Theme-based objectives and endpoints

Objective: Design and create increasingly high-performance power converters and supply devices targeting :
Compactness - Performance - Compatibility with the environment

Through decisive actions involving :

- New semiconductor devices (GaN, diamond, SiC) : gate driver and characterization
- Power integration : packaging concepts, EMI, cooling...
- Converter design : topologies, modular converters, system level converters networks...
- Innovative design methods and tools : electroMagnetic modeling, optimization-oriented models

Keywords : modelling, integrated power electronics, EMC, gate drivers, packaging, power converters design and optimization, cooling.

G2Elab
Grenoble Génie Electrique
Grenoble Electrical Engineering

EP Team
POWER ELECTRONICS

Scientific activities

Power devices and integration

Semiconductor devices
- 2D and 3D integration including wafer level packaging,
- Gate drivers,
- Thermal and electrical characterization

Passive devices
- Integration,
- Characterization

Converter integration
- Integrated modular converter from elementary cells

Power converter Design

Topologies, control, design

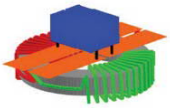
Targets
- Multisource converters,
- Modular converters,
- Applications with high constraints

Modelling, methodologies and design tools

Devices and EMC modelling
- Converters, Systems (network, plane...),
- Evolution of standards (PLC, EMC, ...),
- Semiconductor devices,
- Passive devices

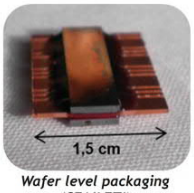
Methodologies for converter design

Tools for rapid prototyping



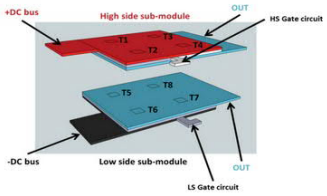
EMC filter model

Achievements

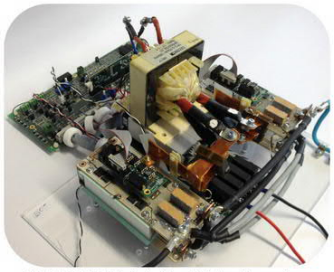


Wafer level packaging (CEA/LETI)

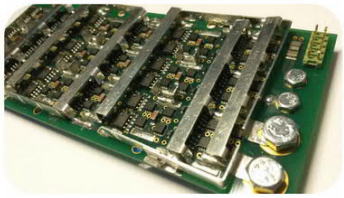
DC-DC converter (15V-5W) with insulation voltage capabilities up to 40kV (Schneider)



PCoC power module with embedded dies



4kW DC-DC Triple Active Bridge Converter for Aircraft Application (Thales)



DC/DC converter from elementary conversion cells

Experimental facilities

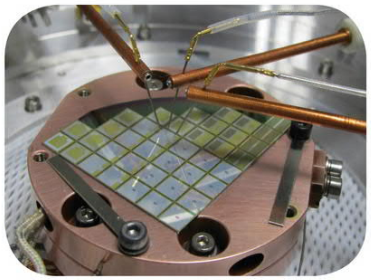
Semiconductor Characterization

Electrical characterization (Temp. 77K-675K)
Thermal impedance measurement.

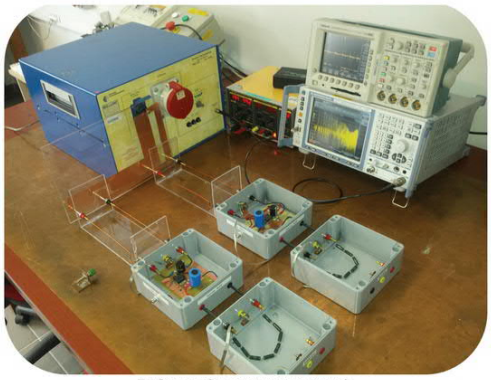
EMC test bench

Technology platforms

CIME Nanotech Clean Rooms and packaging facilities acces



Component testing facility CARAPACE



EMC test of a converter network

Collaborative projects

Industrial projects
Alstom, Altair, Eaton, Ecoways, Freemens, Hager, Luxol, Microspire, Mitsubishi, Renault Truck, Schneider-Electric, Siemens, Thalès, ST Microelectronics, Safran

European project
Green-diamond

Start-up
Freemens (Battery Management Systems)
Sirepe (Power converters design)

National Projects
National research agency, OSEO, FUI, Région Rhone-Alpes, Institut Carnot Energies du Futur, Laboratoires d'Excellence: LANEF, GaNEX, IEED Supergrid

Academic partners
Research group with CEA/LETI, and SAFRAN
Others in Grenoble: CIME Natotech/PTA, LEGI, Néel Institute, IMEP, SIMAP...
National : Ampère (Lyon), LAPLACE and LAAS (Toulouse), SATIE and IFSTTAR (Paris), INES (Le Bourget du Lac).
International: Algérie, Allemagne, Brésil, Bulgarie, Canada, GB, Iran, Japon, Mexique , Pérou, USA