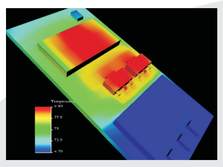
# POWERDEVICES&SYSTEMS
## POWERSYSTEMSINTEGRATION&RELIABILITY

Field of interest: between device and application

Power Systems Integration and Reliability research line is focused on the development of new technologies and methods allowing the implementation of semiconductor power devices in power electronics systems with higher levels of integration. The activities are divided into four areas:

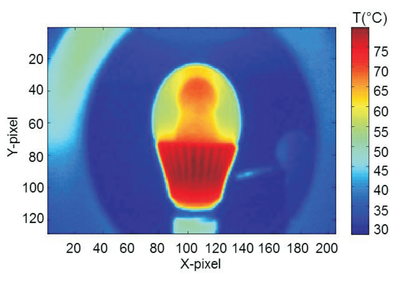


## Thermal management

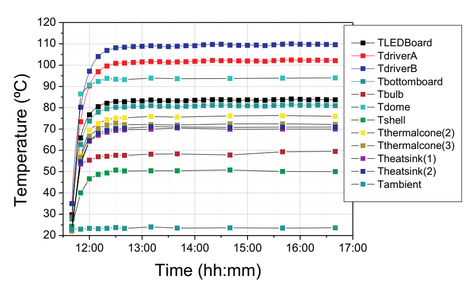
Design of new packages and modules for high efficiency cooling, based on 3D thermal simulation. Thermal characterization of the developed systems and thermal parameters identification

### CSSL PROJECT (Consumerizing Solid-State Lighting)

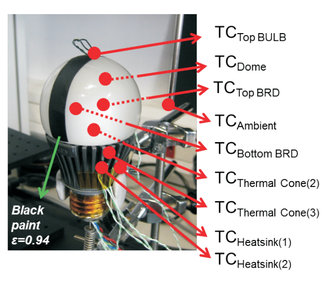
Detailed thermal characterisation of **Philips** LED lamps by means of IR thermography and direct temperature measurements for simulation purposes allowing the development of a new generation of SSL bulbs.

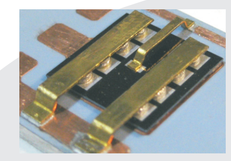



LED lamp infrared image




Transient thermal response of the LED lamp



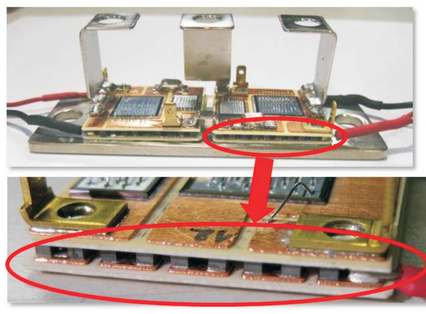



## Power packaging technologies

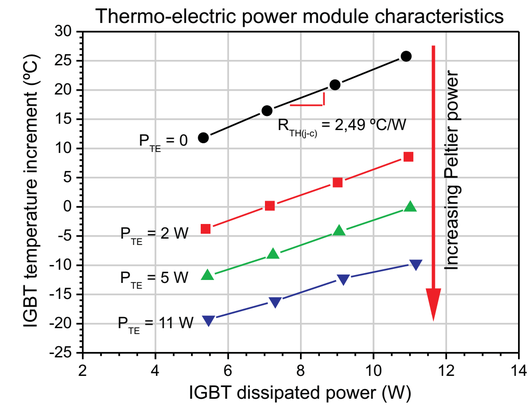
Design and development of new packages and modules for power systems with high power, high temperature and high levels of integration. New interconnection technologies

### CENIT-VERDE PROJECT (Electrical vehicle)

Development and study of new power modules integrating thermoelectric cells for improving their heat disipation and allowing advanced thermal management solutions (temperature regulation). Patent with **LEAR Corporation.**



Thermo-electrical power module 600V-40A half-bridge topology



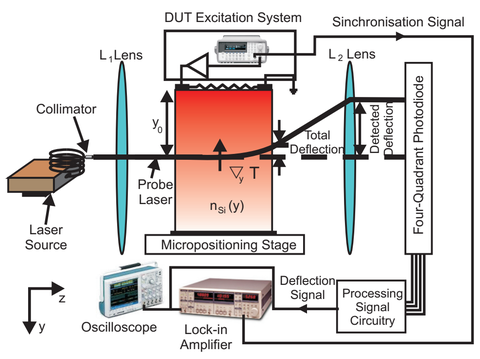

## Electro-thermal characterization

Advanced measurement set-ups based on optical methods and IR thermography for the accurate electro-thermal characterization at chip or system level

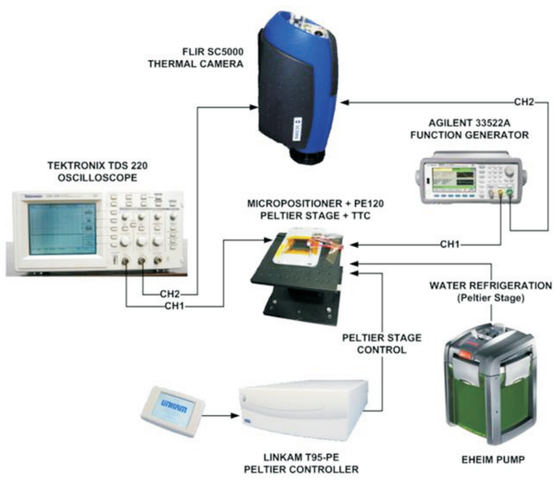
### LOCK-IN THERMAL SENSING FOR DEVICE & IC DEBUGGING

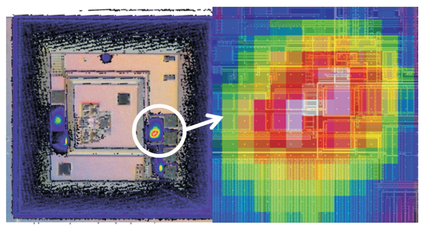
Detection of heat sources modulated in frequency using IR cameras, IIR-LD & Fabry-Perot thermometry techniques. Non-invasive determination of hot spots for IC's and power devices debugging. Main contribution: use of heterodyne detection techniques.

Depth-resolved inspection (IIR-LD / FP techniques)




Surface inspection (IR camera)



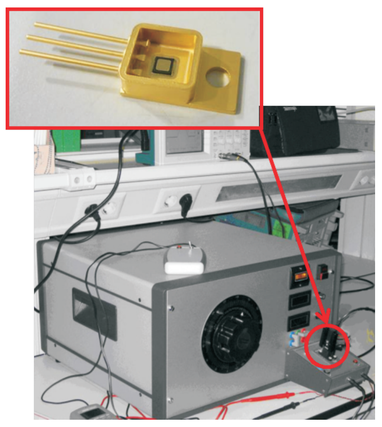
Wire-less pad-free IC for sensing purposes

## Reliability

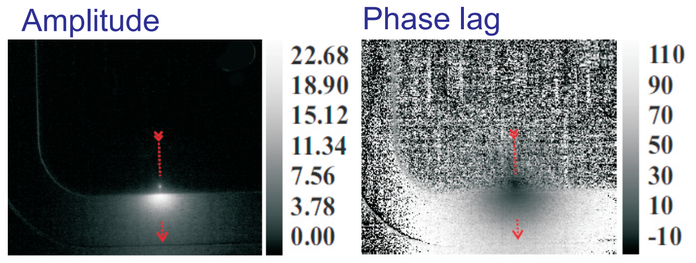
New methodologies for the analysis of the reliability limits of advanced power devices and systems (high temperature, wide band gap)

### STUDIES ON RUGGEDNESS & FAILURE MECHANISMS

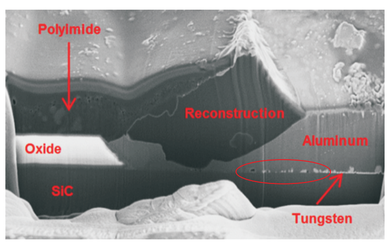
Studies on ruggedness & failure mechanisms in power devices (Si, SiC).
Failure location in SiC diodes after surge current tests.



Surge current test set-up




Failure location by lock-in IR thermography




Failure mechanism analysis (SEM)

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