鐵研 TAK

TM59

中高频低损耗功率材料
MID-HIGH-FREQUENCY LOW-LOSS POWER FERRITE

TM59 为中高频低损耗锰锌功率铁氧体，初始磁导率（μi）1900，饱和磁通密度（Bs）530 mT（25 ℃）/ 430 mT（100 ℃），居里温度高于 260 ℃。其主要特征为大磁通摆幅下之高频损耗：500 kHz / 100 mT 为 600 → 550 kW/m³，为功率系列于此高磁密工作点之最低值；800 kHz / 60 mT 为 330 → 250 kW/m³，500 kHz / 50 mT 为 80 → 50 kW/m³，且各工作点之 100 ℃ 损耗均低于 25 ℃，损耗呈负温度系数。全系列最低之残留磁通密度（Br 35 mT，100 ℃）与 10 A/m 之矫顽力使磁滞损耗维持低值，430 mT 之热态 Bs 使大功率变压器于 100 mT 级磁通摆幅下仍具饱和裕度。典型应用为 500–800 kHz 之高频大功率变压器，包括伺服器与通信电源之 LLC / CLLC 主变压器与大功率高频 DC-DC；其 100 ℃ 直流偏磁能力于八种材料实测中最高（220 nH 档 I@90 % 48.4 A），谐振与输出电感可与主变压器采用同一材料。于中高频功率材料两种之中，TM59 为新设计之建议材料，TM50A 属前一代（μi 2500，供既有设计沿用）；TLVR 等电感应用于 0.7 MHz 以上宜改用 MHz 级之 TM65。

TM59 is a mid-high-frequency low-loss MnZn power ferrite with an initial permeability (μi) of 1900, a saturation flux density (Bs) of 530 mT at 25 °C (430 mT at 100 °C) and a Curie temperature above 260 °C. Its principal characteristic is high-frequency loss at large flux swing: 600 → 550 kW/m³ at 500 kHz / 100 mT, the lowest value in the power series at this high-flux operating point; 330 → 250 kW/m³ at 800 kHz / 60 mT and 80 → 50 kW/m³ at 500 kHz / 50 mT, with the 100 °C loss below the 25 °C loss at every operating point, i.e. a negative temperature coefficient of loss. The lowest remanence in the series (Br 35 mT at 100 °C) and a coercivity of 10 A/m keep hysteresis loss low, and 430 mT of hot-state Bs preserves the saturation margin of high-power transformers at 100 mT-class flux swings. Typical applications are 500–800 kHz high-power transformers, including LLC/CLLC main transformers in server and telecom supplies and high-power HF DC-DC converters; its 100 °C DC-bias capability is the highest of the eight grades measured (220 nH band, I@90 % = 48.4 A), so resonant and output inductors may use the same grade as the main transformer. Of the two mid-high-frequency grades TM59 is the recommended grade for new designs, TM50A the earlier generation (μi 2500, retained for existing designs); for inductor applications such as TLVR above 0.7 MHz the high-frequency grade TM65 is recommended.

500–800 kHz High-Power Transformer | LLC / CLLC Main Transformer | Server / Telecom Power | Resonant / Output Inductor

电磁特性 MAGNETIC CHARACTERISTICS

特性 Characteristic	条件 Condition	25 ℃	100 ℃	单位 Unit
初始磁导率 Initial Permeability μi	100 kHz & <0.2 mT	1900±25%		
增幅磁导率 Amplitude Permeability μa	25 kHz/400 mT	> 3000	> 3000	
饱和磁通密度 Saturation Flux Density Bs	1200 A/m 100 Hz	530	430	mT
残留磁通密度 Remanence Br	1200 A/m 100 Hz	55	35	mT
矫顽力 Coercivity Hc	1200 A/m 100 Hz	15	10	A/m
相对损耗因子 Loss Factor	100 kHz & <0.2 mT	<5		10^{-6}
居里温度 Curie Temperature Tc	100 kHz & <0.2 mT	>260		℃
密度 Density D	阿基米德法 Archimedes method	>4.85		g/cm³
电阻率 Electrical Resistivity ρ	直流电流 DC Current	>10		Ω·m

功率损耗 Pcv POWER LOSS · KW/M³

测试条件 Condition	25 ℃	100 ℃	测试条件 Condition	25 ℃	100 ℃
300 kHz/100 mT	250	230	800 kHz/60 mT	330	250
500 kHz/50 mT	80	50	1 MHz/30 mT	100	70
500 kHz/100 mT	600	550	1 MHz/50 mT	350	250

Steinmetz 系数 Pcv = K·f^α·B^β

频段 Range	K	α	β
100 ≤300	5.129E-09	1.455	3.5423
100 ≤1000	8.028E-11	2.0925	3.6525

TM59

特性曲线
CHARACTERISTIC CURVES











