Power Components
Testing & EMC
Power Applications
Power Research
POWER ELECTRONICS 2017
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Multilayer ferrites with in-rush current capability

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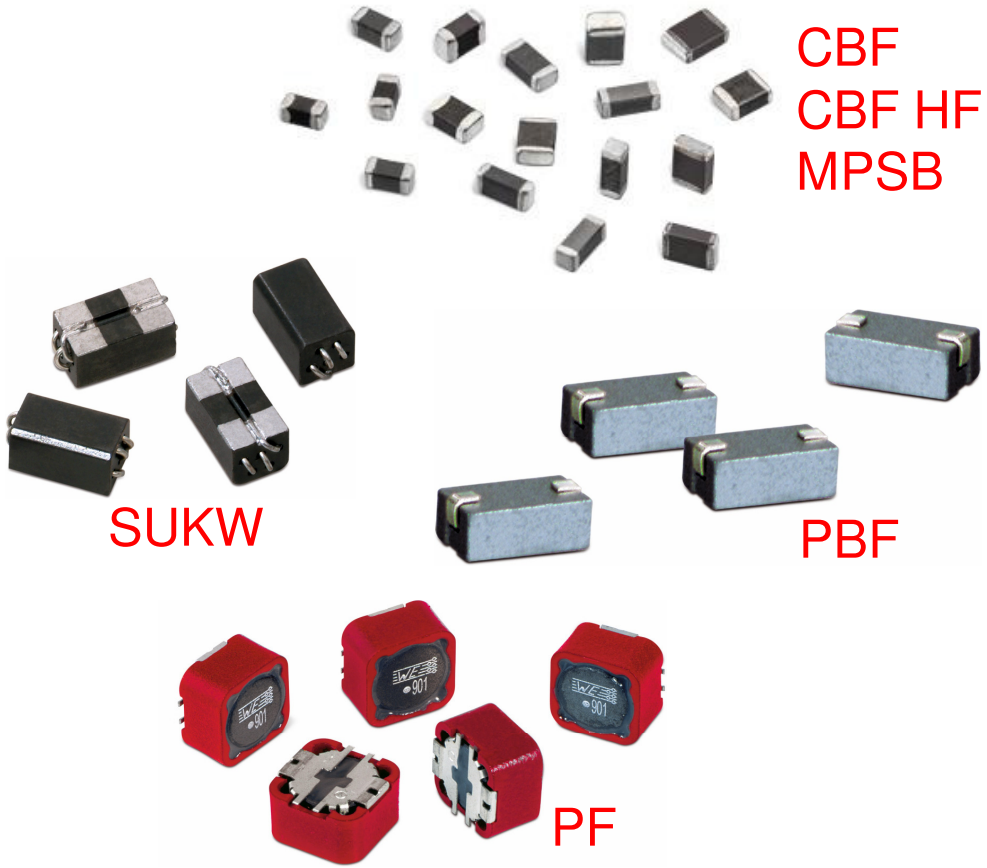
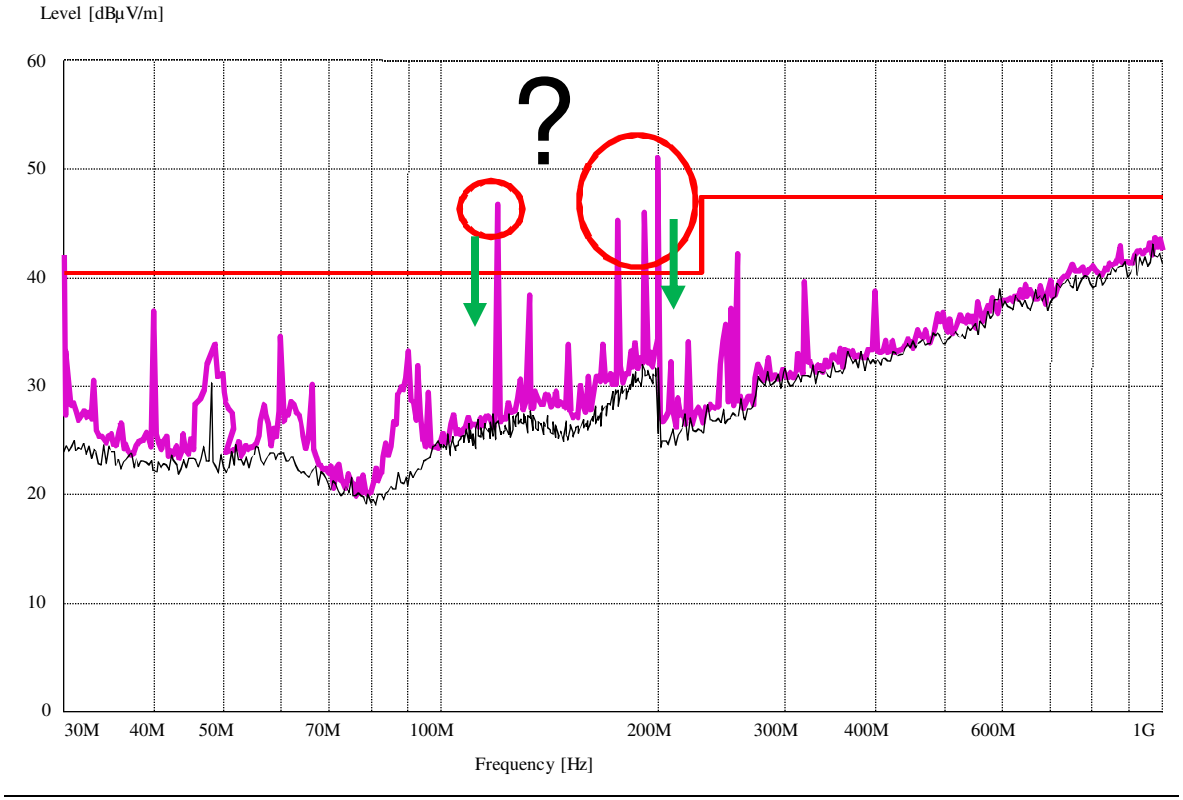
AGENDA

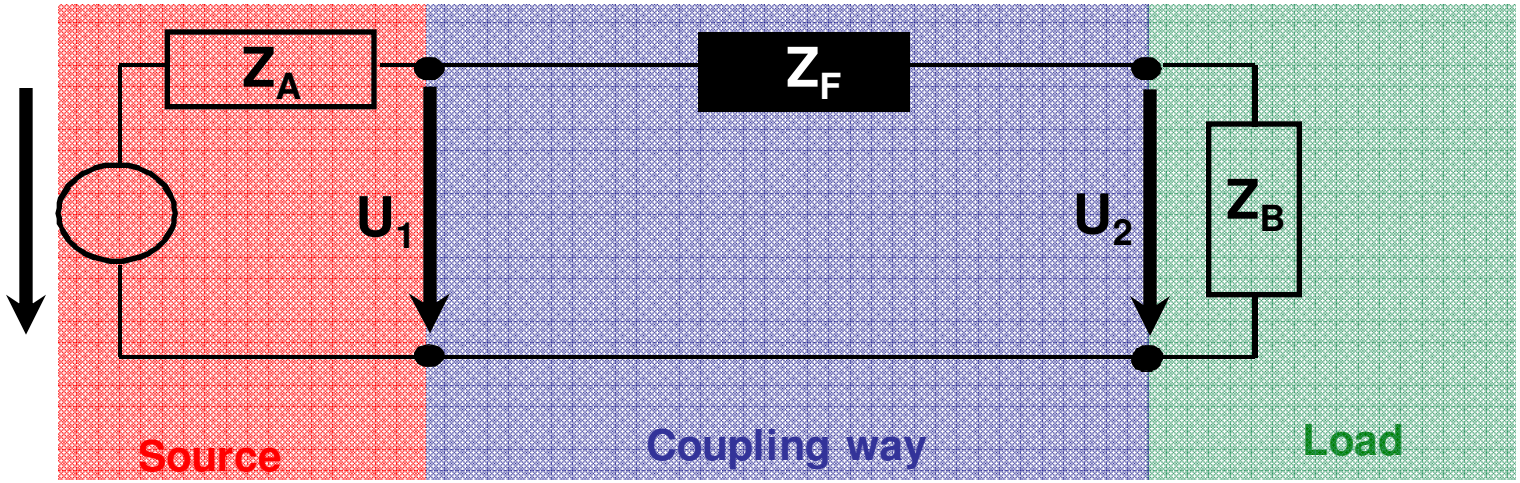
- **SMT chip bead ferrites**
  - **Impedance**
  - **Application**
- **Power line application**
  - **Electrical parameter**
  - **In Rush Current**
- **Tools REDEXPERT**



Attenuation vs Impedance



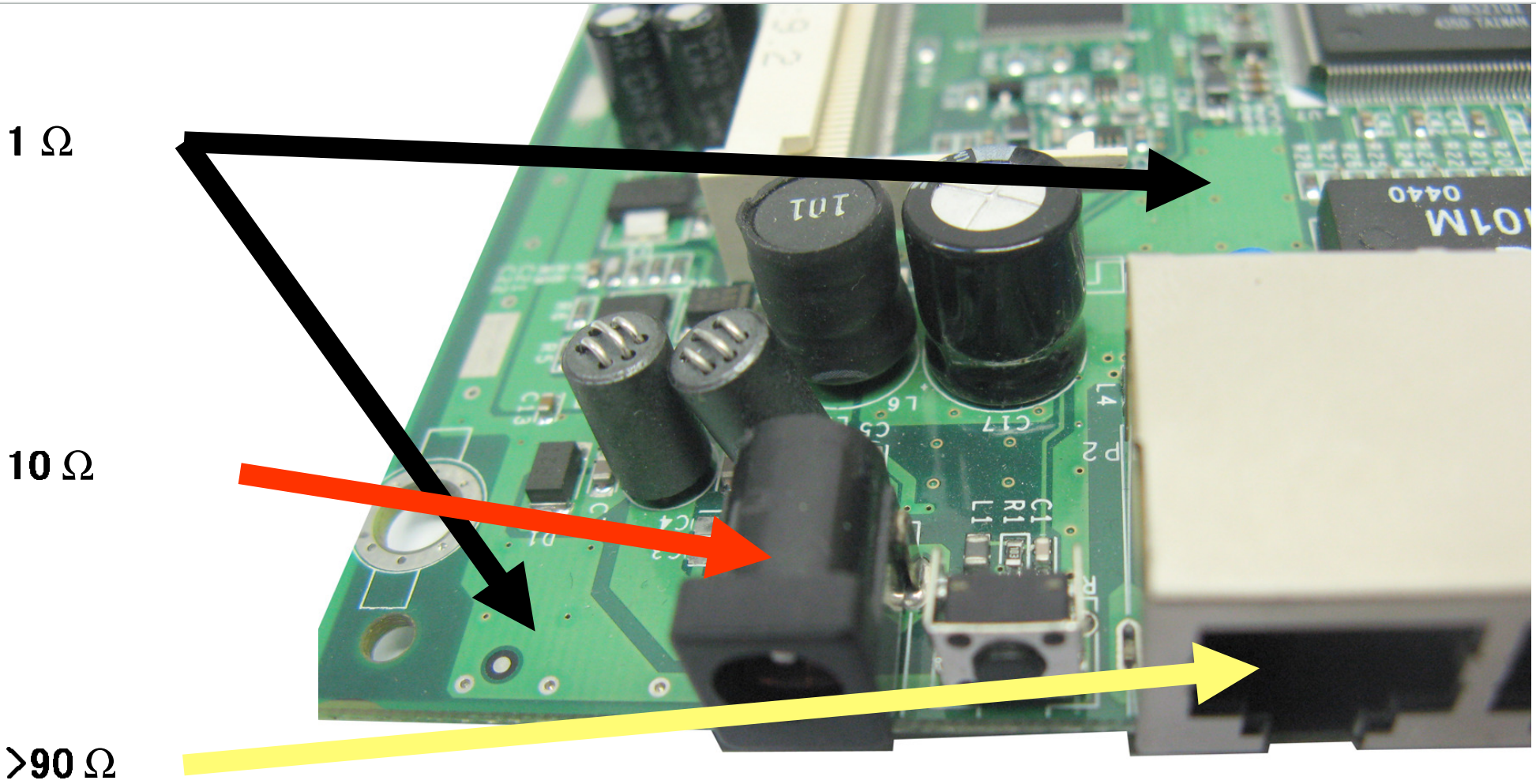
Attenuation vs Impedance



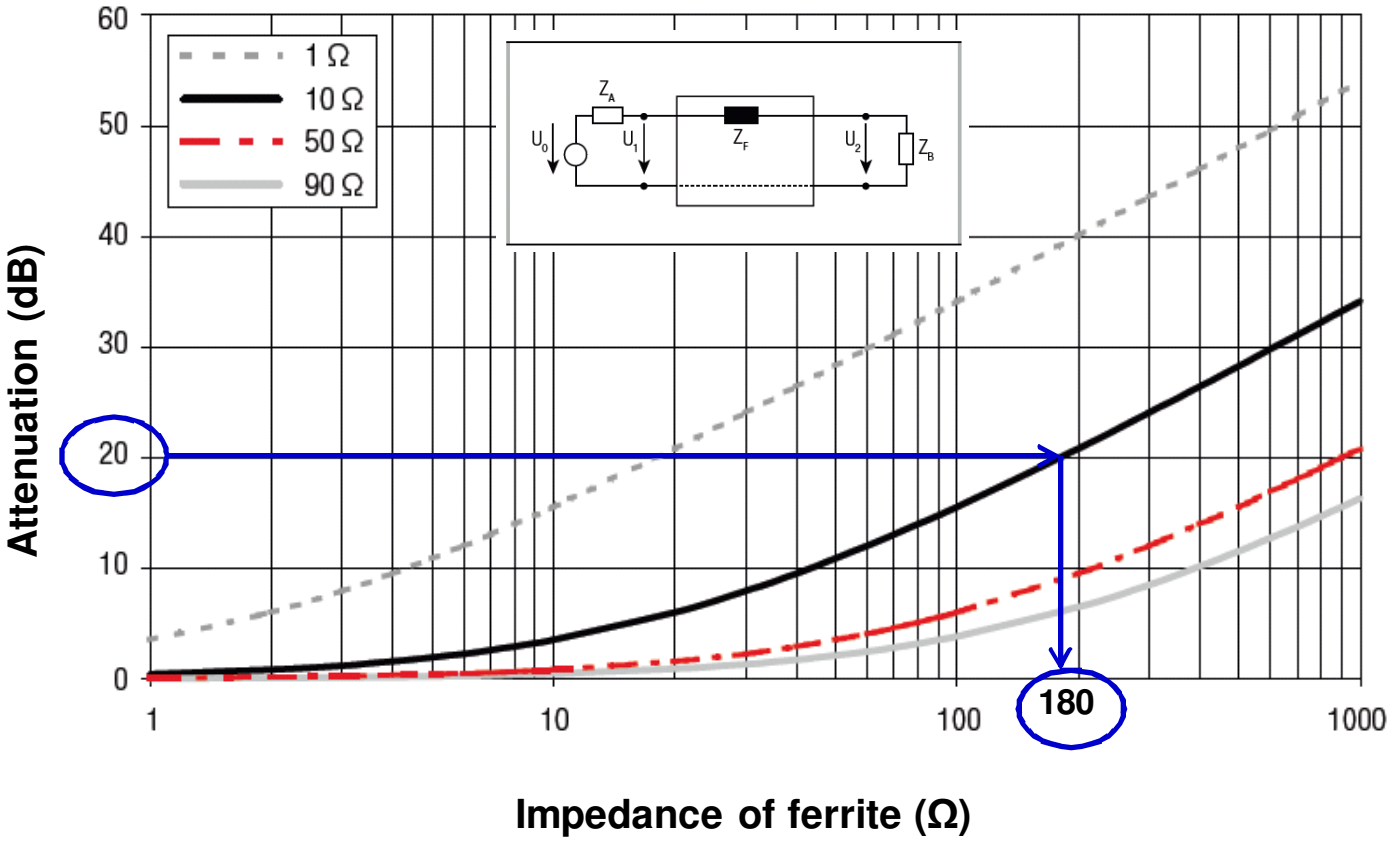
- System attenuation

$$A = 20 \cdot \log \frac{Z_A + Z_F + Z_B}{Z_A + Z_B} \quad in \ (dB)$$

Practical values



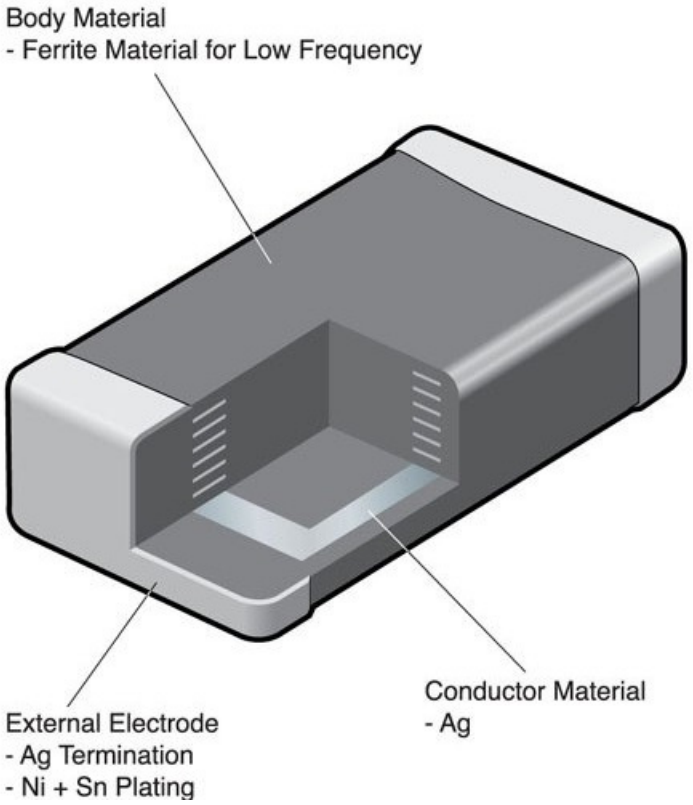
Attenuation vs Impedance



1. 1.Require 20dB of attenuation between 100 and 200 MHz
2. Know that it is a power cable
3. Power port has 10 Ω impedance

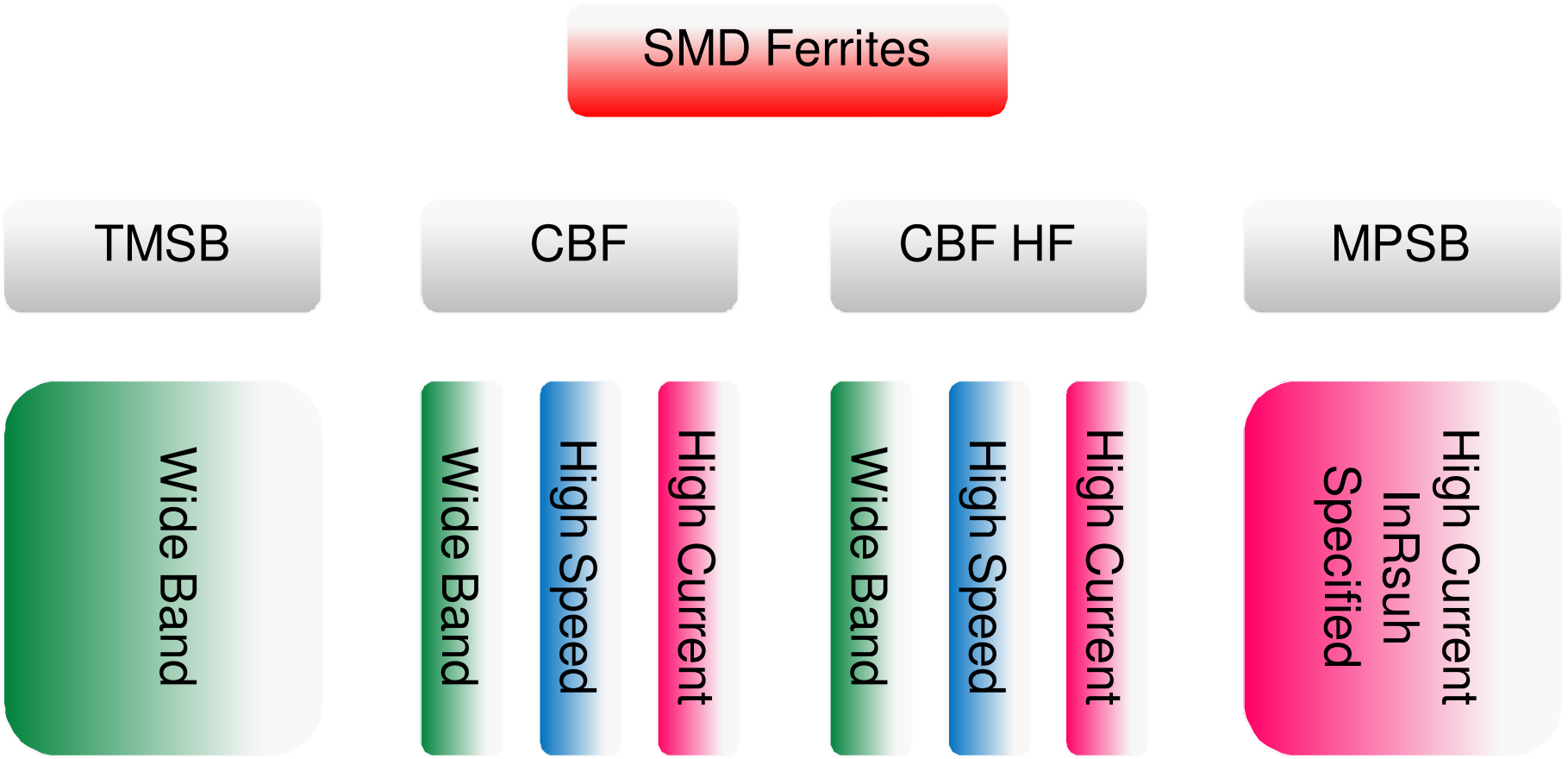
- Result is a minimum impedance of 180Ω

Multilayer ferrite bead : Internal Structure



- SMD-Ferrites are inductive components for pcb solutions in multilayer technology
- They are covered with NiZn and consist of a silver „coil“ inside

CBF series



Power Line Ferrite

CBF – High Current

D Electrical Properties: 742792040

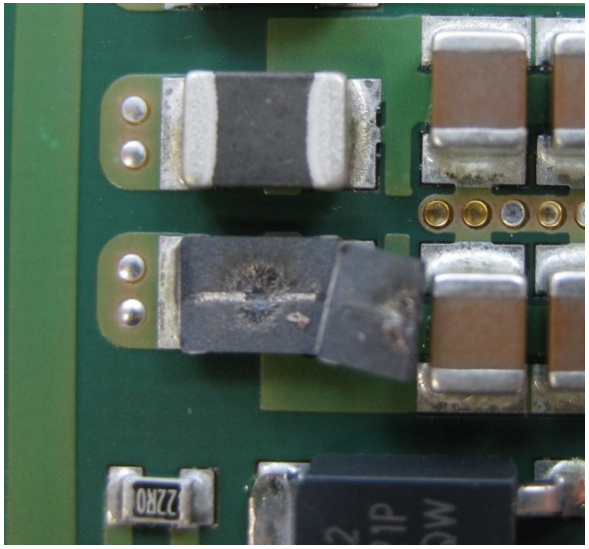
Properties	Test conditions		Value	Unit	Tol.
Impedance @ 100 MHz	100 MHz	Z	600	Ω	±25%
Maximum impedance	150 MHz	Z	700	Ω	typ.
Rated current	ΔT = 40K	I_R	2000	mA	max.
DC Resistance		R_{DC}	0.15	Ω	max.
Type			High Current		

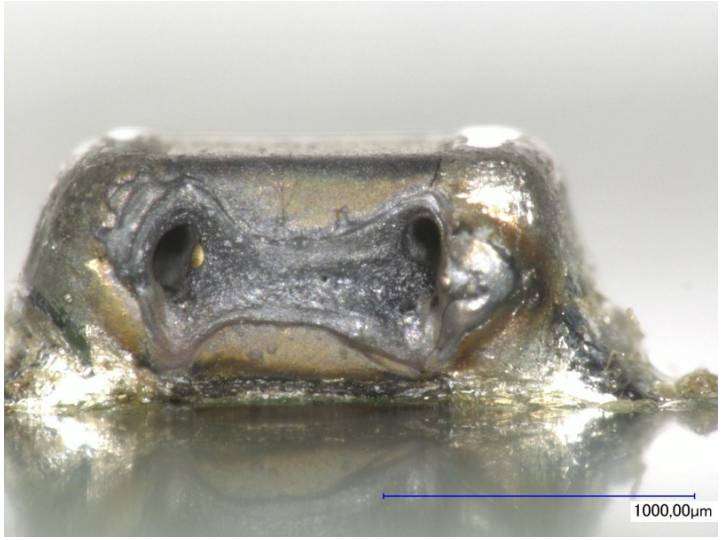
CBF high Current : Ferrite with current higher 1A

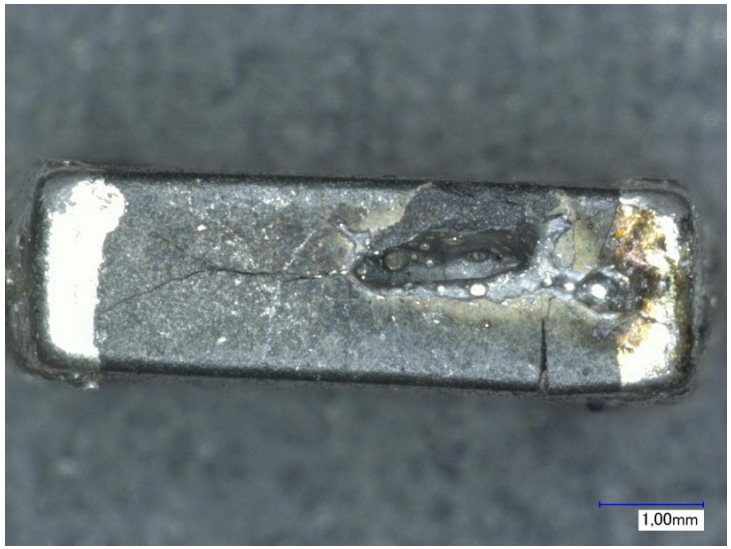
For power Line (CBF, MPSB) the Rated Current is defined for 40K

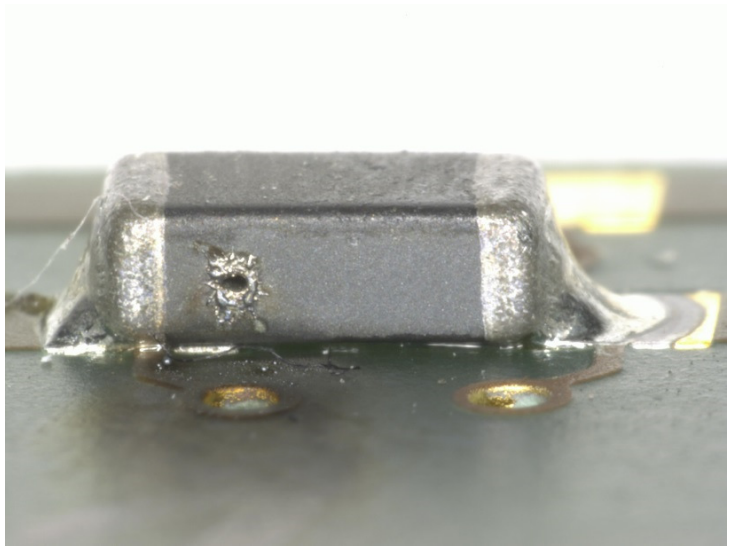
Effect of current and Temperature

Pulse peak after switch on



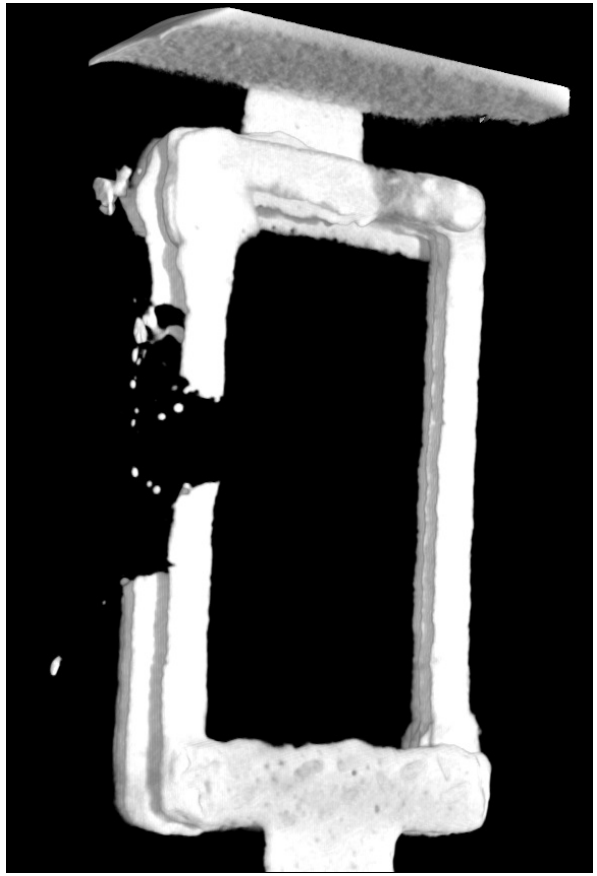


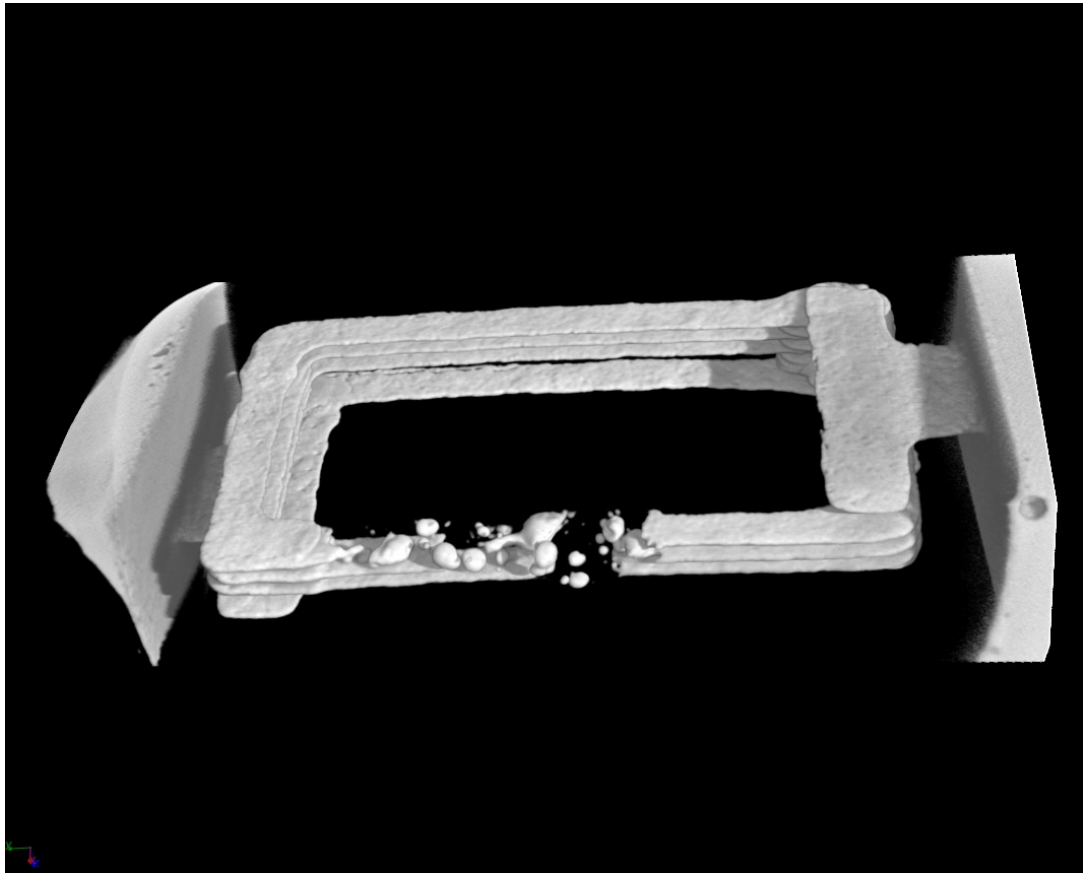




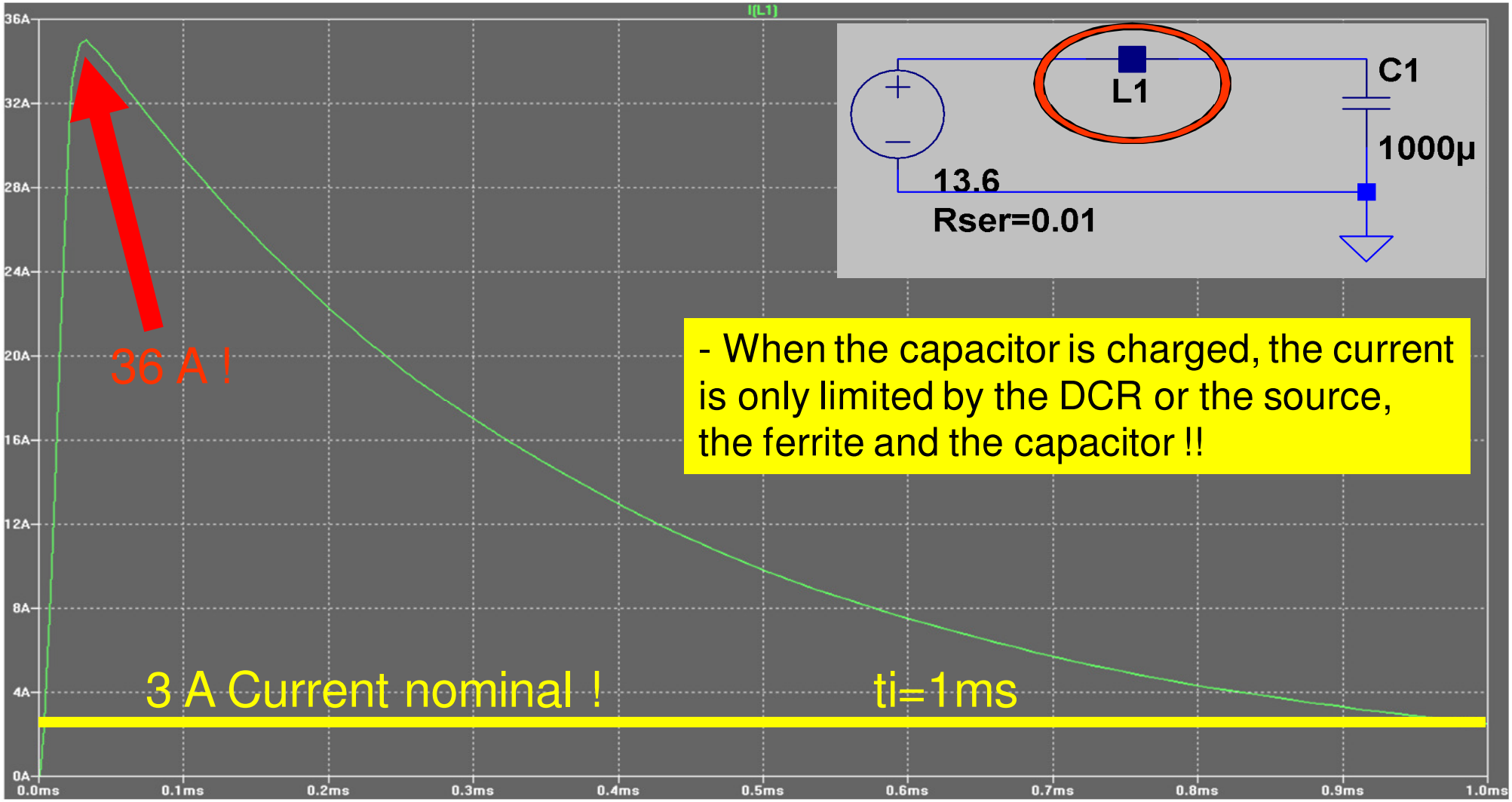
In-Rush Current

- **Multilayer Ferrite (0805)**
- **Destruction at a pulse of 1ms with max. 40A pulse current**

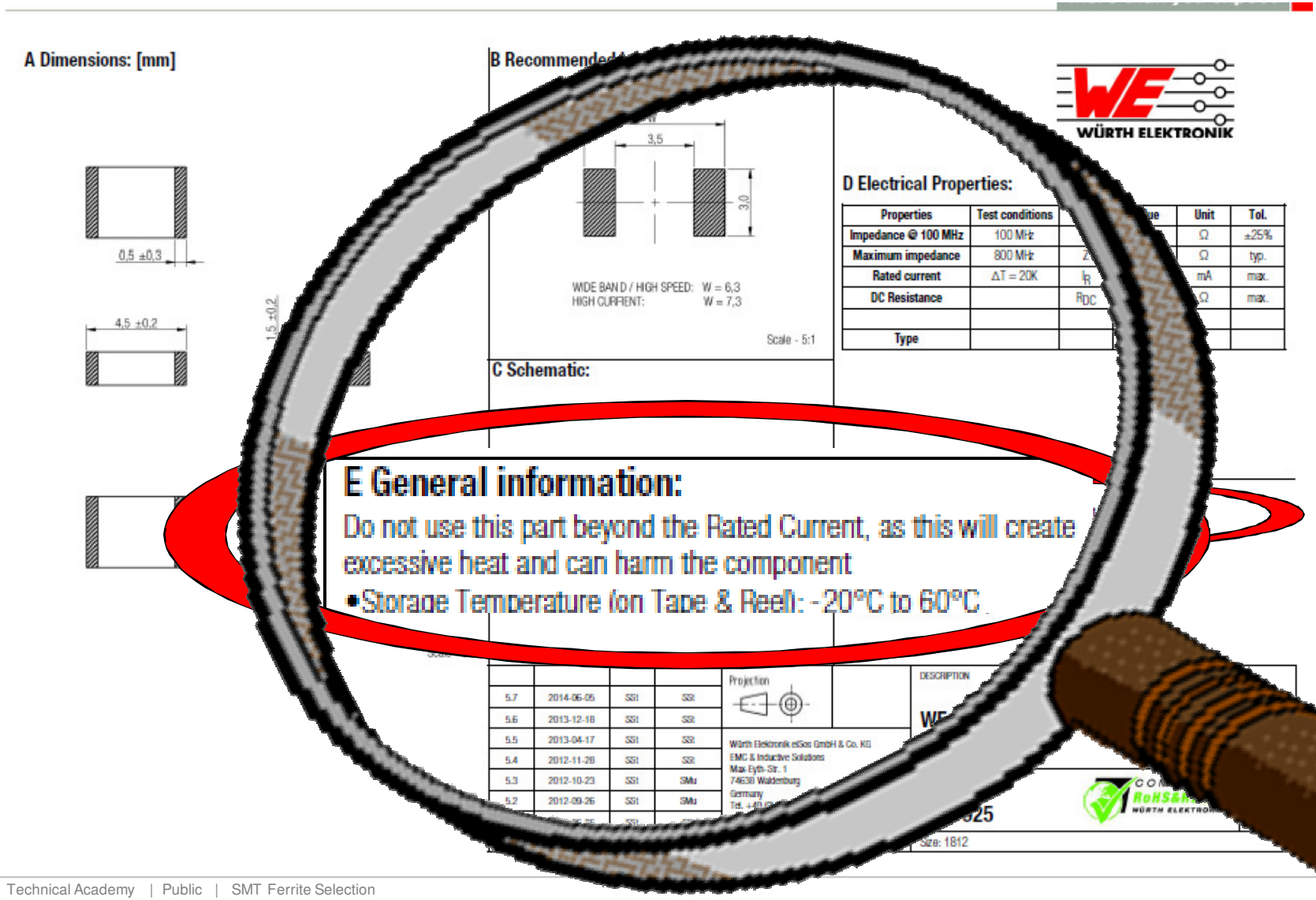




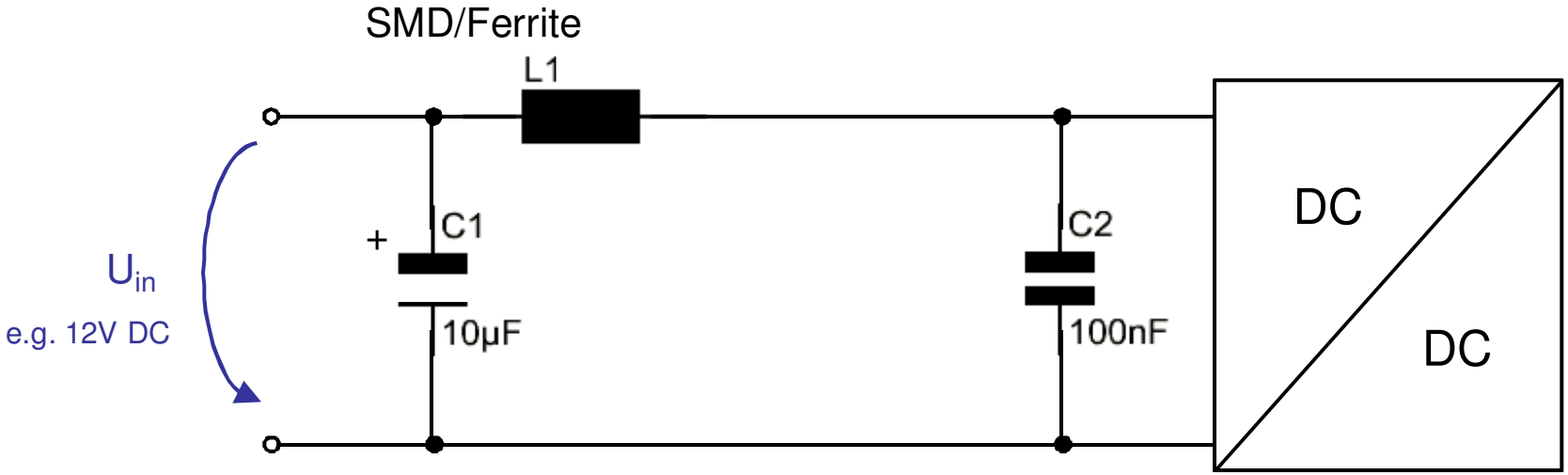
INRUSH Currents : Simulations



CBF Rated Current



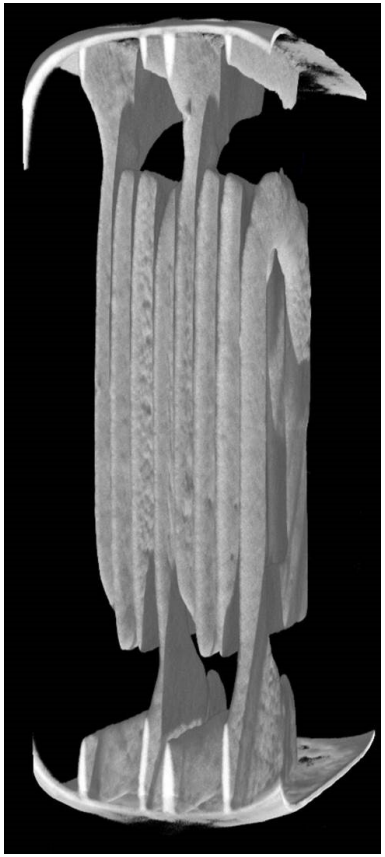
How to protect ferrite



- Protect ferrite from In Rush current during :
  - Power up
  - Hot plugging
  - Line Transient
    - Surge
    - Load dump
    - Safety for SMD ferrite against In-Rush current (load dump) current

WE-MPSB Multilayer Power Suppression Bead

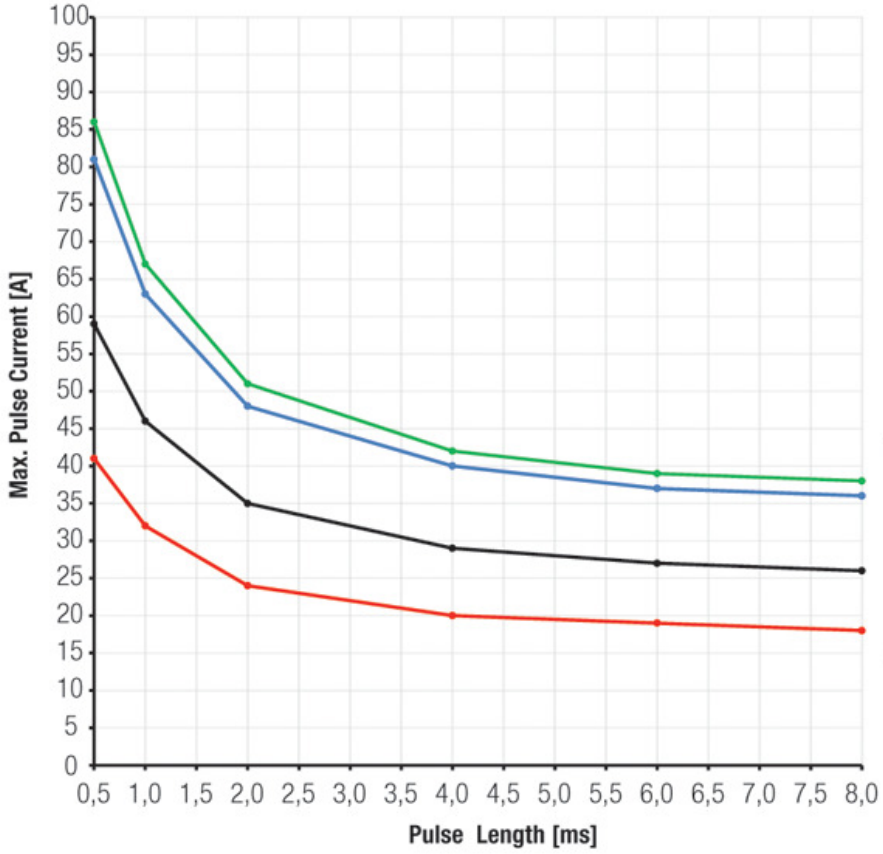
- High pulse peak possible caused of special internal layer design



Size 0805

WE-MPSB Multilayer Power Suppression Bead

Current vs Pulse Length – Single Pulse – Size 0805

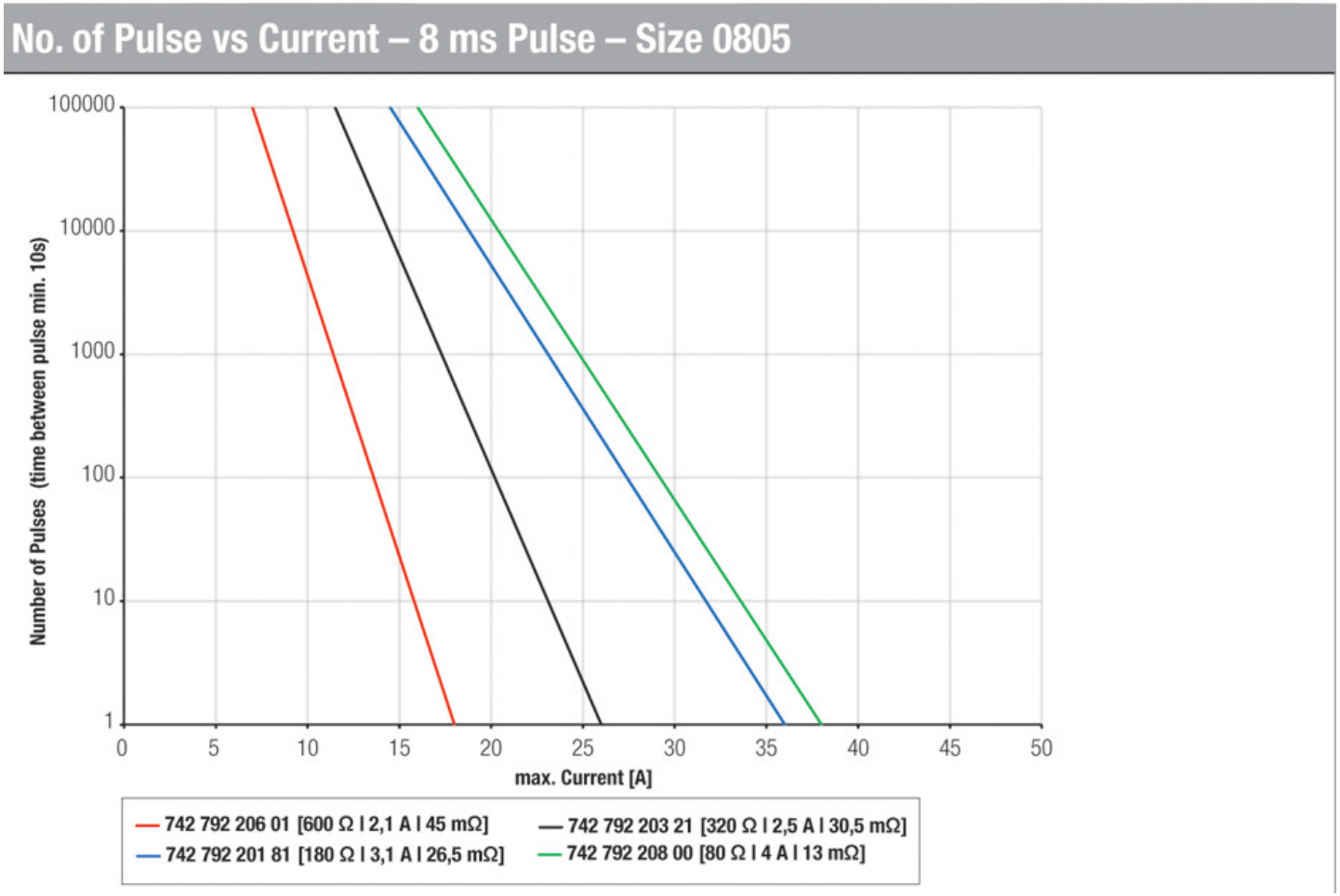


742 792 208 00 [80 Ω I 4 A I 13 mΩ]
742 792 201 81 [180 Ω I 3,1 A I 26,5 mΩ]
742 792 203 21 [320 Ω I 2,5 A I 30,5 mΩ]
742 792 206 01 [600 Ω I 2,1 A I 45 mΩ]

20 Times Higher Peak Current Rating

WE-MPSB Multilayer Power Suppression Bead

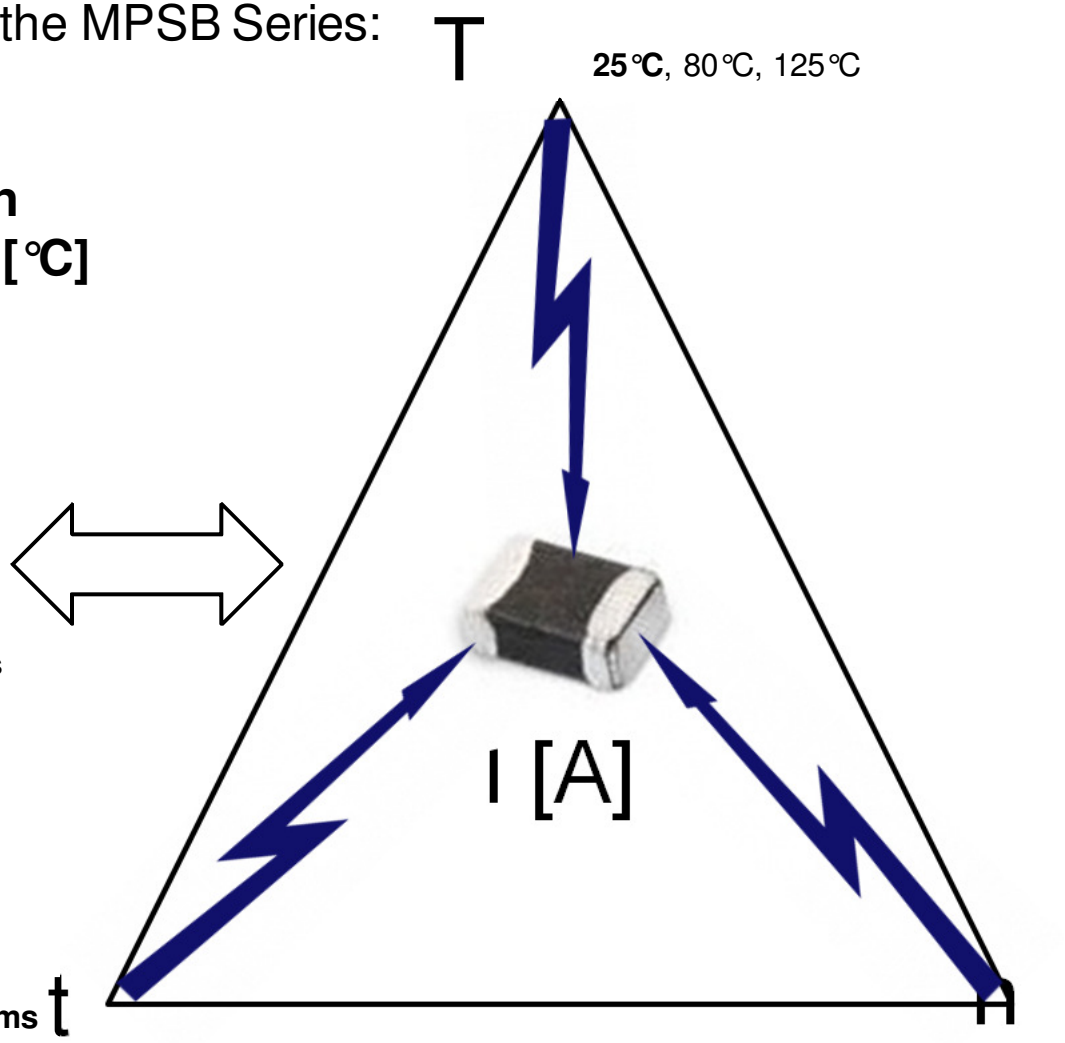
- **Current Load Measurments :**



WE-MPSB T-n-t Triangle

Peak Current Capability of the MPSB Series:

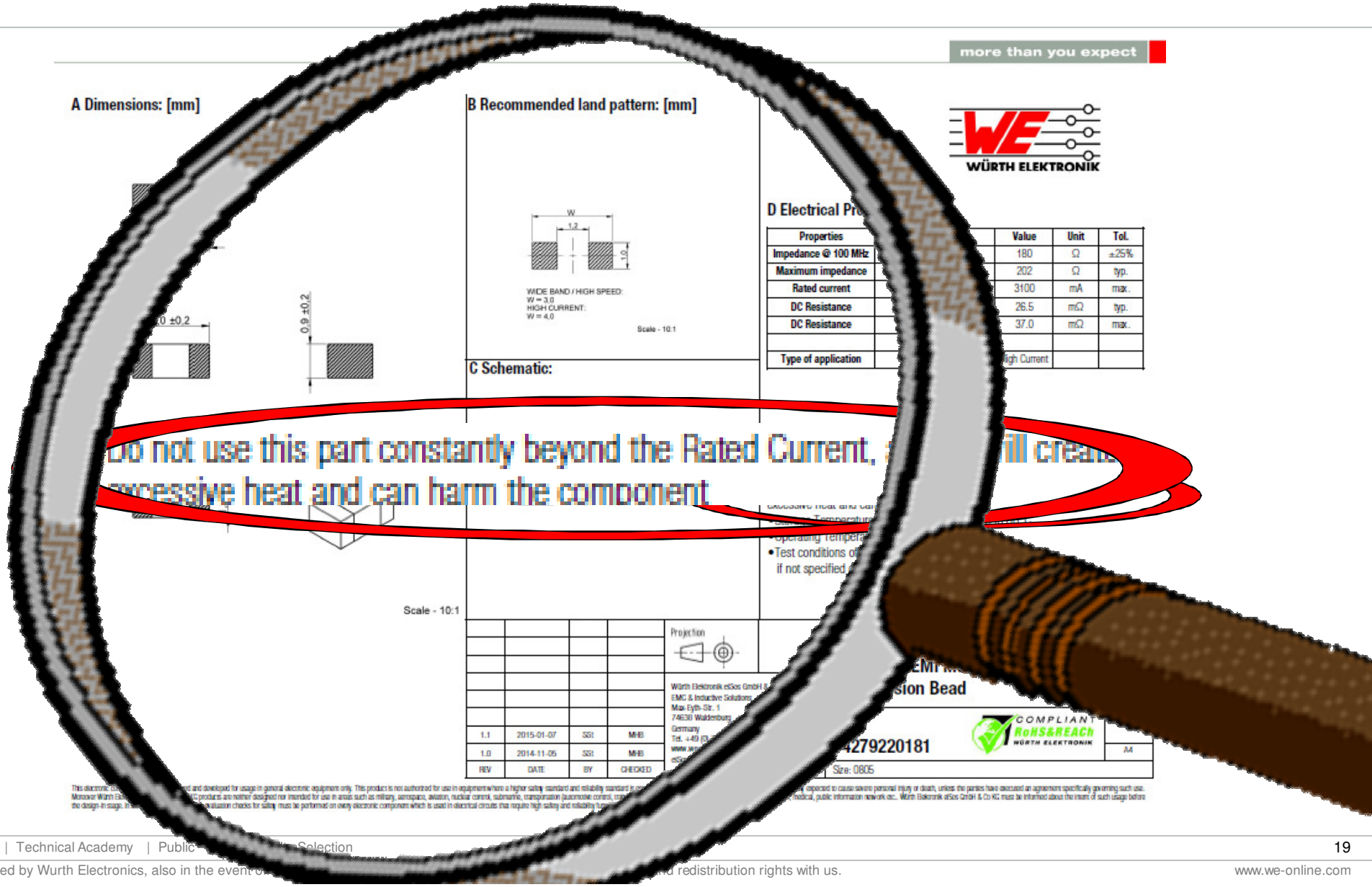
- Pulse length **t [ms]**
- Repetition of the pulse **n**
- Ambient temperature **T [°C]**
- Pulse-Pause **p [s]**



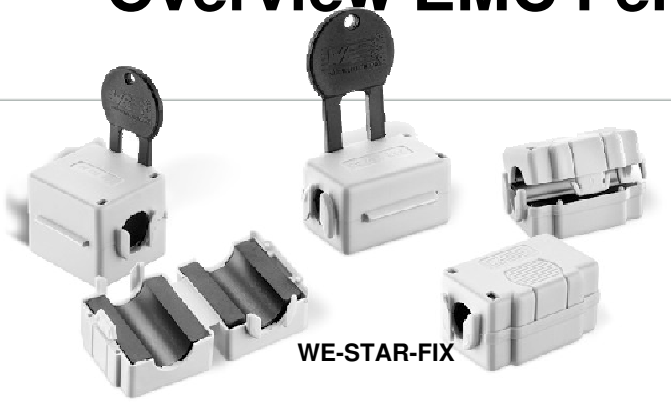
p 1s, 2.5s, **5s**

For each pulse-pause you have a different triangle with the influences of the parameters T-n-t

MPSB Rated Current

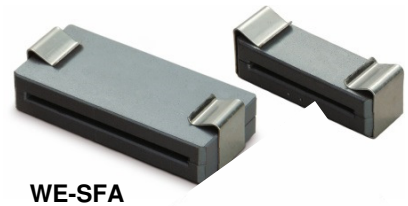


Overview EMC Ferrites



WE-STAR-FIX

WE-STAR-BUENO



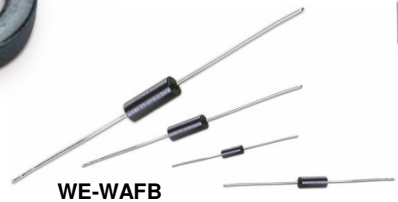
WE-SFA

WE-AFB / WE-TOF

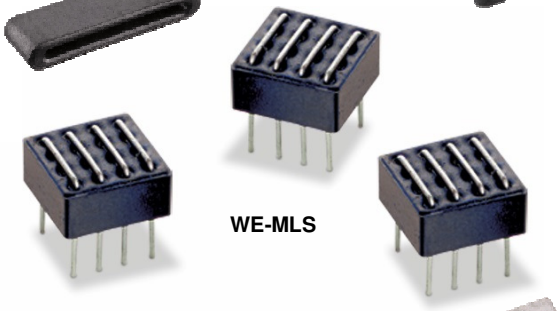
WE-FLAT

WE-RIB

WE-UKW

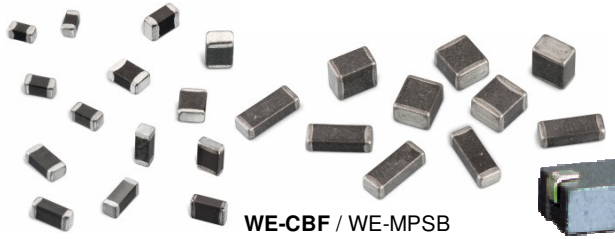


WE-WAFB

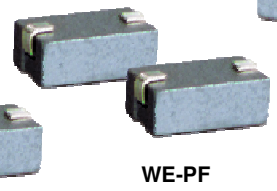


WE-MLS

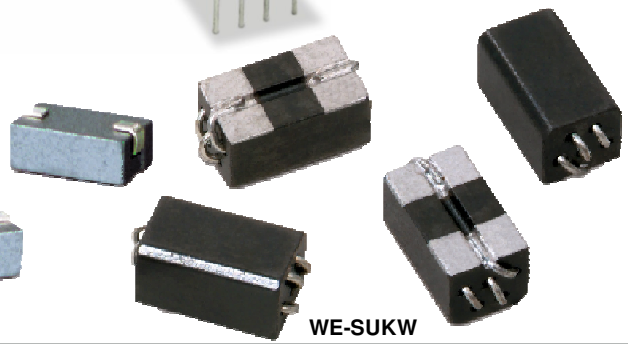
WE-PBF



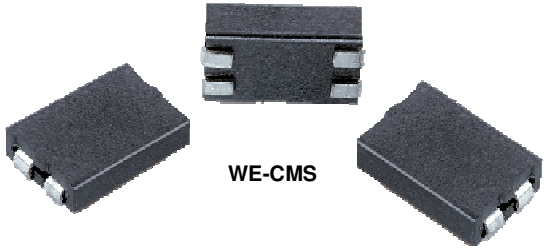
WE-CBF / WE-MPSB



WE-PF



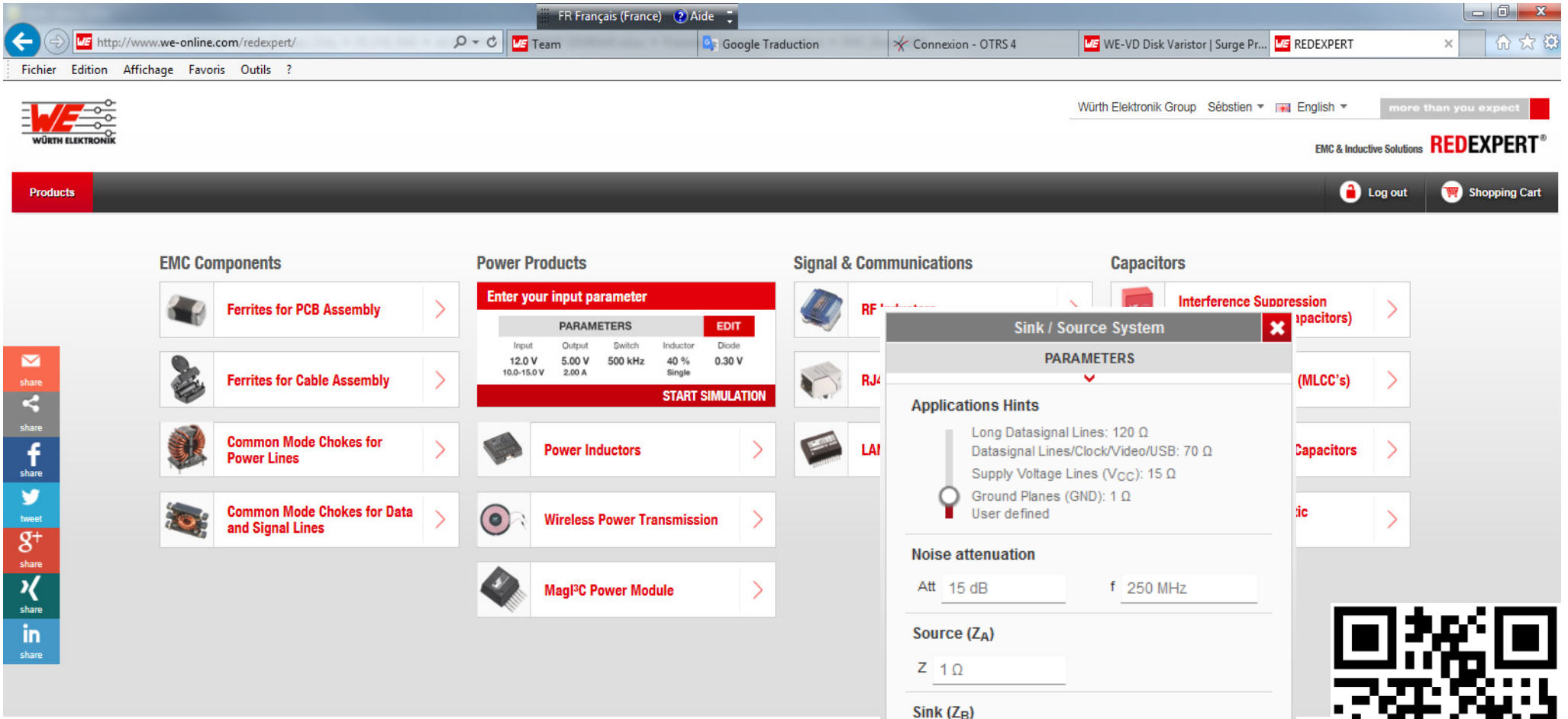
WE-SUKW



WE-CMS

REDEXPERT

WÜRTH ELEKTRONIK



See this example live

http://we-online.com/re/5e7phE

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WÜRTH ELEKTRONIK

Thank you for your attention

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