

DIGITAL WE DAYS

2024



INTRODUCTION TO THERMAL AGING IN
MOLDED INDUCTORS

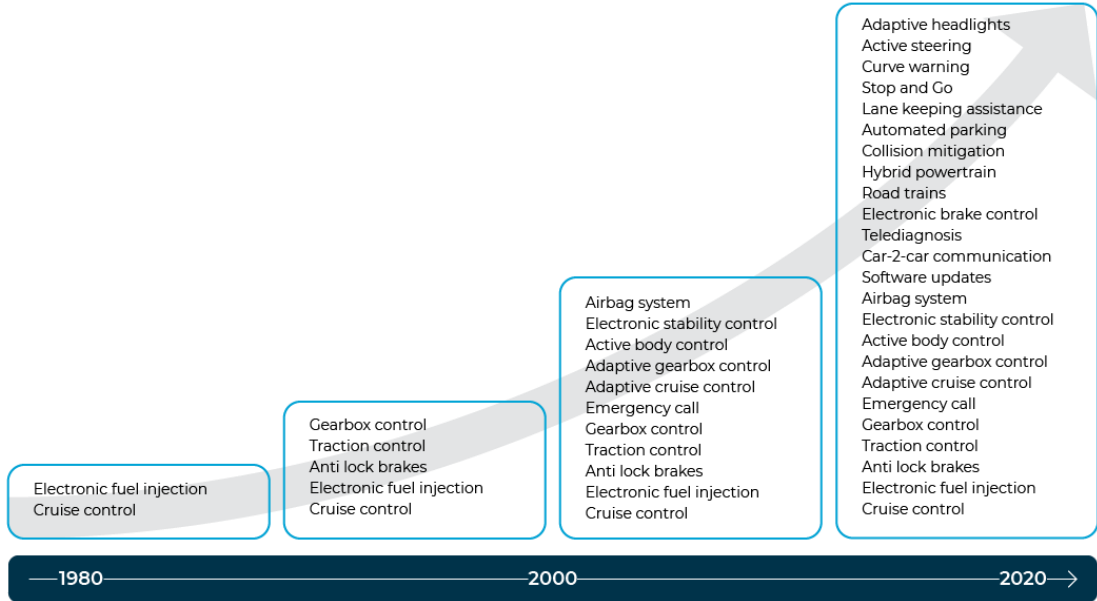
Carlos Farnós | Jose Rocamora

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

AGENDA

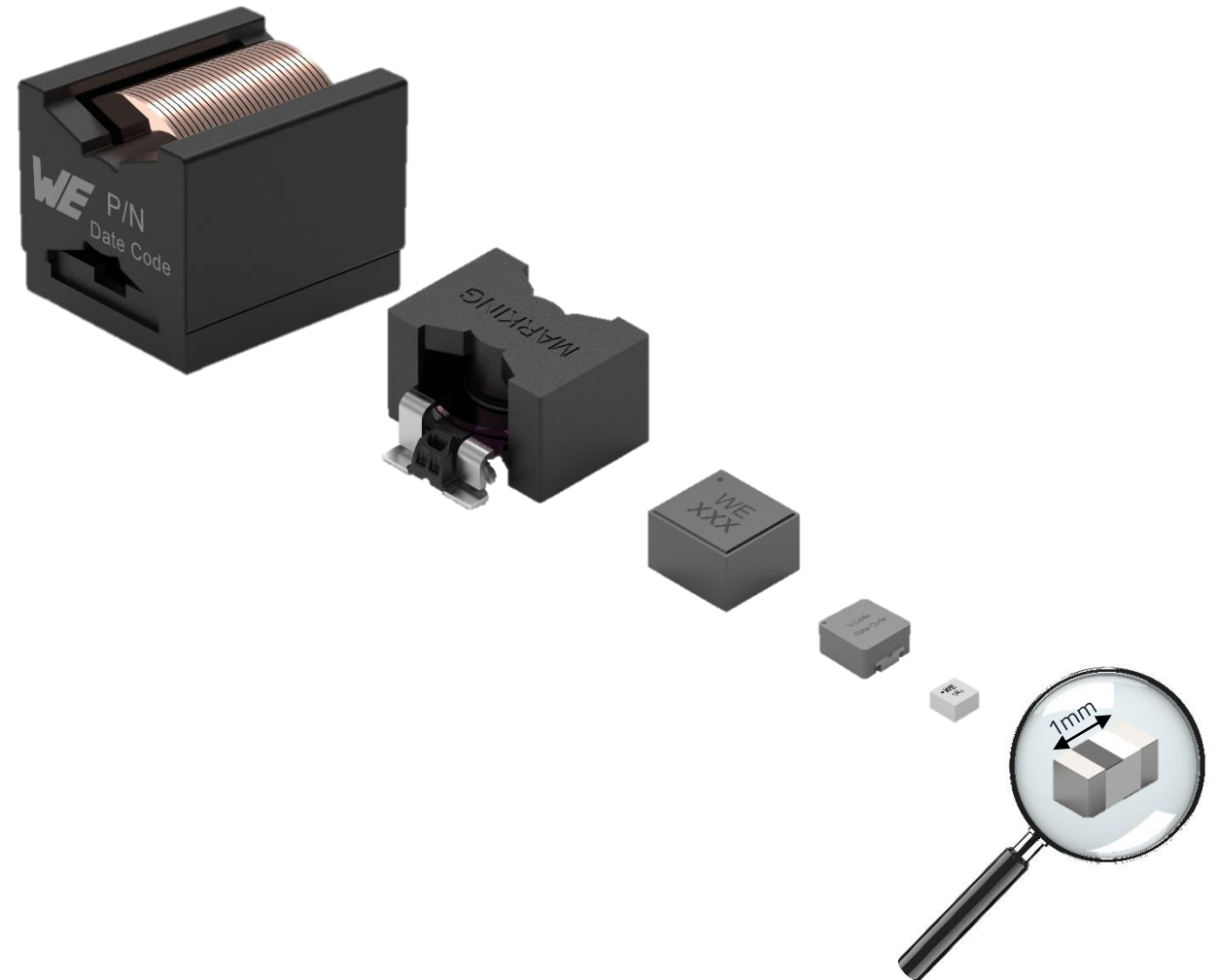
1. Market trends in the power converters
2. From ferrite to molded inductors
3. Characteristics of molded inductors
4. Thermal aging

MARKET TRENDS IN THE POWER CONVERTERS



MARKET TRENDS IN THE POWER CONVERTERS

- **Miniaturization**
- **Power density increase**
- **Reliability**



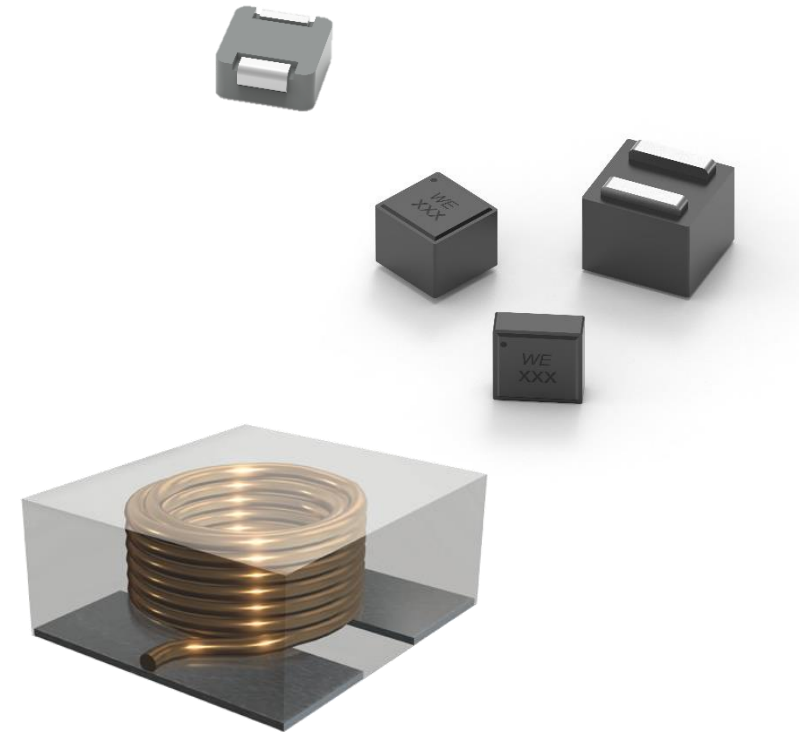
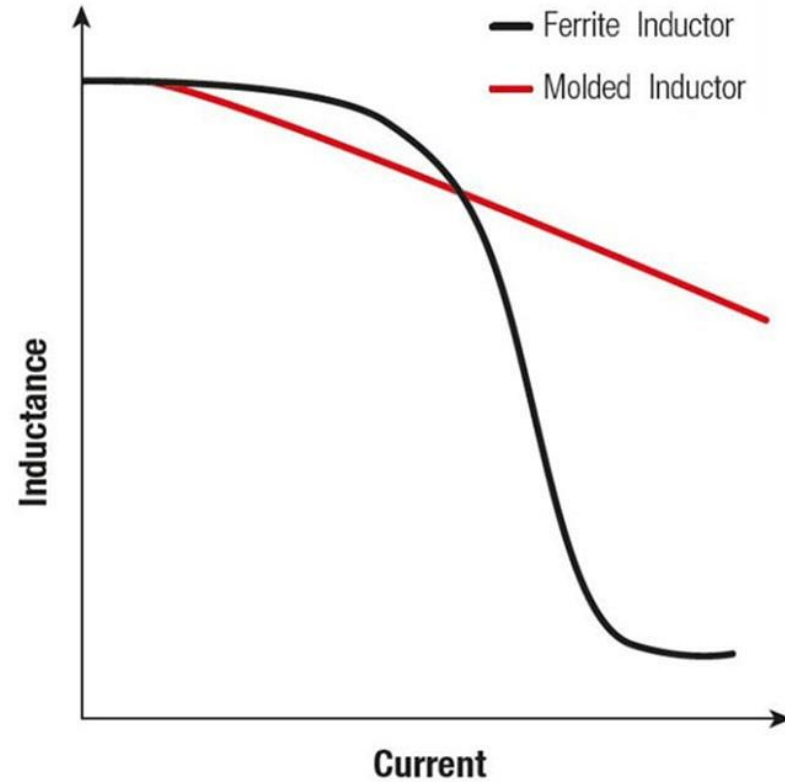
FROM FERRITE TO MOLDED INDUCTORS



- Long time experience
- Relatively economic
- Wide variety of solutions

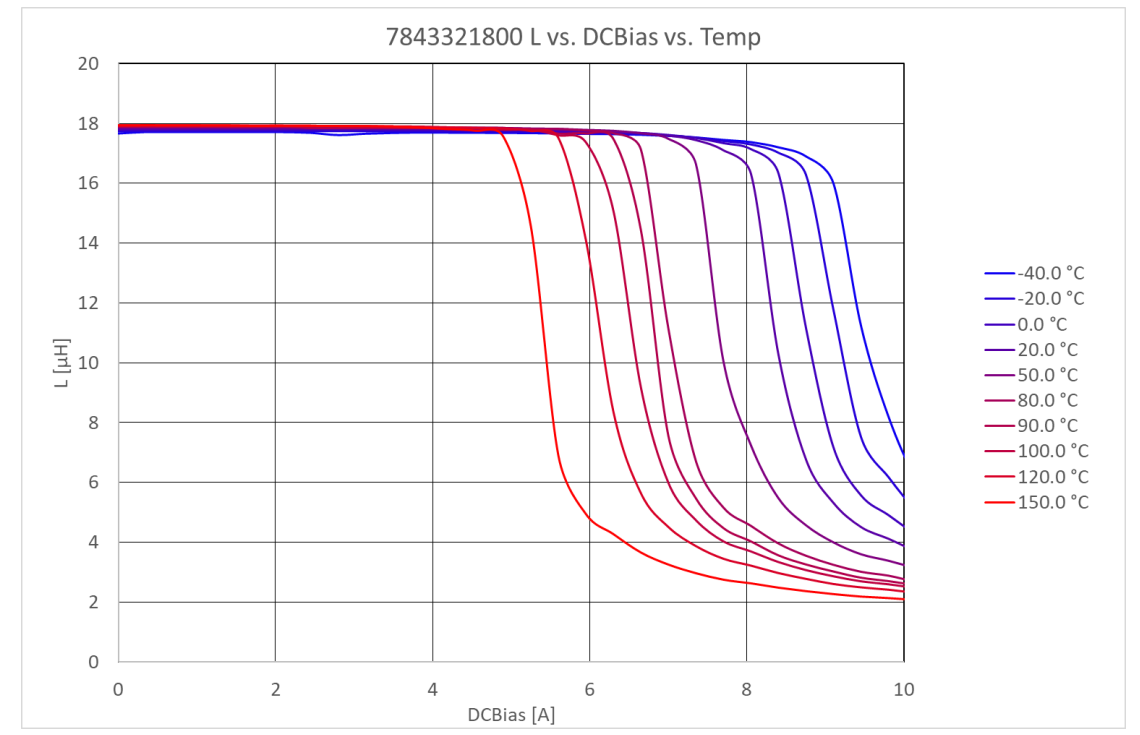
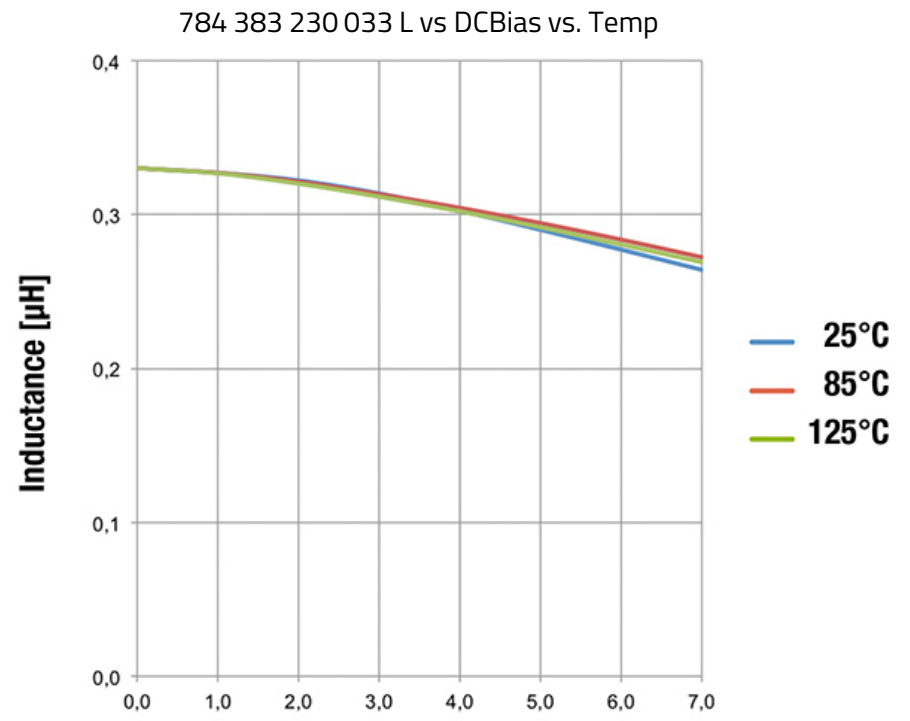
FROM FERRITE TO MOLDED INDUCTORS

Molded inductors vs Ferrite inductors



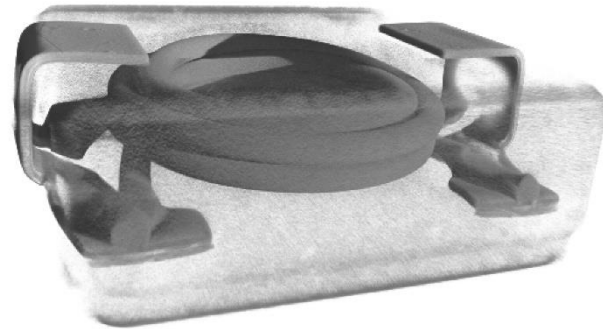
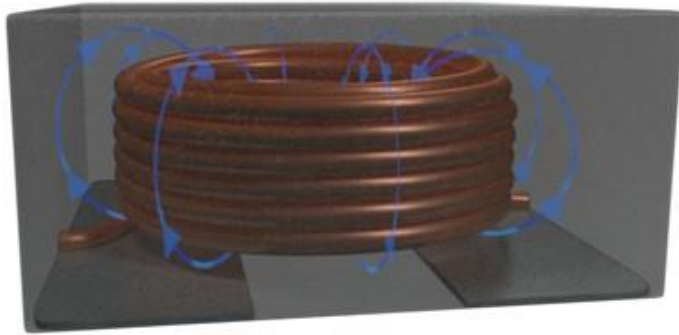
FROM FERRITE TO MOLDED INDUCTORS

Molded inductors vs Ferrite inductors vs Temperature



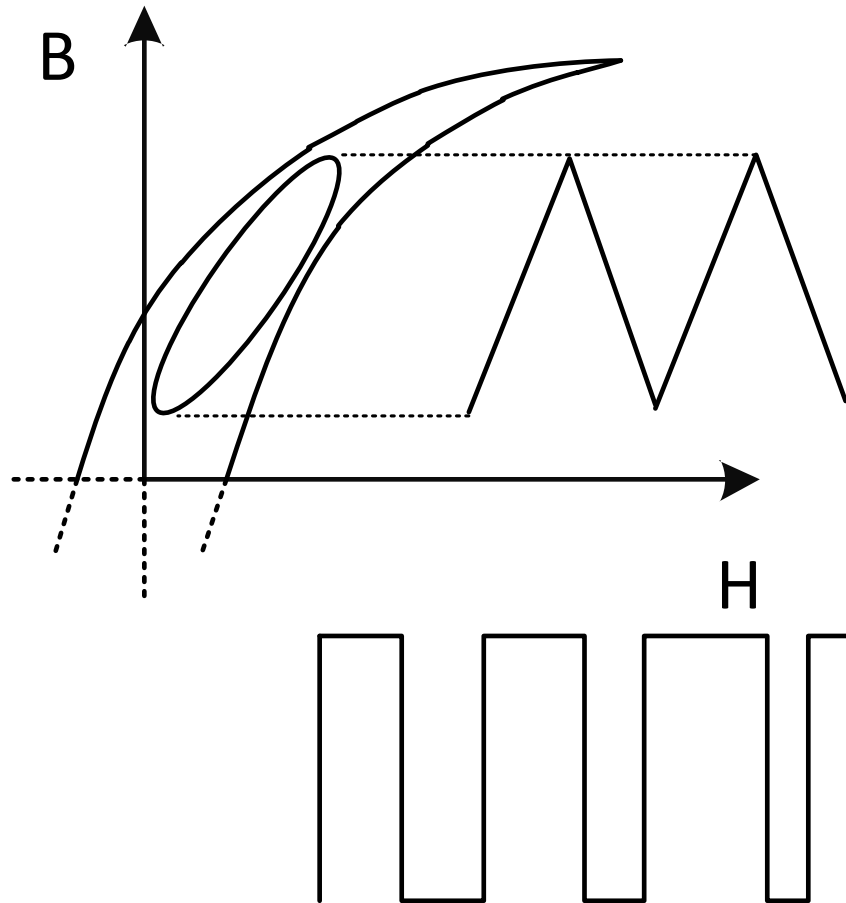
CHARACTERISTICS OF MOLDED INDUCTORS

Molded inductor construction



CHARACTERISTICS OF MOLDED INDUCTORS

Inductor losses



➤ Winding losses

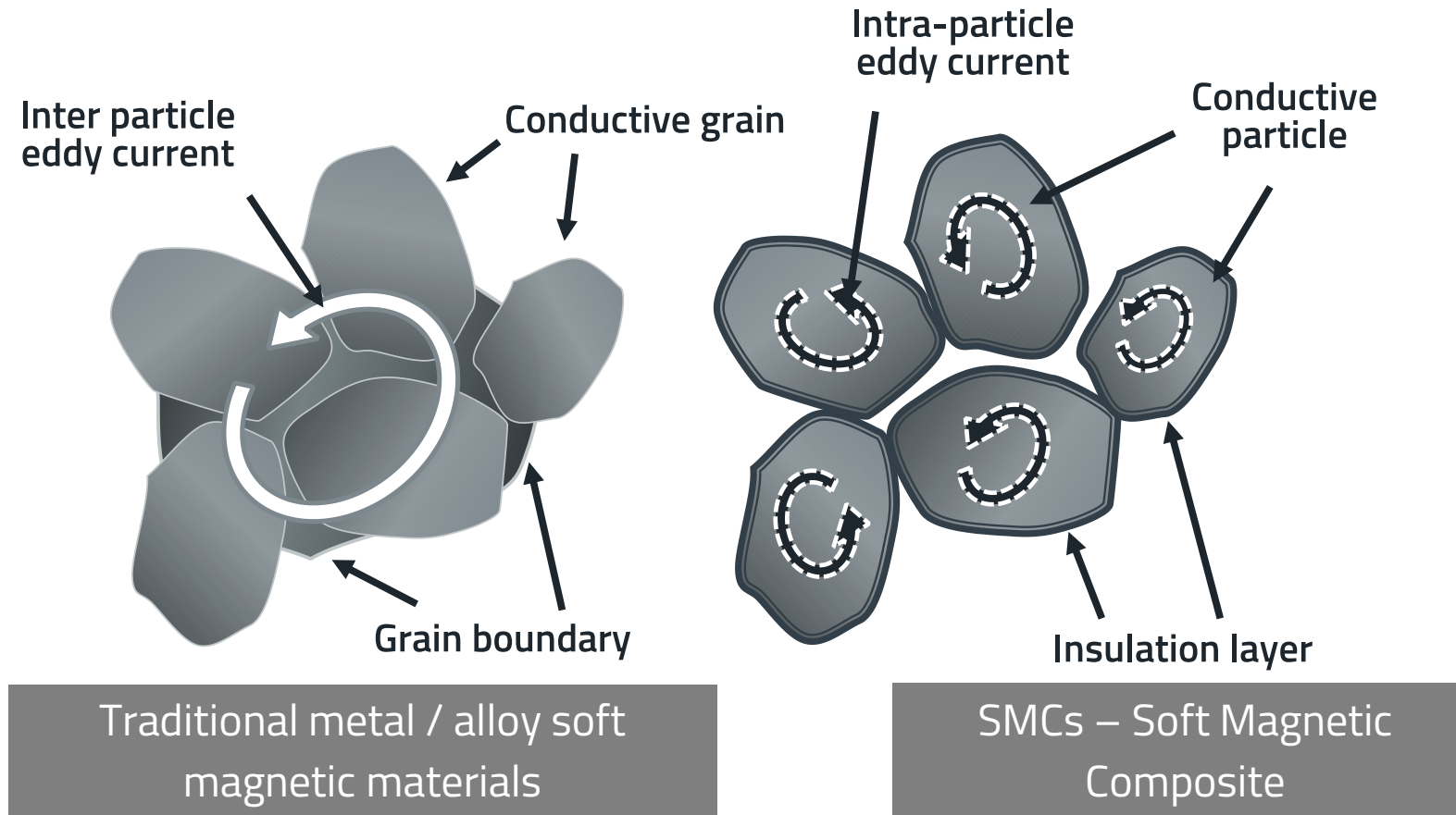
- Ohmic losses
- Skin effect losses
- Proximity effect losses

➤ Core losses

- Hysteresis losses
- Eddy current losses

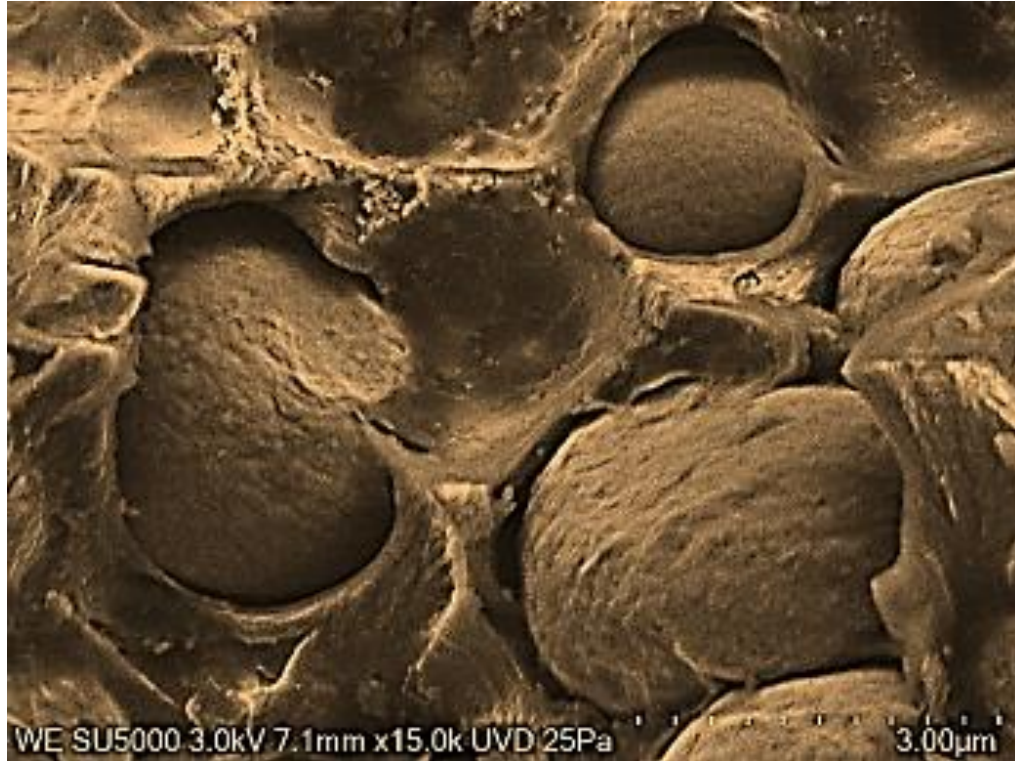
CHARACTERISTICS OF MOLDED INDUCTORS

Molded inductor construction



THERMAL AGING

Effects



- Thermal aging refers to degradation of the insulation between the iron particles
- It is triggered by the continuous exposition to high temperatures
- The effect on the electrical characteristics is permanent

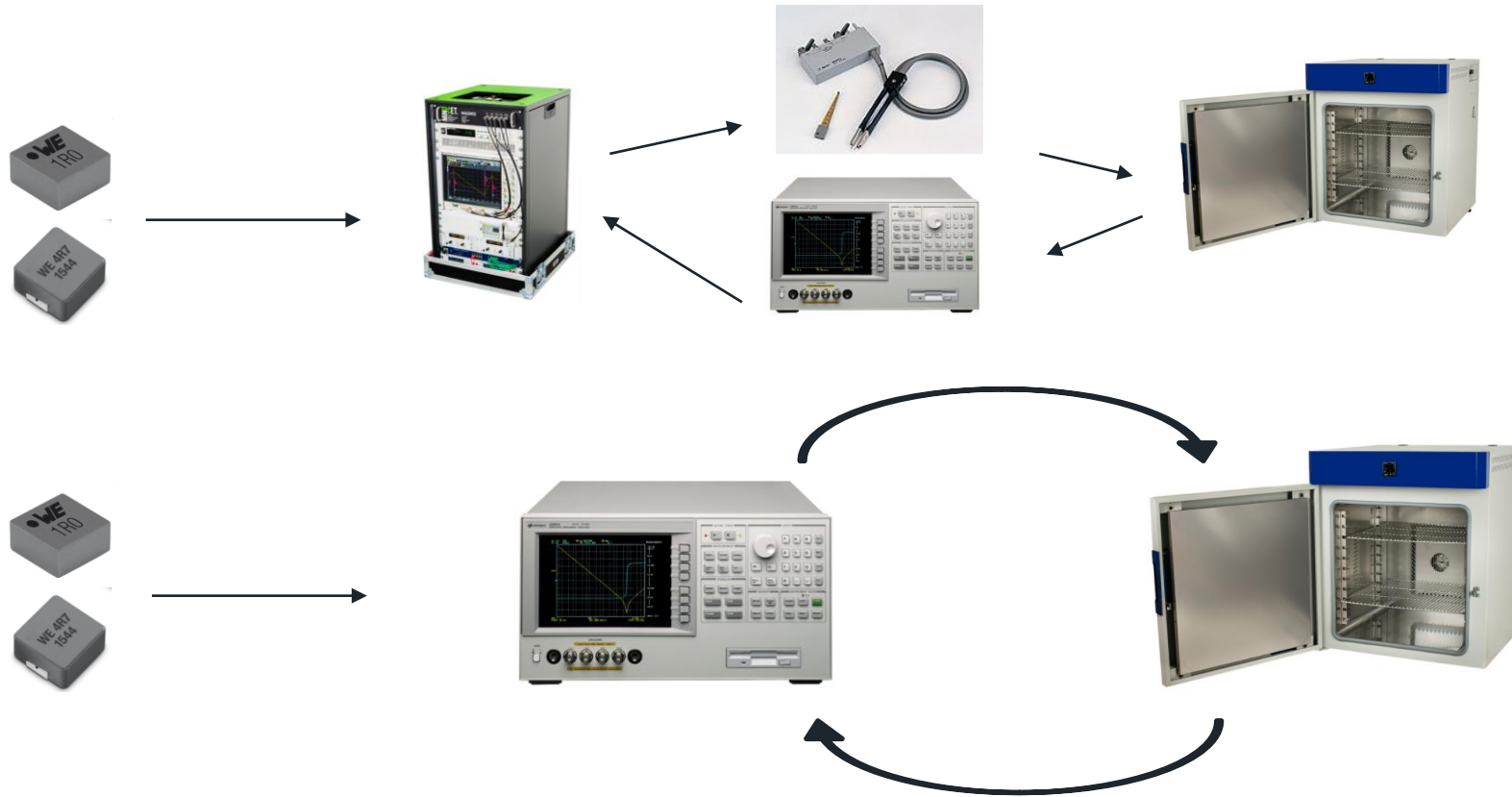
THERMAL AGING

Effect



THERMAL AGING

Testing procedures

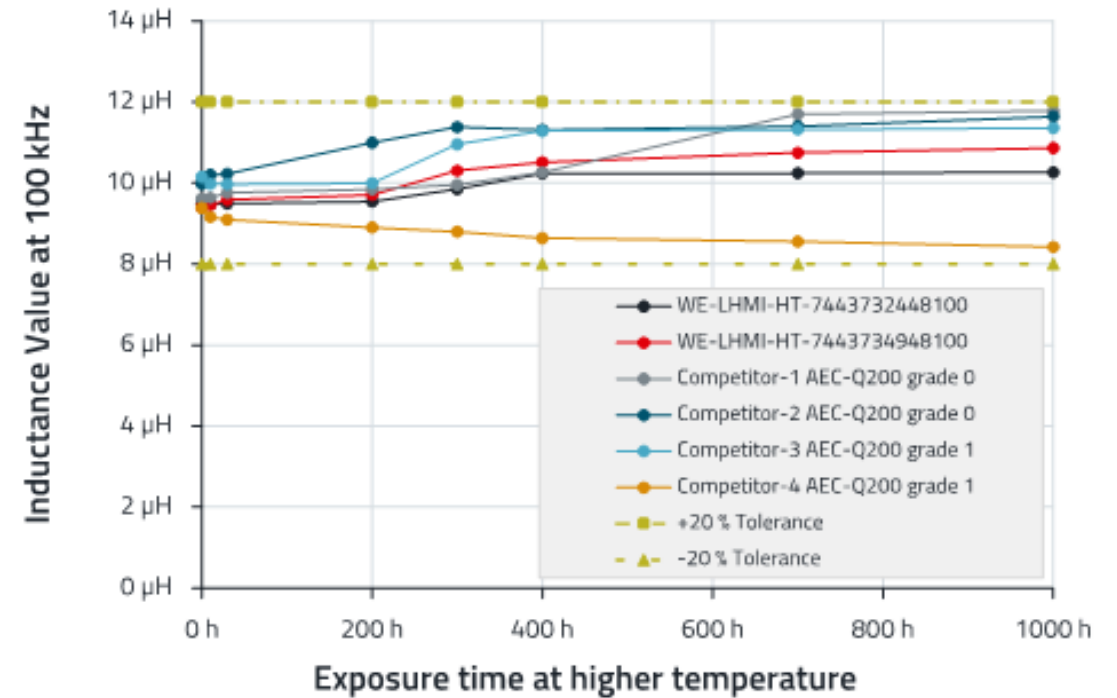


THERMAL AGING

Results

- Inductance value suffer minimum variations due to thermal aging
- The AC losses increases due to degradation of the insulation between particles
- Bigger conductive paths for the formation of eddy current are formed

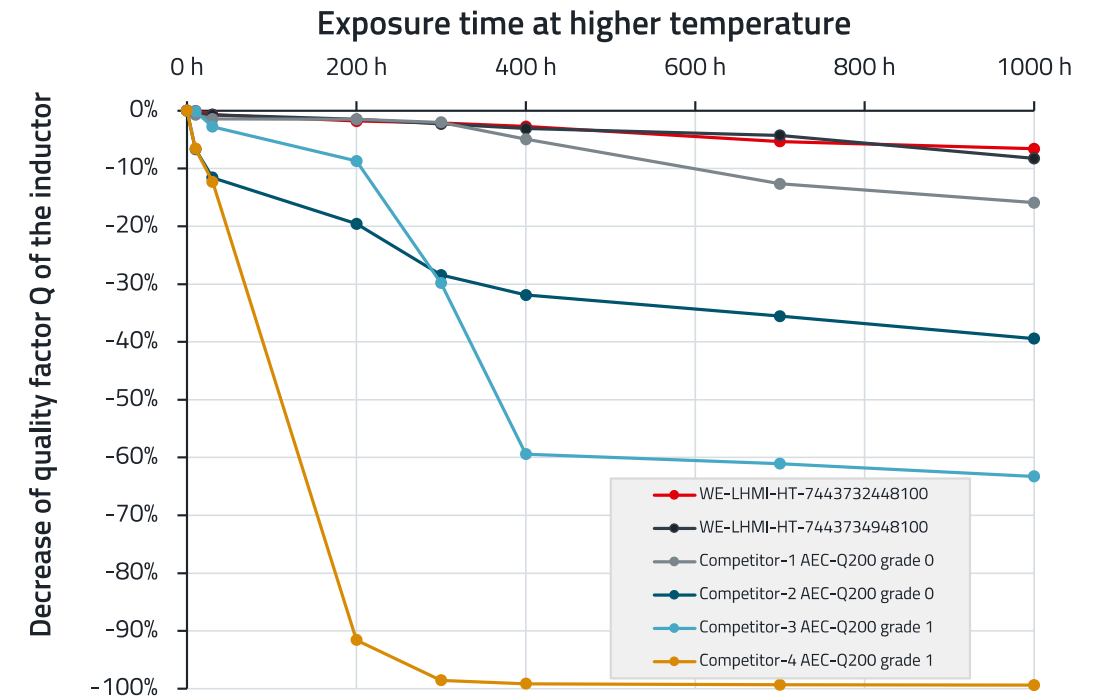
Inductance L value at 100 kHz during 1000 h at 200 °C



THERMAL AGING

Results

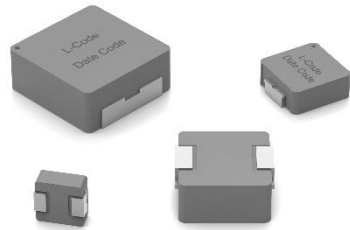
- Q value decreases over time
- We can use as indicator of the thermal aging phenomena
- Q value has a correlation with the increase of the AC losses in the core



Decrease of Q value at 2 MHz during 1000 h at 200 °C

THERMAL AGING

Würth Elektronik molded inductor portfolio



▪ WE-LHMI

4020HT
5020HT
7030HT
7050HT

▪ WE-LHCA

7030
1040
1365
1770

▪ WE-XHMI

4020
4030
5030
7070

▪ WE-XHMA

6030
6060
8080
1090
1510

▪ WE-MAPI

2512HT
3015HT
3020HT
4020HT

▪ WE-MAIA

4020HT

Questions

& Answers



We are here for you now!
Ask us directly via our chat or via E-Mail.

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Mode Totem-Pole PFC

