



Activities and Potential of Slovak University of Technology in Bratislava - power electronics group

Dr. Juraj Marek

juraj.marek@stuba.sk

Projects

- STUBA involved in 25 EU projects in last decade
- **Power electronics group** involved in 14 projects

7 FP Projects

- MORGaN - IP (III-V lab, Alcatel-Thales)

ENIAC JU Projects

- END (ON Semiconductor)
- ERG (ST Microelectronics)
- E2SG (Infineon)
- E2COGaN (ON Semiconductor)
- eRamp (Infineon)

ECSEL projects

- PowerBase (Infineon)
- Hiperform (AVL)
- R3 Power UP (ST Micro)
- Reaction (ST Micro)
- iReL40, (Infineon)
- Power2Power (Infineon)
- UltimateGaN (Infineon)
- HiEFFICIENT (AVL)

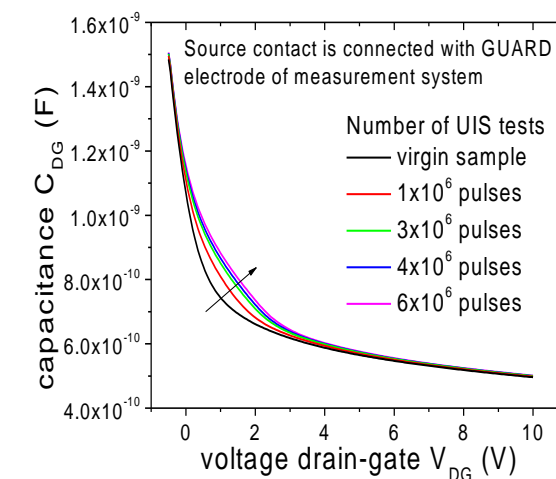
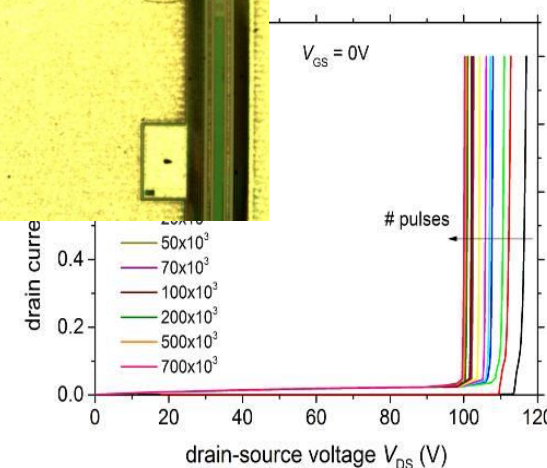
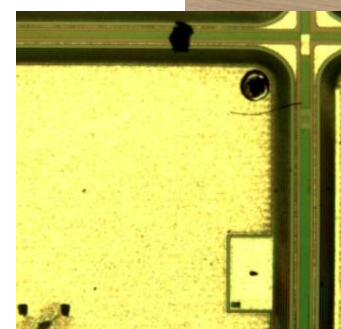
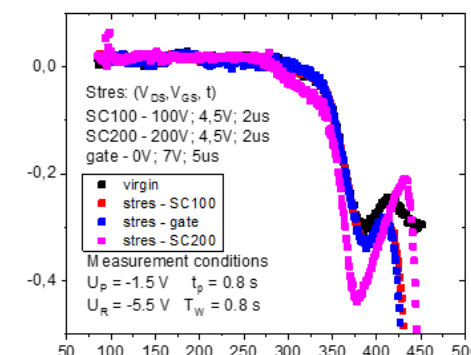
Others Projects

- SRDA project: VertiGaN - Vertical GaN MOSFET for power switching applications, 2019-2022, (SAV+UEF)

Power electronics

Characterization and Reliability of Power Devices

- Characterization, robustness and reliability testing
- Interface and material analysis
- deep level effects (DLTS), degradation analysis,
- Avalanche and short circuit testing, UIS multipulse test, high temperature UIS test
- Highlights: on wafer measurements
 - UIS up to 120 A (pulsed)
 - dynRdson and double pulse measurements
- Use of microscopic methods for localization of critical area
- high temperature measurements up to 200°C on wafer and 500°C on encapsulated samples



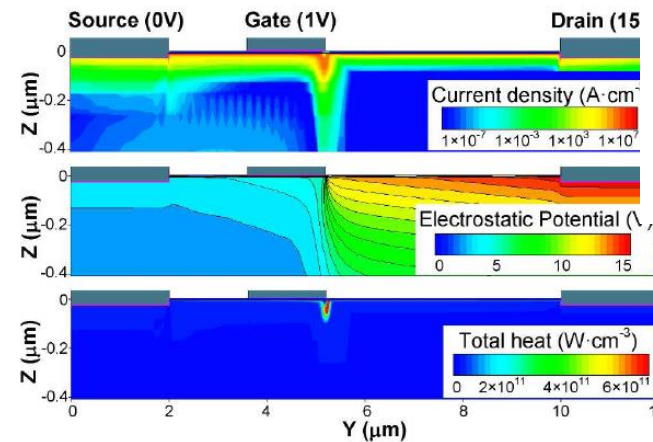
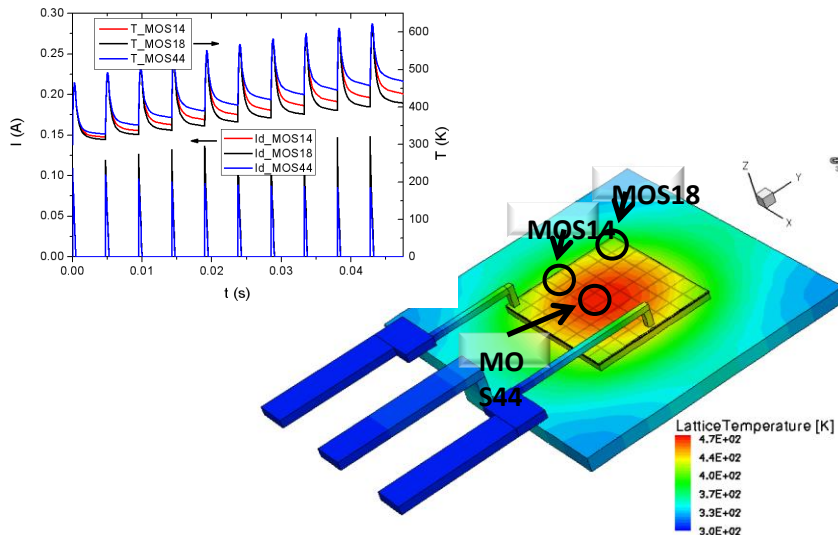
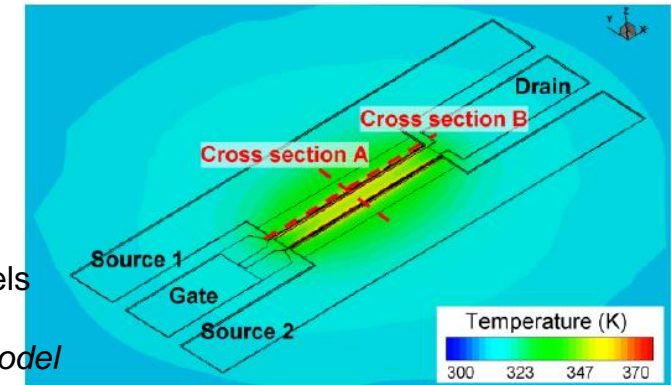
Power electronics – modeling and simulations

- Years of experience with multi physics 3D modeling and simulations of power devices and systems
- Development of special SPICE models
- Developed methodology for fast 3D electrothermal simulations of devices and systems (modules, device with PCB)

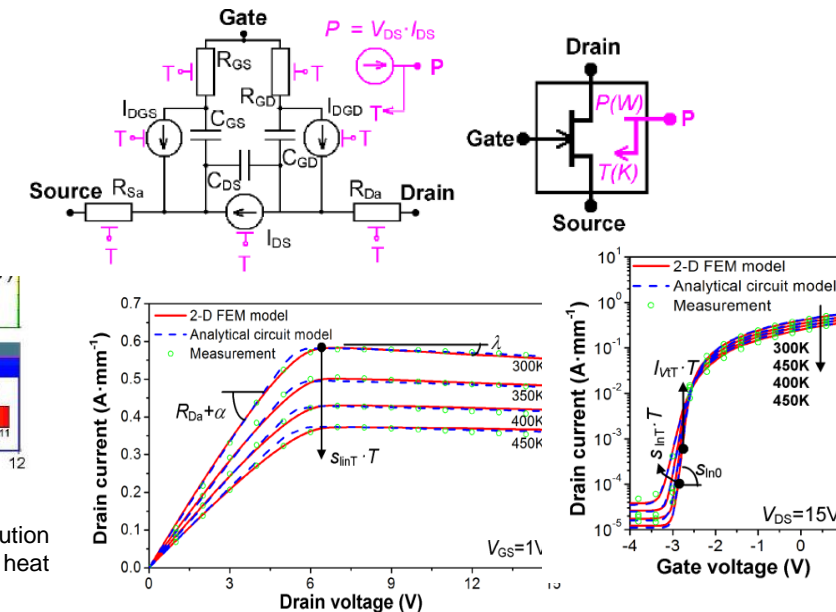
> Electro-thermal SPICE model of GaN HEMT

Done work:

- prepared 2D and 3D calibrated TCAD models
- 2-D FEM electrothermal simulations
- temperature dependent analytical circuit model
- 3-D mixed-mode electrothermal simulation



Current density, electrostatic potential, and total heat distribution during on-state operating conditions. Most of the generated heat is located under the drain side of the gate edge.

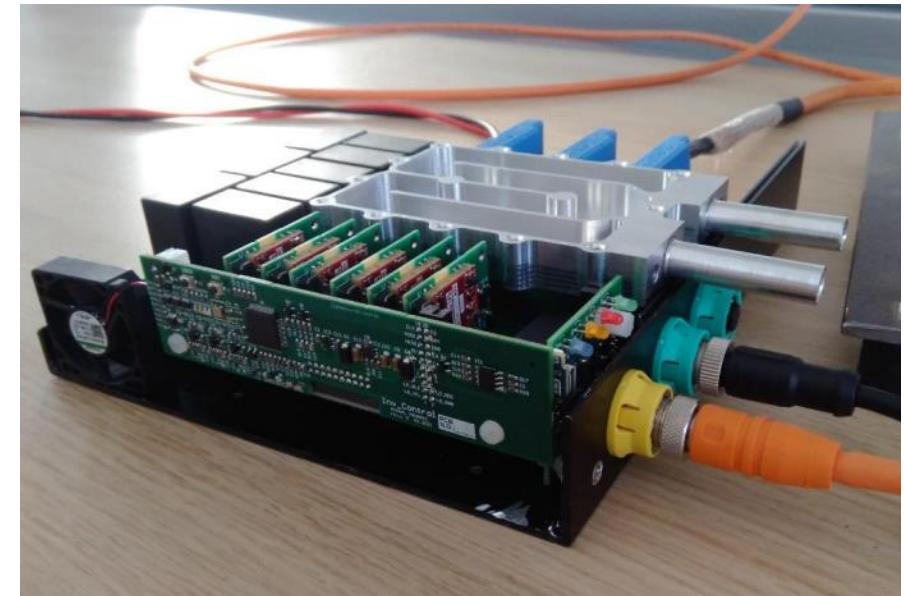


Power electronics – power systems design

- Demo : Inverter demonstrator
- 600V / 150 A
- First prototype with IGBTs modules (Semikron Slovakia)
- Weight reduction 30 % volume reduction 40%
- New prototype with SiC modules (Infineon)
- Weight reduction 60 %, volume reduction 68 %, losses reduction 30%
- Experimental prototype – integration with motor (GaN devices)



Electric formula and its drivetrain build by students of STU



Collaboration potential fields

- Design and development of power systems – inverter, chargers, auxiliary power supply...
- Power devices characterization, reliability, robustness testing
- Modeling and simulation
- Batteries - Aging roots analysis and SOC/SOH estimation by electrical techniques: GITT, ICA, EIS, CV, DTV, CHD etc. Simulation of SOC/SOH.

- Low power design, IOT, sensors...
- ICs design - Ultra low power and low voltage ASIC design

UEF

SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA

FACULTY OF ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY

INSTITUTE OF ELECTRONICS AND PHOTONICS

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Thank you for attention

juraj.marek@stuba.sk