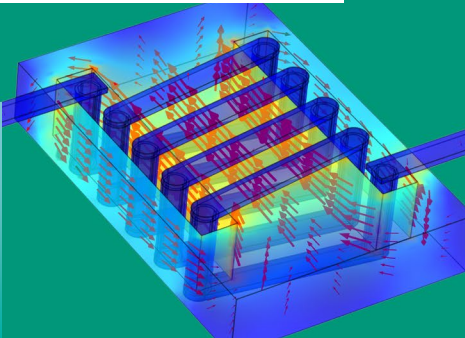


# Integrated Passive Devices

**Back-end-of-line integration of passives in silicon and PCB  
Energy savings by innovative active cooling**



Inductor realization with soft magnetic core

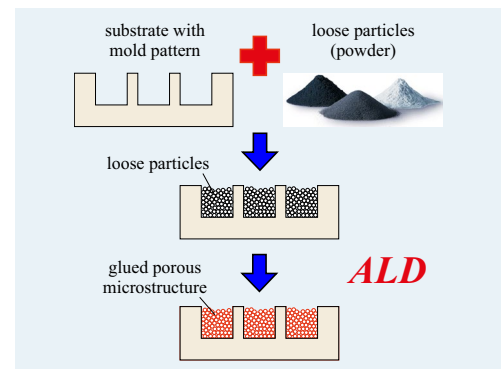
Fraunhofer ISIT has developed a unique technology based on PowderMEMS to create inductors and transformers with magnetic core on a substrate (e.g., silicon, FR4) for high-frequency applications. The design process offers a variety of possibilities. First prototypes were built on 8" silicon wafers, consisting of a magnetic core-based carbonyl iron powder and copper windings from 5 to 8 turns. The powder is agglomerated by atomic layer deposition (ALD). As a result, the magnetic particles are covered with a thin dielectric layer, suppressing eddy currents. Due to the process, higher operating temperatures are possible to enable a new level of integration and reaching higher power densities in products like a power supply in a chip or package.

As a result, this back-end-of-line compatible method offers great solutions to develop small inductors as well as integrated packages with high performance.

## Technical specifications:

<b>Max. inductance</b>	300 nH
<b>Max. quality factor</b>	45
<b>Preferred frequency range</b>	1-40 MHz
<b>Saturation of magnetic flux density</b>	2.1 T
<b>Max. permeability</b>	7
<b>Max. temperature</b>	400°C

## Simplified processing steps



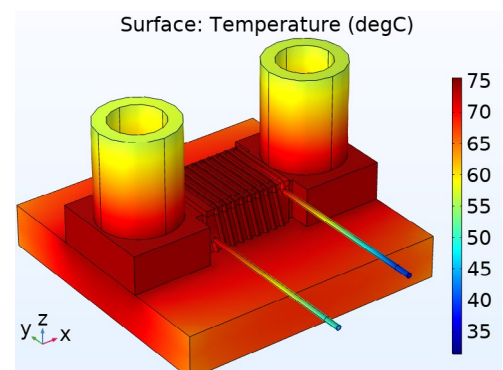
## Integrated micro-inductors with magnetic core by Powder MEMS technology

- Inductor design process with a high degree of freedom
- Great performance for fast switching applications
- Wide temperature operating range
- Back-end-of-line compatible process
- Good integration possibilities (e.g., inductor & GaN HEMT on one substrate)

## Application examples

- Switched-mode power supplies
- Internet of things
- Smart homes
- Embedded systems
- Multimedia consumer market

## Active cooling



# Innovative Power Devices

Customized GaN power semiconductor devices  
and passives made in Northern Germany

## What we can do for you @Fraunhofer ISIT

### GaN processing technology and device platform

- Application-specific development of diodes and transistors
- Adaptation and optimization of devices according to customer requirements
- Proof of concept fabrication on 200 mm process line
- Process and device simulation, testing and device reliability

### Integrated micro-inductors with magnetic core by PowderMEMS technology

- Customized integrated inductors on PCB and silicon
- Integrated solutions with power devices
- Simulation-based design and combined cooling system

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