鐵研 TAK

DL4 高磁通耐热冲击材料

HIGH FLUX & THERMAL SHOCK RESISTANT FERRITE

DL4 为镍锌铁氧体材料，初始磁导率（μi）约 600，饱和磁通密度（Bs）约 350 mT（25 ℃）/ 265 mT（100 ℃），居里温度高于 200 ℃。较高的磁导率提高单位匝数的感量——在环形等闭磁路的精密变压器与滤波器中最为直接；低矫顽力（Hc 约 32 A/m）使磁滞损与信号失真维持低位，低磁通下相对损耗因子仅 12×10⁻⁶（0.1 MHz），适合精密信号路径；损耗随频率上升较快（80×10⁻⁶ @1.5 MHz），故适用频带较 DL3 略偏低中频。耐热冲击与耐焊性能优异，可承受回流焊的急剧温变。典型应用为高精度宽频变压器、传感线圈、EMI 滤波器与阻抗调谐线圈，特别适合对灵敏度要求高的 SMD 设计，亦可用于低电流高频功率电感等信号 / 电源混合模块。在 DL 系列中，DL4 是灵敏度取向的一支：与 DL3（μi 约 350）相比标称磁导率高约七成、频带略窄；需要高饱和磁通与耐温时改选 DL5 / DL6。

DL4 is a NiZn ferrite with an initial permeability (μi) of approx. 600, a saturation flux density (Bs) of approx. 350 mT at 25 °C (265 mT at 100 °C) and a Curie temperature above 200 °C. The higher permeability raises the inductance per turn — most directly in toroids and other closed-magnetic-circuit precision transformers and filters — while the low coercivity (Hc approx. 32 A/m) keeps hysteresis loss and signal distortion low; with a relative loss factor of only 12×10^{-6} at 0.1 MHz under low flux it suits precision signal paths, though the loss rises faster with frequency (80×10^{-6} at 1.5 MHz), placing its useful band somewhat lower than DL3's. Excellent thermal-shock resistance and solderability withstand reflow temperature swings. Typical uses are high-accuracy wideband transformers, sensing coils, EMI filters and impedance-tuning coils — especially sensitivity-critical SMD designs — as well as low-current HF power inductors in mixed signal/power modules. Within the DL family, DL4 is the sensitivity-oriented grade: its nominal permeability is roughly 70 % above DL3's (μi approx. 350) over a slightly narrower band; choose DL5/DL6 for higher flux density and temperature capability.

Wideband Transformer | Sensing Coil | EMI Filter | Impedance Tuning Coil | HF Power Inductor

电磁特性 MAGNETIC CHARACTERISTICS

特性 Characteristic	条件 Condition	值 Value	单位 Unit
初始磁导率 μi Initial Permeability	100 kHz & <0.2 mT	600±25%	
饱和磁通密度 Bs Saturation Flux Density	3000 A/m · 25 ℃ 100 Hz	350	mT
饱和磁通密度 Bs Saturation Flux Density	3000 A/m · 100 ℃ 100 Hz	265	mT
残留磁通密度 Br Remanence	3000 A/m · 25 ℃ 100 Hz	170	mT
残留磁通密度 Br Remanence	3000 A/m · 100 ℃ 100 Hz	110	mT
矫顽力 Hc Coercivity	3000 A/m · 25 ℃ 100 Hz	32	A/m
矫顽力 Hc Coercivity	3000 A/m · 100 ℃ 100 Hz	20	A/m
αμr（温度系数） Temperature coefficient of permeability	20 ~ 60 ℃	30	$\times10^{-6}$/K
相对损耗因子 tanδ/μi Relative Loss Factor	0.1 MHz & <0.2 mT	12	$\times10^{-6}$
相对损耗因子 tanδ/μi Relative Loss Factor	1.5 MHz & <0.2 mT	80	$\times10^{-6}$
居里温度 Tc Curie Temp.	100 kHz & <0.2 mT	>200	℃
密度 D Density	阿基米德法 Archimedes method	5.0	g/cm³
电阻率 ρ Volume Resistivity	直流电流 DC Current	10^7	Ω·m
功率损耗 Pcv Power Loss	100 kHz/100 mT | 500 kHz/30 mT | 1 MHz/30 mT · 25 °C	756 | 420 | 1233	kW/m³

备注：各项数值均为环形磁芯T31×19×8测得的典型数值，由于几何形状和尺寸的影响，产品规格将与这些数据有所差异。25 ℃ 之功率损耗 Pcv 为 T31×19×8 环形磁芯绕线 3 匝实测。

Note: all values are typical data measured on a T31×19×8 toroidal core; actual product specifications will vary with geometry and size. Pcv values at 25 °C are measured on a T31×19×8 toroid wound with 3 turns.

特性曲线详见次页 CHARACTERISTIC CURVES — SEE NEXT PAGE

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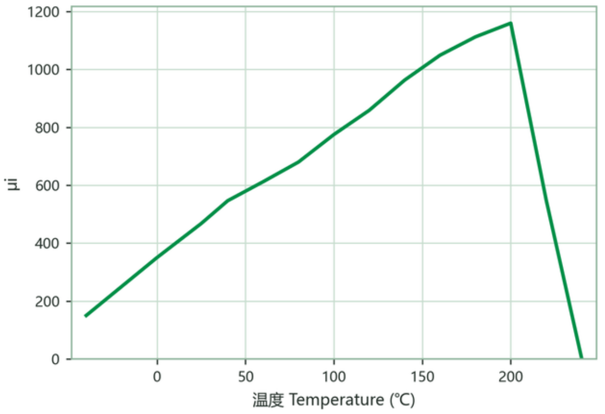
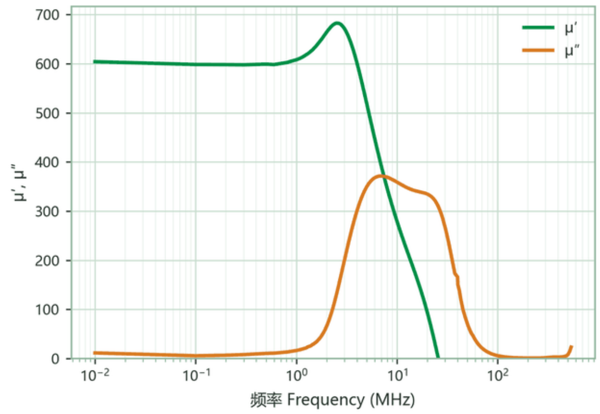
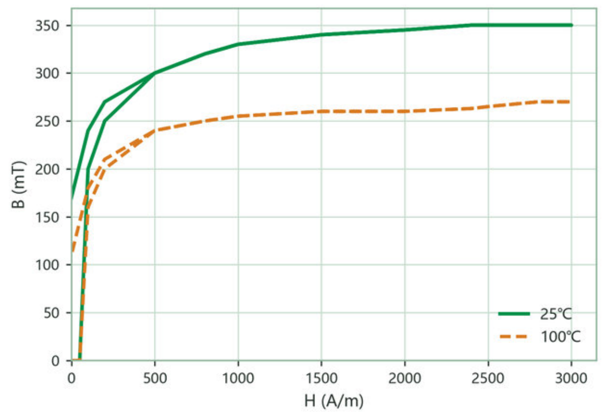
DL4 特性曲线 CHARACTERISTIC CURVES



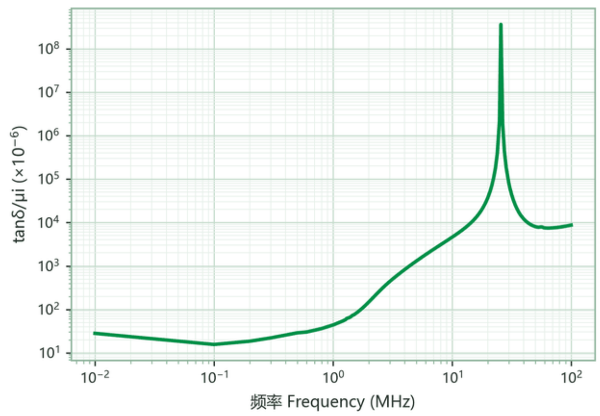
初始磁导率—温度特性
Initial Permeability vs. Temperature



复数磁导率—频率特性
Complex Permeability (μ′, μ″) vs. Frequency



静态磁化曲线
Static Magnetization Curves (B–H)



相对损耗因子—频率特性
Relative Loss Factor (tanδ/μi) vs. Frequency