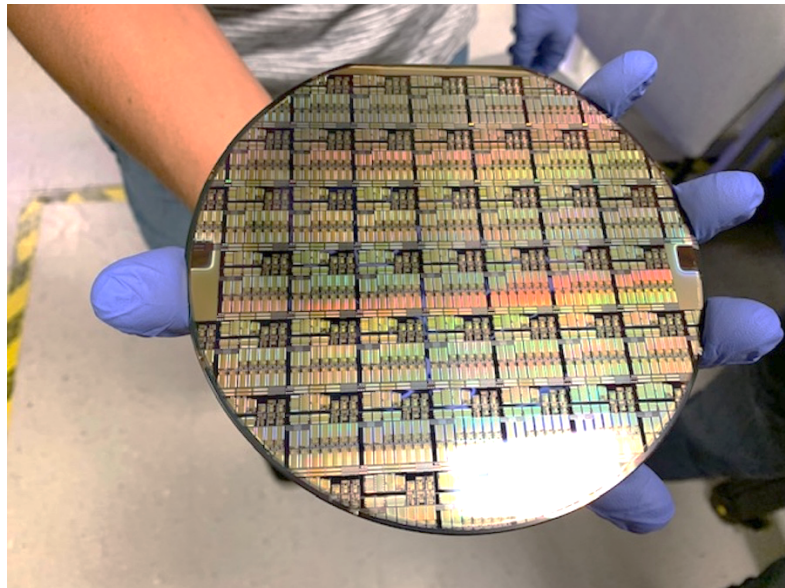


# GaN/Si integrated power devices performance, analysis and design

RESEARCH PROGRAMM FOR MASTER'S DEGREE AND PHD



*GaN-IC wafer from TSMC. Photo Th .Bouchet, CEO of wise-integration*

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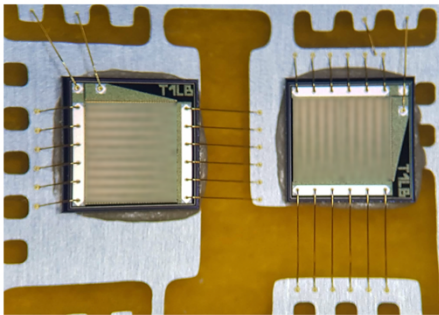
## WISE-INTEGRATION

Wise-Integration is a French company founded in 2020, specialised in GaN IC-based power supplies miniaturization. As a CEA-Leti spin-off, the French technological research institute in micro and nanotechnologies, the company has benefited from 7 years of R&D to develop and test its GaN-IC power supply: WiseGaN (component) and WiseWare (architecture) system. Today, the company owns three patents on architecture and GaN component under exclusive licence with CEA.

### A FOUR-YEAR RESEARCH PROGRAM ON GAN

Wise-integration application laboratory, based in Meylan, close to Grenoble, has identified a losses mechanism within their GaN inverter legs components, known as passive switching losses. When a high frequency square voltage wave is applied to a switched-Off (all gates are short circuited) Gan inverter leg, additional power losses occurs and the temperature rises. This phenomenon is thought to have a link with capacitive current injection in the gate circuit during fast dv/dt transients, mainly because of the large dimensions of the power devices.

The global research activity implies experimental electrical measurements, analysis of thermal data, simulation exploration of existing devices under CADENCE, modelling of the losses to validate hypothesis, then, finally, redesigning of an optimized device, manufacturing the devices at TSMC and then testing the improvements in performance.



On the left, a GaN inverter leg before packaging. Open frame devices (un-packaged) will be provided for the research work in order to proceed to real time infrared imaging. Doing so permits to locate heat generation areas and to compare with CADENCE layout extractions and simulations.

*Pre-production PQFN devices before molding  
Photo courtesy of Synergie-CAD, Toulouse.*

### WORK FOR A MASTER'S SIX MONTHS EXPERIENCE

- Bibliographic study of state-of-the-art knowledge on the losses phenomenon
- Defining the experimental protocol in order to provide pertinent data for analysis
- Building the experimal set-up with the support of the company's technical staff
- Doing the measurements at wise-integration headquarters in Meylan
- Analysis of the results and proposal of tracks for reducing passive losses

### PHD FOLLOW UP

A three-year PHD program is scheduled, following the master's work.

### INTERNSHIP

The internship takes place at wise-integration headquarters in Meylan, near Grenoble.

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