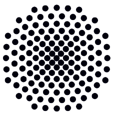
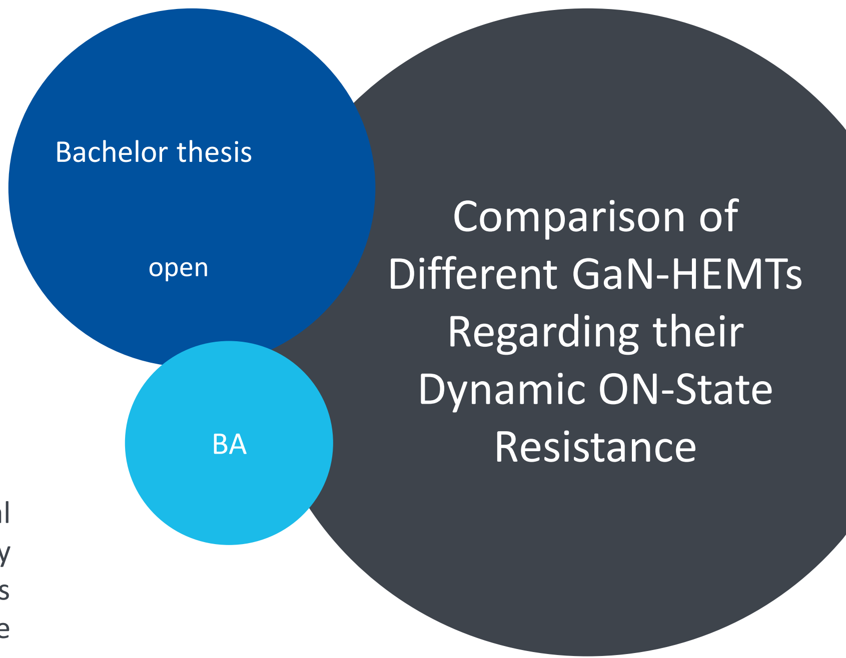


Universität Stuttgart

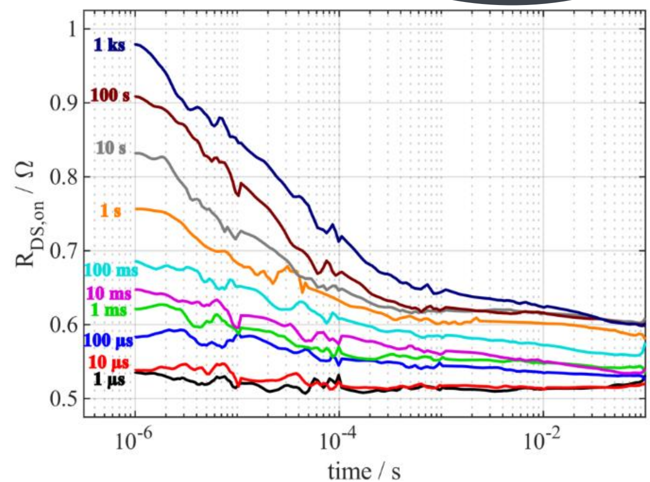
Institut für Robuste
Leistungshalbleitersysteme

Mathias Weiser
Pfaffenwaldring 47, D-70569 Stuttgart
Mathias.weiser@ilh.uni-stuttgart.de
+49 (0)711 / 685 69570
12.10.2022

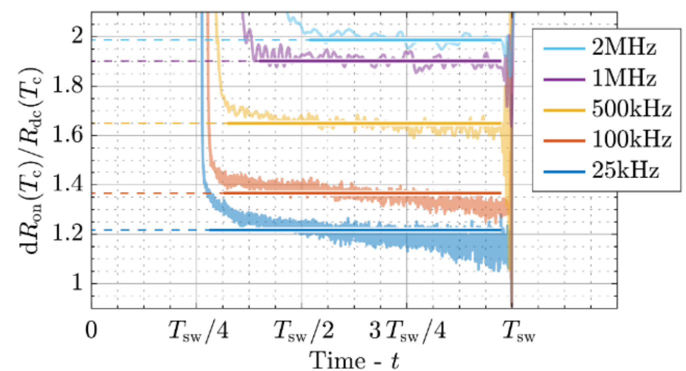


Comparison of Different GaN-HEMTs Regarding their Dynamic ON-State Resistance

The ‚dynamic ON-state resistance‘ is a critical aspect of gallium nitride high electron mobility transistors (GaN-HEMTs) in power electronics applications. When stress voltage is applied to the transistor or in case of high-power semi-ON-state scenarios, electrons are captured in charge carrier traps inside the device, which leads to degraded performance in RF and switched-mode operation. One of the manifestations of this effect is the temporary increase of the ON-state resistance of the transistor, which translates to higher losses and higher junction temperature during switched-mode operation. This effect is commonly described as ‚dynamic ON-state resistance‘ or ‚current collapse‘. Despite efforts to decrease the impact of this effect, it is still present in state-of-the-art devices. In this work, the magnitude and time-dependency of different GaN-HEMTs is to be characterized and compared.



Time dependency of the dynamic on-state resistance of a 100 V/ 0.5 Ω GaN-HEMT [1]



Switching frequency dependency of the dynamic on-state resistance [2]

Time plan

- Familiarization and literature research (10%)
- Measurement plan creation and familiarization with the test setup (10%)
- Dyn. RDS,on Measurements (35%)
- Data Processing (30%)
- Thesis writing and presentation (15%)

Useful previous knowledge (not mandatory)

- Knowledge in Data Processing (e.g., Matlab, data filtering, automated data processing …)
- Hands-on experience with Oscilloscopes
- Basic knowledge of power electronics and power transistor technology
- STM32 programming

[1] Weiser et al, „A Novel Approach for the Modeling of the Dynamic ON -State Resistance of GaN-HEMTs", IEEE Transactions on Electron Devices, 2021
[2] Zulauf et al, "The Impact of Multi-MHz Switching Frequencies on Dynamic On-Resistance in GaN-on-Si HEMTs", IEEE open journal on Power Electronics, 2020

www.ilh.uni-stuttgart.de