

How will advanced packaging change the supply chain?

Building supply chains for next-generation highly integrated packaging

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DER-IC Centre Lead

Business Development Manager – Advanced Packaging

We work with Innovate UK



UK Research & Innovation Landscape



Department for
Science, Innovation,
& Technology



Science and
Technology
Facilities Council



Arts and
Humanities
Research Council



Engineering and
Physical Sciences
Research Council



Biotechnology and
Biological Sciences
Research Council



Economic and
Social
Research Council



Research
England



Natural
Environment
Research Council



Innovate
UK



Medical
Research
Council

18,785

INDUSTRY
COLLABORATIONS



11,916

SMES SUPPORTED



5,560

ACADEMIC
COLLABORATIONS



5,130

EMPLOYEES IN 2022



OVER £1.3BN

OF RESEARCH AND DEMONSTRATION
FACILITIES UNDER MANAGEMENT



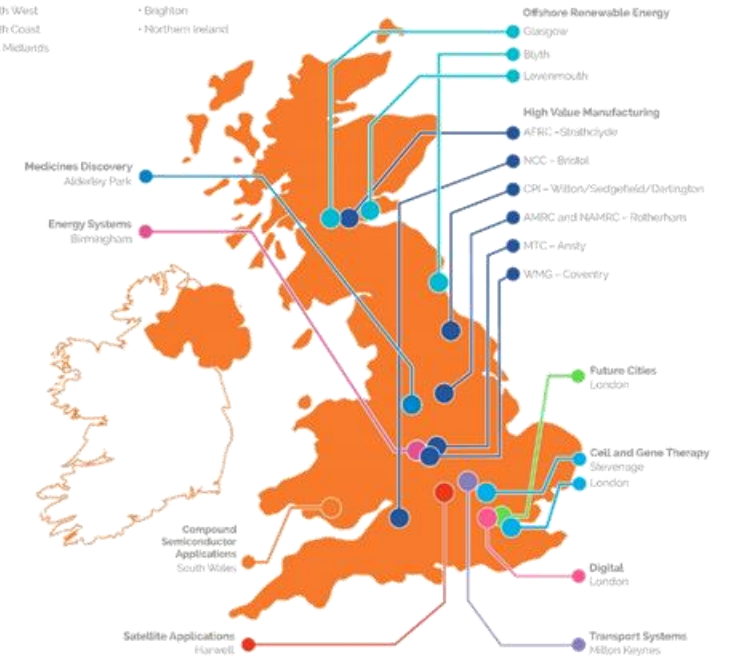
1,120

INTERNATIONAL PROJECTS

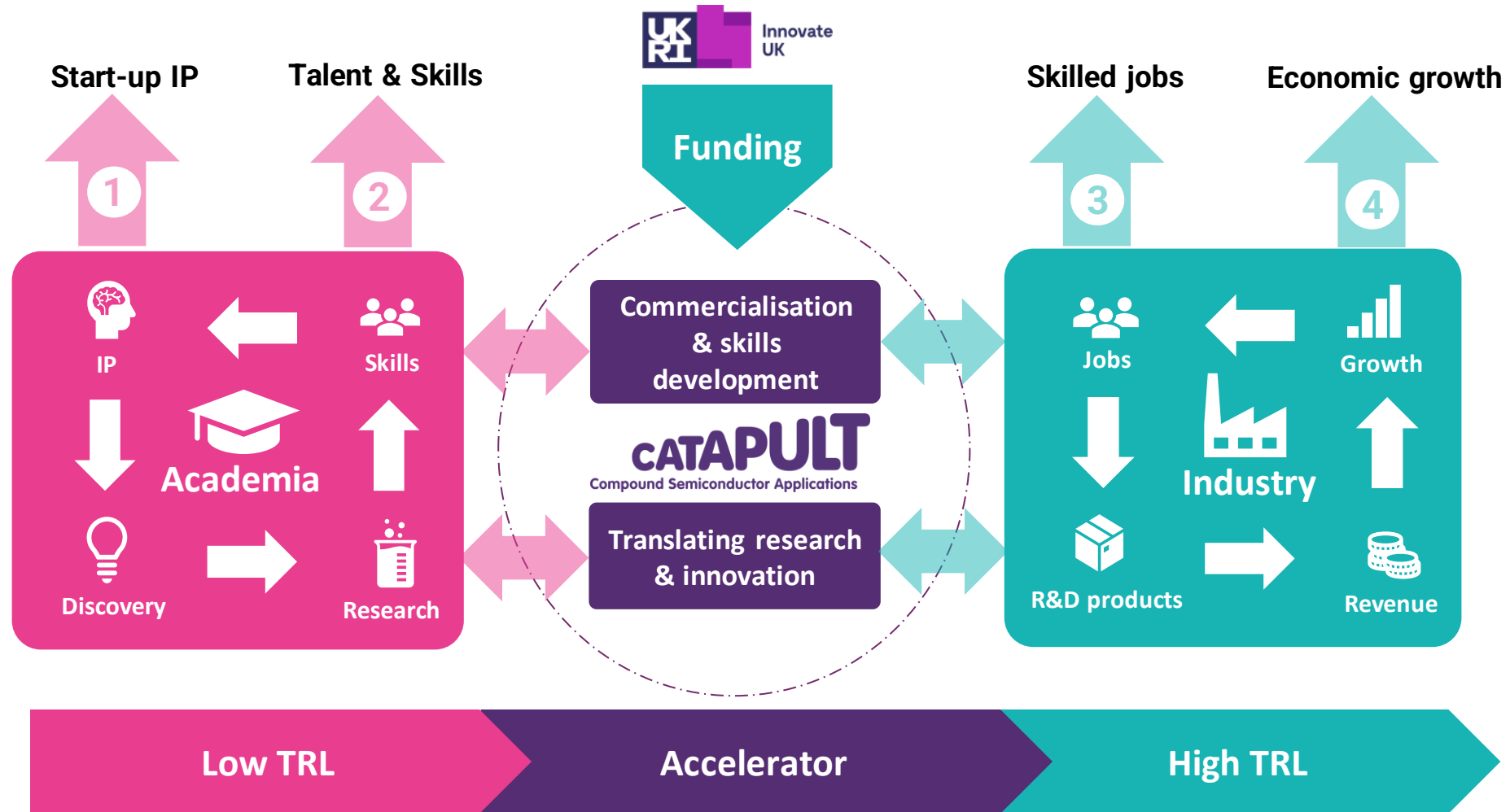


• Scotland
• South West
• South Coast
• East Midlands

• Yorkshire
• Brighton
• Northern Ireland

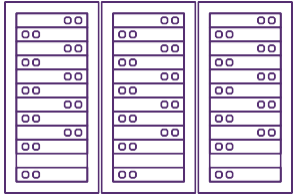
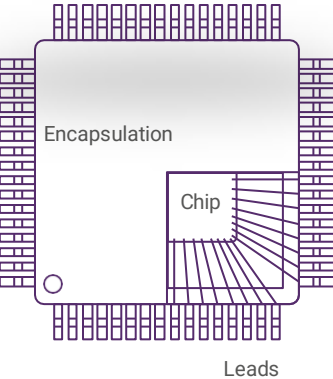
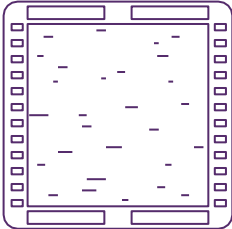
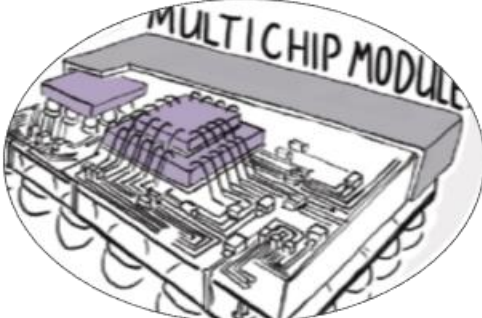


At the centre of the innovation ecosystem

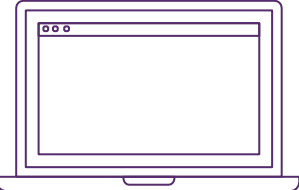


Advanced semiconductor packaging

Highly integrated



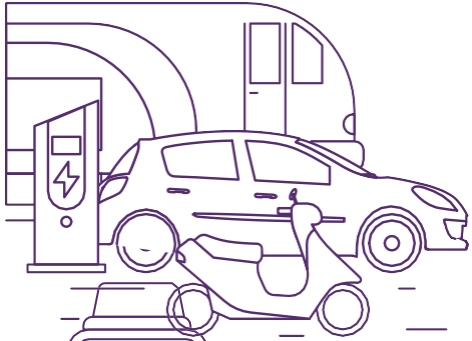
Data centres



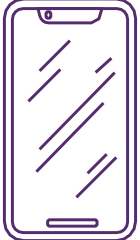
Computers



Game consoles



Wearables



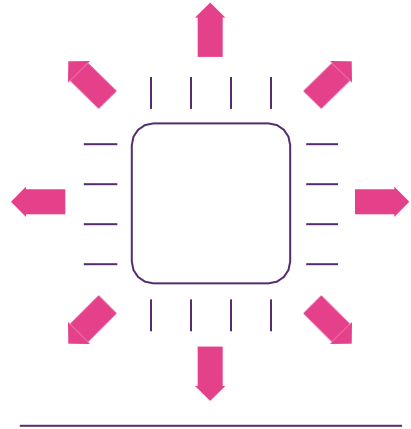
Aviation

Semiconductor Chip
Si + SiC/GaN/InP

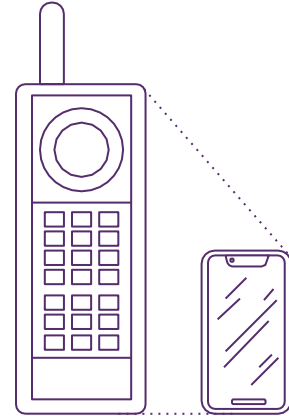
Packaging

Every chip must undergo the packaging process to become functional, empowering our daily technology

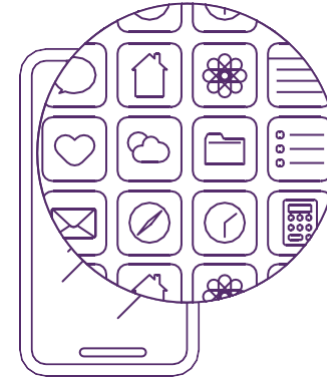
Advanced packaging driven by applications and cost



Enhanced Heat Dissipation
Thermal management



Reduced Size
Embedded packaging



Added Functionality
Heterogenous Integration



Increased Reliability & Efficiency
Digital Manufacturing

Intelligent packaging process to enhance system-level performance, reliability, reduce size and cost

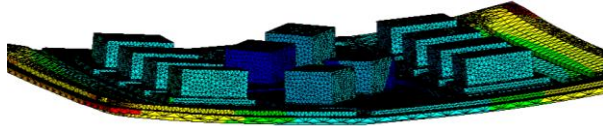
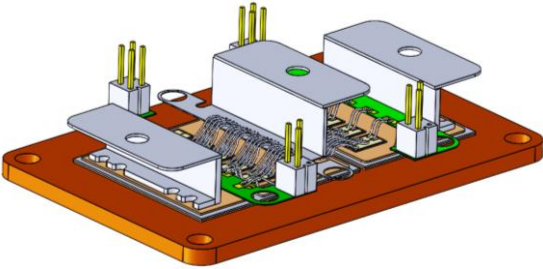
UK packaging capability

Packaging techniques

- Attaching electrical connections to semiconductor die then to PCB
- Attaching die directly to a PCB
- Hybrid packaging: integrating semiconductor die with passive components to create a hybrid module
- Heterogeneous integration: integrating compound semiconductor 'chips' with silicon 'chips' to create a highly functional module
- Photonic packaging: aligning optical fibres or light guides with a photonic semiconductor, such as a laser or a detector, to create a photonic module
- RF packaging: coupling RF output to an antenna or array (e.g. metamaterial) to radiate the RF signal



CSA Catapult's package prototyping facility



Define package Architecture
Technology/
substrate
/materials/floor
planning/DFM



Schematic & Layout
Device/module
layout/component
placement
/routing/interface
definition/DFM/
BOM selection



Design/Modelling
Mechanical,
Thermal, Electrical,
RF, Optics,
DRC/DFA



**Assembly process
engineering/
prototyping**
Component/device/
substrate/
integration/bonding
/encapsulation/ test



**Performance
Testing**
Power and Signal
Integrity,
Mechanical,
Thermal, Reliability

Comprehensive suite of package design, assembly and testing capability

Thermal management

Thermal conductivity tester
Thermatest MP1

Heatsink optimisation and Generative design



CSA Catapult's packaging facility



Hesse BJ653 Automatic wire bonder
12µm -500 µm wire to 2mm wide ribbon



Fineplacer femto2
Submicron precision hybridisation capability



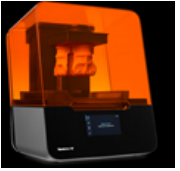
Thinky-ARV 310 P
Vaccum encapsulant mixer



Dage propector
Bond & Die shear tester



Form 3 printer



Vacucell 55L EVO vacuum Oven



FLIR X6900sc Thermal imager
1.5 - 5.0µm, 640x512, 1004Hz



Keyence Digital Microscope VHX700



Class 10,000 clean room



Tressky T-3002-PRO Die bonder
Pressure and pressure less sintering process



tpt HB16 Wedge & Ball bonder
Wedge, Ball, Bump and Ribbon bonding



PE-25 Plasma etcher



Nordson Quadra 7 X-ray with CT scan
Defect detection 100 nm

3D-packaging: Additive manufacturing facility

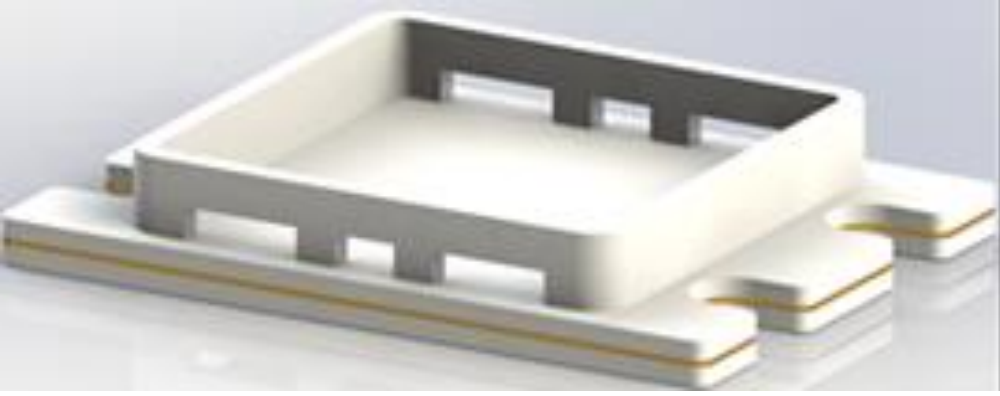
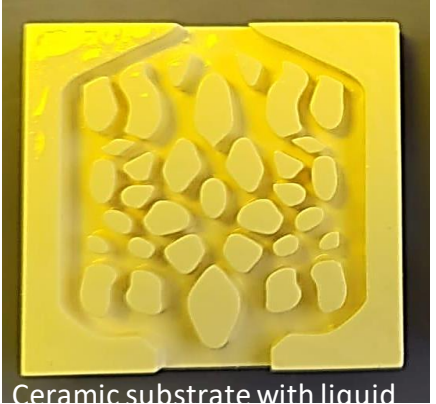
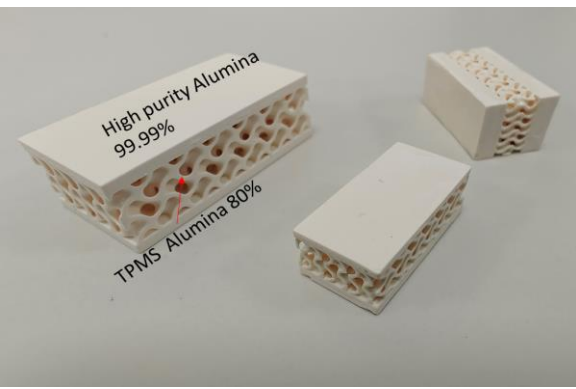


Ceramic and Metal 3D printing for advanced packaging and integration

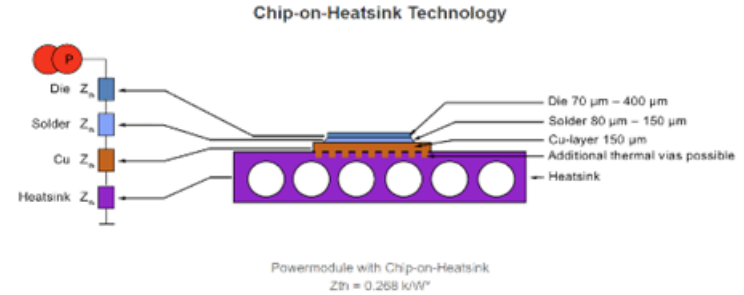
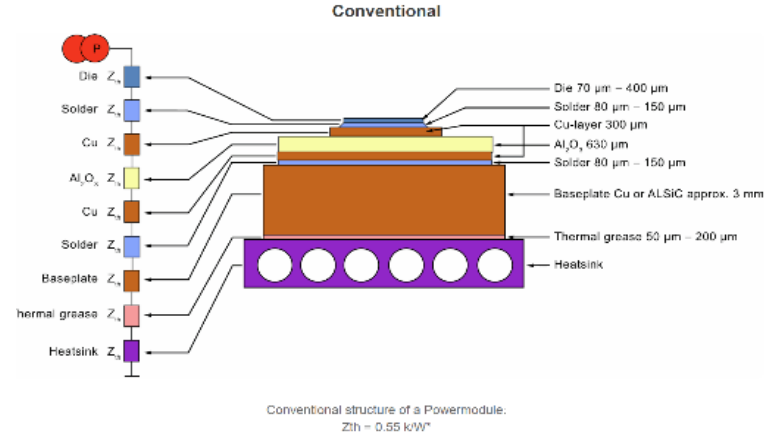


3D-printed Ceramic and Metal heat treatment facility

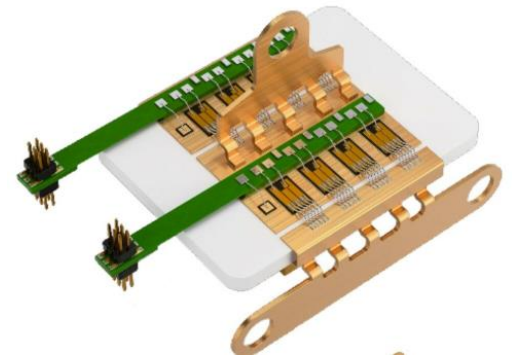
Engineering new substrates and packages



Multimaterial Substrates



* Examination done by Fraunhofer IISB, Nuremberg



Fraunhofer IISB
ceramtec

Half-bridge
converter directly
on ceramic
substrate

Custom package prototyping

Miniaturisation, low thermal resistance and inductance – high-performance devices

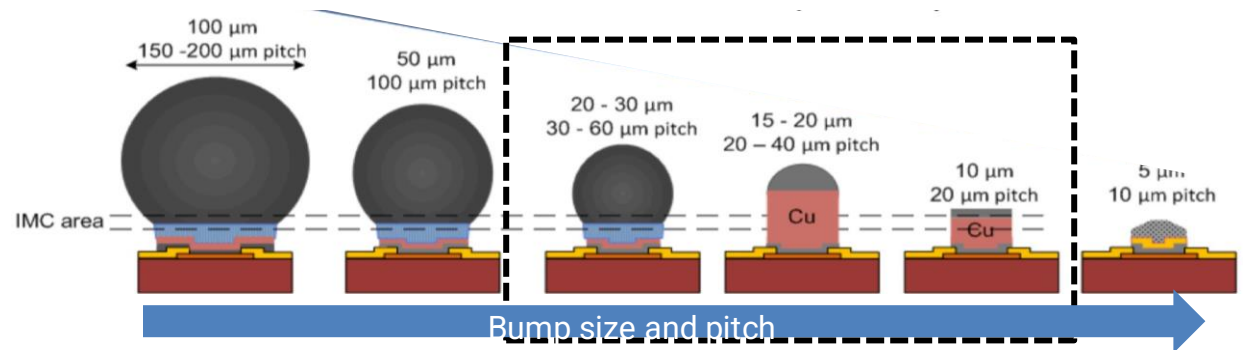
Technology path to more integrated packaging

Hybridisation

Vertical integration two or more dies that are manufactured using different semiconductor processing technology

Hybrid bonding stacks and connects semiconductor chips using vertical interconnects - **wireless bonding**

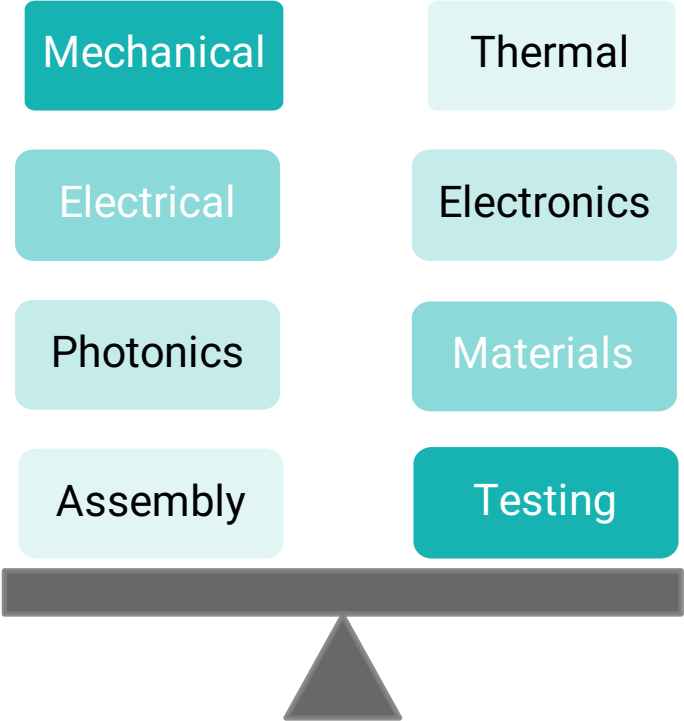
Vertical interconnects - **micro-bump assembly**



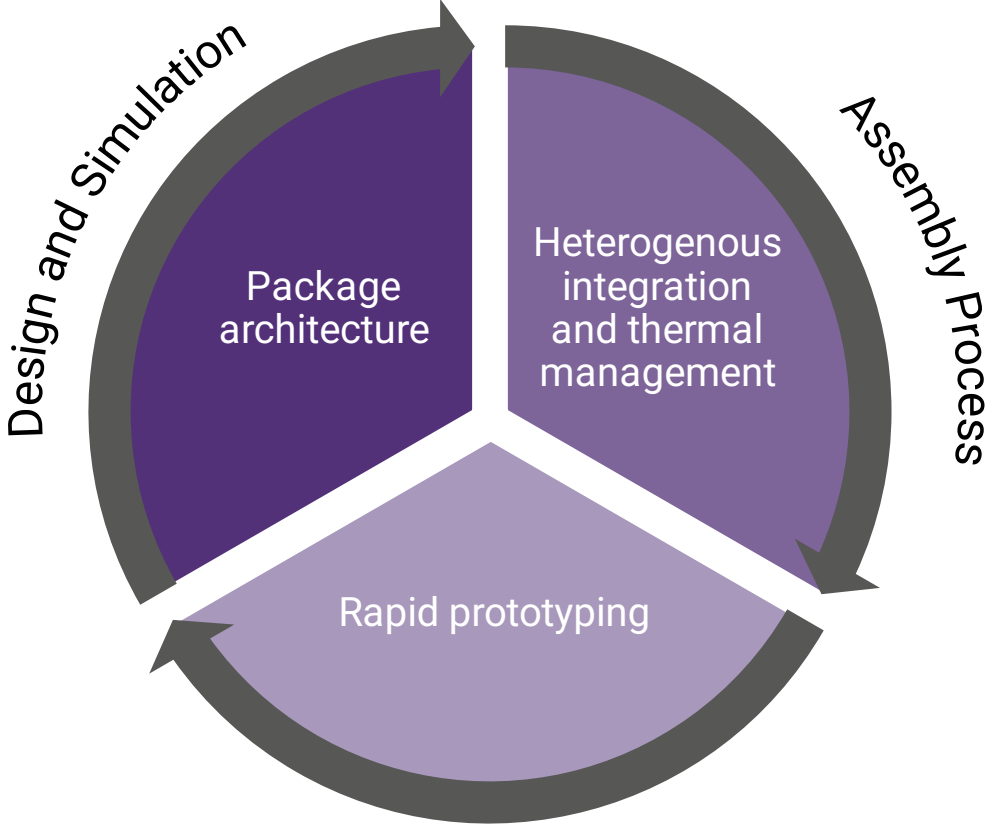
Growing the supply chain



Growing packaging capabilities and skills in UK



Highly skilled multidisciplinary engineers



Validation/testing

Developing the next-generation semiconductor packaging solutions combining design and advanced interconnects
Industrial research focus: **Digital manufacturing, Thermal management, Heterogenous Integration**

Driving the Electric Revolution Industrialisation Centres – DER-IC

University of Strathclyde Glasgow

Propulsion and powertrain systems validation capability at MW scale with hardware in the loop.

UNIVERSITY OF BIRMINGHAM

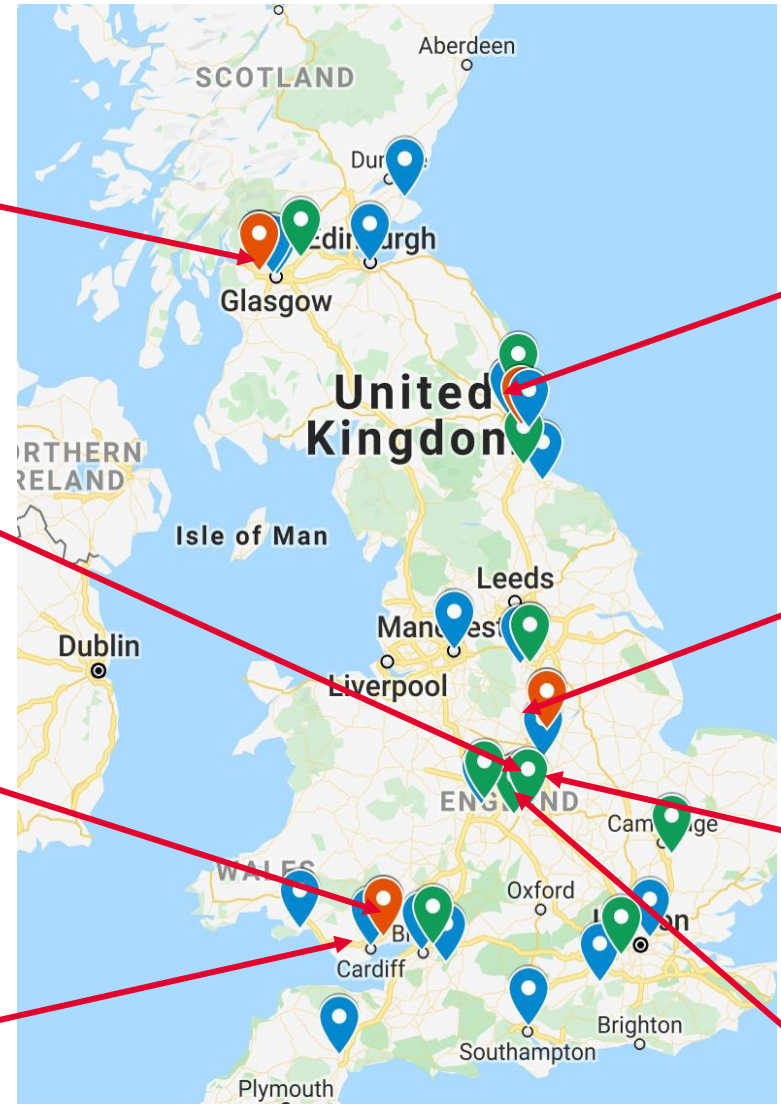
A production line to for recycled sintered magnets with 'end to end' supply chain to enable UK supply of recycled rare earth magnets from processed oxides for more secure UK supply.

CATAPULT
Compound Semiconductor Applications

A facility to prototype ceramic and copper elements and sub-assemblies within highly integrated PE modules..

Swansea University Prifysgol Abertawe

A Wide Bandgap Power Electronics Component Industrial Pilot Line.



Newcastle University

Reconfigurable **Power Electronics assembly line** for semi or fully integrated high-power density drives. **Flexible electric machines assembly line** which includes stator, rotor assembly, chemical dispensing, automated machine assembly line end of line testing.

University of Nottingham
UK | CHINA | MALAYSIA

A High Frequency Coil Manufacturing and Magnetic Test Characterisation capability to develop and manufacture electrical Machines to operate at higher frequencies.


WARWICK
THE UNIVERSITY OF WARWICK

A Power Electronics reliability and failure analysis facility.

WMG
THE UNIVERSITY OF WARWICK

A Winding Centre of Excellence facility to manufacture all types of windings at production quality; specialising in hairpin stators.

New UK Semiconductor Institute


 [Home](#) > [Business and industry](#) > [Science and innovation](#) > [Research and development](#)

Press release

New independent Institute to steer UK semiconductor innovation and support semiconductor strategy

UK Semiconductor Institute announced to support key components of the government's Semiconductor Strategy.

From: [Department for Science, Innovation and Technology](#) and [Saqib Bhatti](#)
Published 20 May 2024



[New independent Institute to steer UK semiconductor innovation and support semiconductor strategy - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

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 **@CSACatapult**

 **Compound Semiconductor
Applications (CSA) Catapult**

We work with Innovate UK

