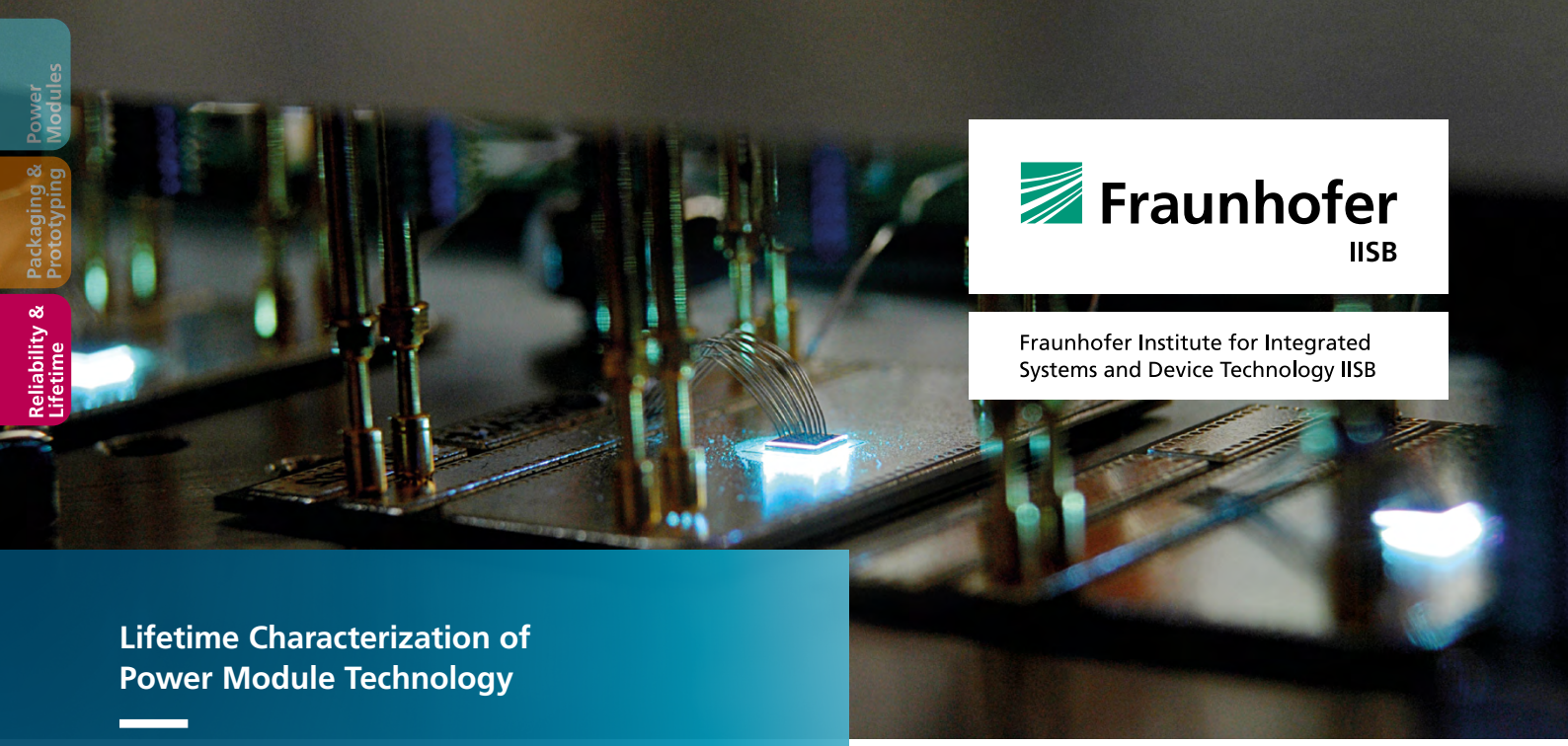
Power Modules

Packaging & Prototyping

Reliability & Lifetime



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Lifetime Characterization of Power Module Technology

Active Power Cycling Test

Mounting samples on a cold plate
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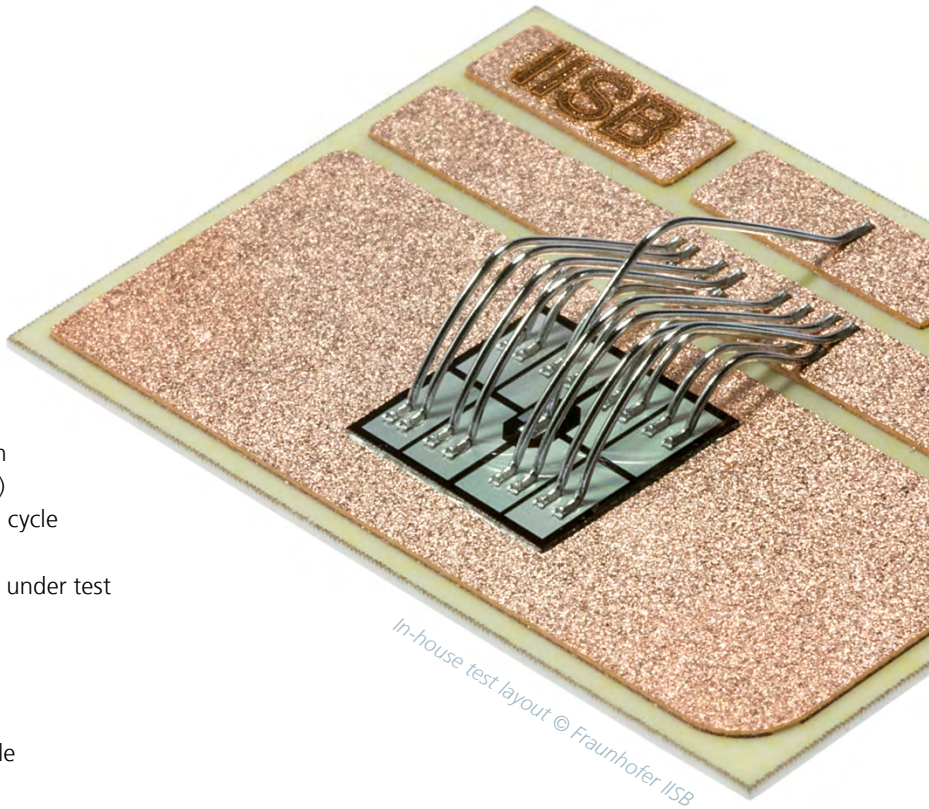
Fields of research and service

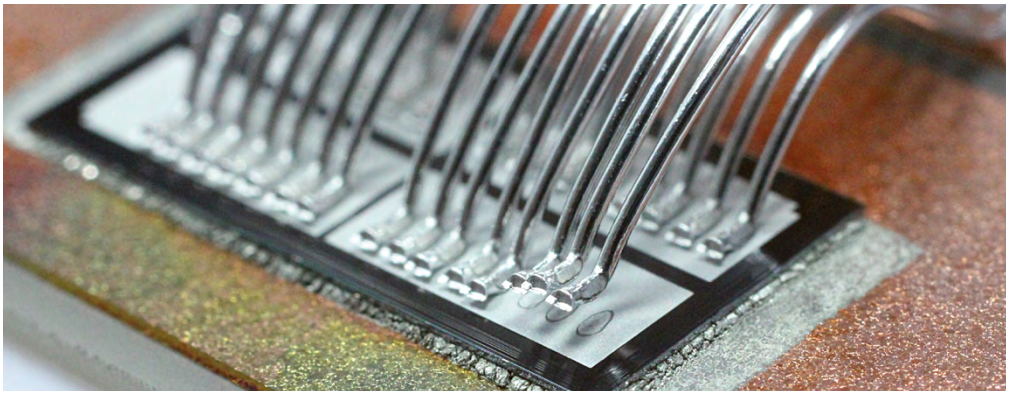
- Power module qualification according to AQG 324
- Design and assembly of power modules for testing (silver sintering, soldering, wire bonding)
- Generation of lifetime data
- Statistical analysis and interpretation of measured lifetime data
- Lifetime modelling for die attach technologies and power modules
- Long-term experience on power cycling tests and analyzing of failure mechanisms
- Consultancy on test planning, failure modes, and result interpretation

Special features

- 7 independent test benches available
- Up to 40 devices within one test run
- On-line measurement and control system for each device under test (indirect measurement principle)
- Thermal impedance Z_{th} measurement during each cycle and of all samples
- Individual setting of gate-voltage for every device under test
- Automatic end-of-life-detection
- Heating current from 0.1 A up to 2000 A
- Heating voltage up to 35 V
- Heating and cooling power up to 20 kW
- Coolant temperatures from -60... +350 °C possible



In-house test layout © Fraunhofer IISB



Power Module © Fraunhofer IISB

Description of test principle

- Active temperature cycling is an accelerated lifetime test for power electronic devices
- Reliability characterization of new packaging concepts, materials, devices and technologies
- The device is heated up via DC current by semiconductor power losses
- After heating, the samples are cooled down by the heat sink coolant

Devices for testing

- IGBTs, MOSFETs, JFETs, thyristors
- Resistors
- Schottkydiodes, pn-diodes
- Si, SiC, and GaN devices

Packaging for testing

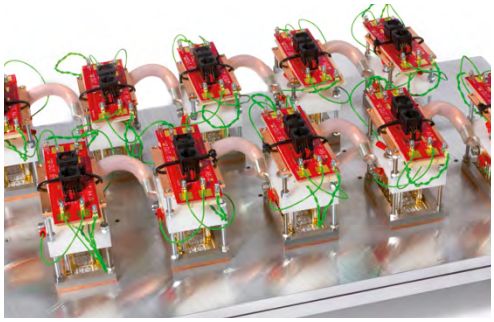
- Power modules with or without baseplate
- PCB-boards with discretes (To-devices, D2Paks, etc.)
- In-house test layouts and samples
- Packaging services

Coolant strategies

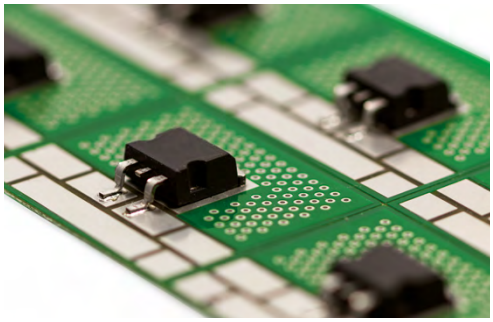
- Liquid and air cooling
- Coolant temperatures from -60... +350 °C possible
- Coolant pressure up to 8 bar possible
- Various coolants possible
- Interaction of power cycling with temperature or pressure swings in coolant possible

Test procedures

- Constant heating current (application near)
- Constant temperature swing (academic by adjusting the gate voltage)
- Constant heating power



Heat sink for ten power modules
© Fraunhofer IISB



Discrete on PCB © Fraunhofer IISB

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