EPCOS: Integrated GaN Power Package (2016)

Project

Integrated switching cell in package
Funding: direct industrial, internal R&D research, disseratation

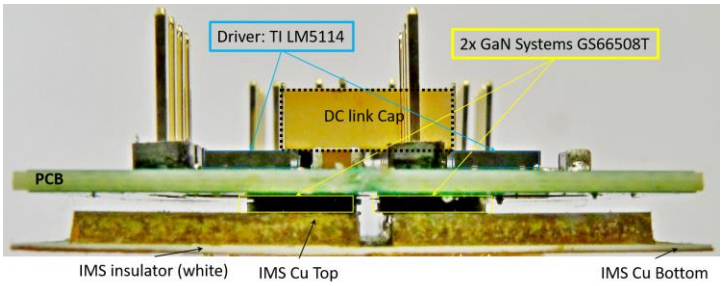
PCB Embedded GaN discretes integrated into a power package

- 2x 55mohm GaN HEMTs for 30A$_{dc}$ at 450V
- Using GaN Systems GS 66508T discrete GaN Packages soldered to structured IMS substrate and PCB with booster stage and DC link cap
- Isolated with silicon

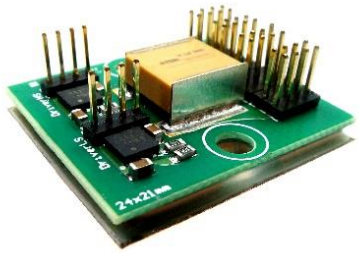
Performed tasks

- project management
- concept worked-out based on the customer requirements (current rating, and simple realization)
- manufacturing flow design
- manufacturing and testing of 30 A-Samples internally
- manufacturing and testing of 200 B-samples
- technology transfer to external EMS
- static thermal design (Solidworks)
- electro-magnetic design of the power module (Altium, Ansys, LTSpice, Portunus)
- design of the development sample including current measurement (s. next slide)
- mechanical integration design
- static electrical tests (Keysight B1505A)
- EM parasitics extraction of the power module by simulation and measurement
- design of the demonstrator (inkl. DC link and gate driver)
- dynamic electrical tests (DPT)
- thermal static testing
- application note

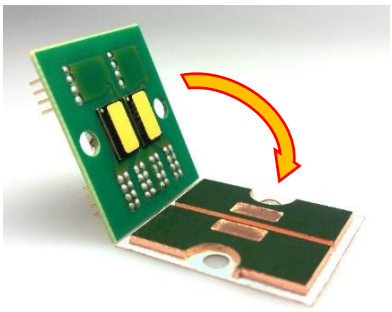
Side view (no silicon inside)



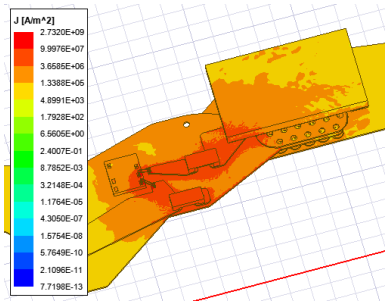
Power module like integration of the discrete PCB Embedded GaN power packages



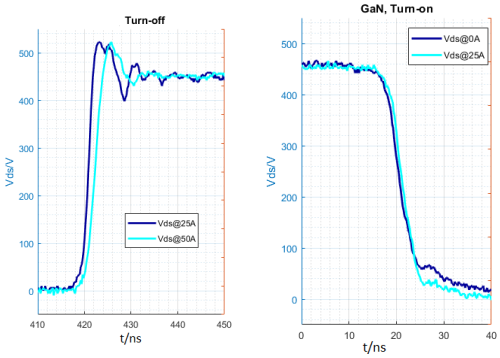
Assembly: soldering step



Gate path EM deisgn (Ansys)

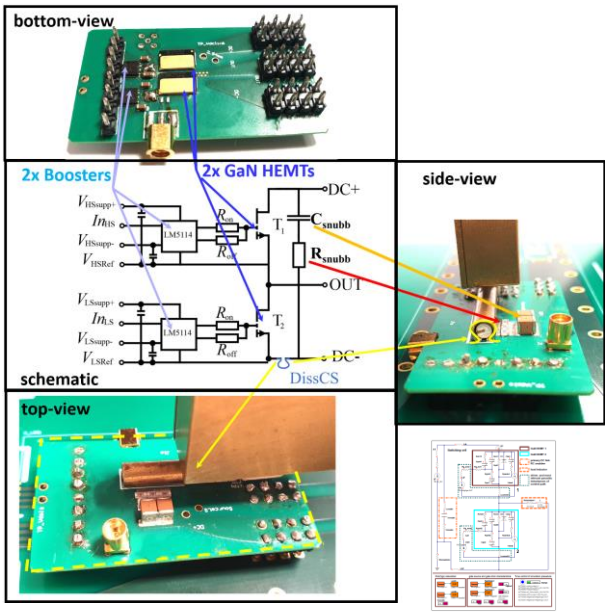


Superior switching performance up to 50A



Switching performance demonstrator achieved the maximum switching speed limit of GaN

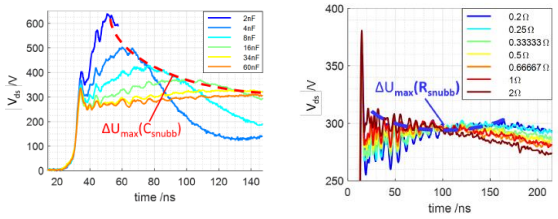
Switching performance demonstrator



Performed tasks

- semiconductor SPICE switching model building
- parasitic inductances estimation by simulation
- parasitic inductances measurement (novel measurement principle)
- manufacturing of all the samples needed for research
- electro-magnetic design of the gate driver and switching cell (Ansys, Portunus)
- Study on DC link capacitors and their properties for different temperatures and different signal amplitudes (novel measurement principle)
- modular mechanical integration design
- This work is highly related to my dissertation, so more details can be found there

RC Snubber design



[TU BERLIN] **K.KLEIN DISSERTATION**
"Electromagnetic switching cell design for fast switching semiconductors" 2023, TU BERLIN

