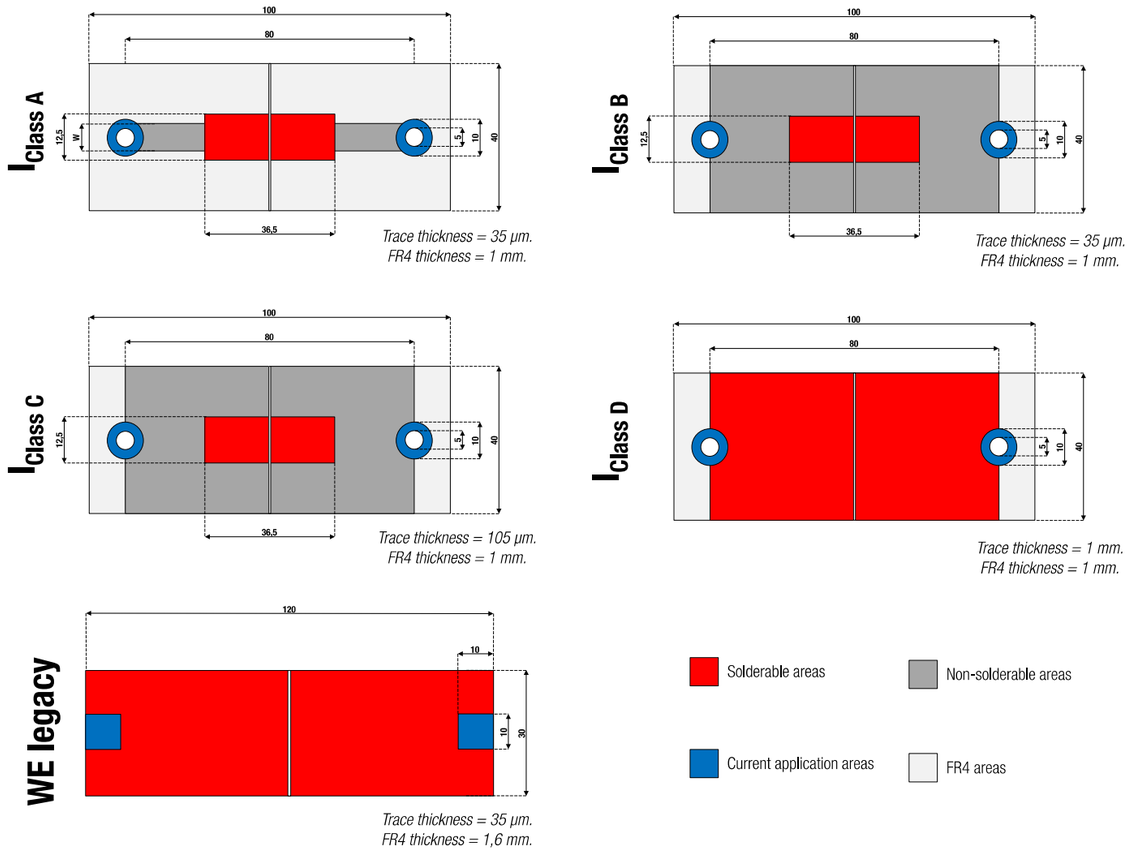
Redefining Rated Current Measurements for Power Inductors

How has rated current been measured and how to interpret the value

Rated current measurement method

Rated Current Class	Rated current of inductor I_r (A)	Trace width W (mm)
$I_{Class\ A}$	$I_r \leq 1$	1 ± 0,2
	$1 < I_r \leq 2$	2 ± 0,2
	$2 < I_r \leq 3$	3 ± 0,3
	$3 < I_r \leq 5$	5 ± 0,3
	$5 < I_r \leq 7$	7 ± 0,5
	$7 < I_r \leq 11$	11 ± 0,5
	$11 < I_r \leq 16$	16 ± 0,5
	$16 < I_r < 22$	22 ± 0,5

Würth Elektronik endeavors to be transparent with the disclosure of the measurement procedures used and the reporting of rated current (I_r) data of the temperature rise of power inductors. The method used is based upon section 6 of the IEC 62024-2:2020 standard. The test PCB is contained within a box of roughly 20 cm on each side. The test PCB does not contact directly with the surrounding box. Only natural convection occurs, with no forced convection applied to the test PCB. Würth Elektronik measurement differs from the standard in that an infrared camera is used in place of thermo-couple. This is done to eliminate measurement error caused by placement of the thermocouple. In this way, the hottest external area of the magnetic core is measured. Current is passed through the sample with the temperature allowed to stabilize to less than 1 °C per minute.



Trace thickness = 35 µm. FR4 thickness = 1 mm.

Trace thickness = 35 µm. FR4 thickness = 1 mm.

Trace thickness = 105 µm. FR4 thickness = 1 mm.

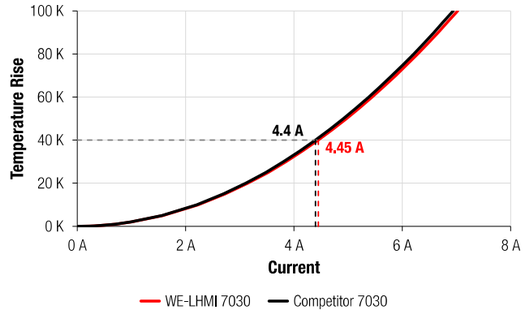
Trace thickness = 1 mm. FR4 thickness = 1 mm.

Trace thickness = 35 µm. FR4 thickness = 1,6 mm.

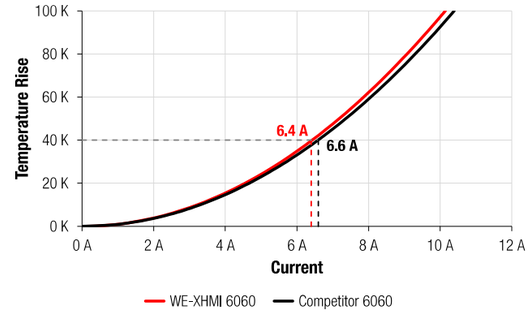
comparison

Schematic of test PCBs used for rated current measurements

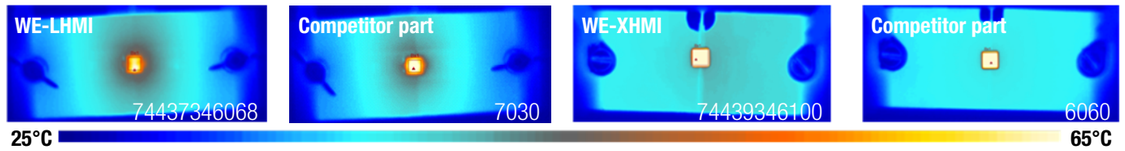
Competitor comparison



Self heating comparison of WE-LHMI 744 373 460 68 (red) with competitor 7030 (black)



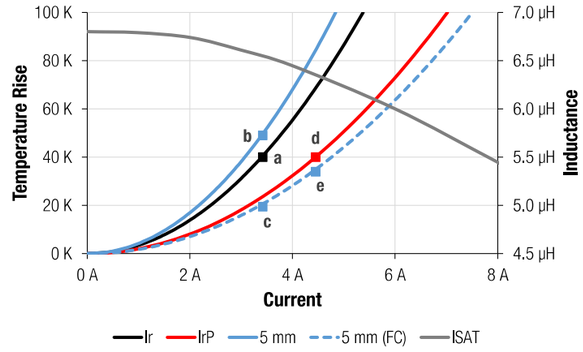
Self heating comparison of WE-XHMI 744 393 46 100 (red) with competitor 6060 (black)

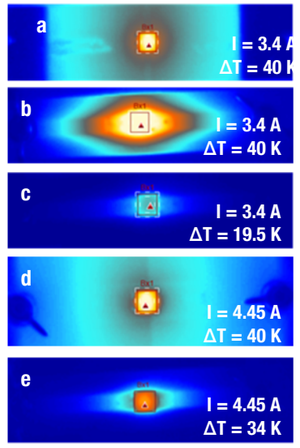


How to interpret performance rated current

Consider the WE-LHMI (744 373 460 68) which has a rated current of 3.4 A (a) and a performance rated current of 4.45 A (d) measured on a WE Legacy and IClass C respectively. The part on a 5 mm wide trace at the rated current results in a temperature rise of 49 K (b), well within the operating temperature of the part. If forced convection (FC) is used on the same PCB at the same current there is a 19.5 K temperature rise (c). Although this may be desirable in some applications, there is a lot of thermal “head room”. When the performance rated current of 4.45 A was applied to the part on a 5 mm wide trace with FC, the temperature rise was 34 K (e).

The performance rated current (IRP) parameter mimics application conditions that implement thermal management methods. IR and IRP are numbers to compare and guide in the selection of inductors before prototyping.





Thermal images of WE-LHMI 744 373 460 68 on different PCBs and measurements conditions

For more information check out the full version of our Application Note www.we-online.com/ANP096