cultures and operational models.

In effect graduate recruitment has become undergraduate recruitment, with E3 scholars being selected by their sponsoring companies in parallel with, and supportive of, the university admissions process. While this approach requires some upfront investment, the benefits are considerable. During their university course E3 scholars spend at least 24 weeks on vacation work placements, so they are well positioned to make an immediate impact after graduation.



Summer School 2012 included a visit to Nissan at Washington with a chance to examine the new Nissan Leaf electric vehicle .

E3 Academy scholars at Enginuity, Ironbridge .

EPSRC



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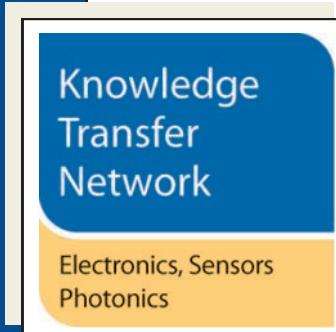
OVERVIEW

EPSRC - ENGINEERING AND PHYSICAL SCIENCES RESEARCH COUNCIL

EPSRC is the main UK government agency for funding research and training in engineering and the physical sciences, investing more than £850 million a year in a broad range of subjects – from mathematics to materials science, and from information technology to structural engineering.

The EPSRC is establishing a flagship multi-site Centre of Excellence in Power Electronics. The centre will have a strong focus on the underpinning science and engineering research challenges, and will coordinate and draw on the strengths of the UK community to deliver a high quality and adventurous research vision that will drive innovation in this field for years to come. The centre will act as a national hub, coordinating and stimulating novel, transformative research programmes and will build capacity in the academic sector to ensure that Power Electronics research in the UK achieves critical mass and delivers the skills and long term support required by a vibrant academic research base and a successful and diverse national industry.

ESP KTN



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OVERVIEW

MAKING NETWORKING COUNT

We like to see innovation making an impact, and we do this by finding out who has got what and who needs what, then overcoming the barriers to bringing them together.

In ESP we cover all of the underpinning hardware technologies that we use every day and take for granted. So, we are thoroughly networked with the companies and academics in all of the technology sectors of electronics, sensors, photonics and more, and we use this knowledge to reach out to people with problems to solve.

We work this way because we believe that, for example, experts in low-energy lighting do not so much need to talk to other experts in their field as much as architects, artists and town-planners. We make these relationships happen.

ESP's staff's long experience in working in innovation has proven time and time again that, although there is always room for people to be inspired by technology, nothing beats talking to a real end user to discover what they actually need.

HOT TOPICS FOR ESP AT THE MOMENT INCLUDE THE BIG CHALLENGES OF :

Power: How can we generate this? How can we make devices that use less of it?

Transport: How can technology improve vehicles and also improve how we travel on our end-to-end journey?

Sustainability: Making the best use of technology; meeting with farmers to explore how technology can improve food production

Security: Using technology for monitoring and protecting assets and people

Quality of life: How can technology help with assisted living and improving medical diagnostics and therapies?

Connected world: Recognising the way that the internet is continuing to change our world and working with the new possibilities opened up by the 'internet of things'.

ESP is well connected with other networking and support organisations and a leader in effective practice in knowledge sharing.

We like to see innovation making an impact, and we do this by finding out who has got what and who needs what, then overcoming the barriers to bringing them together.

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GAMBICA



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OVERVIEW

GAMBICA is the Trade Association for Instrumentation, Control, Automation and Laboratory Technology in the UK. It has a membership of over 200 companies including the major multinationals in the sector and a significant number of smaller and medium sized companies.

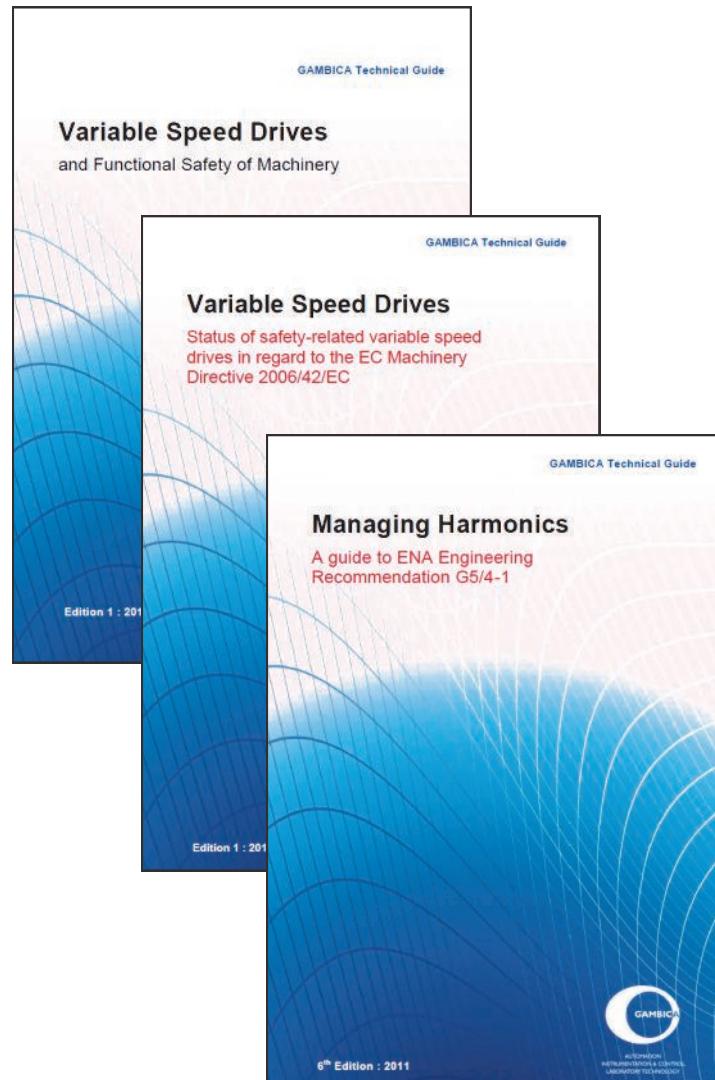
The diverse nature of the industry is reflected in the five industry sectors represented by the Association:

- Industrial automation products and systems
- Process control and instrumentation
- Environmental analysis and monitoring equipment
- Laboratory technology
- Test and measurement equipment for electrical and electronics industries

We develop and deliver value to our members by;

- Representing and strengthening the position of the Instrumentation, Control, Automation and Laboratory Technology industries of the UK in an increasingly competitive world
- Being the voice of our sector in the areas of regulation and economic policy
- Offering a common platform for voicing opinions and representing common interests
- Influencing and setting regulations and standards
- Providing technology and market-oriented services at the intersection of companies, markets, politics and institutions

GAMBICA members cover a wide range of industrial products, within which Power Electronics will feature. These include motor control technology, such as Variable Speed Drives (VSD) and Soft Starts, and power continuity technology such as Uninterruptible Power Supplies (UPS).



IMAPS UK



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OVERVIEW

IMAPS is the International Microelectronics And Packaging Society. It is the largest Society dedicated to the advancement and growth of microelectronics, electronics packaging and related sectors. The Society offers chapters around the globe, creating a network with more than 8,000 worldwide members. IMAPS- UK, the United Kingdom chapter, operates as a trade organisation /learned society and is set up as a 'Registered Charity'. It was the first international Chapter and continues to maintain strong links with other European countries, the USA and Asia.

IMAPS-UK plays a leading role in the UK electronics industry, working closely with other governing bodies, societies, industrial and academic institutions, to ensure that members are kept up to date with the latest developments & innovations in microelectronics and to provide a forum for the industry to meet and shape its future.

The Society's objectives are achieved through regional seminars, workshops, major international conferences and exhibitions, the publication of newsletters, & technical papers and other activities relevant to promoting knowledge within the industry.

IMAPS-UK is supports the UK power electronics sector by organising specialised conferences, events and seminars that offer industry and academia the chance to exchange innovative technical solutions and practical problems to stimulate new applications and to help to establish an infrastructure for a more cost effective, energy efficient future. These events, such as the iPOWER event, cover: Applications, Trends & Emerging Markets; Packaging, Test and Reliability; Assembly Materials & Technologies; Devices & Integrated Processes (micro-machining, micro-moulding); Thermal Management & Efficiency; Product Design Development & Modelling; Interconnection, Integration & Systems; Solutions For Harsh Environments; High Reliability & Temperature and aspects covering Novel Designs & Future Concepts.

INTELLECT

intellect
REPRESENTING THE UK TECHNOLOGY INDUSTRY

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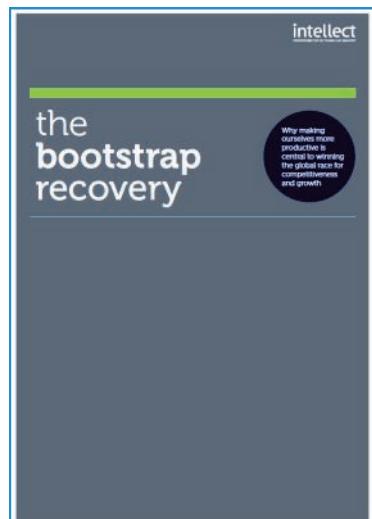
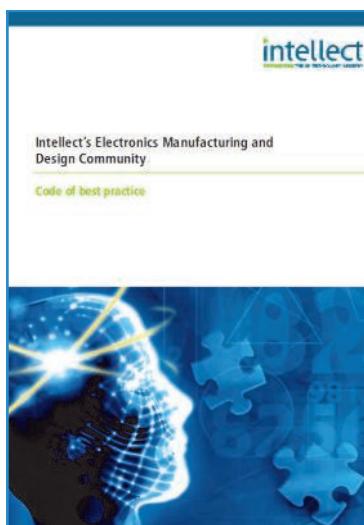
OVERVIEW

Intellect is the UK trade association for the IT, telecoms and electronics industries – a community of thousands of individuals from over 800 member organisations, working together to put the technology industry at the very heart of modern society and the economy. Intellect provides a collective voice for its members and drives connections with government and business to create a commercial environment in which they can thrive. As the hub for this community, Intellect is able to draw upon a wealth of experience and expertise to ensure that its members are best placed to tackle challenges now and in the future.

We believe that a vibrant and successful technology sector is vital to the long term economic well-being of the country. Our business services help companies of all sizes compete and innovate in a dynamic global market. We represent the views of industry to government and regulators and also provide opportunities for government and regulators to interact with industry on key policy and market issues. Our work focuses on three themes: to make the UK good for tech | to make tech good for UK PLC | to make tech good for UK people.

Specific Power Electronics related activities:

Members of Intellect active in power electronics range from large electronics systems OEMs to SME components suppliers. Many strategic activities focused on emerging power electronics markets are carried out in areas such as energy (smart meters and smart grids), transport (infrastructure, electric vehicles) and consumer products.



RENEWNET



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OVERVIEW



RenewNet is the industrial engagement platform for Scotland's leading electrical power engineering research groups. We provide an engagement process that helps give accessible technical support and expertise to companies that help accelerate their research and development for their products.

RenewNet pulls together world leading expertise that focuses on electrical machine design, power electronics and hardware control to support both the design process and power strategies.

Our engagement process make a simple and effective way for industry to engage with the science base and their facilities.

RenewNet has 5 stand-by academics we call Knowledge Exchange Fellows (KEFs) who provide direct support to companies and give informed solutions to their research and development needs in electrical power engineering. These KEFs are supported and guided by Professors and academics who give technical insight and access to their testing facilities.

RenewNet also works closely with funding bodies to help industry find funding mechanisms that support industry and University collaboration to help meet industry needs.

RenewNet is a partnership between the universities of Edinburgh, Strathclyde, Glasgow, Aberdeen and Heriot-Watt and is funded by the European regional development fund and the Scottish Funding Council.

**Imagine the World's
best power
engineers working
with you**

Ask us how?
www.renewnet.org.uk
 0131 650 5694

Funded by

University of Edinburgh University of Strathclyde University of Glasgow University of Aberdeen European Regional Development Fund Scottish Funding Council Scottish Government

TSB

Technology Strategy Board
Driving Innovation

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OVERVIEW

The Technology Strategy Board is all about driving innovation.

Our role is to stimulate technology-enabled innovation in the areas which offer the greatest scope for boosting UK growth and productivity. We promote, support and invest in technology research, development and commercialisation. We spread knowledge, bringing people together to solve problems or make new advances. We advise Government on how to remove barriers to innovation and accelerate the exploitation of new technologies. And we work in areas where there is a clear potential business benefit, helping today's emerging technologies become the growth sectors of tomorrow.

We offer a range of programmes and tools, each with different strengths, to support businesses on the innovation journey. Funding for Research, Development and Demonstration projects ranges from small proof -of-concept grants and feasibility studies through to large multi-partner collaborative R&D and demonstration projects. The businesses we support range from pre start-up, start-up and early stage micro businesses, to large multi-nationals. There are different models depending on the specific needs of companies, sectors and technologies. We also provide academic-business knowledge transfer opportunities, open innovation networking platforms, the route for UK businesses to access European support for innovation and technology and opportunities for innovative businesses through our growing network of Catapult centres.

Power electronics is one of our focus areas in the electronics sector. It is fundamental to enabling rapid growth and innovation in transport; energy generation, transmission and distribution; consumer electronics and lighting; and industrial drives. We recognise that there are challenges such as insufficient collaboration across industry sectors, supply chain barriers and potential gaps between universities, SMEs, systems integrators and end users. The Technology Strategy Board will provide funding programmes for power electronics organisations in the UK to accelerate the exploitation of new technologies.

THE IET



The Institution of
Engineering and Technology

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OVERVIEW

The Institution of Engineering and Technology

The Institution of Engineering and Technology (IET) is a not-for-profit organisation and is the largest professional society of engineers and technicians in Europe, with approximately 153,000 members in 127 countries right across the world.

Formed in 1871 as the Society of Telegraph Engineers, the organisation has continued to evolve to reflect the changing environment of engineering and technology.

The IET has prioritised five key sectors: Built Environment; Design & Production; Energy; Information & Communications; and Transport to provide a focal point for engineers and technicians from all disciplines to access expertise, find current and reliable information, participate in active communities and attend industry leading events.

The IET is the Professional Home for Life® for engineers and technicians, and a trusted source of essential engineering intelligence.



IET Power Electronics activities

Power Electronics, Machines and Drives Conference (PEMD) - The IET's flagship power electronics event focuses on the latest developments in electrical drives, machines and power electronic systems. Attendees to PEMD hear about the latest research concepts and ideas, technical issues, industrial applications and tutorials by leading experts. The 2013 PEMD event programme is currently being finalised.

www.theiet.org/pemd

Electronic Letters journal - Electronics Letters is an internationally renowned peer-reviewed rapid-communication journal, which publishes short original research papers every two weeks. The broad and interdisciplinary scope covers the latest developments in all electronic and electrical engineering related fields. Selected research from each issue is highlighted through feature articles and author interviews on the Electronics Letters website.

www.theiet.org/el

Power Electronics journal - The Power Electronics journal brings together technical research of the highest quality covering five principal power electronics themes; applications of power semiconductor technology circuits, devices, techniques and performance management.

<http://digital-library.theiet.org/IET-PEL>

IET Power Communities

The Power Networks are free to join technical communities where professionals who work or are interested in power engineering and technology come together to exchange knowledge. These networks cover the interrelating stages of the power industry from generation and conversion to the design and operation of generation, transmission and distribution systems.

Power Generation, Conversion and Utilisation – covers a wide area of the power sector focusing on technologies in electricity generation, power electronic devices and systems, machines and drives, industrial and commercial power applications and electrical safety.

www.theiet.org/power-generation

Power Systems and Equipment – for anyone who has an active interest in power systems and equipment. It is also relevant to those involved with the design and operation of generation, transmission and distribution systems including the associated protection and control equipment.

www.theiet.org/power-systems

Other power activities which the IET is organising include:

Powering the QE Class Aircraft Carrier: The MT30 Gas Turbine, Civitas Renaissance Hybrid Buses, Power Quality and Harmonic Factors, Electric futures - The B320 powertrain for hybrid buses, Electric cars and bio fuels

UKESF



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OVERVIEW

THE UKESF - THE UK ELECTRONICS SKILLS FOUNDATION

Is a collaboration between industry, universities and the public sector

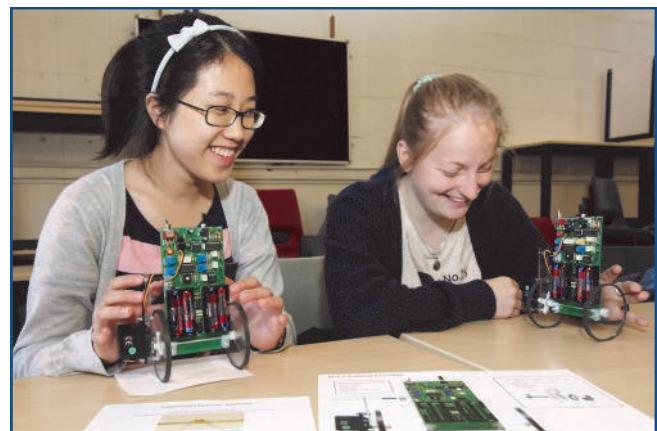
- Connecting employers with students in schools and universities;
- Promoting the electronics industry and its value to society and the economy;
- Raising awareness of the range of stimulating careers in electronics.

Why was UKESF set up?

To address the threat of diminishing skills capability in the UK electronics sector.

UKESF is addressing the risk posed by the significant decline in the numbers of UK students accepting places on Electronic Engineering degree courses.

To secure a sustainable supply of quality and industry-prepared graduates UKESF is helping to attract, prepare and retain talent for the UK electronics industry to maintain and grow its global leadership position.



How does UKESF work?

- UKESF offers a sector-specific programme for employers in the electronics sector to engage with young people at school and university through to graduate employment, by sponsoring and participating in a programme that is:
- Increasing the number of employers in the sector that are Working with Schools;
- Offering talented 17 year-old school students the opportunity to attend UKESF Summer Schools to find out about degree study and careers in Electronic Engineering;
- Linking employers with high-calibre students for Scholarships offering bursaries and practical experience of the industry through mentoring and work placements.

UKTI



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OVERVIEW

UK Trade & Investment

UK Trade & Investment (UKTI) is the Government Department that helps UK-based companies succeed in the global economy and helps overseas companies bring their high quality investment to the UK's dynamic economy – acknowledged as Europe's best place from which to succeed in global business.

UKTI offers expertise and contacts through its extensive network of specialists in the UK and in British embassies and other diplomatic offices around the world and provides companies with the tools they require to be competitive on the world stage.

UK Overview

- The UK is the number one location for European headquarters. More than 50 per cent of EHQ operations reside in the UK.
- The UK has one of the lowest Corporation Tax rates in the G8. Corporation Tax, currently at 24 per cent, will be reduced to 22 per cent by April 2014.
- The UK is the easiest place to set up and run a business in Europe. It takes on average just 13 days to establish a business in the UK. (Source: World Bank).
- The UK is one of the most stable political and regulatory environments to do business. It has a higher transparency rating than France and the USA.
- The UK's flexible labour market is one of the world's least restrictive systems. Labour costs are well below the EU average.
- **UK ICT Sector Overview**
- UK offers companies one of the largest ICT markets in Europe. The UK's ICT market is Europe's largest in terms of consumer per head expenditure.
- The UK ICT market is more concentrated and more accessible than anywhere else in Europe.
- At 12% the UK ICT sector contributes a higher proportion of GDP than all comparable countries including France, Germany and USA
- The UK ICT sector has a market value of £140 billion.
- More than 27% of UK jobs are ICT-related; the highest percentage in the G20.
- The UK is home to the world's No 1 ranked university (Cambridge) as well as three of Europe's top 5 technology universities (Cambridge, Oxford and Imperial College London).

The UK is a strong market for new technology and design with a sophisticated consumer base. UK consumers are early adopters of new technologies and design making the UK market an excellent 'test bed' for ICT companies.

Electronics, Photonics and Electrical Systems manufacturing employ more than 330,000 people in 14,000 UK businesses, with a £42 billion turnover. This amounts to 10 per cent of the UK manufacturing industry. UK electronics exports in 2010 totalled £22.5 billion. (Source: BIS)

Support for Innovation

Government has committed more than £200 million to deliver a network of Catapult Centres to drive innovation across 7 key areas including High Value Manufacturing, The Connected Digital Economy and Future Cities. All Catapults are expected to be fully operational in 2013.

R&D Tax Credits offer tax relief of 225% and 130% on allowable R&D costs for SMEs and large companies respectively from 1 April 2012.

Patent Box offers a 10% rate of Corporation Tax from 1 April 2013 to all profits attributable to qualifying patents.



Together We're Better

NMI is a leading UK Trade Association for the Electronic Systems, Semiconductors and Microelectronics communities.

Our objective is to aid the development of a sustainable, world-leading industry by building a strong network and acting as a catalyst and facilitator for commercial and technological development.

NMI's work in Power Electronics includes:

Representation : Leading the development of the UK National Strategy for Power Electronics launched by Mark Prisk, Minister of State for Business & Innovation in October 2011.

Innovation : NMI links technical capabilities to market opportunities, working with key market sectors such as automotive, aerospace and energy.

Excellence : In 21st century Electronics, it's not enough to be good, you need to be excellent. NMI provides a platform to learn from others, sharing best & next practice.

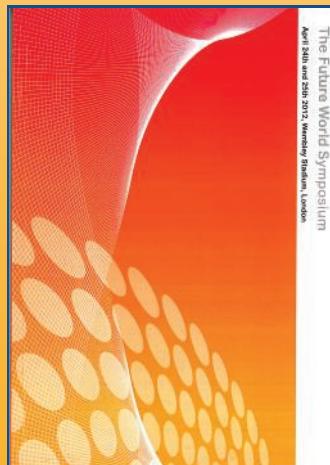
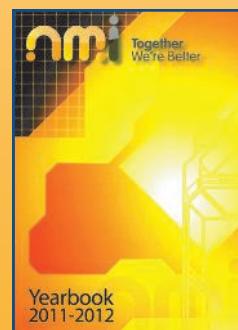
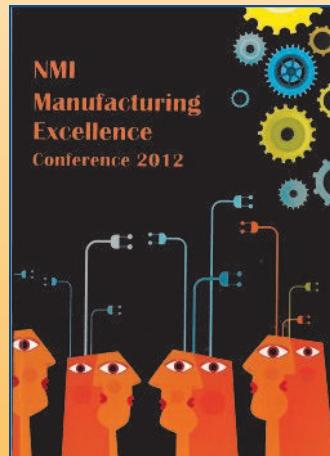
Skills : NMI has a range of activities supporting skills development, education and training.

Trade & Investment : NMI supports organisations develop a UK National capability for international markets.



NMI membership gives you the following benefits :

- Membership and free attendance of all NMI operated innovation and Excellence Networks
- Free attendance to all Business Networks
- Access to qualifying Best Practice Forums
- Preferential rates for conferences and partner events
- Members Area of the NMI website - includes materials from networks, surveys and reports
- Electronic Members Forums
- Representation to Government, Legislators and Policy Makers
- Access to Education and Training Activities
- Publicity and Marketing Opportunities
- Access to the extensive NMI Knowledge resources
- Access to NMI's Legal Advice Helpline
- Access to NMI's bespoke Brokering and Signposting Services
- NMI's Regular Newsletter and Bulletins



NMI is proud to be a leading partner in PowerElectronics UK, which acts as a co-ordinating focal point to ensure the UK is recognised as a world leader in power electronics, creating jobs, and attracting investment.

FOR MORE INFORMATION CONTACT

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WWW.NMI.ORG.UK

POWER ELECTRONICSUK

The UK is recognised as a world leader in power electronics, and PowerelectronicsUK is the new voice of the industry.

It provides a neutral, focal point that promotes Power Electronics in the UK with the aim of growing the industry further, creating jobs and attracting investment.

PowerelectronicsUK Provides:

- Leadership, direction and guidance for UK Power Electronics
- Engagement and organisation across all relevant stakeholders
- Coherence and co-ordination in the delivery of key programs that support its ambition
- Communication channels to and from the Power Electronics Community

It is an industry-led organisation formed as a result of a call for a single industry voice from the government report 'Power electronics - a Strategy for Success'. It is driven through a cross-industry leadership group chaired by Steve Burgin, President of Alstom UK, and Vice-Chaired by Paul Taylor, CEO of Dynex Semiconductors. The secretariat is organised by NMI.

PowerelectronicsUK draws in and unifies the UK community through three main workstreams:

Technology – defining the strategic R&D priorities and needs of the industry.

Supply Chain – mapping the UK capability and highlighting challenges and opportunities.

Skills – acting as a focal point for UK initiatives and helping to promote Power Electronics as a career.

Each workstream is led by a different industry association or body, and participation in the workstreams is open to leading contributors within the Community.

www.Power-electronics.org.uk website is a signpost for all key activities within the sector, bringing together information from all key stakeholders in UK Power Electronics.

FOR MORE INFORMATION CONTACT

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This publication was compiled by NMI with support from the Department for Business, Innovation & Skills (BIS). It provides a showcase for businesses and universities with Power Electronics capabilities. It is intended to help raise the profile of the UK Power Electronics community and those organisations with it.

The online version will be updated with new contributors and it is intended that there will be future hard copy publications. To be included or for further information contact info@nmi.org.uk or see www.nmi.org.uk.

<http://www.nmi.org.uk/electronic-systems/power-electronics/power-electronics-capability-directory>

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