The i-EDGE project aims to bring intelligence to devices operating under harsh environments at the edge of the network, by building a next-generation computing platform based on nano-electro-mechanical relays: NEM switches.

Four key objectives are addressed by i-EDGE, supporting the goal of European autonomy in chip manufacturing as per the EU Chips Act:

1. **Advance NEM switches fabrication and integration technology to TRL-5** to achieve 10^{10} hot switching cycles with high yield

2. **Develop System-on-Chip (SoC) hardware solutions using NEM switch integration platform** to co-integrate nanomechanical logic and memory with sensing, wireless trickle charging and data transmission on one chip

3. **Develop CAD tools, firmware and software for NEM-based systems** to facilitate broad usage by application engineers

4. **Map applications identified by Business Interest Group (BIG) to prototype hardware** to facilitate take-up of technology demonstrators in their respective applications

Market studies show that by 2026, automotive MEMS sensors will be a €4.5 billion market, while industrial IoT will be worth €1.2 trillion.

THE i-EDGE PARTNERS REPRESENT A WELL-BALANCED CLUSTER OF INDUSTRIES, SMEs AND ACADEMIC INSTITUTIONS ACROSS SIX DIFFERENT COUNTRIES, AND WORK IN CLOSE COLLABORATION WITH OUR BUSINESS INTEREST GROUP (BIG).

AMO · csem · University of Bristol · KTH Vetenskap och Konst · TU Wien Technische Universität Wien · Microchip · SCIPROM Science, Management & Communication

CONTACT US IF YOU ARE INTERESTED IN JOINING OUR INDUSTRIAL BOARD

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Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union, European Health and Digital Executive Agency (HADEA), SERI or UKRI. Neither the European Union nor the granting authorities can be held responsible for them.

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EDGE COMPUTING FOR EXTREME ENVIRONMENTS

i-EDGE

www.i-edge-project.eu
i-edge-project

NEM SWITCHES ARE NANOSCALE RELAYS BASED ON SEMICONDUCTOR WAFER TECHNOLOGY

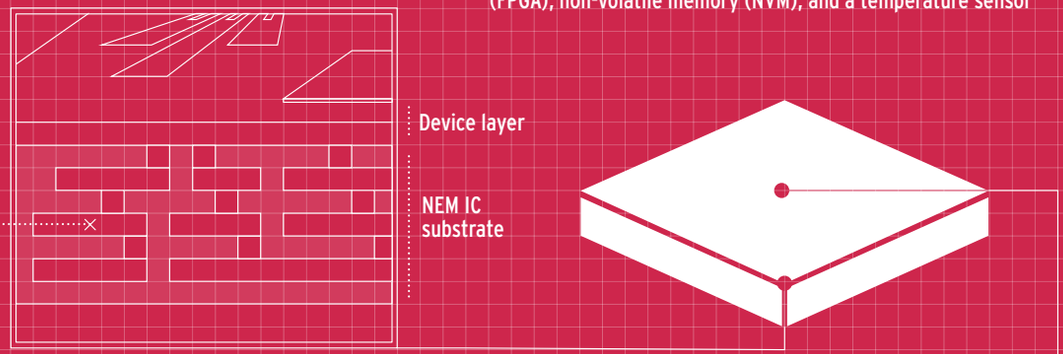
OUR CHIPS HAVE UNMATCHED CAPABILITY TO OPERATE AT HIGH TEMPERATURES AND RADIATION WITH ZERO STANDBY POWER, FOR THE FUTURE IoT

Project: *i-EDGE*
Duration: *2023–2026*
Web: *www.i-edge-project.eu*

THE i-EDGE DEVICE

Proof-of-concept demonstrator of a NEM switch based 'system-on-chip' (SoC) IoT node with a field-programmable gate array (FPGA), non-volatile memory (NVM), and a temperature sensor

Vertical cross section



INTERCONNECT STACK

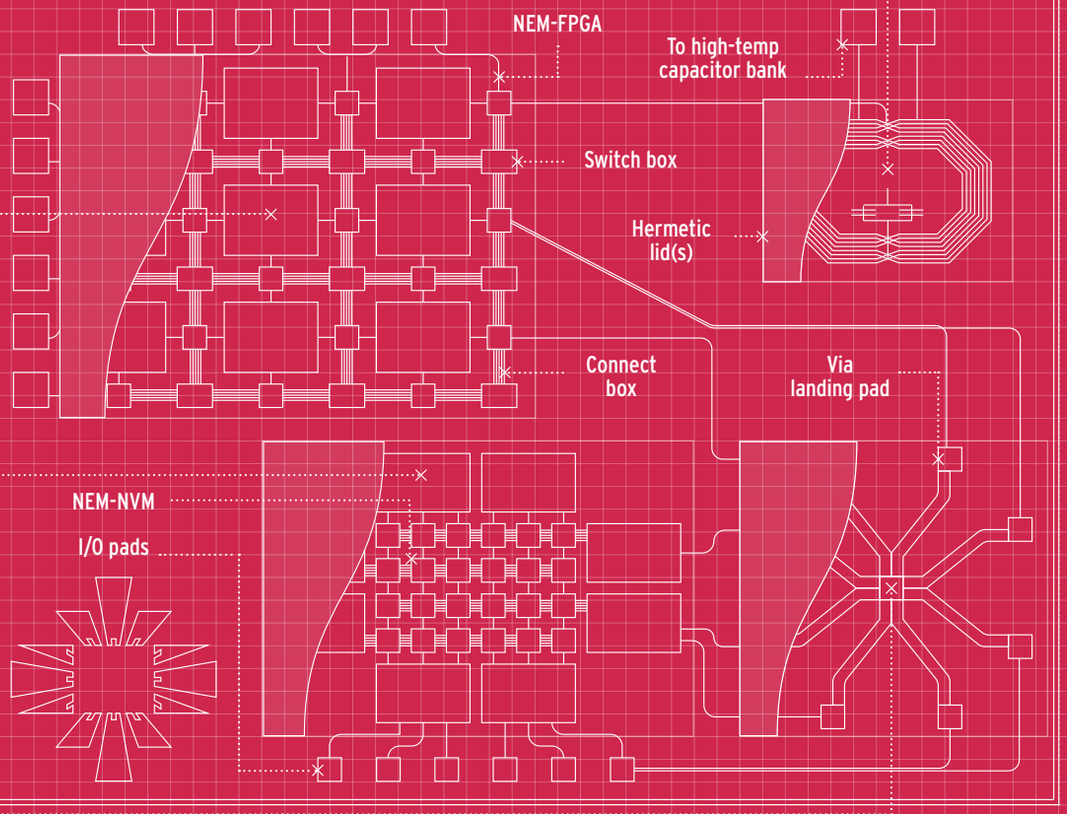
Top view of the device

WIRELESS POWER & DATA TRANSCEIVER

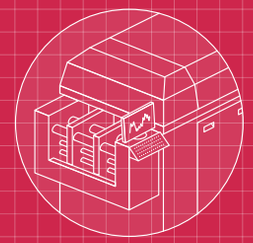
CONFIGURABLE LOGIC BLOCK

MEMORY ACCESS & CONTROL

TEMPERATURE SENSOR

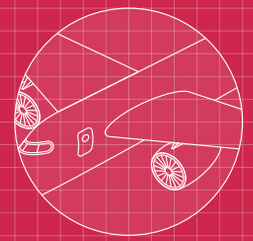


OUR USE CASES



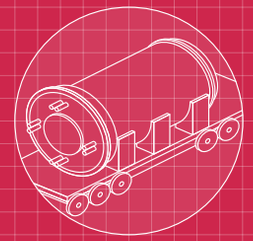
TEMPERATURE RECORDING AND DATALOGGING

To enable easy monitoring of oven temperature profiles, we are replacing CMOS ICs with our NEM switch ICs, and providing a temperature datalogger with no inconvenient trailing wires and boxes



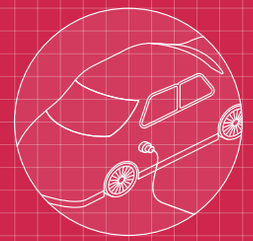
DIGITAL CALIBRATION FOR SENSORS IN HARSH ENVIRONMENTS

To ensure sensor calibration integrity, our high temperature non-volatile memory aims to enable a physical lock of digital calibration data to the sensor whilst reading the memory at up to 325 °C



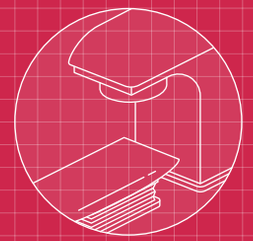
HIGH RADIATION PROCESSES

To improve human safety and health in the nuclear industry, our i-EDGE platform hopes to allow remote asset tracking and condition monitoring of items such as fuel rods and nuclear waste



ELECTRICAL VEHICLES BATTERY "PASSPORTS"

To simplify battery recycling and passporting, we envisage mounting NEM switch memory to a battery's over current/temperature fuse and locking an event history inside every EV battery



RADIOTHERAPY TREATMENT

To move towards faster mapping of radiation dosage to cancer patients, we wish to explore linking multiple radiation sensors on the patient to our i-EDGE platform for a simple wireless readout