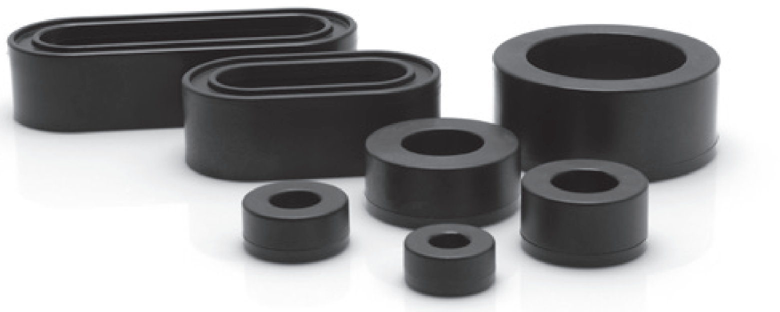
NEW TYPE SERIES

CORES FOR COMMON MODE NOISE SUPPRESSION
for Automotive Applications



- Developed for noise suppression of the high-voltage DC battery or at the DC output of the drive inverter as well as at the AC output of the drive inverter in hybrid and electric vehicles.
- Automotive qualified according to AEC-Q200
- Ambient temperature: T_a = -40 °C…+105 °C
- Max. continuous operating temperatures depending on type T_{op} = +130 °C or T_{op} = +150 °C
- Production in IATF 16949 certified VAC production facilities
- Design with plastic housing taking into account "Technical cleanliness" according to VDA 19 Part 2 and ZVEI guideline "Technical Cleanliness in Electrical Engineering"

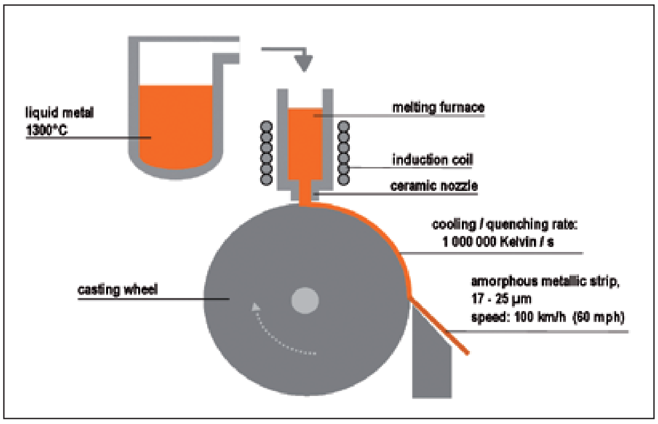
General advantages and benefits of nanocrystalline cores

- **Small size**
  → High μ, high B_S
- **Suitable for high currents and/or high voltages**
  → High μ, high B_S, optimized core designs
- **Compact filter concepts possible**
  → Extremely broadband attenuation behaviour, high permeability, low capacitance designs, slow μ-decrease towards high frequencies, low Q-factor in the range of 150 kHz
- **High efficiency, low power losses**
  → Low number of turns required for high L, ideally no turn required, filter stage reduction
- **Suitable for high and low ambient temperatures and high working temperatures**
  → High Curie temperature, material properties (μ, B_s, λ_s) almost temperature-independent
- **„Easy filter design"**
  → Material properties (μ, B_s, λ_s) almost temperature-independent, constant impedance over a wide common mode current range due to linear magnetization curve
- **Optimally adapted solutions available for various applications**
  → Different μ levels, different VITROPERM alloys

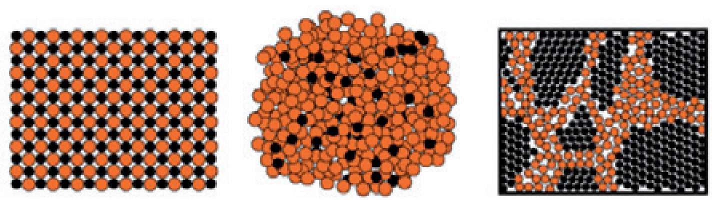
VITROPERM: Making the most of iron

The nanocrystalline VITROPERM® alloys are materials based on iron, silicon and boron with additions of niobium and copper. By using rapid solidification technology, which VAC is one of only very few companies in the world to have mastered, they are produced as thin strips in a single step in their final thickness of approximately 18 µm. High-purity raw materials are melted at 1300 °C and cast onto a cooled, spinning copper wheel. A cooling rate of 1 million degrees Kelvin per second results in an amorphous ribbon, which undergoes a heat treatment at 500 °C to 600 °C to form the nanocrystalline microstructure. On special winding machines, the strips are further processed into toroidal tape-wound cores with outside diameters of 2 mm to 600 mm.

The two-phase structure with fine crystalline grains (mean diameter 10 - 40 nm) resulting from the heat treatment is embedded in an amorphous residual phase. This structural feature is the prerequisite for achieving the highest permeability and the lowest coercivity values. In addition, the low ribbon thickness and the relatively high electrical resistance of 1.1 - 1.2 µΩm ensure the lowest eddy current losses and an excellent frequency response of the permeability. The combination of these properties together with a saturation flux density of 1.2 T and excellent thermal properties, make the nanocrystalline soft magnetic state-of-the-art VITROPERM material the universal solution for EMC problems, superior in many ways to conventional ferrites and amorphous material solutions.



Rapid solidification technology for the manufacture of metal ribbons with an amorphous (vitreous) structure



Crystalline Structure | Amorphous Structure | Nanocrystalline Microstructure

Nanocrystalline cores and components have already been used with great success for many years in common mode suppression chokes (CMC) in automotive applications due to their superior soft magnetic properties. Through the use of cost-effective alloying elements (Fe based) and modern large-scale series production, VITROPERM has already established itself as a competitive solution in many diverse applications.

Toroidal cores

Type T60006-L…	Dimension d_a x d_i x h [mm]	A_{L0} nominal* [µH]		Saturation current I_{cm} [A], typical**			Iron cross section [cm²] A_{fe}	Mean path length [cm] l_{fe}	Weight [g] m_{Fe}
		10 kHz	100 kHz	DC	10 kHz	100 kHz			
2020-V311	23.0 x 9.8 x 11.1	20	10.6	1.0	1.0	1.7	0.25	5.1	9.2
2020-V312		59.4	13.7	0.2	0.2	0.5			
2025-V313	28.1 x 13.1 x 13.1	23.7	12.6	1.3	1.3	2.1	0.37	6.4	17.4
2025-V314		70.2	16.2	0.3	0.3	0.6			
2030-V315	33.1 x 17.0 x 18.1	30.5	16.2	1.6	1.6	2.6	0.58	7.9	33.6
2030-V316		90.4	20.8	0.3	0.4	0.8			
2040-V317	43.0 x 21.9 x 18.1	35.2	18.7	2.0	2.1	3.3	0.87	10.2	65.4
2040-V318		104	24.0	0.4	0.5	1.0			
2063-V319	66.8 x 46.1 x 28.4	28.6	15.2	3.5	3.6	5.8	1.23	17.8	160
2063-V320		85	19.6	0.7	0.8	1.7			
2025-V321	28.6 x 16.7 x 14.8	12.1	6.4	1.4	1.4	2.3	0.20	7.1	10.6
2025-V322		36.4	8.3	0.3	0.3	0.7			
2022-V323	24.9 x 11.6 x 16.0	30	15.9	1.1	1.2	1.9	0.41	5.7	17.2
2022-V324		90.6	20.6	0.2	0.3	0.6			

Other designs available upon request.

*A_{L0}: inductance for N = 1 (tolerance +45 % / -25 %)

**I_{cm}: the listed saturation currents are guidelines, only. They are calculated for nominal core dimensions at room temperature and for approx. 70 % saturation flux density.

Example: T60006-L2025-V314

m_{Fe} ≈ 14.7 g

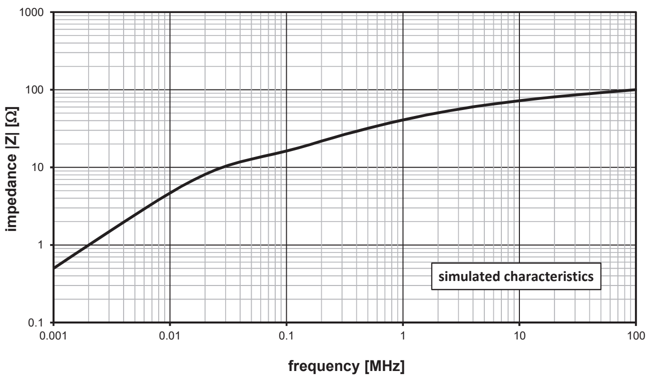


Fig. 1: Impedance |Z| [Ohm] / frequency [MHz]

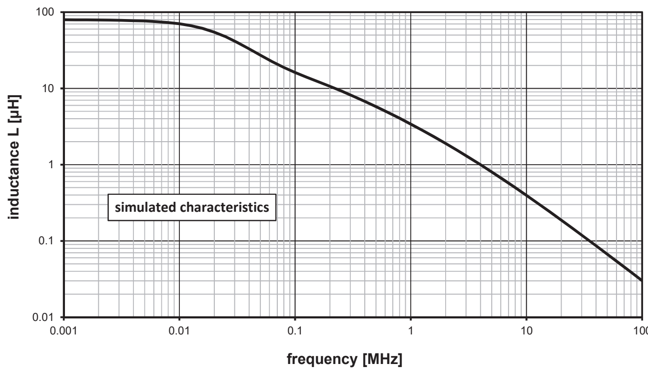


Fig. 2: Inductance A_L [µH] / frequency [MHz]

Oval cores

Type T60006-L…	Dimension d_a x d_i x h [mm]	A_{L0} nominal* [µH]		Saturation current I_{cm} [A], typical**			Iron cross section [cm²] A_{fe}	Mean path length [cm] l_{fe}	Weight [g] m_{Fe}
		10 kHz	100 kHz	DC	10 kHz	100 kHz			
2071-V280	75.2 x 42.2 x 25.0	51.3	15.2	1.1	1.2	2.3	1.01	16.6	123
2071-V380		25.3	13.4	3.3	3.4	5.4			
2071-V281	108.3 x 42.2 x 25.0	36.7	10.8	1.5	1.6	3.2		23.2	172
2071-V381		18.1	9.6	4.6	4.7	7.6			

Other designs available upon request.
*A_{L0}: inductance for N = 1 (tolerance +45 % / -25 %)
**I_{cm}: the listed saturation currents are guidelines, only. They are calculated for nominal core dimensions at room temperature and for approx. 70 % saturation flux density.

Example: T60006-L2071-V280
$m_{Fe} \approx$ 123 g

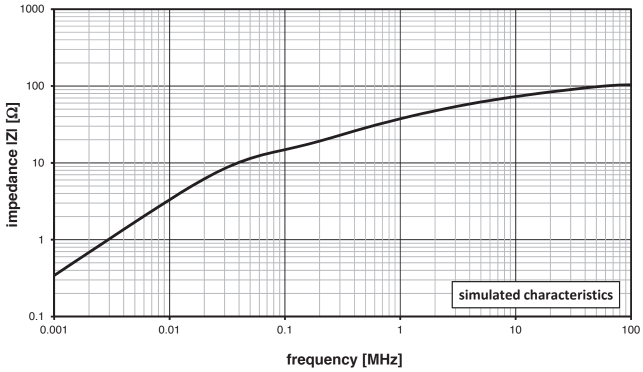


Fig. 3: Impedance |Z| [Ohm] / frequency [MHz]

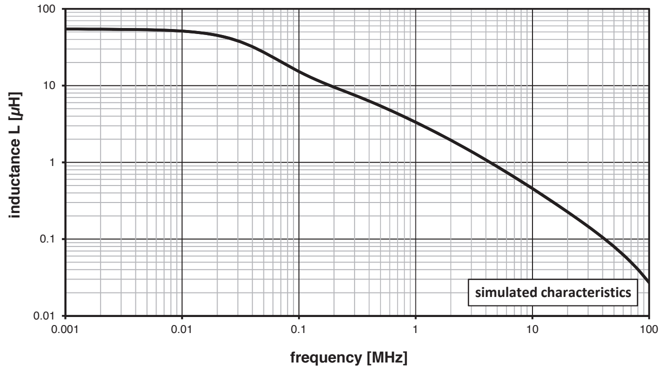


Fig. 4: Inductance A_L [µH] / frequency [MHz]

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