M80: Multi-E Choke

High Energy Storage Chokes for Inverter Applications

M80 HIGH ENERGY STORAGE CHOKE

Introduction

PREMO GROUP introduces a new high energy storage chokes standard series for inverter applications. It is developed both for DC and AC inverter chokes. Its high inductance values (up to 5mH) make them perfect for high eficiency solar inverter aplication. It handles powers up to 10kW.

M80 series is based on a combination of high performance multi-E sendust alloy (Kool Mμ) cores and rectangular copper wire.This kind of combination allows us to offer the highest efficiency inductor (>99.5%) in the market on a reduced dimension.

M80 series exhibits excellent stability and reliability at high temperatures. Because of the distributed air gap, the inductance shift with temperature change is relatively small. Due to its high Curie temperatures of powder core alloys, changes in saturation characteristics are minor over normal operating temperature ranges. Also, it is resistant to thermal shock and is rated for continuous operation up to 200°C.

Advantges

M80 series has some remarkable advantages:

1.- It has none of the the thermal aging concerns associated with powdered iron cores. Due to the magnetics parts are pressed with a non-organic insulating material; no binder is used, so there is no problem, even when the cores are operated continuously at high temperatures (up to 200°C).

2.-Main characteristic over powdered iron is its lower core losses and over silicon steel is its much lower core losses, which becomes more dramatic as the frequency increases. For switching regulator inductors, the effect of AC current produces a high frequency magnetic field which creates core losses and causes the core to heat up, this effect is lessened with M80 series making inductors more efficent and run cooler.

3.- It offers similar DC bias characteristic when compared to iron powder.

4- It has near zero magnetostriction, eliminating the noise associated with powder iron cores, ferrite, or silicorn iron lamination, when they are operated in the audible range from 20 Hz to 20kHz (filter inductors).

5.- Sendust alloy has a high saturation level (Bsat= 1 T) that provides a higher energy storage capability , that can be obtained with gapped ferrite, resulting in smaller core size (with more than twice the flux capacity of ferrite, at a typical 50% roll-off design point, this can result in a 35% reduction in core size). Avoiding as well as the gap loss problem associated with ferrites (fringing flux).

6.- It has a soft saturation (sharp saturation for gapped ferrite or silicon steel blocks with discrete gap), in some cases, this swinging inductance is desirable since it improves efficiency and accomodates a wide operating range. With a fixed current requirement, the soft inductance versus DC bias curve provide added protection against overload conditions (fault-tolerance).

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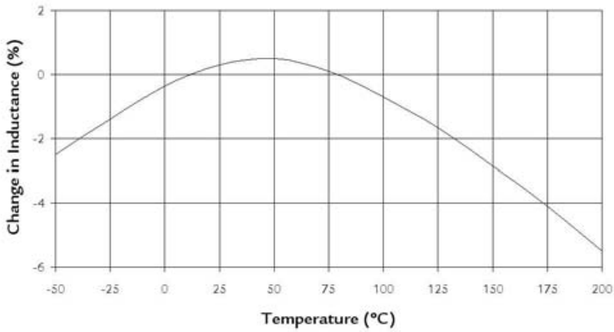
PERFORMANCE CHARACTERISTICS

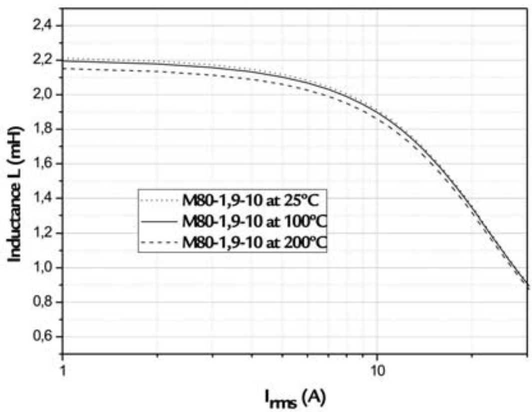
Inductance vs Temperature

The non-magnetic material separating small particles, results in a distributed gap in powder cores. The inductance shift with changing temperature in the M80 series is relatively small. This is largely due to the distributed gap, as well as to the stability of the alloys used. Even though the magnetic alloys used in the powder cores show greater changes in permeability with temperature, the effective permeability of the material is dramatically stabilized by the presence of the distributed gap. The absolute permeability in the gap is the magnetic constant (μ=μ0 μr), no matter what the temperature is, because gap is made with a non-magnetic material (μr=1). Consequently, the lowest permeability cores, having the largest effective gaps, exhibit the most temperature stability. The M80 series presents a decrease of inductance lower than 6% at 200°C.



Permeability vs DC Bias

The M80 series exhibits soft saturation. Due to the gap distributed microscopically through the material, powder cores do not reach saturation flux density (Bsat) rapidly. Permeability rolls off, gradually and predictably losing its value at higher and higher magnetizing levels. As per above, the saturation characteristic varies by only a couple of percent, even across quite wide temperature ranges.



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PERFORMANCE CHARACTERISTICS

Thermal Shock

Compared with other technologies M80 series is resistant to thermal shock. The sendust alloy routinely passes the most stringent military and aerospace thermal shock testing of electronic components.

Temperature Ratings

M80 series is normally rated for continuous operation up to 200°C, a maximum temperature that is quite adequate for nearly all power electronics applications. The factor that limits the M80 series to 200°C is the square wire, (which thermal class is 200°C). In fact, after pressing, kool mu material is given a stress-relief anneal for several hours at temperatures above 500°C. It is after this anneal that an epoxy paint to applied for dielectric protection and extra physical strength in toroidal cores, not in E cores.

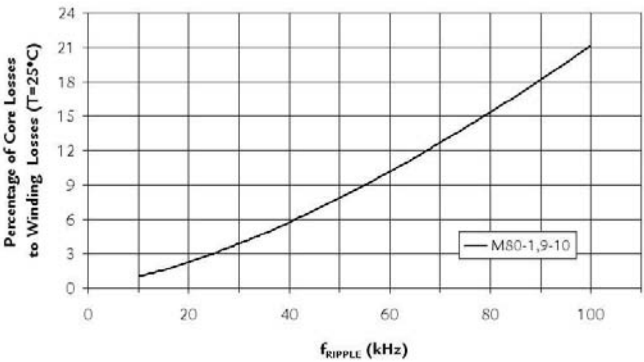
Therefore, there is no doubt that 200°C has no damaging effects on the cores, even if applied continuously. This is possible because the magnetic material itself is not damaged or aged, even when operated at temperatures that are too high for the coating.

Unlike powdered iron energy storage chokes, M80 series, which cores are made of a magnetic material that is manufactered without the use of an organic binder, therefore M80 series has no aging effects.

Core losses

Only AC current (ripple current) in an inductor generates core losses. At typical power frequencies sendust alloy is a better solution compared to iron powder cores, due its much lower core losses.

M80 series does not have increasing losses over temperature, additionally, does not have significant decrease in saturation at high temperature.



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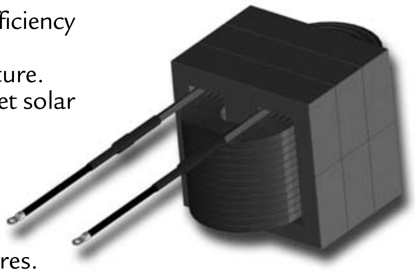
Features

-Based on squared copper wire windings around Kool-Mu E shape cores.
-High storage currents (up to 45A).
-High storage low losses designs, improved efficiency for renewable energy inverters (>99%).
-Very good inductance stability vs temperature.
-High inductance values (up to 6 mH) to meet solar inverters requirements.
-Operating frequency up 50 kHz.
-Chokes designed for a 10% ripple current.
-Soft saturation curve (L vs Current).
-Low magnetostriction.
-Combination of up to 6 stacked sets of cores.
-Operating temperature from -40°C to 85°C.
-Wide range of output terminals (racket, fast-on, direct leads,...).



Applications

-High efficiency renewable energy inverters (Solar, Eolic, Fuel cells).
-Welding Inverters.
-High efficiency UPS.

Electrical specifications

Code	L (mH)	L (Ipk) (mH)	Irms (A)	Ipk (A)	Ripple (App)	RDC (mΩ)	Losses (W)	ΔT (°C)	Power 230 V	η (%)	Power 190 V	η (%)	Weight (kg)
M80-1,9-10	2,2	1,9	10	14,6	1,0	61	6,10	<17	2300	99,73	1900	99,68	2,0
M80-2,9-10	4,3	2,9	10	14,6	1,0	80	8,66	<16	2300	99,62	1900	99,54	3,1
M80-3,9-10	6,4	3,9	10	14,6	1,0	96	10,53	<16	2300	99,54	1900	99,45	3,9
M80-1,8-12	2,5	1,8	12	17,6	1,2	68	9,58	<19	2760	99,65	2280	99,58	2,5
M80-2,6-12	4,3	2,6	12	17,6	1,2	77	11,97	<20	2760	99,57	2280	99,48	3,1
M80-3,5-12	5,8	3,5	12	17,6	1,2	92	14,42	<21	2760	99,48	2280	99,37	3,8
M80-1,3-18	1,8	1,3	18	26,4	1,8	69	18,35	<39	4180	99,56	3420	99,46	1,9
M80-1,9-18	3,8	1,9	18	26,4	1,8	71	24,88	<43	4180	99,40	3420	99,27	2,6
M80-2,6-18	5,1	2,6	18	26,4	1,8	84	29,49	<43	4180	99,29	3420	99,14	3,3
M80-2,1-22	3,4	2,1	22	32,2	2,2	78	40,65	<57	5060	99,20	4180	99,03	3,2
M80-1,6-26	3,4	1,6	26	38,1	2,6	60	40,60	<57	5980	99,32	4940	99,18	1,6
M80-1,3-33	1,9	1,3	33	48,3	3,3	55	60,20	<63	7590	99,21	6270	99,04	2,4
M80-0,7-45	1,1	0,7	45	65,9	4,5	25	55,26	<59	10350	99,47	8550	99,35	3,7

Inductance measured at 10kHz, 10mVac, T=25°C.
Inductance tolerance ±10%.
Based on natural cooling convection.

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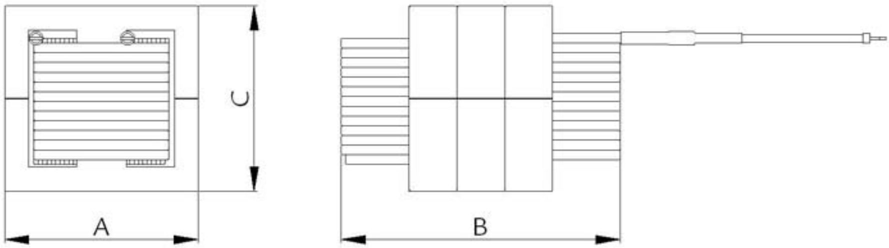
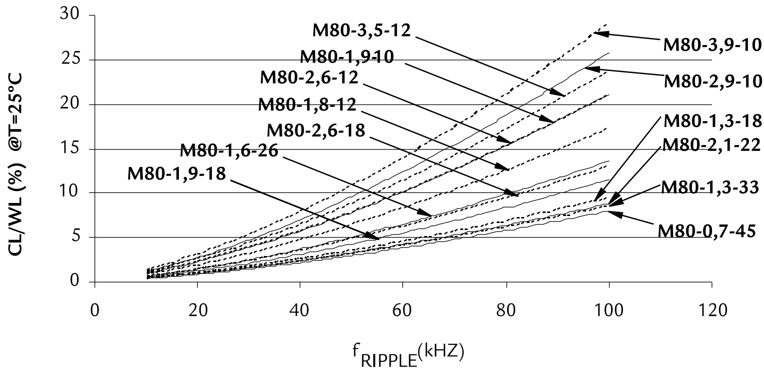
Dimensions (in millimeters)



Code	A ±2	B MAX	C ±2
M80-1,9-10	80,0	100	76,2
M80-2,9-10	80,0	120	76,2
M80-3,9-10	80,0	140	76,2
M80-1,8-12	80,0	100	76,2
M80-2,6-12	80,0	120	76,2
M80-3,5-12	80,0	140	76,2
M80-1,3-18	80,0	100	76,2
M80-1,9-18	80,0	120	76,2
M80-2,6-18	80,0	140	76,2
M80-2,1-22	80,0	140	76,2
M80-1,6-26	80,0	160	76,2
M80-1,3-33	80,0	160	76,2
M80-0,7-45	80,0	180	76,2



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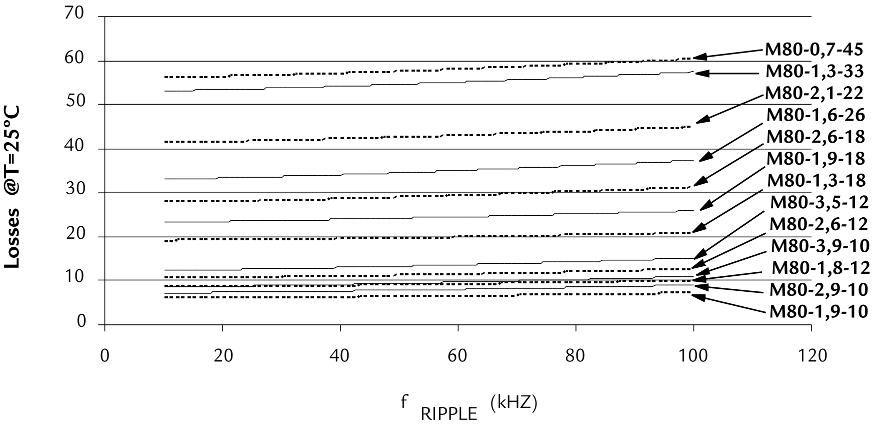

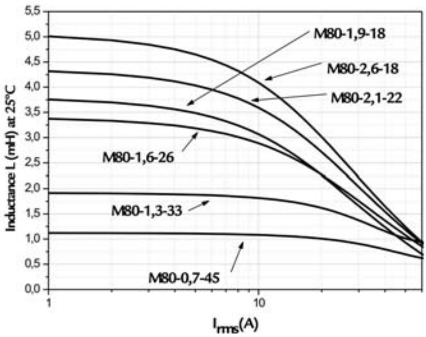

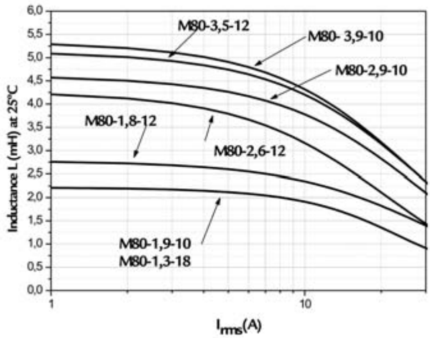

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