COMMON MODE SUPPRESSION CHOKES IN NANOCRYSTALLINE VITROPERM

for Automotive Applications

New Model Range of Common Mode Chokes for Automotive Applications

- Developed for DC/DC converters in hybrid and electric vehicles
- Automotive qualified in compliance with AEC-Q200
- Ambient temperature: T_a = -40 °C…+115 °C
- Max. operating temperature with limited duration: T_{op} = 160 °C
- Rated insulation voltage: U_i = 525 V_{RMS} (functional insulation, pollution degree 1)
- Manufacture conforming to "Technical Cleanliness" according VDA Volume 19

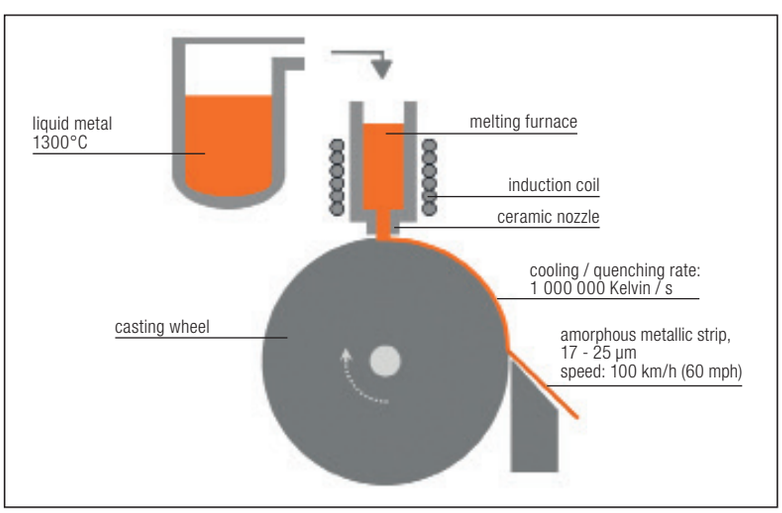
General Advantages and Benefits of Nanocrystalline Chokes

- **Small size**
  → High μ, high B_S
- **Suitable for high currents and/or high voltages**
  → High μ, high B_S, optimized core design
- **Single-stage filter concepts possible**
  → Extreme broadband attenuation behaviour, high permeability, low capacitance designs, slow μ decline towards higher frequencies, low Q factor in the 150 kHz range
- **High efficiency, low dissipation loss**
  → Low number of windings necessary for high L, filter stage reduction
- **Suitable for high and low ambient temperatures and high operating temperatures**
  → High Curie temperature, material properties (μ, B_s, λ_s) virtually independent of temperature
- **„Easy filter design“**
  → material properties (μ, B_s, λ_s) virtually independent of temperature, constant impedance over a wide common mode current range due to linear magnetization curve
- **Optimally adapted solutions for various applications available**
  → Various μ levels, various VITROPERM alloys

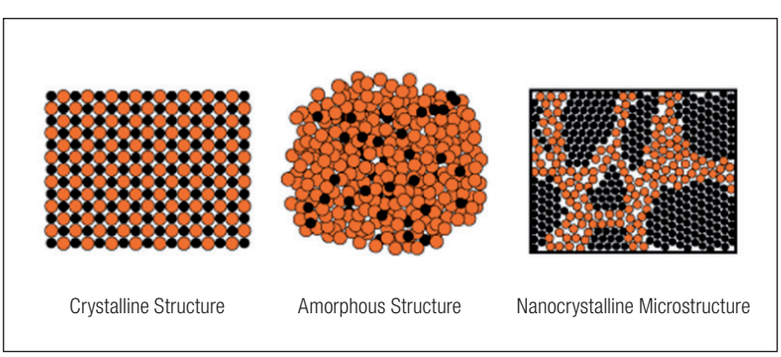
VITROPERM: Making the most of iron

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 1,300 °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.

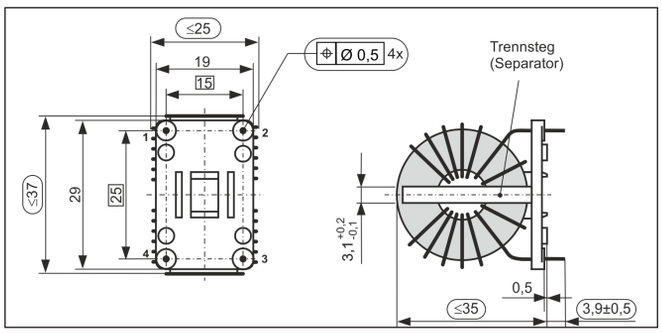


Rapid solidification technology for the manufacture of metal ribbons with an amorphous (vitreous) structure



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.

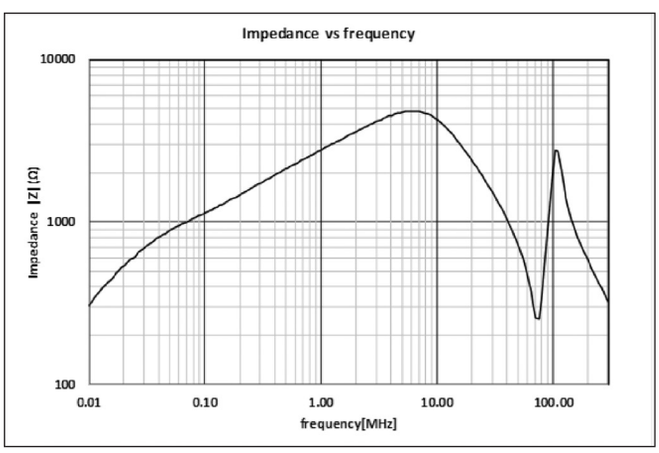
Type 1: Dimensions 37 mm x 25 mm x 35 mm

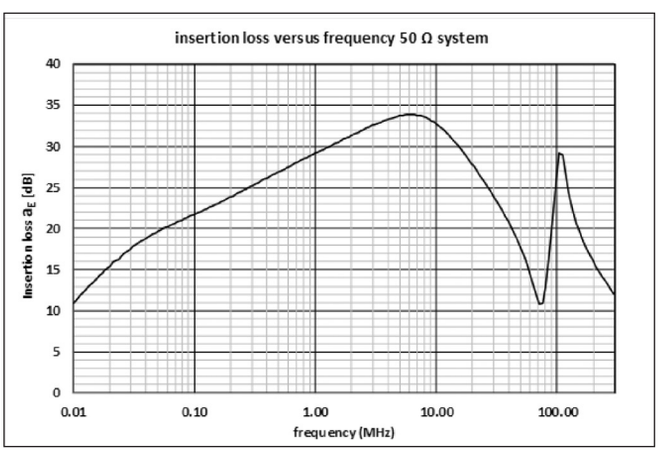


Type T60405-R…	Dimensions l x b x h [mm]	Core (magn.) Ext. Dia x int. Dia x h [mm]	Windings Ø [mm]	Windings No. of Wind.	I_N [A]	L [mH] 10 kHz	L [mH] 100 kHz	|Z| [Ω] 10 kHz	|Z| [Ω] 100 kHz	$I_{unbal.}$ [mA] 10 kHz	$I_{unbal.}$ [mA] 100 kHz	$I_{unbal.}$ [mA] DC
6127-X010	37 x 25 x 35	25 x 16 x 10	1.12	2 x 20	8	26.8	6.2	1,770	6,630	16	33	14
6127-X011			1.18	2 x 18	9	21.7	5.0	1,440	5,320	18	36	16
6127-X012			1.25	2 x 16	10	17.1	4.0	1,130	4,180	20	41	18
6127-X013			1.32	2 x 14	11	13.1	3.1	867	3,180	23	47	20
6127-X014			1.4	2 x 13	12	11.3	2.7	748	2,730	24	50	22
6127-X007			1.5	2 x 11	13	8.1	1.9	535	1,930	29	59	26
6127-X008			1.6	2 x 10	14.5	6.7	1.6	442	1,590	32	65	28
6127-X022			1.8	2 x 8	19.4	4.3	1.0	284	1,030	40	81	35
6127-X009			1.9	2 x 7	21	3.3	0.8	216	780	45	93	40

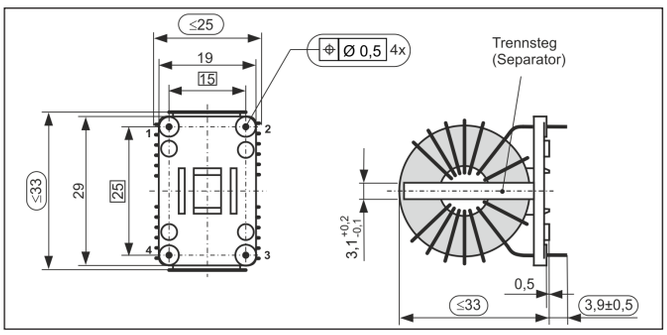
Other designs available on request.

Example: T60405-R6127-X022





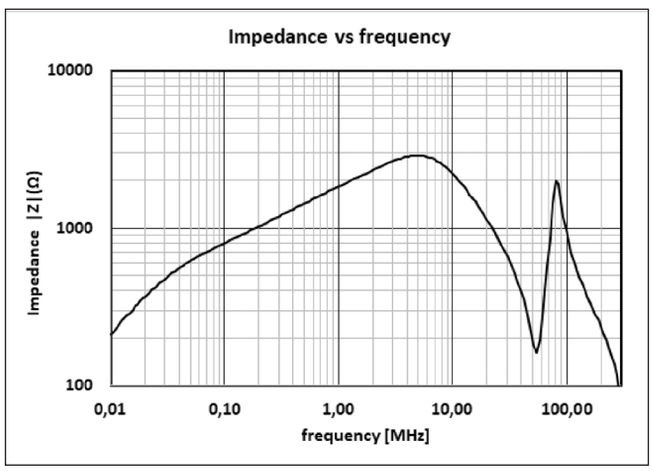
Type 2: Dimensions 33 mm x 25 mm x 33 mm

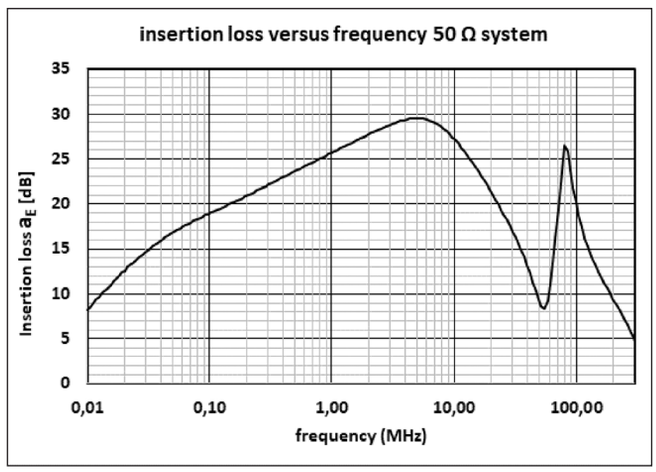


Type T60405-R...	Dimensions l x b x h [mm]	Core (magn.) Ext. Dia x int. Dia x h [mm]	Windings Ø [mm]	Windings No. of Wind.	I_N [A]	L [mH] 10 kHz	L [mH] 100 kHz	|Z| [Ω] 10 kHz	|Z| [Ω] 100 kHz	$I_{unbal.}$ [mA] 10 kHz	$I_{unbal.}$ [mA] 100 kHz	$I_{unbal.}$ [mA] DC
6127-X015	33 x 25 x 33	21.5x15.6x10.3	1.12	2 x 16	8	13.8	3.2	914	3,310	18	36	16
6127-X016			1.18	2 x 14	9	10.5	2.5	696	2,530	20	41	18
6127-X017			1.25	2 x 13	9.5	9.1	2.1	602	2,180	22	44	19
6127-X018			1.32	2 x 11	11	6.5	1.5	431	1,540	25	52	23
6127-X019			1.4	2 x 10	12	5.4	1.3	356	1,280	28	58	25
6127-X020			1.5	2 x 9	14	4.4	1.0	288	1,030	31	64	28
6127-X021			1.6	2 x 8	15.2	3.4	0.8	228	820	35	72	31

Other designs available on request.

Example: T60405-R6127-X021





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ADVANCED MAGNETIC SOLUTIONS