Core-as-a-Sensor

Ferrite DC-Resistance-Based Core Temperature Measurement of Magnetics

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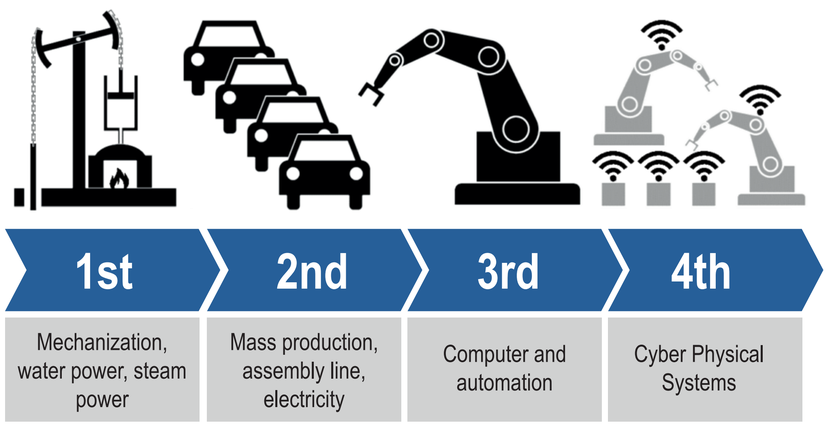
I. Industry 4.0

- Continuous monitoring of power components
- Improved failure diagnostics,
- Predictive maintenance / lifetime prognostics

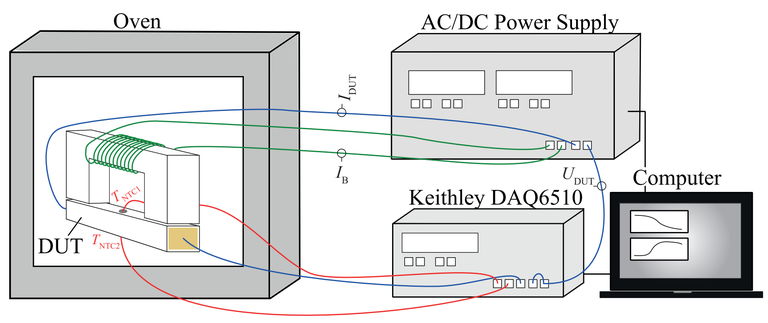


In-situ temperature monitoring of components:

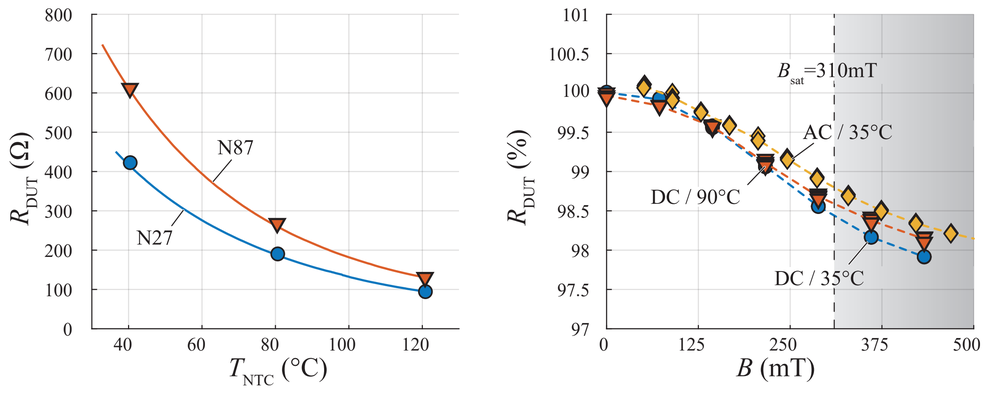
- Semiconductor on-state voltage
- Electrolytic capacitor ESR
- Method for transformers / inductors?

II. Ferrite Resistivity

- Temperature dependent MnZn ferrite conductivity
- Opportunity for in-situ monitoring
- Automate measurement setup

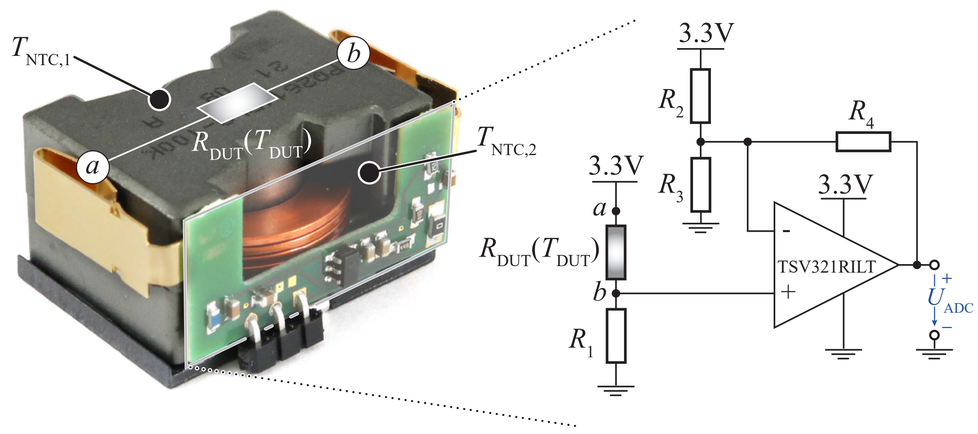


- DUT contacted with silver-epoxy glue
- N27 and N87 material characterized
- Parasitic Schottky diode
- Mild impact of magnetic field on resistivity



III. Smart Inductor Prototype

- In-situ measurement of the core resistivity
- Based on Bourns PQ2614BLA-100K with 10 µH
- Extended with auxiliary PCB

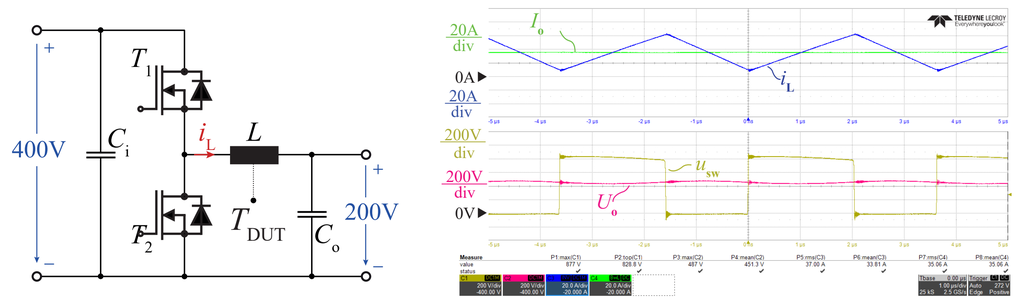


Wheatstone-bridge resistivity measurement:

- 3.3V supply / temp. dependent resistive divider
- Output voltage compatible with standard ADC input

IV. Experimental Results

- Buck dc-dc converter with smart-inductor prototype
- 1200V SiC / 72kHz / 1.6kW
- Proof-of-concept experiments



- Average core temperature observed
- Lower core surface temperature (NTCs)
- Methods converge in off state
- Low error due to HF B-field