Fraunhofer IISB

Fraunhofer Institute for Integrated Systems and Device Technology IISB

Highly Integrated SiC Power Module on Ceramic Heat Sink

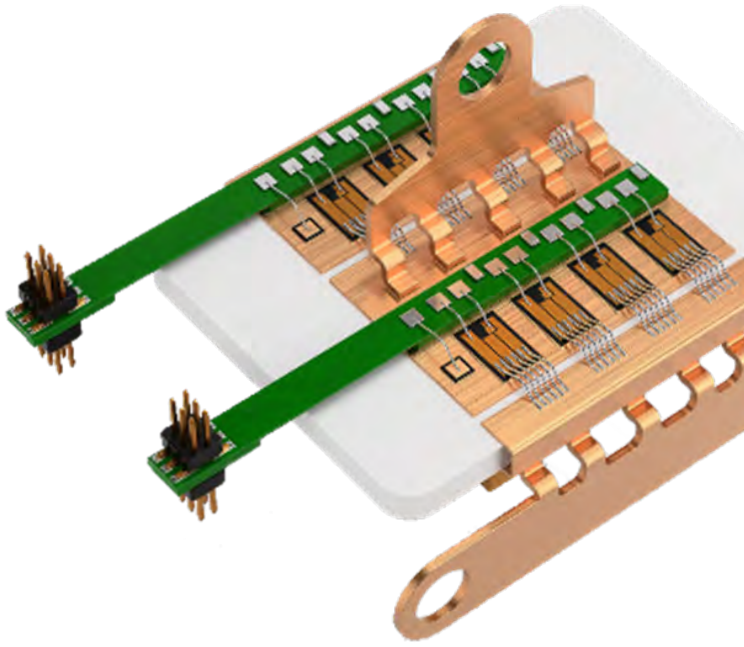
For Future Power Electronics

Power Module Design

- 1200V SiC-half bridge power module based on CeramTec AlN heat sink
- Ceramic heat sink – Integration of cooler & ceramic substrate
- Direct sintering of SiC-chips on metallized ceramic heat sink
- Double sided use of ceramic heat sink – Integrated ceramic capacitors on back side for easy system application
- Scalable & flexible design

Key Features

- Low thermal resistance (Rth' = 0,15 Kcm²/W)
- Low stray inductance
- Very low weight and size (ceramic weight = ~10 g)



1200 V full SiC half bridge with sintered semiconductor devices on CeramTec AlN ceramic heat sink
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CeramTec
THE CERAMIC EXPERTS

Fraunhofer IISB - Your Partner in Power Modules

Concepts & Engineering

Design of custom-specific power modules:

- **High Power**
  - Double-sided cooling
  - High parallelization
  - Reliable interconnection technologies for high thermal cycling capability
- **High Performance**
  - Fast-switching SiC and GaN
  - Integrated RC-snubber
- **Application specific**
  - Power modules on ceramic substrates, IMS,...
  - Innovative cooling
  - 3D-integrated design

Characterization & Modelling

- **Electrical performance analyses**

Switching behavior, switching & static losses

- **Extraction of parasitic elements**

Inductances in commutation loops, current density estimation and capacitive coupling

- **Thermal & thermo-mechanical analyses**

By simulation and measurement

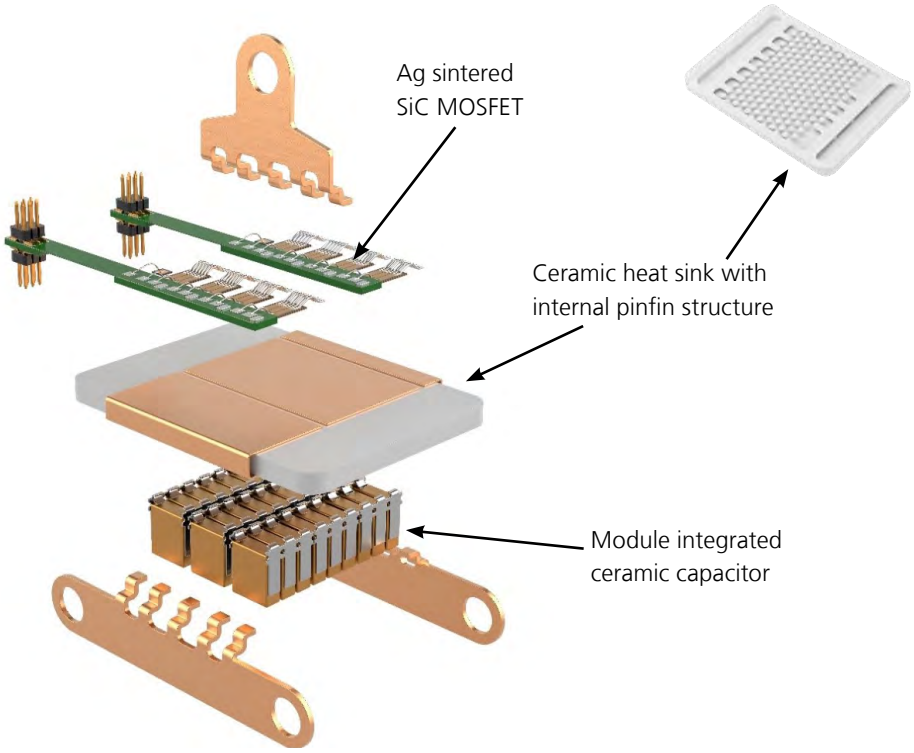
- **Modelling setup**

For virtual switching cell prototypes & thermal networks

Prototyping

Manufacturing of **custom-specific prototypes** with newest packaging technologies including tests under clean room standards

- **Manufacturing of custom- specific power modules**
- **Packaging technologies**
  - For top & bottom side chip contact (sintering, soldering, wire bonding, direct bond,…)
  - Encapsulation & coating
- **Subtractive** and **additive manufacturing** processes
- **Test**
  - Electrical & thermal characterization
  - Destructive & non-destructive analyses of die attach
  - Lifetime testing & reliability



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