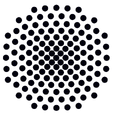

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Institute of Robust Power
Semiconductor Systems

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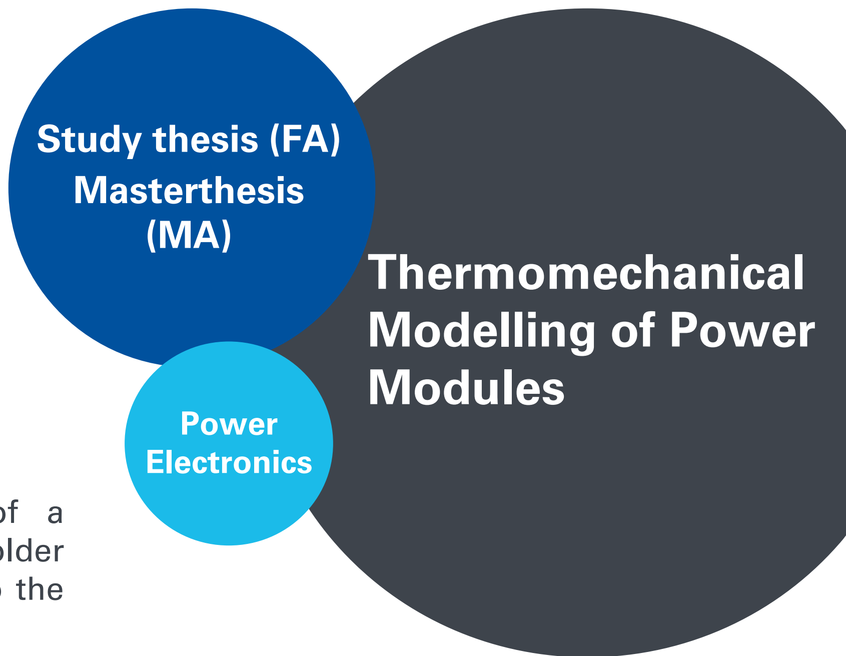


Thermomechanical Modelling of Power Modules

Conventional power modules consist of a multilayer structure joined together by solder material and use bond wires to connect to the top metallization of the chip (Fig. 1).

Solder joints and bond wires are the weakest links in conventional power modules and limit their reliability. Due to a mismatch of their coefficients of thermal expansion of the components of the module, a temperature induced stress develops, which under cyclic load produces fatigue of these components and ultimately failure of the power module

The goal of this study thesis is to study through simulation the effect of selected parameters on the thermomechanical response of a power module.

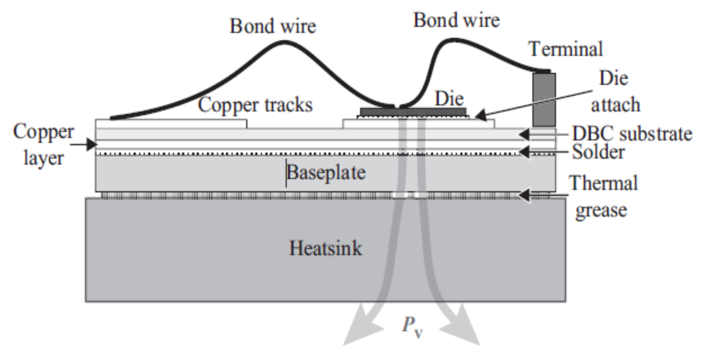


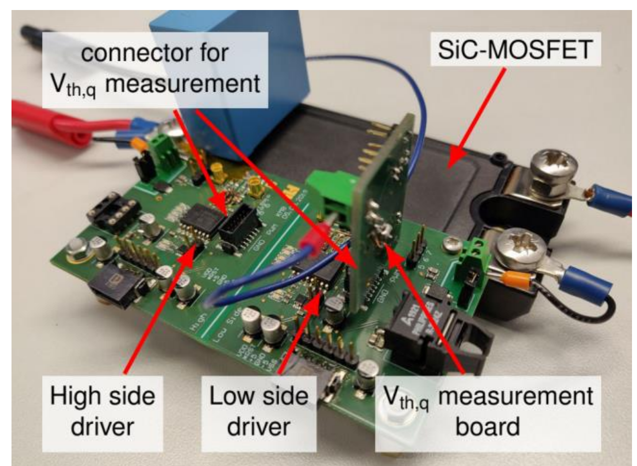
Fig 1. Conventional power module [1]

Main points (can be weighted on an individual basis)

- Thermo-Mechanical Analysis
- Finite Element Simulation
- Experimental Verification

Prerequisites (depending on the actual topic)

- Experience with Ansys Mechanical (or the willingness to learn it before the study thesis)
- Experience with microcontrollers (for experimental part)



Acquisition of the threshold voltage V_{th} as an example of a DSEP [2]

[1] Chung, Wang, Blaabjerg, Pecht, Modelling for the lifetime prediction of power semiconductor modules. Ch. 5 of "Reliability of Power Electronic Converter Systems"
[2] K. Muñoz Barón et al. "Characterization of Threshold Voltage for Application-Oriented Power Cycling Conditions for Wide-Bandgap Power Devices", in PCIM Europe 2020