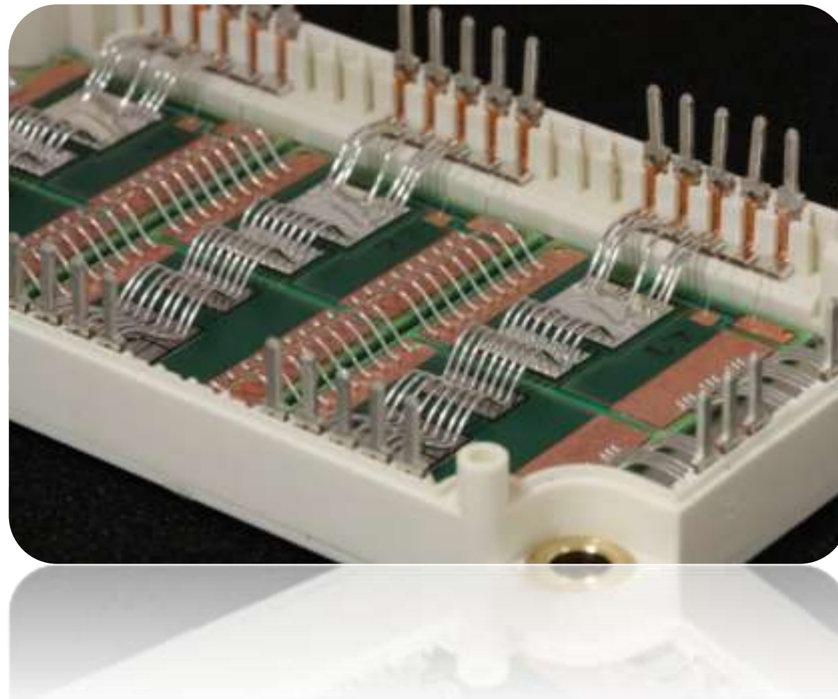
Panel Discussion ECTC 2012
Pioneering Innovative Packaging Technologies

Klaus-Dieter Lang



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Global Challenges for Innovative Power Electronics

Energy Turnaround

Energy Efficiency

E-Mobility

Automation/ Drives

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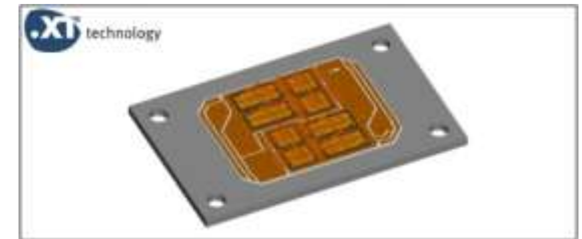
Driving Forces for High Performance Packaging

Systemintegration

- Increasing performance and complexity ⇨ higher heat losses
- Different places of installation ⇨ high temperature environment
- Miniaturization ⇨ higher power density



Infineon: XT-Technology for Power Packages

Manifold Applications

- Control Units
- Converter for eCar, Solar, …
- LED-Systems
- Power Supplies
- Smart power electronics

Fraunhofer IZM: Sandwich Technology for Power Modules

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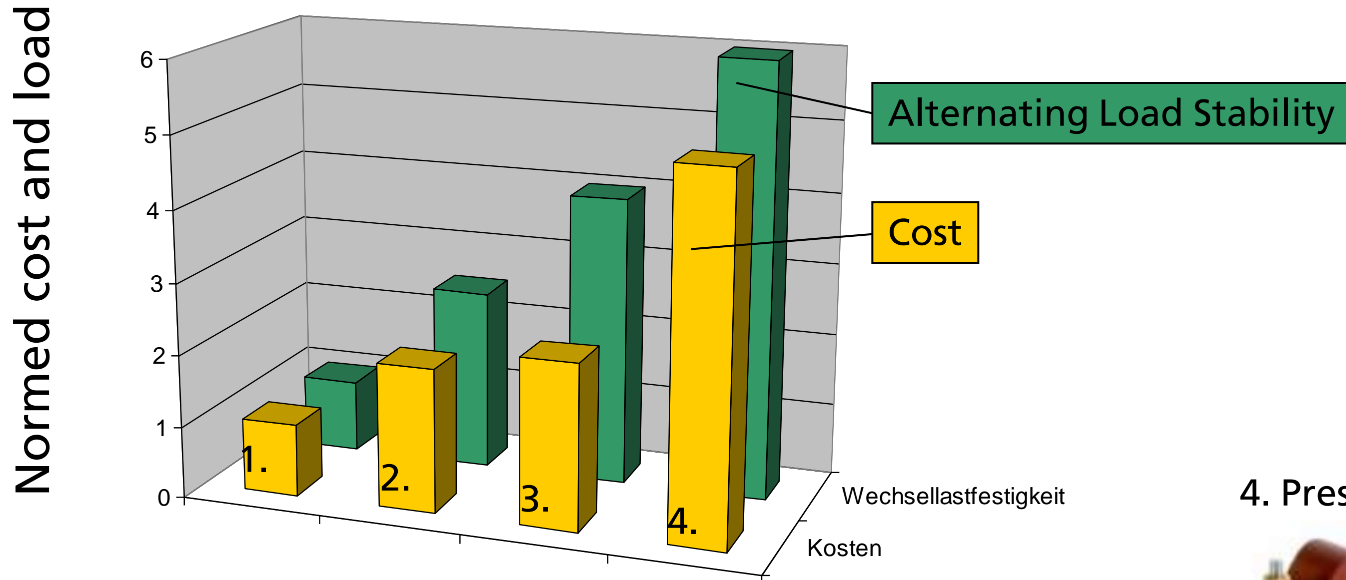
Classification of Today's Packaging Solutions



4. Presspack

1.Transfer Mold Module

2.Module with Baseplate

3. Module without Baseplate

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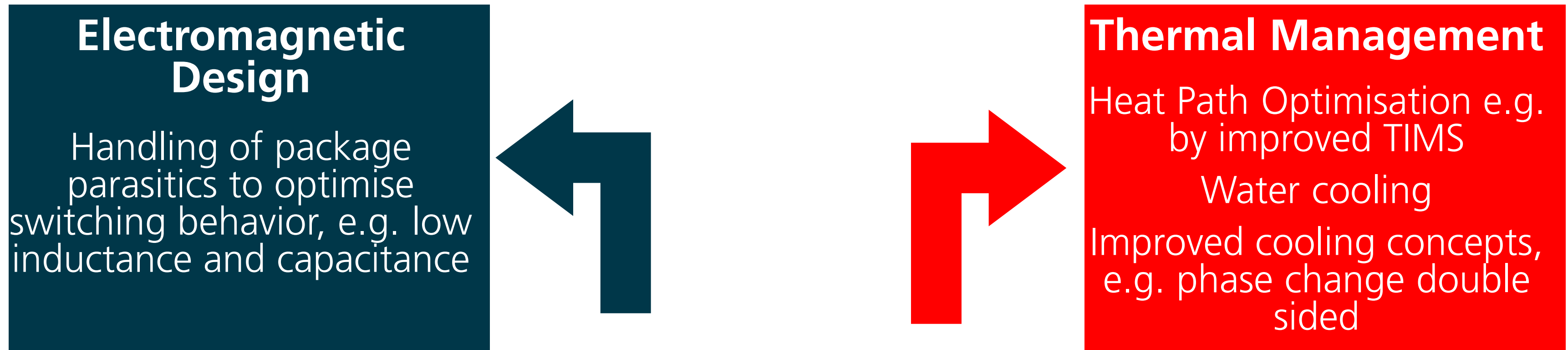
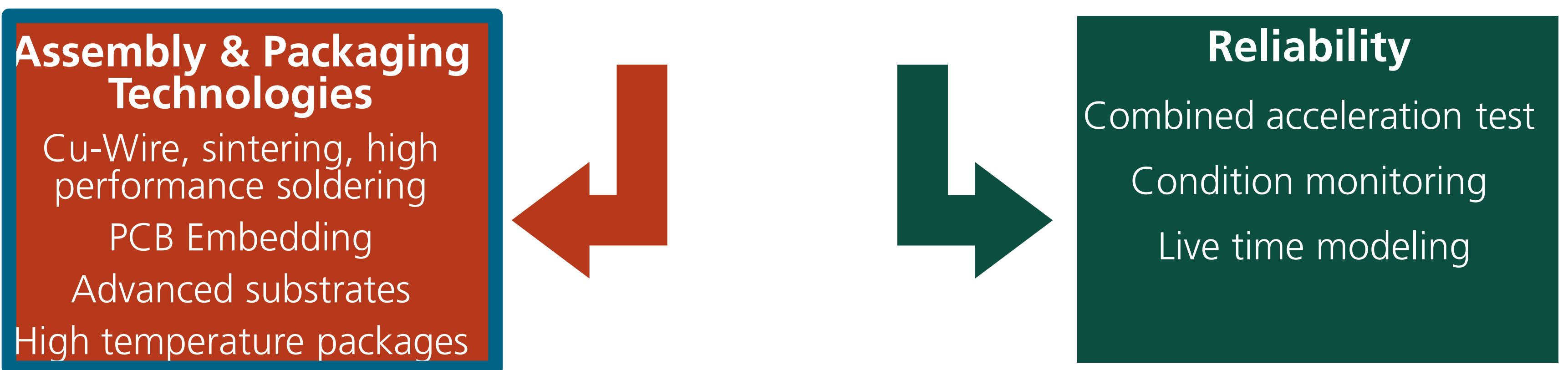
Demands on Innovative Power Electronics



Demand for Pioneering Packaging Technologies

- Integration of Control and Power Electronics
- Compact High Power Modules
- Cost Efficient Technologies
- Mechanical Interconnects



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Assembly and Packaging Technologies

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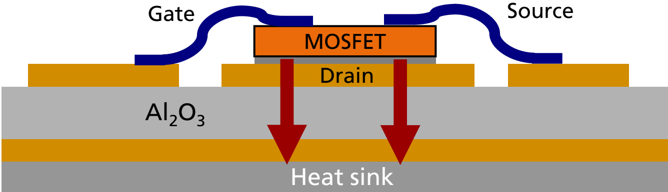
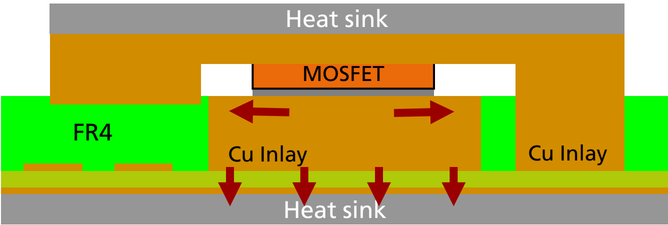
Assembly and Packaging Strategies

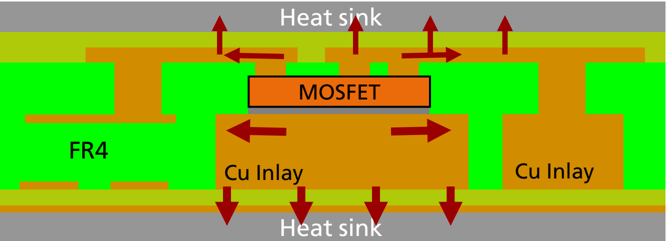
power chip wire-bonded on DCB



power chip double side sandwich on PCB



power chip embedded into power PCB



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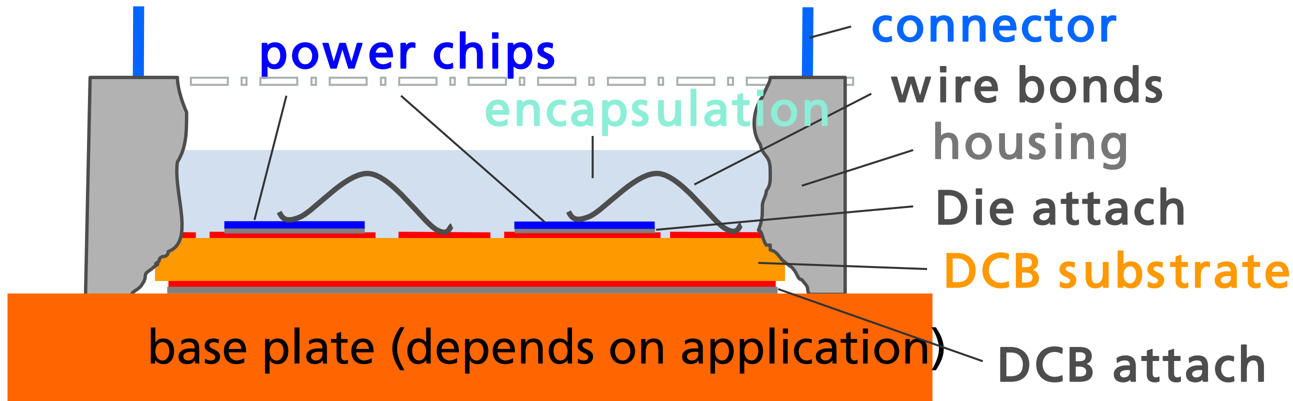
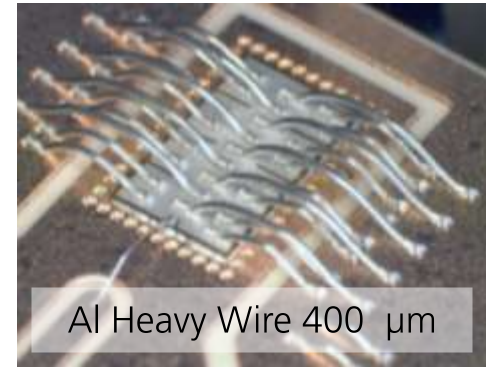
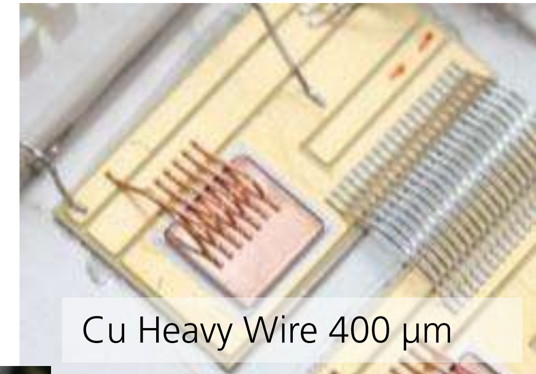
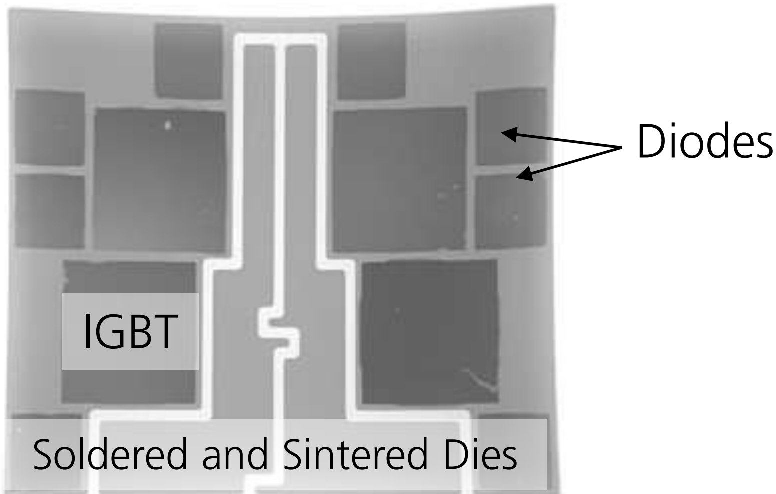
New Interconnection Technologies for Power Modules




Al Heavy Wire 400 µm


Cu Heavy Wire 400 µm



Soldered and Sintered Dies

Al Ribbon

Cu/Al Ribbon

Advanced Chip and Wire Technologies

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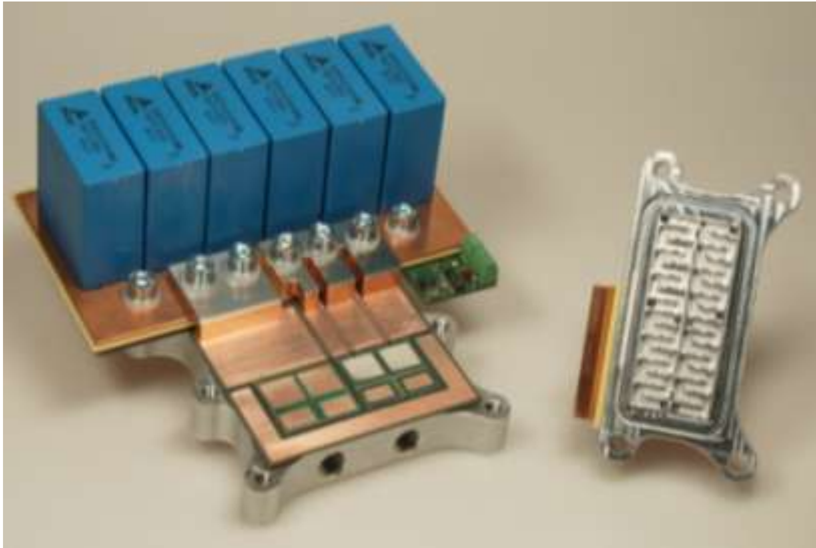
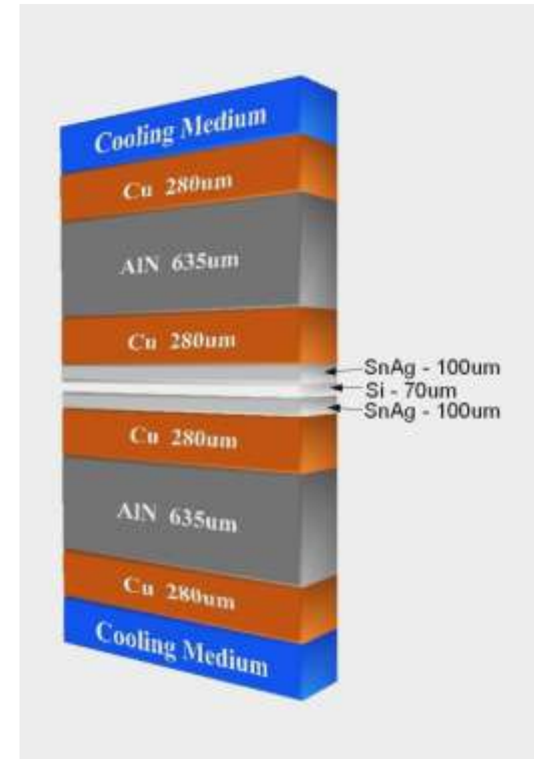
Sandwich Packaging with Double Side Cooling





- Package with very low thermal resistance due to short distance to heat sink and minimized number of interfaces
- Package for 500A peak, 600V
- Cooling by Cooling cycle combustion engine

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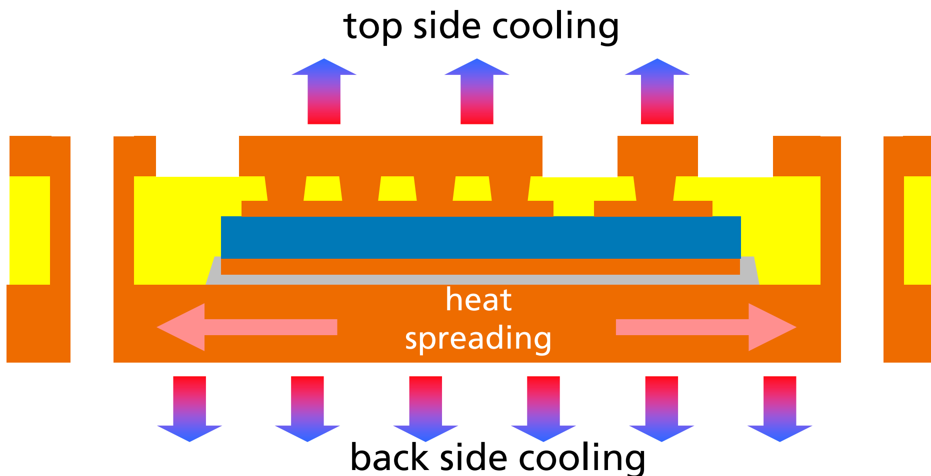
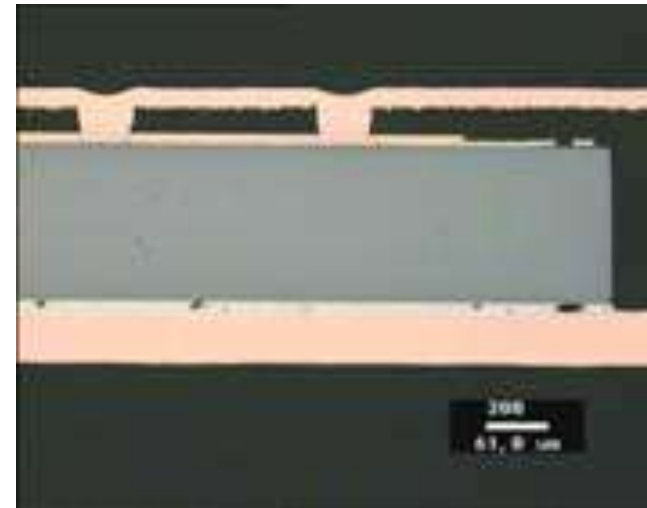
Power Chip Embedding

- low inductances
- 3D packaging
- high reliability
- top and back side heat transfer
- shielding capability





embedded MOSFET

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Applications

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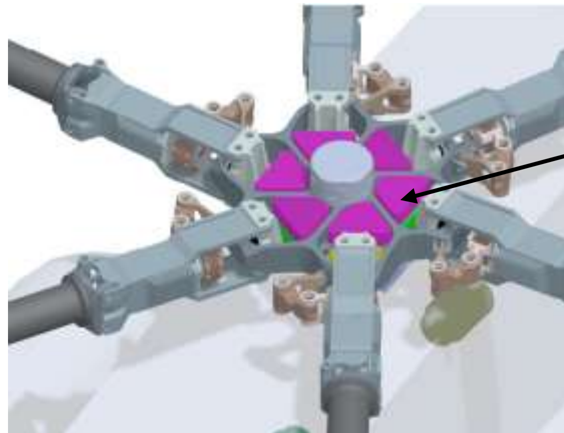
Converter for Helicopter Rotor Blade Control

- Converter system for harsh environment
- Hoch redundant, Volume < 3litre, 270V, 44Aeff, rotation resistant, air cooling
- All parts airworthy
- Formfactor optimized, volume reduction, higher performance



Courtesy of ZF

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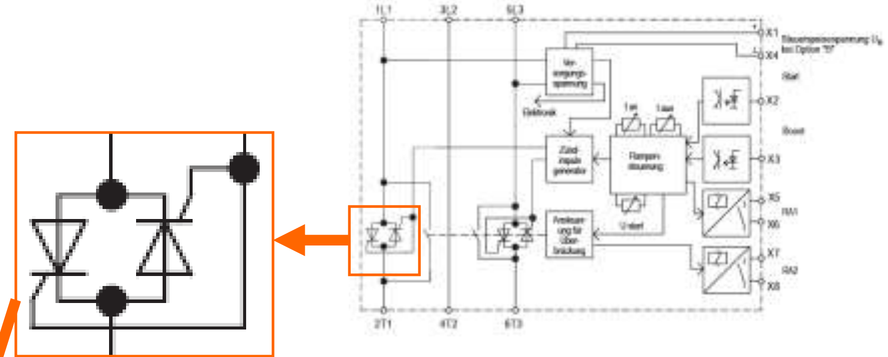
Thyristor Power Module

andus ELECTRONIC — PETER electronic

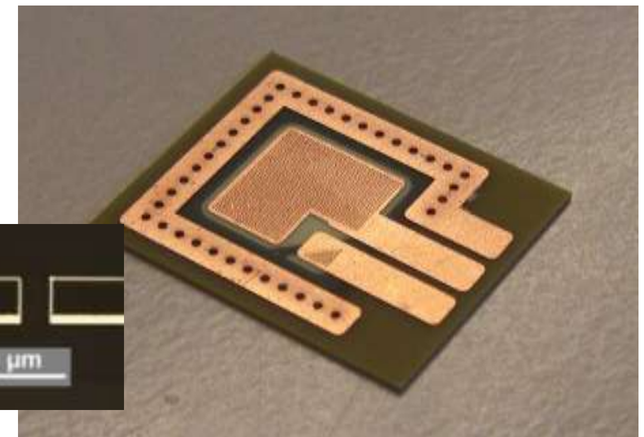
project goal

- soft starter for large motors
- phase angle control using of 4 thyristors
- 400 V, 45 A
- first test module
  - 1 embedded thyristor
  - Ag-filled adhesive
- final system
  - 4 embedded thyristors
  - die bonding by Ag sintering
  - PCB with 2 mm Cu core
  - attached to air cooler



first test module with embedded thyristor

cross-section test module



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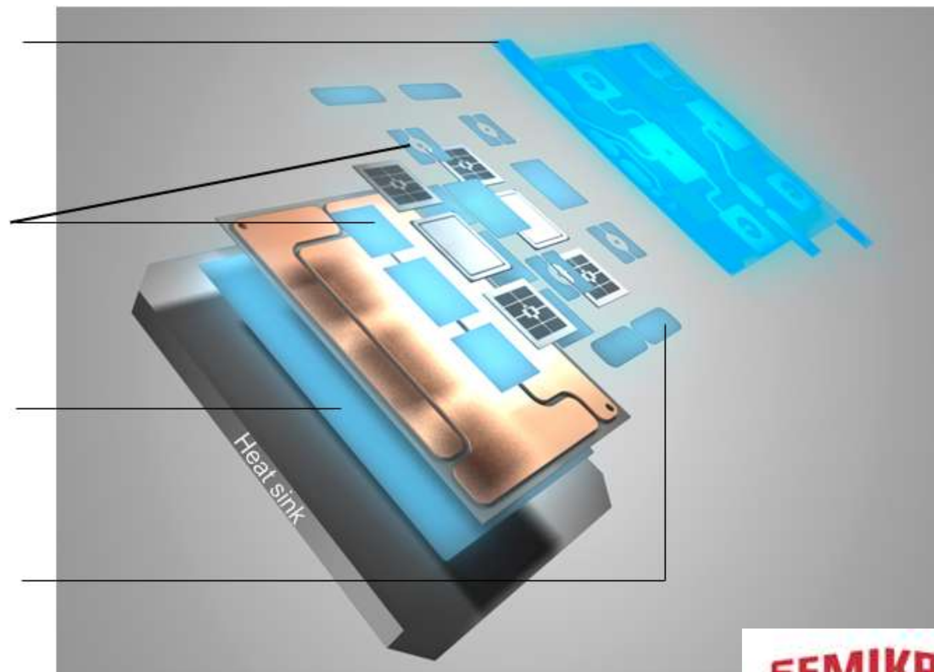
Development trends: Top-side bonding

Alternative top side interconnection technology

Low-temperature sintering with Ag powder or paste of metallic shapes and strands or flex material is in discussion and partial in production:

- The SKiN flex layer replaces the bond wires
- Chips are sintered on chip upper and underside
- The thermal paste layer is replaced by a sinter layer
- Terminals are sintered to the DBC



Courtesy of SEMIKRON innovation+service

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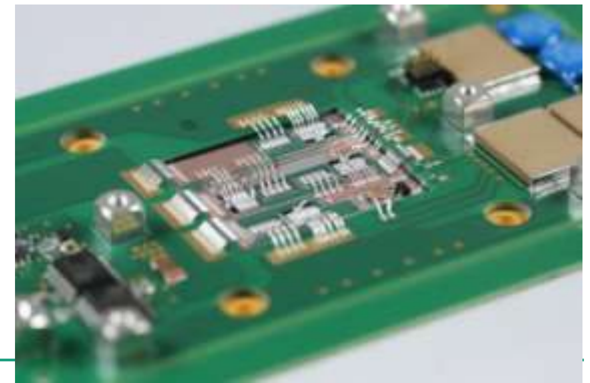

THANK YOU VERY MUCH FOR YOUR ATTENTION

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