Technical Bulletin

BULLETIN NO. MPP-T1

MAGNETICS MPP THINZ™

Introduction

MPP THINZ™, or Molypermalloy Powder washer cores, are distributed air gapped toroidal cores made from a 79% nickel, 17% iron, and 4% molybdenum alloy powder having the highest permeability of any powder core material and significantly higher saturation flux density compared to discrete gapped ferrite. THINZ™ offer an extremely low height self shielded power inductor core allowing finished inductor heights in the 1.5 mm to 2 mm range. Excellent temperature stability, superior inductance under DC bias, and low core losses highlight the outstanding magnetic properties.

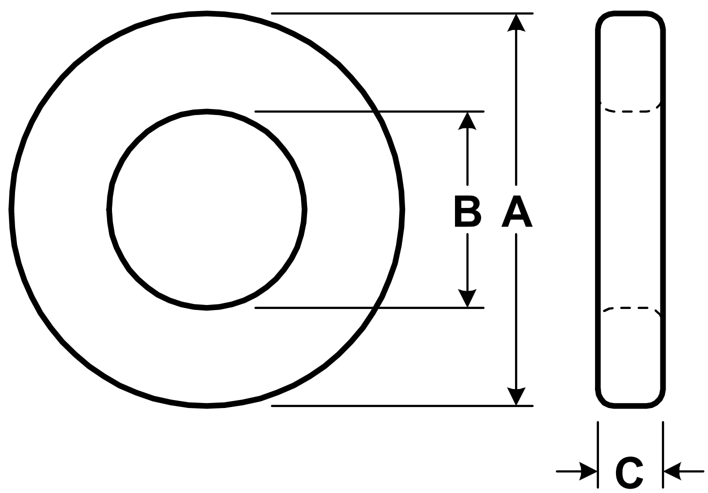

Figure 1

Table 1

PART NO.		A nom	B nom	C nom	A max	B min	C max*
00M0301T	in (mm)	0.120 (3.05)	0.070 (1.78)	0.032 (.81)	0.123 (3.12)	0.067 (1.70)	0.035 (.89)
00M0302T	in (mm)	0.140 (3.55)	0.070 (1.78)	0.032 (.81)	0.143 (3.63)	0.067 (1.70)	0.035 (.89)
00M0402T	in (mm)	0.155 (3.94)	0.088 (2.23)	0.032 (.81)	0.159 (4.04)	0.084 (2.13)	0.035 (.89)
00M0502T	in (mm)	0.181 (4.60)	0.093 (2.36)	0.032 (.81)	0.185 (4.70)	0.089 (2.26)	0.035 (.89)
00M0603T	in (mm)	0.250 (6.35)	0.110 (2.79)	0.032 (.81)	0.255 (6.47)	0.105 (2.67)	0.035 (.89)
00M0804T	in (mm)	0.310 (7.87)	0.156 (3.96)	0.032 (.81)	0.315 (8.00)	0.151 (3.83)	0.035 (.89)

*special core heights are available, consult factory.

Magnetic Data

THINZ™ are available in four permeabilities, 125µ, 160µ, 200µ, and 250µ. The magnetic data for each core is shown in Table 2.

Table 2

PART NUMBER	A_L mH/1000 turns ±15 %				Path Length l_e (cm)	Cross Section A_e (cm^2)	Volume V_e (cm^3)
	125µ	160µ	200µ	250µ			
00M0301T***	8.4	10.8	13.5	16.9	0.704	0.004	0.003
00M0302T***	11.6	14.8	18.7	23.4	0.806	0.006	0.005
00M0402T***	9.6	12.3	15.4	19.3	0.944	0.006	0.006
00M0502T***	11.7	15.0	18.7	23.4	1.058	0.008	0.008
00M0603T***	14.9	19.1	24.0	30.0	1.361	0.013	0.018
00M0804T***	12.6	16.2	20.2	25.3	1.789	0.015	0.026

*** Add material code to part number, e.g., for 125µ the complete part number is 00M0502T125

Figure 2 illustrates permeability versus frequency for the four permabilities listed above.

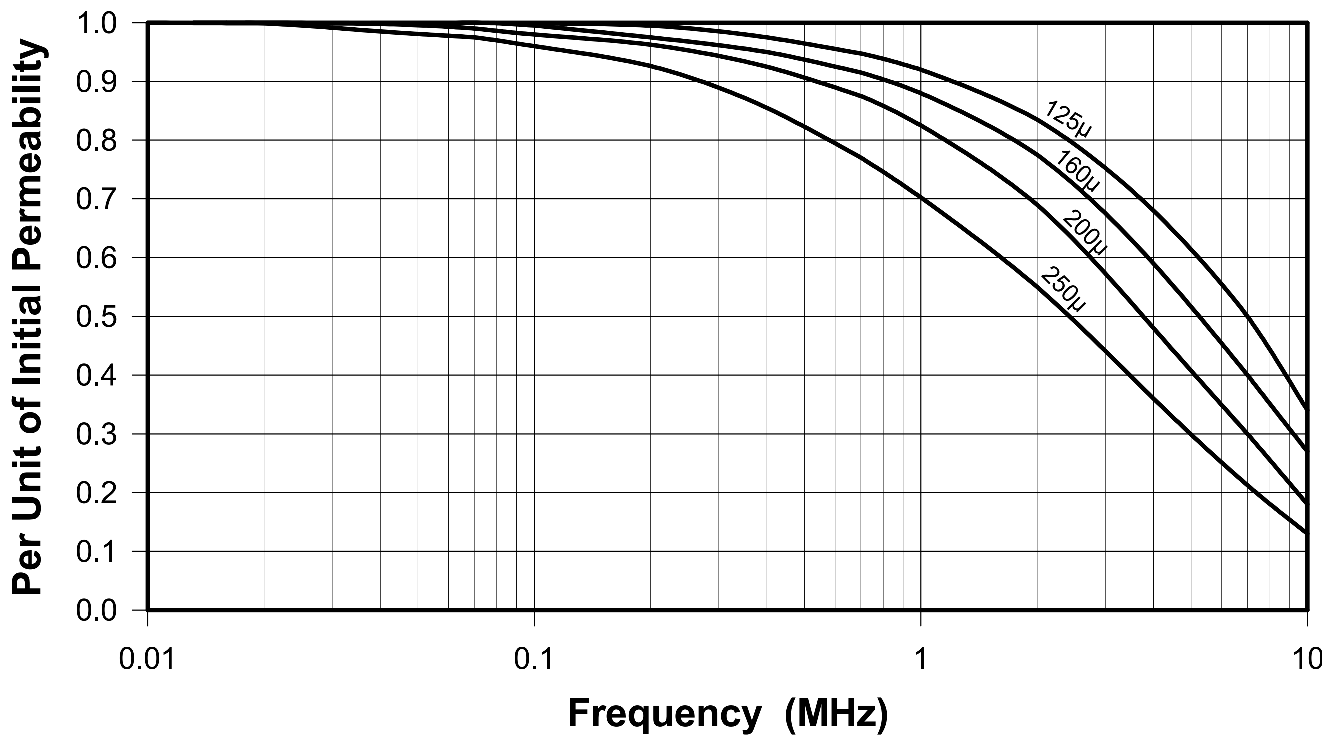

Figure 2

Materials and DC Bias

The most critical parameter of a power inductor material is its ability to provide inductance, or permeability, under DC bias. The distributed air gap of MPP results in a soft inductance versus DC bias curve. This swinging inductance is often desirable since it improves efficiency and accommodates a wide operating range. With a fixed current requirement, the soft inductance versus DC bias curve provides added protection against overload conditions. With a variable current requirement a more efficient inductor is achieved. Figure 3 shows the reduction of permeability as a function of DC bias. Figure 3 is plotted on a semi-log scale to show the DC bias characteristics at high DC magnetizing forces. The following equation can be used to relate current to magnetizing force, or H.

$H = .4\,\pi\,N\,I / l_e$ where:

H = DC Magnetizing force in Oersteds
N = number of turns
I = current in amps
l_e = magnetic path length in cm^2

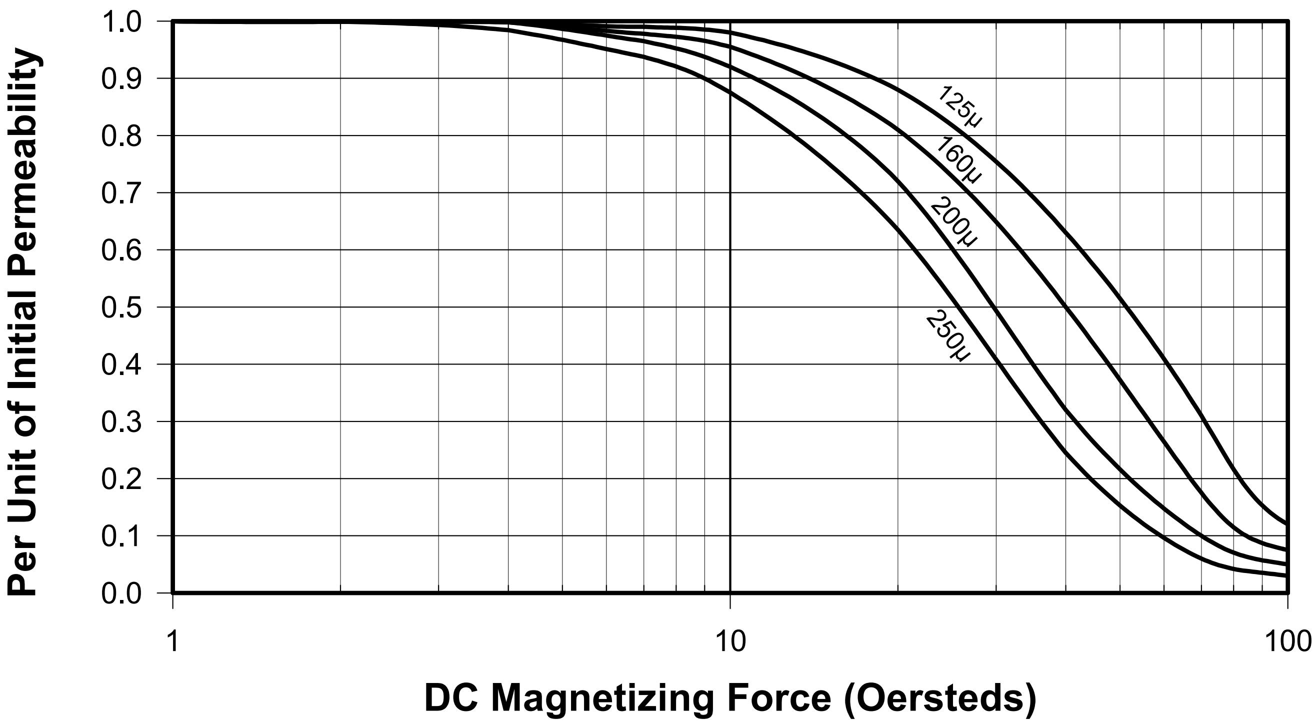

Figure 3

Comparison with Gapped Ferrite

With a higher flux capacity than ferrite, MPP offers significantly better DC bias characteristics. At a typical 50% roll-off, this can result in a substantial reduction in core size and a more robust design that utilizes the soft saturation of MPP. The flux capacity difference is even more dramatic at high temperatures, since the flux capacity of ferrites decreases with temperature while MPP stays relatively constant. This results in even greater DC bias performance for MPP at high temperatures (Figure 5). Additionally, the distributed air-gap structure of MPP minimizes potential EMI problems since almost all of the magnetic flux is contained within the core structure. Discrete gapped ferrite cores have a magnetic field that fringes around the two air-gaps and can couple into nearby circuit board traces causing EMI problems.

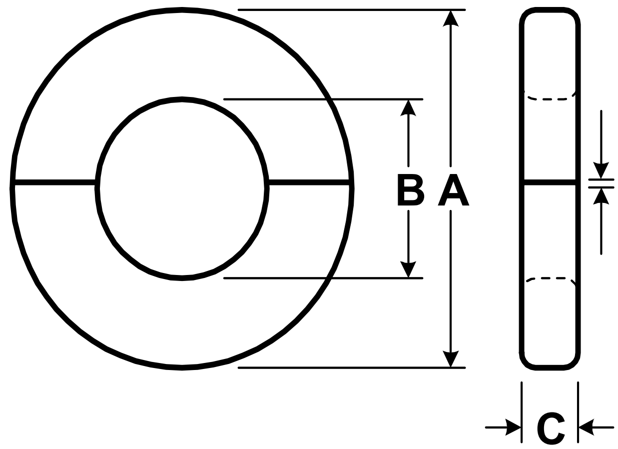

Figure 4

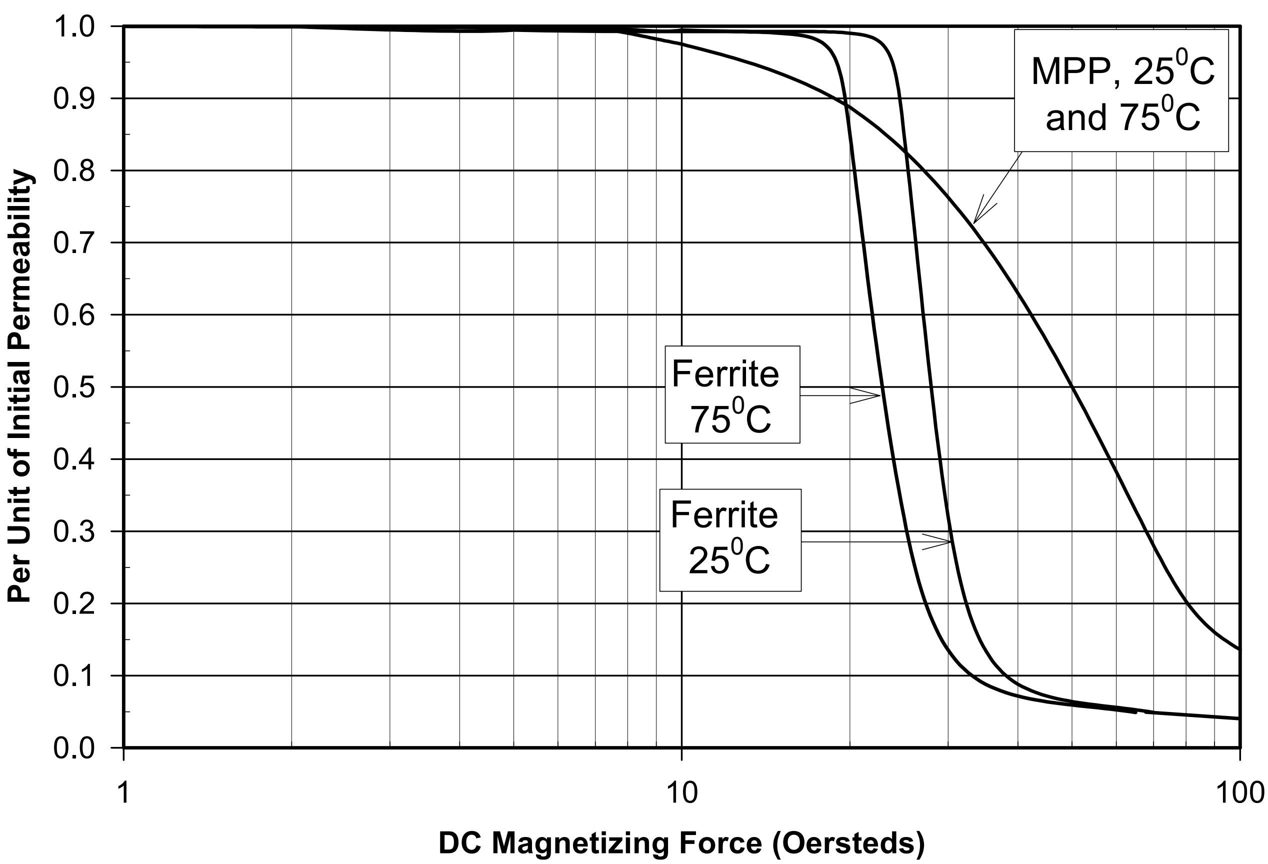

Figure 5

Comparison with Powdered Iron

With permeabilities up to 250, MPP offers higher values than powdered iron, which has a maximum permeability of 100. MPP AC core losses are much lower than powder iron losses. With a Curie temperature of approximately 460°C and rated for continuous operation from -65°C up to +130°C, MPP offers excellent performance over temperature. Unlike powdered iron, MPP is manufactured without the use of an organic binder. Therefore, MPP has none of the thermal aging concerns associated with powdered iron cores. MPP also offers a very stable inductance over temperature compared to powdered iron (Figure 6).

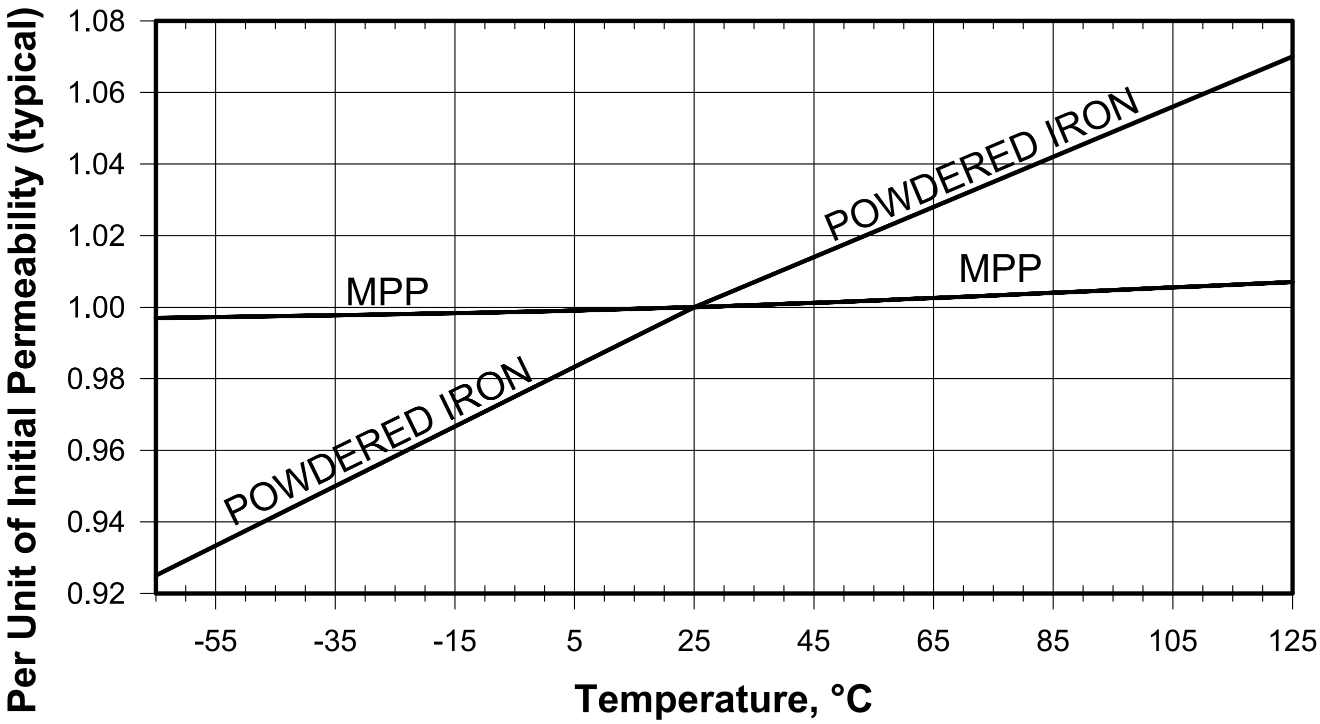

Figure 6

Core Finish

THINZ™ are coated with parylene to minimize the constriction of the inside diameter and minimize height. The parylene coating has a minimum breakdown voltage guarantee of 300 volts rms from wire to core (tested at 750 volts rms wire to wire at 60 Hz). The maximum steady-state operating temperature for the parylene coating is 130°C, but it can be used as high as 200°C for short periods, such as during infrared solder re-flow. High temperature operation of the cores does not affect the magnetic properties. The Curie temperature of MPP is about 460°C. In addition, there is no binder used during manufacturing as is used in powdered iron cores. THINZ are manufactured with radiuses on all corners, and they are strong enough that winding with relatively heavy magnet wire is practical.

MPP THINZ Advantages

High saturation
Soft saturation
Low losses
Temperature stability
High permeability
High temperature rating
Self-shielding
Good strength
Radiused edges
Custom heights available
Excellent for very low profile power inductors

MAGNETICS ®

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