Lehrstuhl für Technische Elektrophysik
TUM School of Computation, Information and Technology
Technische Universität München

# Master's thesis: Experimental characterization and simulation of the mechanical eigenfrequency behavior of discrete semiconductor power packages (in cooperation with Infineon Technologies AG)

High power density of band gap power semiconductor solutions require, especially for discrete packages, new innovative packaging and cooling concepts. In this respect, high-performance applications nowadays start shifting shift away from standard bottom-side cooling (BSC) concepts to top-side cooling (TSC) concepts, where the PCB is only used for the electrical functionality, but the cooling of the discrete package is done via the top-side of the package (see Figure 1. left). Naturally, TSC concepts require novel package designs such as the QPDAK (see Figure 1, right). The objective of this thesis work is to investigate the mechanical eigenfrequency behavior of different novel discrete packaging concepts by Finite Element Analysis (FEA) and experimental characterization.

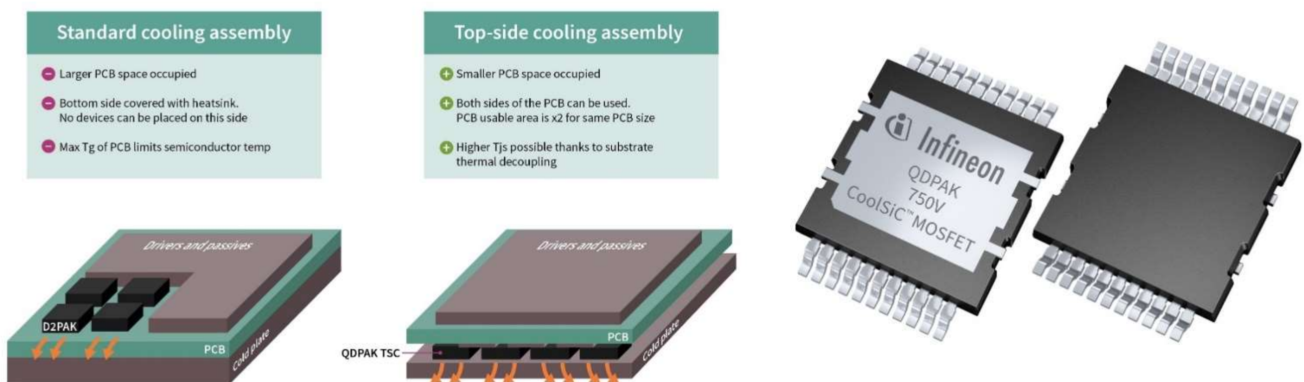


Figure 1: Comparison of standard bottom-side cooling, vs. top-side cooling concepts and recently released package QPDAK, which carries a 750V CoolSiC™ power semiconductor chip. Source: Infineon press release [1]

**Tasks:**

- Get familiar with eigenfrequency behavior of mechanical components, finite element anaylsis (FEA) tool ANSYS, modal and harmonic component analysis and measurement equipement (vibrometer measurement equipment at Chair of Physics of Electrotechnology, TUM, bulding N4)
- Perform modal and harmonic analyses of discrete power packages
- Adapt the current vibrometer measurement setup for the characterization of discrete power packages and perform vibrometer measurements
- Compare the results from simulation vs. measurement, calibrate the FEA model where needed

Prerequisites:

- You are able to work independently in a hybrid setup which involves supervisors from both the university and the industry
- You are willing to perform hands-on experimental work
- Knowledge in mechanics and in finite element analysis is a plus

More information and supervision:

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- Dr. Martin Niessner, Infineon Technologies AG, Am Campeon 1-15, 85579 Neubiberg, Tel- +49 89 234 24864, Email: martin.niessner@infineon.com

Sources:

[1] Infineon Press Release „Infineon QDPAK and DDPAK top-side cooling packages registered as JEDEC standard for high-power applications“, 2023-Feb-09, https://www.infineon.com/cms/en/about-infineon/press/market-news/2023/INFPSS202302-057.html