天通控股股份有限公司
TDG HOLDING CO., LTD.

SOFT FERRITE MATERIALS

软磁铁氧体材料

磁业公司
MAGNETIC COMPANY
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公司简介

天通控股股份有限公司是国家重点高新技术企业，中国电子元器件百强企业，是中国首家自然人控股的上市公司。

建立于1984 年，经过30年的努力，天通控股已成为拥有中国最大的磁性材料研发、制造基地，并设有省级软磁研发中心的高新技术企业。公司拥有先进的试验、检测设备，专业从事铁氧体材料和磁心的研发、制造和销售。可生产50余类材料，5000多种规格的锰锌、镍锌铁氧体磁心及非晶合金磁心、微波铁氧体磁心。

产品广泛用于现代通信、计算机及外部设备、开关电源、液晶显示器、等离子彩电、自动化办公、自动控制、绿色照明、仪器仪表、抗电磁干扰、太阳能及风能的电源逆变器、以及汽车电子、航空航天等电子科技领域，客户遍及亚洲欧美。

天通人本着“自信、诚心、创新”的企业精神，以世界规模第一、技术领先为目标，视服务客户为己任，诚信不懈，追求卓越，奉献自我，共图发展。

质量是我们一贯的坚持，用户满意是我们一贯的追求！

天通在浙江海宁、安徽六安、四川绵阳分别建立了磁性材料的产业基地。

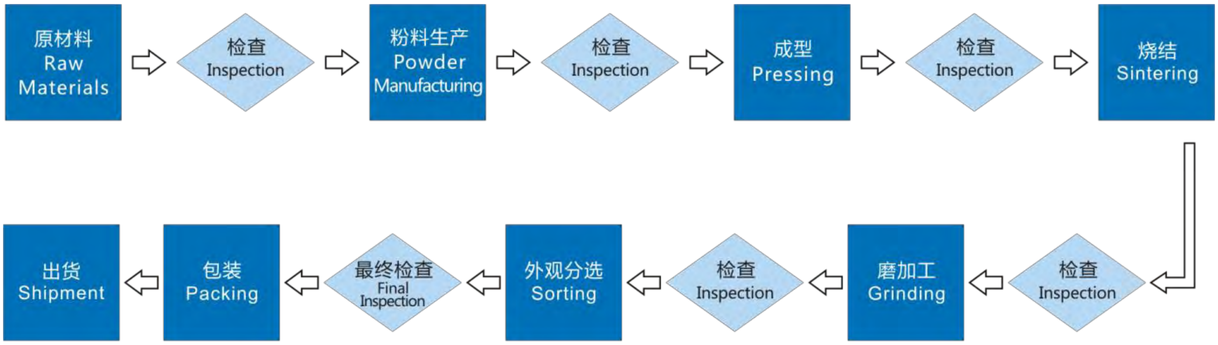
COMPANY BRIEF INTRODUCTION

TDG Holding Co., Ltd, a national and provincial key Hi-Tech enterprise and one of the top 100 Chinese electronic components enterprises, is the first public company held by individuals in China.
Founded in 1984, after three decades' efforts, TDG has been developed into a Hi-tech enterprise with the largest soft magnetic core base in China and a provincial researching center which has the advanced test and inspection equipment. TDG is specialized in developing, manufacturing and selling soft ferrite materials and magnetic cores. TDG can produce more than 50 kinds of materials and more than 5000 specifications of MnZn ferrite cores, NiZn ferrite cores, Amorphous alloy cores and microwave ferrite cores.
The products are widely used in electronics technology field, like modern communication, computer and external facility, switching power supply, LCD screen, plasma TV, office automation, automatic control, green lighting, instrument and apparatus, Electronic Magnetic In EMI, power inverter of the solar and wind energy, automotive electronics, aerospace etc. Our customers are located all over the Asia, America and Europe.
With the spirit of “confidence, integrity and innovation”, we regard large-scaled production and advanced technology as our goal, best quality as our principle and customer satisfaction as our duty!

TDG has set up magnetic materials industrial base in Haining Zhejiang, Luan Anhui, Mianyang Sichuan.

锰锌制造流程图

MnZn Ferrite Production Process



粉料生产
Powder Manufacturing

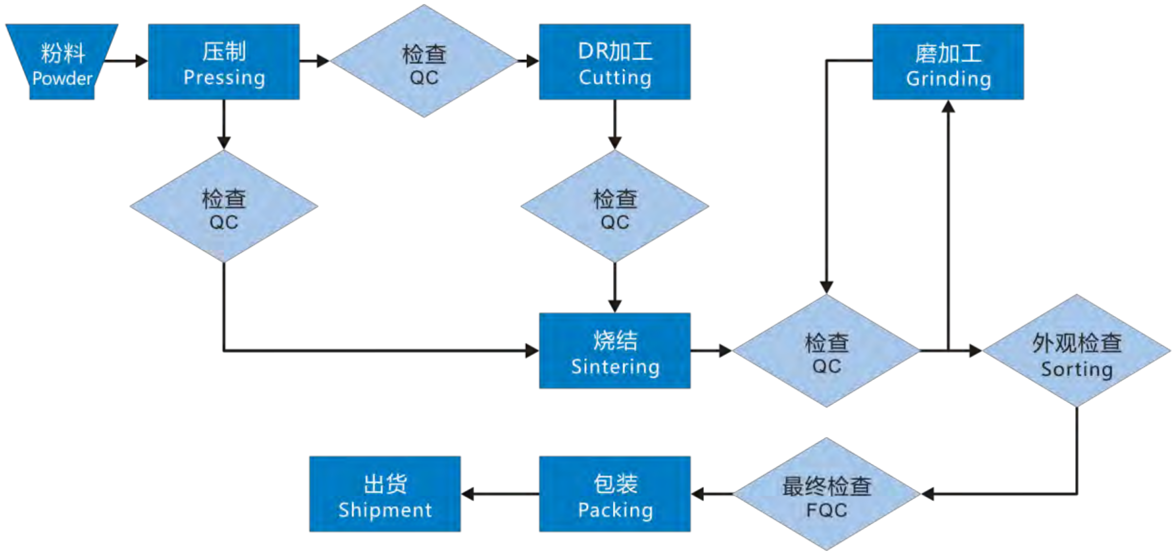
成型
Pressing

磨加工
Grinding

烧结
Sintering

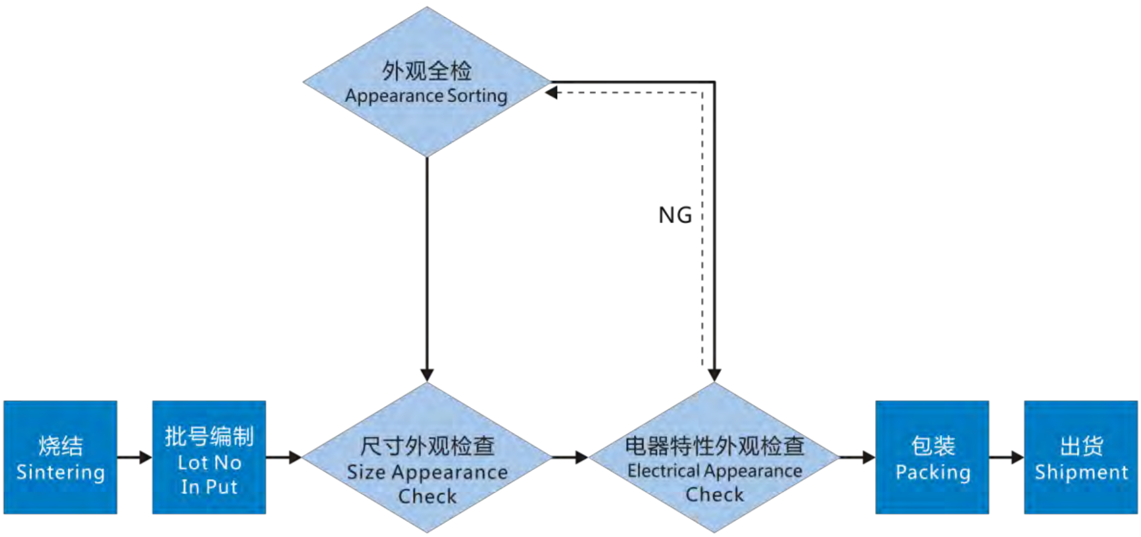
镍锌制造流程图

NiZn Production Flow Diagram



品管流程图

QC Flow Diagram



When Ordering

In order to avoid unexpected cases or misuse, and to fully understand the products and safety regulations, please contact us first.

The specifications listed here are approximate values. Some products may change when the characteristics are improved. Please confirm the related data with us before using.

This catalog shows our standard products. if you need special shapes or material, please contact us without hesitate.

注意事项

为充分了解产品规格值及特性，以及有关安全标准是否适用于本制品，避免使用不当及可能发生的意外情况，请与我司联系。

此样本书中所列各制品的特性规格为近似值。在产品特性改良等过程中可能发生一些变化。在使用前可联系我司确认相关数据。

此样本书列出的是我们的标准制品。如果应用除这些产品外的其他形状以及其他材质的产品，请及时与我司联系。

锰锌材料规范：

本公司对所生产的铁氧体材料作了如下规范：

材料命名：

T　X　Y

- Y —— 同一材料系列中不同特性的材质
- X —— 材料系列代码
- T —— 公司名称的第一个字母

例：

T　P　4

- 4 —— 功率铁氧体材料中一种材质
- P —— 表示MnZn功率铁氧体材料
- T —— 天通的第一个拼音字母，代表天通公司

本公司MnZn铁氧体材料现有5大系列，30余种材料牌号，4000余种磁心规格。

一、TP系列：用于开关电源变压器及传输高频功率的MnZn功率铁氧体材料，TP4、TP4A、TP4B、TP4C、TP4D、TP4E、TP4F、TP4S、TP5、TP5i、TP5E、TPB22、TPB12、 TPB16、TPW33、TPG30、TPW30 、TPG33 。

二、TD系列：用于ISDN网络、背景照明、照相机闪光灯用的高磁导率高饱和磁通密度MnZn铁氧体材料，TD3、TD5B。

三、TL系列：用于宽带变压器、脉冲变压器、滤波器、电感器的高磁导率MnZn铁氧体材料，TLD5、 TLD10、 TL13、TL15。

四、TS系列：用于抗电磁干扰，具有优良频率特性的用于制作共模滤波器的MnZn铁氧体材料，TS5、TS7、TS10、TSR5、 TSR7、 TSR10、 TSR13。

五、TH系列：用于滤波器、扼流圈和调制解调器用变压器的低失真高品质因子材料，TH2、TH4、TH7、TH10。

Standard:

Naming rule of TDG's products:

Naming:

T X Y

- Y — The different material in the same series
- X — The code of material series
- T — The first letter of company name

Example:

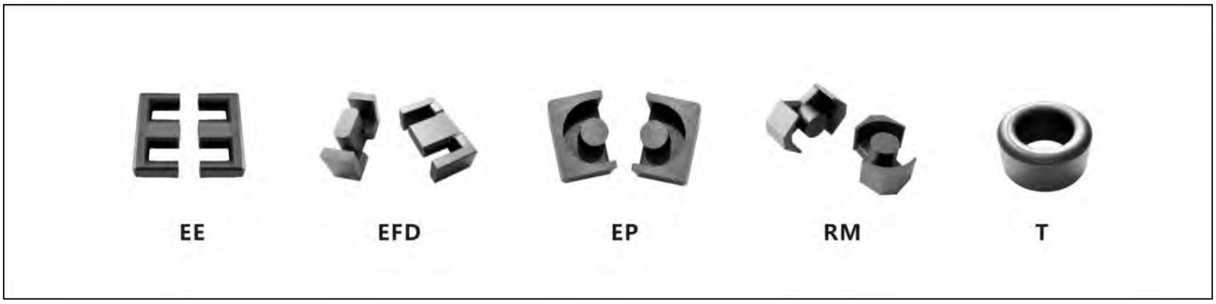
T P 4

- 4 — One of the power ferrite materials
- P — MnZn power ferrite materials
- T — The first letter of company name

There are 5 series of materials which include more than 30 types and 4000 specifications, all of these can be available in our company.

1. TP Series: is a kind of MnZn Power Ferrite Material which is applied to the switching power transformer and high frequency power transmission device (i.e. TP4、TP4A、TP4B、TP4C、TP4D、TP4E、TP4F、TP4S、TP5、TP5i、TP5E、TPB22、TPB12、 TPB16、 TPW33、TPG30、TPW30 、TPG33).
2. TD Series: is a kind of MnZn Ferrite Material with high permeability and high saturation magnetic flux density which is applied to ISDN, network, background illumination and camera flash (i.e.TD3、 TD5B).
3. TL Series: is a kind of MnZn Ferrite Material with high high permeability which is applied to wide band transformer, pulse transformer, wave filer,inductor(i.e. TLD5、 TLD10、 TL13、TL15).
4. TS Series: is a kind of MnZn Ferrite Material with high quality frequency which is applied to anti-electromagnetic disturbance and common mode filter(i.e. TS5、TS7、TS10、TSR5、 TSR7、TSR10、 TSR13).
5. TH Series: is a kind of MnZn Ferrite Material with low distortion and HQ, which is applied to the transformers of filter, choking coil, XDSL modem(i.e. TH2、TH4、TH7、TH10).

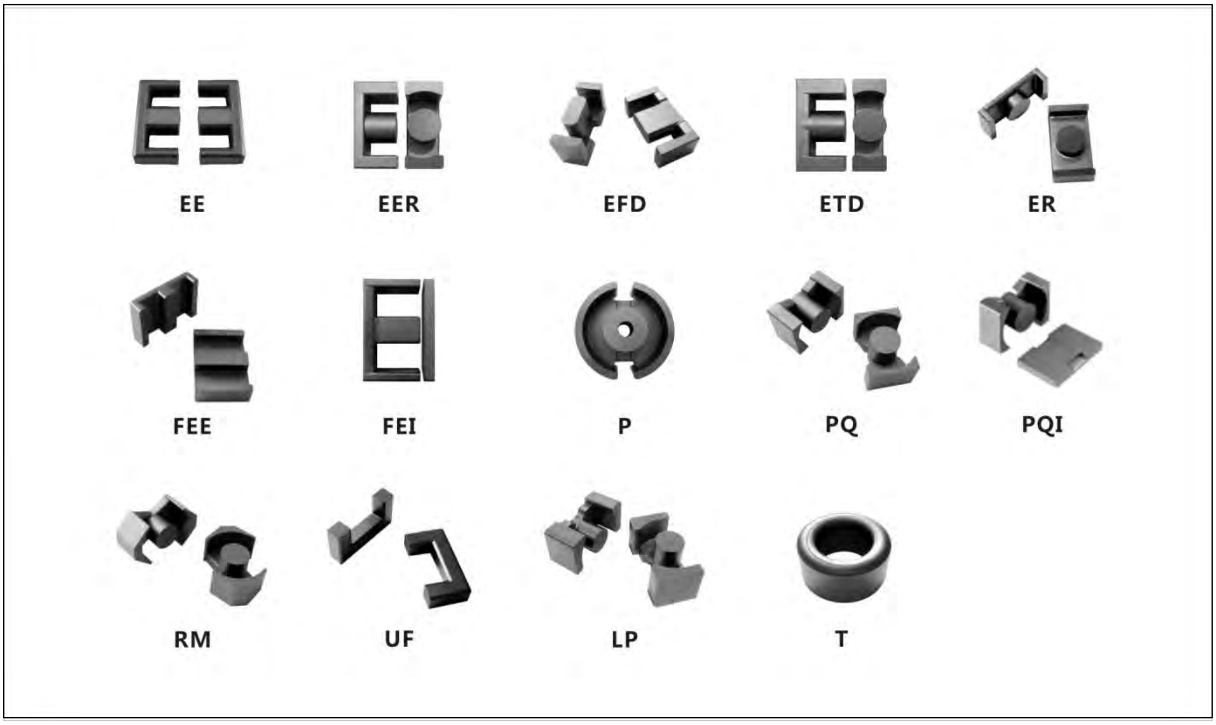
一. 功率转换 Power Conversion



驱动变压器 Driver Transformers

产品型号 Core Types：EE, EFD, EP, RM, T

材料 Materials：TP4, TP4A, TP4B, TP4E, TP4F, TPB12, TPB16, TPW33, TPG33, TP5, TS5, TH2



功率电感器 Power Inductors

产品型号 Core Types：EE, EC, EFD, ETD, ER, FEE, FEI, P, PQ, PQI, RM, UF, LP, T

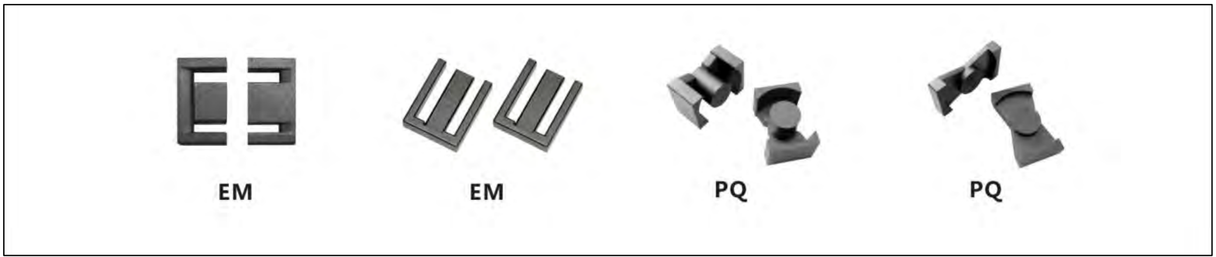
材料 Materials：TP4, TP4A, TP4B, TP4E, TP4F, TP4S, TPB12 , TPB16 , TPW33 , TPG33 , TP5, TD3, TD5B

一. 功率转换 Power Conversion

电流变压器 Current Transformers

产品型号 Core Types： T, UF

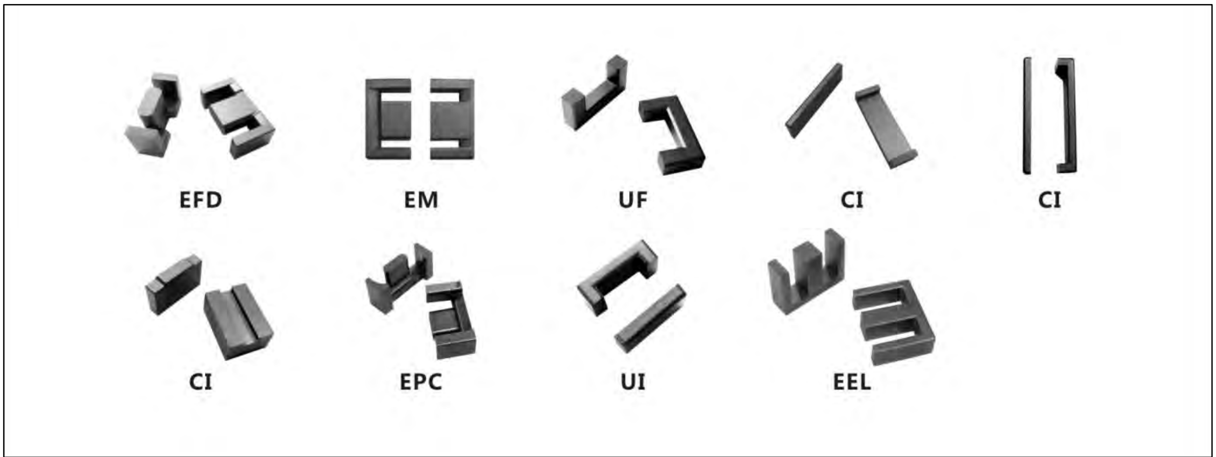
材料 Materials：TP4, TP4A, TP4B, TP4E, TP5, TS5, TS10, TL13, TL15



液晶显示器LED背光源变压器 LED Backlight Transformers（LED)

产品型号 Core Types： EM49, PQ38等

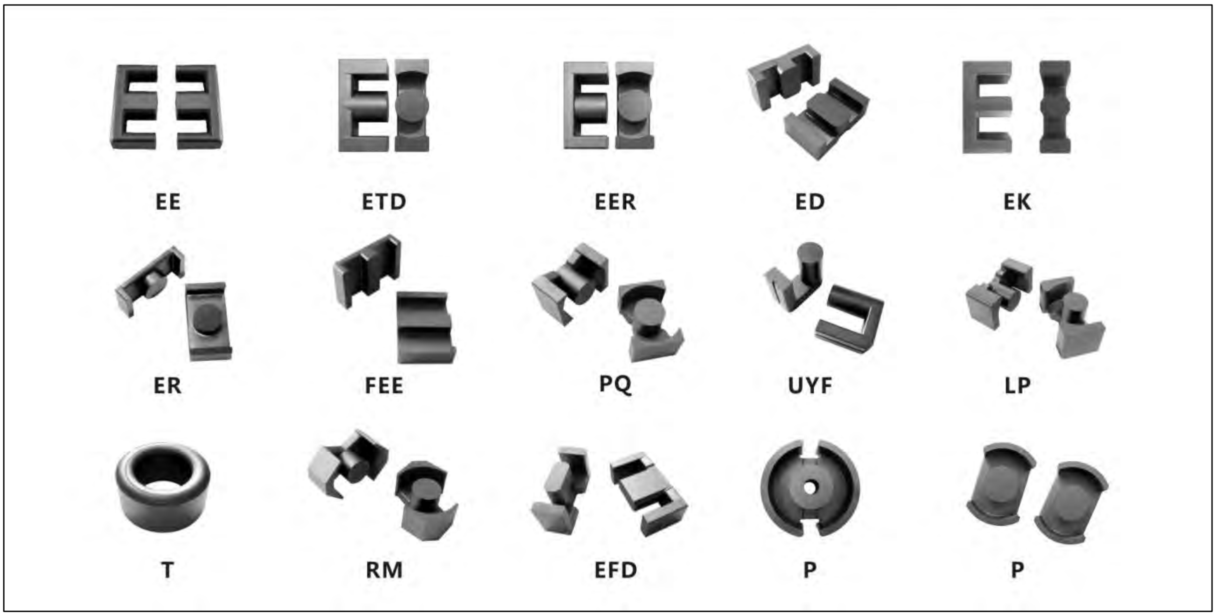
材料 Materials：TP4A, TPW33, TP4D



液晶显示器CCFL背光源变压器 LED Backlight Transformers（CCFL）

产品型号 Core Types： EFD, EM, UF, CI, EPC, UI, EEL

材料 Materials：TP4, TP4A, TP4B, TP4C, TP4D, TP4S

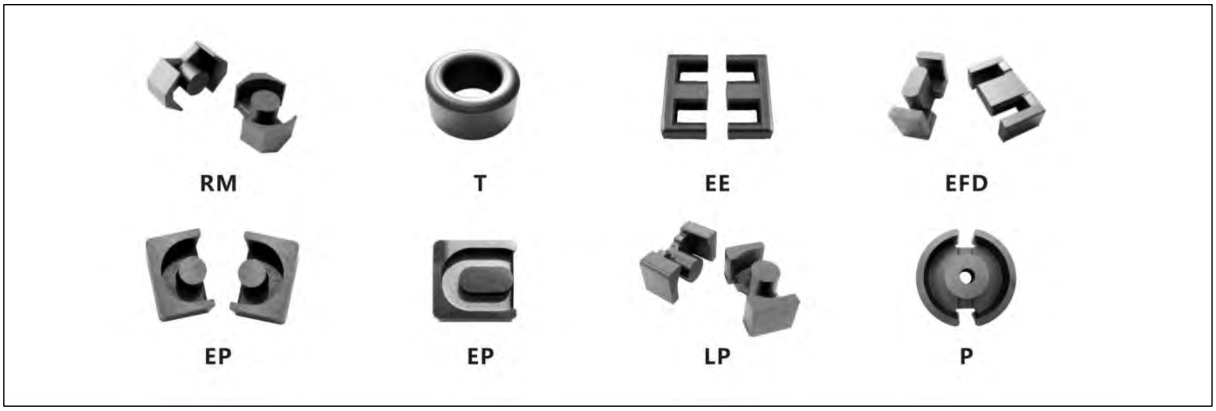


功率变压器 Power Transformers

产品型号 Core Types：EE, ETD, EC, ED, EK, ER, FEE, PQ, UYF, LP, T, RM, EFD, P

材料 Materials：TP4, TP4A, TP4B, TP4E, TP4F, TP4S, TPB12 , TPB16 , TPW33 , TPG33 , TP5, TD3, TD5B

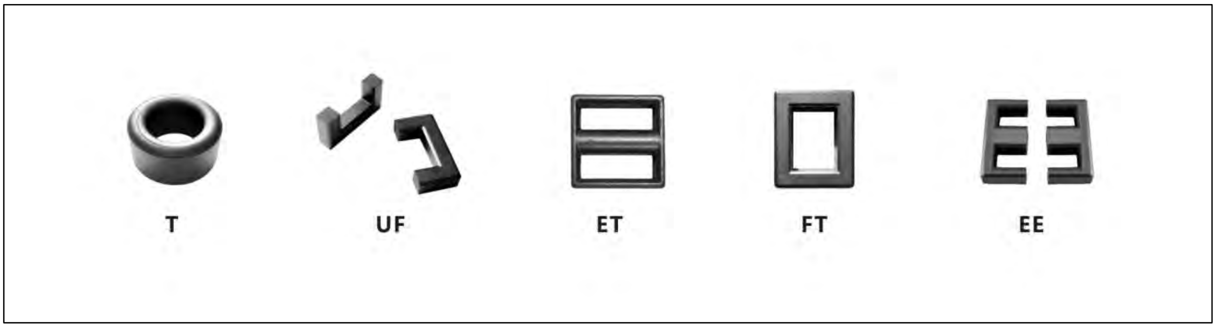
二. 信号处理 Signal Processing



产品型号 Core Types： RM, T, EE, EFD, EP, LP, P

材料 Materials：TP4, TD3, TD5B, TS5, TS10, TL13, TL15, TH2, TH10

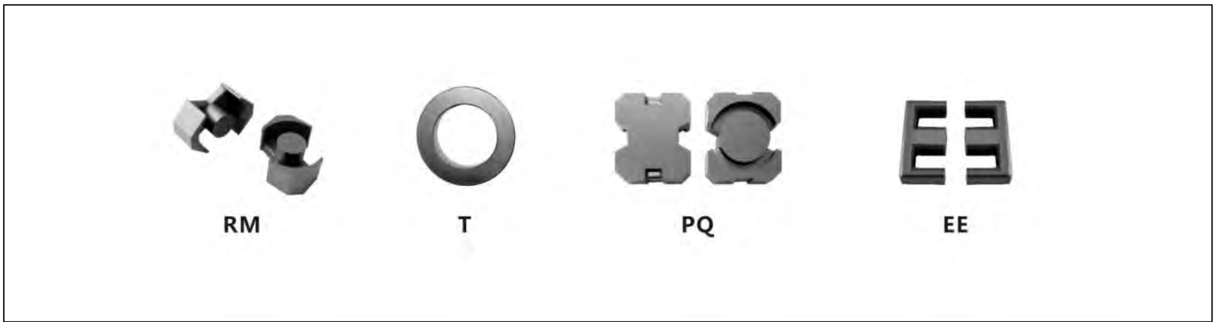
三. 抗电磁干扰 EMI Suppression



产品型号 Core Types：T, UF, ET, FT, EE

材料 Materials：TP4, TS5, TS7, TS10, TL13, TL15 , TSR7, TSR10

四. 新能源逆变器 Cores for New Energy Inverters



产品型号 Core Types：PQ34, RM14, EE80, T80等

材料 Materials：TP4, TP4E, TPW33, TPG33, TP5, TP5i, TS10, TSR7, TSR10

锰锌功率铁氧体材料特性

Characteristics of MnZn Power Ferrite Material

类型 Type			低损耗 Low Loss			低温低损耗 Low Loss at Low Temperature		
特性 Characteristics	温度 Temp.	单位 Unit	TP4	TP4A	TP4D	TP4B	TP4C	TPG30
初始磁导率μ_i(10kHz) Initial permeability	25˚C		2300 ±25%	2400 ±25%	2500 ±25%	2500 ±25%	3200 ±25%	3000 ±25%
饱和磁通密度Bs Saturation magnetic flux density (H=1194A/m)	25˚C	mT	510	510	520	530	530	530
	100˚C	mT	390	390	410	420	420	425
剩磁Br Remanence	25˚C	mT	100	110	210	120	130	100
	100˚C	mT	55	60	60	80	80	75
矫顽力Hc Coercivity	25˚C	A/m	14	13	14	12	11	15
	100˚C	A/m	9	6.5	7	8	10	12
功率损耗Pcv Core Loss 100kHz 200mT	0˚C	kW/m^3	/	/	/	/	/	380
	25˚C	kW/m^3	650	600	600	570	350	330
	60˚C	kW/m^3	/	/	400	250 (75˚C)	250 (45˚C)	/
	100˚C	kW/m^3	410	300	250	460	660	350
	120˚C	kW/m^3	500	400	/	/	/	380
	140˚C	kW/m^3	/	/	/	/	/	/
电阻率ρ Electrical resistivity		Ω·m	6.5	6.5	4	3	3	4
居里温度Tc Curie temperature		˚C	≥220	≥215	≥220	≥220	≥220	≥225
密度d Density		kg/m^3	4.8×10^3	4.8×10^3	4.8×10^3	4.8×10^3	4.8×10^3	4.8×10^3

注：各表格所列值均为典型值，不包括客户的特殊要求；有特殊要求时，应在订货合同或协议中给予明确。

Remark：The value of material's characteristics are typical value, excluding customers' special requirements.
Please contact our company for more characteristics in your order or agreement.

锰锌功率铁氧体材料特性

Characteristics of MnZn Power Ferrite Material

类型 Type			高温低损耗 Low Loss at High Temperature			高饱和磁通密度 High Bs			
特性 Characteristics	温度 Temp.	单位 Unit	TP4S	TP4F	TPW30	TP4E	TPB22	TPB12	TPB16
初始磁导率 μ_i(10kHz) Initial permeability	25˚C		2000 ±25%	1800 ±25%	3000 ±25%	1500 ±25%	2200 ±25%	1200 ±25%	1600 ±25%
饱和磁通密度Bs Saturation magnetic flux density (H=1194A/m)	25˚C	mT	520	520	530	510	540	560	590
	100˚C	mT	410	430	425	440	450	475	480
剩磁Br Remanence	25˚C	mT	135	130	100	210	180	250	150
	100˚C	mT	60	80	75	70	70	100	250
矫顽力Hc Coercivity	25˚C	A/m	13	13	15	24	14	20	35
	100˚C	A/m	7	9	12	13	7	10	30
功率损耗Pcv Core Loss 100kHz 200mT	0˚C	kW/m^3	/	/	/	/	/	/	/
	25˚C	kW/m^3	650	900	/	1000	700	1100	280[a]
	60˚C	kW/m^3	/	/	320	/	/	/	/
	100˚C	kW/m^3	300	500	/	480	320	500	470[a]
	120˚C	kW/m^3	350	/	320	/	/	/	/
	140˚C	kW/m^3	/	400	380	/	/	/	/
电阻率ρ Electrical resistivity		Ω·m	6.5	4	4	3	4	6	5
居里温度Tc Curie temperature		˚C	≥220	≥240	≥220	≥285	≥255	≥280	≥280
密度d Density		kg/m^3	4.8×10^3	4.8×10^3	4.9×10^3	4.8×10^3	4.8×10^3	4.9×10^3	4.8×10^3

注：各表格所列值均为典型值，不包括客户的特殊要求；有特殊要求时，应在订货合同或协议中给予明确。

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测试条件/Test Conditions：a-25kHz/200mT;

锰锌功率铁氧体材料特性

Characteristics of MnZn Power Ferrite Material

类型 Type			宽温低损耗 Low Loss in a Wide Temperature Range		高频低损耗 Low Loss at High Frequency		
特性 Characteristics	温度 Temp.	单位 Unit	TPW33	TPG33	TP5	TP5i	TP5E
初始磁导率μ_i(10kHz) Initial permeability	25°C		3300 ±25%	3300 ±25%	1400 ±25%	1500 ±25%	1200 ±25%
饱和磁通密度Bs Saturation magnetic flux density (H=1194A/m)	25°C	mT	530	530	470	470	520
	100°C	mT	410	410	380	380	420
剩磁Br Remanence	25°C	mT	85	80	140	140	100
	100°C	mT	60	60	98	98	65
矫顽力Hc Coercivity	25°C	A/m	12	10	36.5	36.5	40
	100°C	A/m	9	8	27.2	27.2	25
功率损耗Pcv Core Loss 100kHz 200mT	0°C	kW/m^3	/	/	/	/	/
	25°C	kW/m^3	380	340	130^c	$300(30°C)^b$ $80(30°C)^c$	450^d 250^e
	80°C	kW/m^3	290	260	600^d	300^b 100^c	/
	100°C	kW/m^3	300	270	80^c 500^d	400^b 120^c	300^d 150^e
	120°C	kW/m^3	350	315	/	/	/
	140°C	kW/m^3	/	/	/	/	/
电阻率ρ Electrical resistivity		Ω·m	4	4	8	8	9
居里温度Tc Curie temperature		°C	≥220	≥220	≥240	≥240	≥270
密度d Density		kg/m^3	4.9×10^3	4.9×10^3	4.7×10^3	4.6×10^3	4.7×10^3

注：各表格所列值均为典型值，不包括客户的特殊要求；有特殊要求时，应在订货合同或协议中给予明确。
Remark：The value of material's characteristics are typical value, excluding customers' special requirements.
Please contact our company for more characteristics in your order or agreement.
测试条件/Test Conditions：a-25kHz/200mT;

锰锌高磁导率铁氧体材料特性

Characteristics of MnZn Ferrite Materials with High Permeability

类型 Type			高磁导率 High Permeability				
特性 Characteristics	温度 Temp.	单位 Unit	TS5	TS7	TS10	TL13	TL15
初始磁导率μ_i Initial permeability	10kHz 25°C B<0.5mT		5500 ±30%	7500 ±30%	10000 ±30%	13000 ±30%	15000 ±30%
比温度系数$\alpha_{\mu ir}$ Relative temperature coefficient	20°C~60°C	10^{-6}/°C	-0.5~2.0	-0.5~2.0	-0.5~2.0	-0.5~3.0	-0.5~2.0
比损耗因子$\tan\delta/\mu_i$ Relative loss factor	100kHz	$\times 10^{-6}$	＜10	＜20	＜30	＜7.0 (10kHz)	＜7.0 (10kHz)
减落因子D_F Disaccommodation factor	1 to 10 minutes	$\times 10^{-6}$	＜3.0	＜2.5	＜2.0	＜2.0	＜2.0
饱和磁通密度Bs Saturation magnetic flux density	1194A/m 25°C	mT	410	410	380	360	360
剩磁Br Remanence	25°C	mT	70	80	120	100	100
矫顽力Hc Coercivity	25°C	A/m	6	6	6	4.4	4.4
电阻率ρ Electrical Resistivity		Ω·m	1	0.3	0.2	0.15	0.15
居里温度Tc Curie Temperature		°C	≥150	≥125	≥125	≥115	≥110
密度d Density		kg/m^3	4.8×10^3	4.8×10^3	4.9×10^3	4.95×10^3	4.95×10^3

注：各表格所列值均为典型值，不包括客户的特殊要求；有特殊要求时，应在订货合同或协议中给予明确。
Remark：The value of material's characteristics are typical value, excluding customers' special requirements.
Please contact our company for more characteristics in your order or agreement.

锰锌高磁导率铁氧体材料特性

Characteristics of MnZn Ferrite Materials with High Permeability

类型 Type			宽温高磁导率 High Permeability in Wide Temperature		高频高磁导率 High Permeability in High Frequency			
特性 Characteristics	温度 Temp.	单位 Unit	TLD5	TLD10	TSR5	TSR7	TSR10	TSR13
初始磁导率μ_i Initial permeability	25°C 10kHz		5000 ±30%	10000 ±30%	5500 ±30%	7000 ±30%	10000 ±30%	13000 ±30%
			4500 -40°C (10kHz)	6500 -40°C (10kHz)	3000 25°C (1MHz)	3500 25°C (800kHz)	9500 25°C (200kHz)	10000 25°C (200kHz)
比温度系数$\alpha_{\mu ir}$ Relative temperature coefficient	20~60°C	10^{-6}/°C	/	/	-0.5~2.0	-0.5~2.0	-0.5~2.0	-0.5~2.0
	-40~25°C		-0.7~0.7 (-35~25°C)	-0.7~0.7	/	/	/	/
比损耗因子$\tan\delta/\mu_i$ Relative loss factor	100kHz	$\times 10^{-6}$	＜15	＜5.0 (10kHz)	＜10	＜15	＜20	＜20
减落因子D_F Disaccommodation factor	1 to 10 minites	$\times 10^{-6}$	/	/	＜3.0	＜2.5	＜2.0	＜2.0
饱和磁通密度Bs Saturation magnetic flux density	1194A/m 25°C	mT	380	380	430	430	410	400
剩磁Br Remanence	25°C	mT	140	120	70	80	100	100
矫顽力Hc Coercivity	25°C	A/m	7	5	6	6	5	6
电阻率ρ Electrical Resistivity		Ω·m	1	0.1	1	0.3	0.2	0.15
居里温度Tc Curie Temperature		°C	≥120	≥110	≥150	≥150	≥130	≥130
密度d Density		kg/m^3	4.85×10^3	4.95×10^3	4.9×10^3	4.9×10^3	4.95×10^3	4.95×10^3

注：各表格所列值均为典型值，不包括客户的特殊要求；有特殊要求时，应在订货合同或协议中给予明确。
Remark：The value of material's characteristics are typical value, excluding customers' special requirements.
Please contact our company for more characteristics in your order or agreement.

锰锌高饱和磁感应强度、低失真铁氧体材料特性

Characteristics of MnZn Ferrite Materials with High Saturation Magnetic Flux Density and Low Distortion

类型 Type			高叠加 High DC-Bias		低THD Low Total Harmonic Distortion				高频高阻抗 High Impedance at High Frequency
特性 Characteristics	温度 Temp.	单位 Unit	TD3	TD5B	TH2	TH4	TH7	TH10	Ti1
初始磁导率μ_i Initial permeability	25℃ 10kHz B<0.5mT	/	3200 ±25%	4000 ±25%	2300 ±25%	4000 ±25%	7500 ±25%	10000 ±30%	1500 ±25%
比温度系数$\alpha_{\mu ir}$ Relative temperature coefficient	5~25℃	$\times 10^{-6}$/℃			0.3~1.5	0.3~1.5		/	/
	-40~25℃						0.5~1.5		
	0~20℃							-1~1	
	20~60℃							-1~1	
	20~70℃								＜10.6
	25~55℃				0.3~1.3	-0.3~1.0			
	25~85℃						0.5~2.0		
磁滞常数η_B Hysteresis material constant	25℃ 10kHz 1.5-3mT	$\times 10^{-6}$/mT	/	/	＜0.4	＜0.3	＜0.2	＜0.3	/
比损耗因子$\tan\delta/\mu_i$ Relative loss factor	10kHz 100kHz	$\times 10^{-6}$	＜3 ＜4.5	＜1.0 ＜2.0	＜2.7 ＜4.2	＜5 ＜70 (500kHz)	＜2 /	＜3 ＜20	/ ＜20
饱和磁感应强度Bs Saturation magnetic flux density	25℃ 100℃	mT	490 390	550 435	430 320	430 270	390 160	420 220	400 230
剩磁Br Remanence	25℃ 100℃	mT	100 80	90 240	65 60	80 70	90 80	90 100	300 170
矫顽力Hc Coercivity	25℃ 100℃	A/m	16 12	15 21	26 19	8 6	8 6	8 7	25 10
功率损耗P_{CV} Core loss (100kHz 200mT)	25℃ 100℃	kW/m³	380 660	/	/	/	/	/	/
电阻率ρ Electrical resistivity		Ω·m	1	1	3	0.8	0.5	0.2	10
居里温度Tc Curie temperature		℃	≥200	≥260	≥180	≥140	≥105	≥120	≥130
密度d Density		kg/m³	4.8×10^3	4.9×10^3	4.7×10^3	4.9×10^3	4.95×10^3	4.9×10^3	4.8×10^3

注：各表格所列值均为典型值，不包括客户的特殊要求；有特殊要求时，应在订货合同或协议中给予明确。

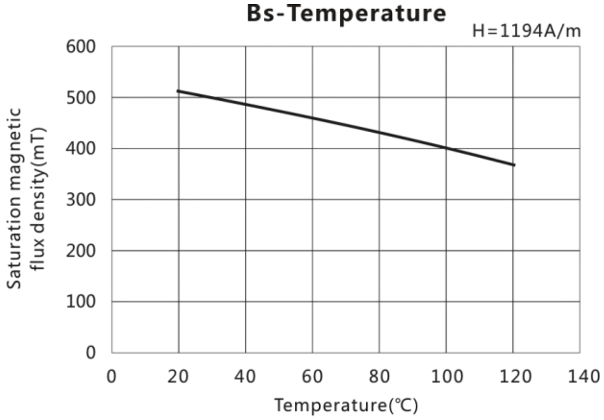
Remark：The value of material's characteristics are typical value, excluding customers' special requirements.
Please contact our company for more characteristics in your order or agreement.

材料 / Material: **TP4**

特点 / Features:

1. 主要应用于中频段(小于200kHz) / Mostly Used at Middle Frequency(Less than 200kHz)
2. 低磁心损耗，高饱和磁感应强度 / Low Core Loss and High Saturation Flux Density
3. 损耗最低的温度点约在90℃ / The Temperature Point of the Lowest Core Loss is 90℃

Bs-Temperature



Initial permeability	μ_i	25℃	2300±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	510
		100℃	390
Remanence	Br(mT)	25℃	100
		100℃	55
Coercivity	Hc(A/m)	25℃	14
		100℃	9
Core loss	Pcv(kW/m^3) 100kHz 200mT	25℃	650
		100℃	410
		120℃	500
Curie temperature	Tc(℃)		≥220
Electrical resistivity	ρ(Ω·m)		6.5
Density	d(kg/m^3)		4.8×10^3

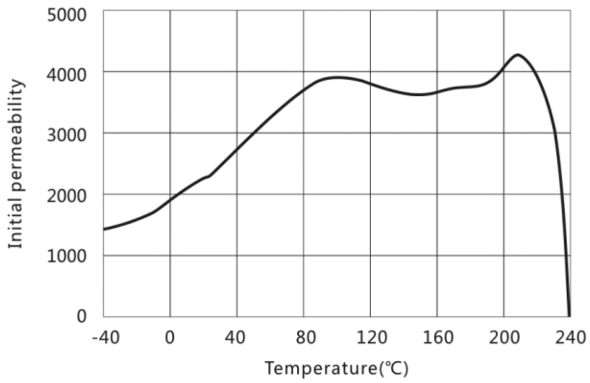
Test core：Toroid(mm)

OD：25

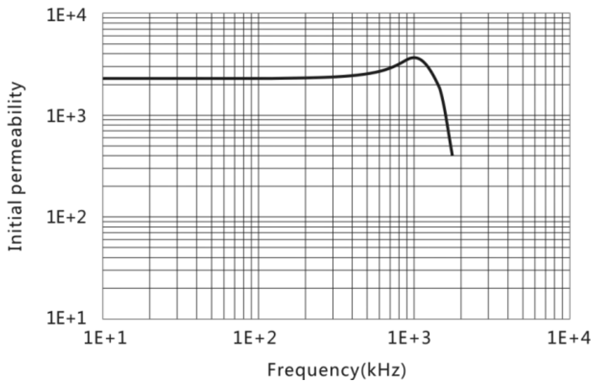
ID：15

H：7.5

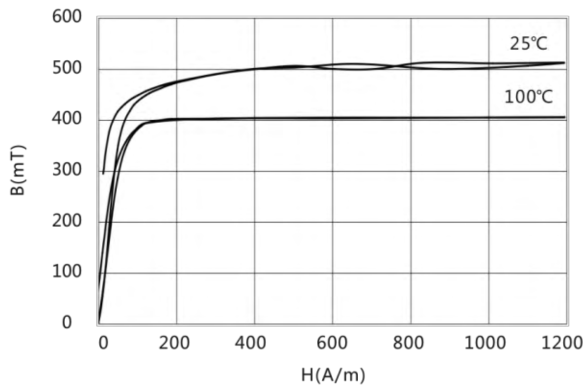
μ_i-Temperature



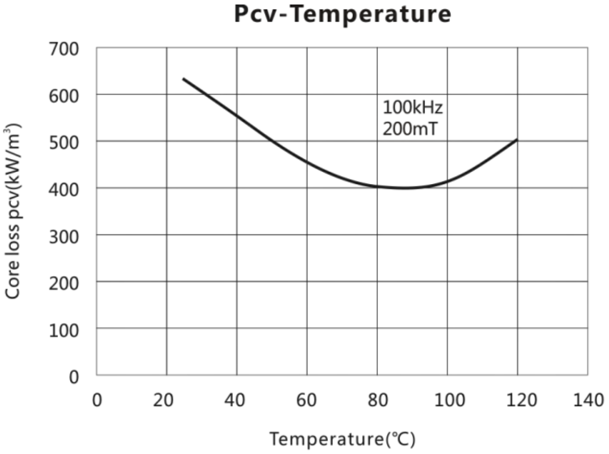
μ_i-Frequency

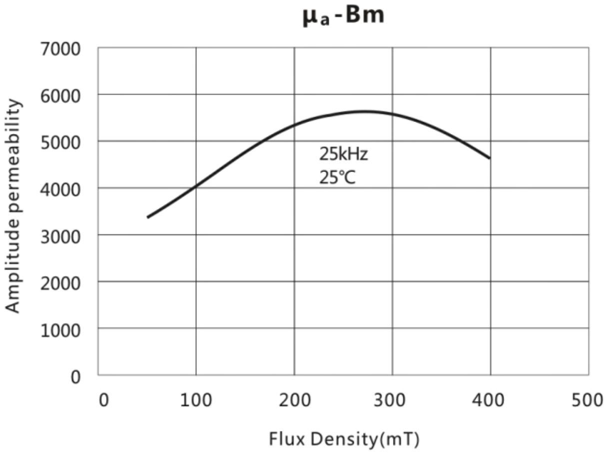


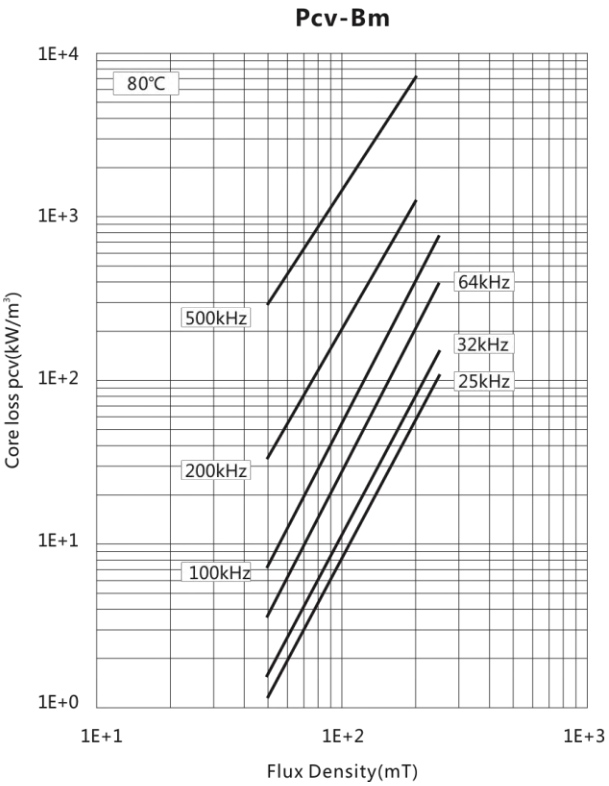
B-H

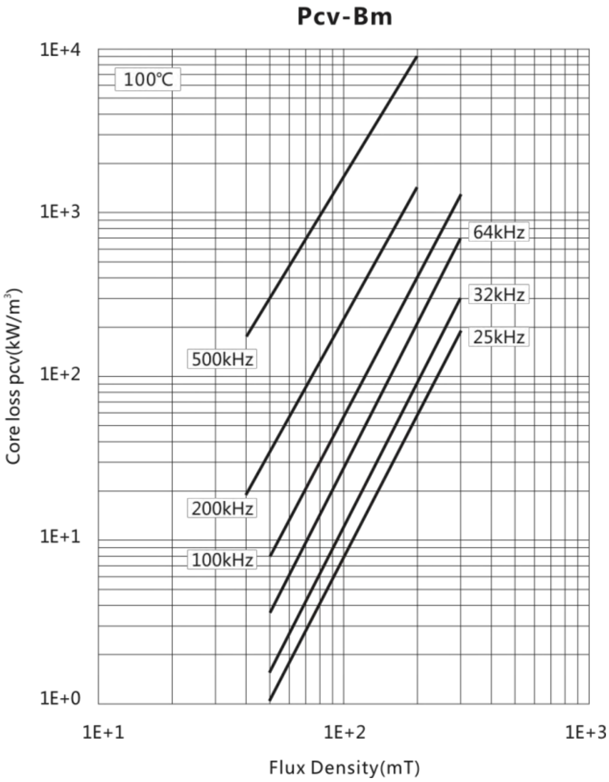


材料 / Material: **TP4**







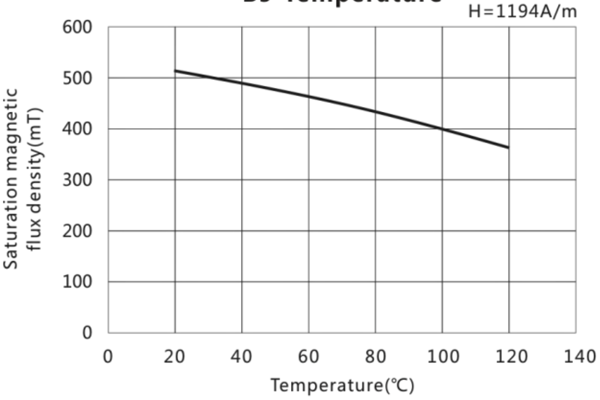


材料 / Material: **TP4A**

特点 / Features:

1. 主要应用于中频段(小于300kHz) / Mostly Used at Middle Frequency(Less than 300kHz)
2. 低磁心损耗，高饱和磁感应强度 / Low Core Loss and High Saturation Flux Density
3. 损耗最低的温度点约在90℃ / The Temperature Point of the Lowest Core Loss is 90℃

Bs-Temperature



Initial permeability	μ_i	25℃	2400±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	510
		100℃	390
Remanence	Br(mT)	25℃	110
		100℃	60
Coercivity	Hc(A/m)	25℃	13
		100℃	6.5
Core loss	Pcv(kW/m^3) 100kHz 200mT	25℃	600
		100℃	300
		120℃	400
Curie temperature	Tc(℃)		≥215
Electrical resistivity	ρ(Ω·m)		6.5
Density	d(kg/m^3)		4.8×10^3

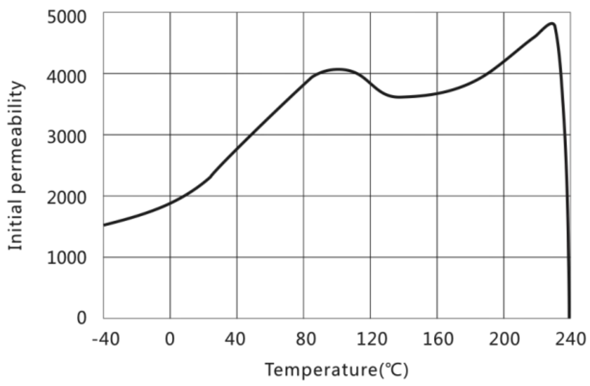
Test core：Toroid(mm)

OD：25

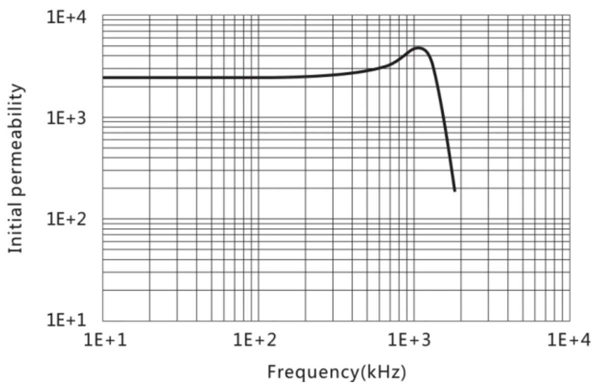
ID：15

H：7.5

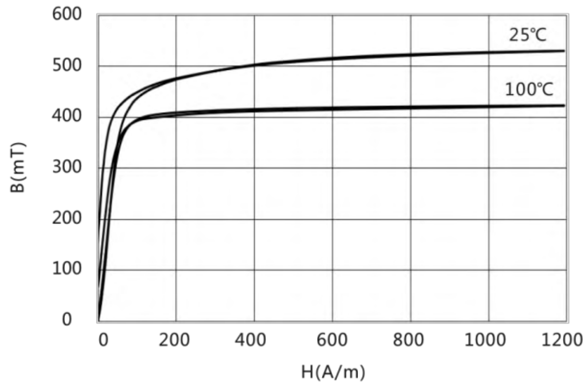
μ_i-Temperature



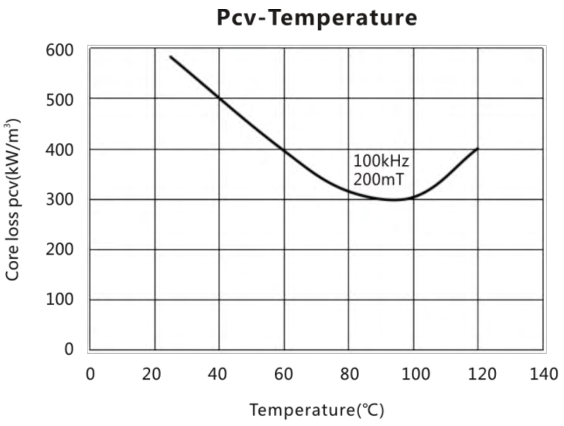
μ_i-Frequency

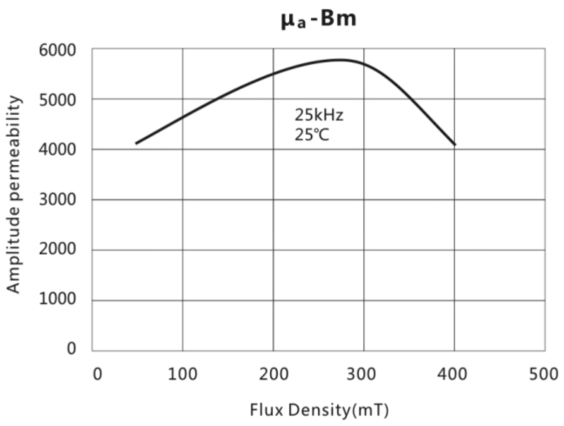


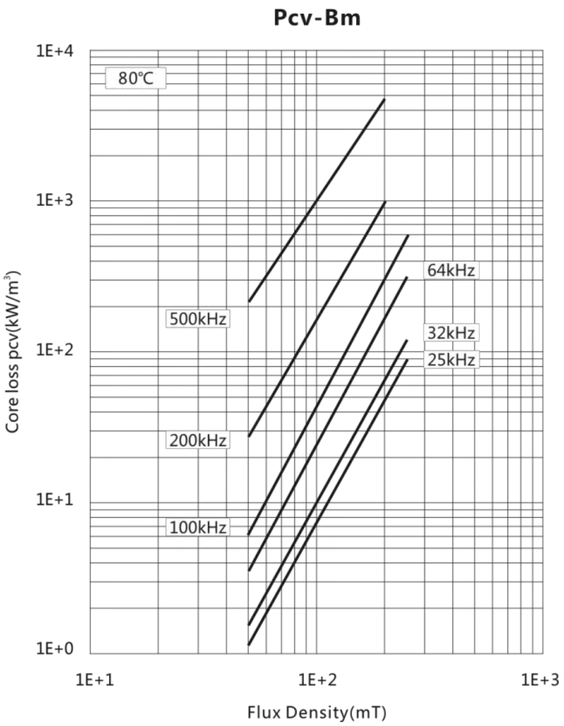
B-H

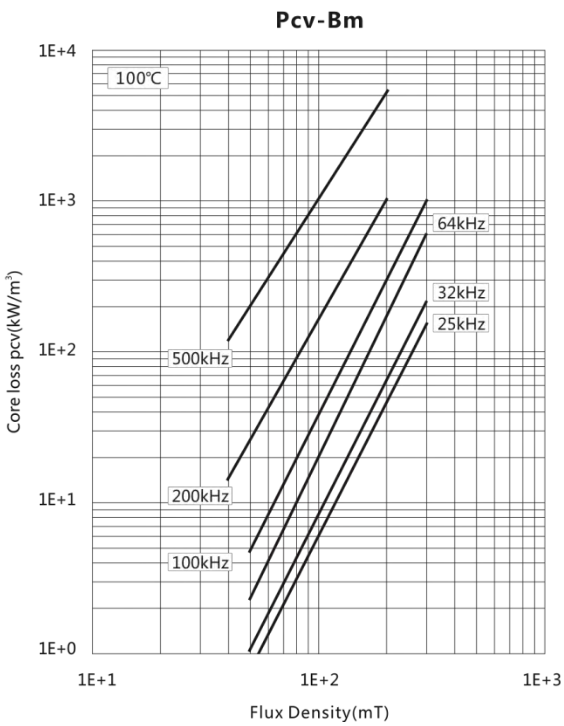


材料 / Material: **TP4A**







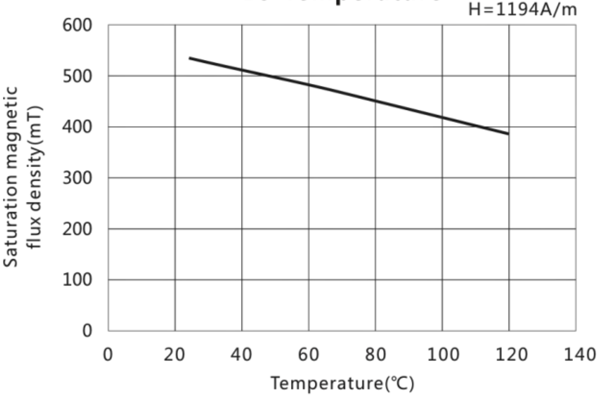


材料 / Material: **TP4B**

特点 / Features:

1. 低磁心损耗，高饱和磁感应强度 / Low Core Loss and High Saturation Flux Density
2. 主要应用较低温度(60℃～80℃)和中频段(100kHz到300kHz) / Mostly Used on Lower Temperature (60℃～80℃) and Middle Frequency(100kHz to 300kHz)

Bs-Temperature



Initial permeability	μ_i	25℃	2500±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	530
		100℃	420
Remanence	Br(mT)	25℃	120
		100℃	80
Coercivity	Hc(A/m)	25℃	12
		100℃	8
Core loss	Pcv(kW/m^3) 100kHz 200mT	25℃	570
		75℃	250
		100℃	460
Curie temperature	Tc(℃)		≥220
Electrical resistivity	ρ(Ω·m)		3
Density	d(kg/m^3)		4.8×10^3

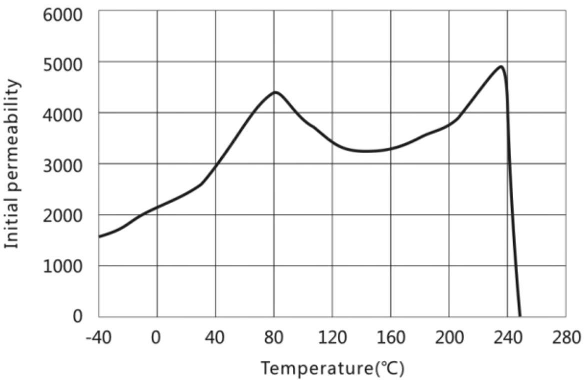
Test core：Toroid(mm)

OD：25

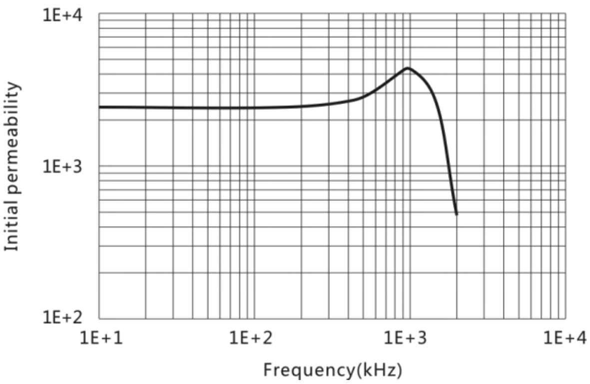
ID：15

H：7.5

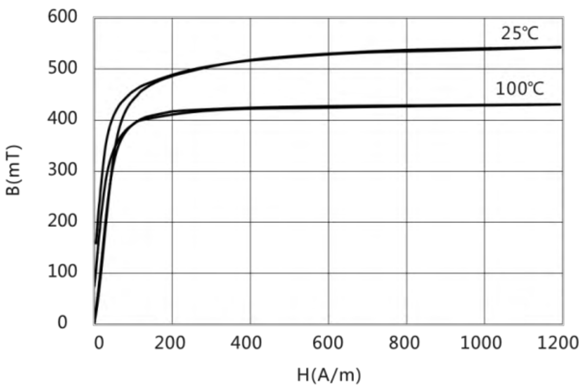
μ_i-Temperature



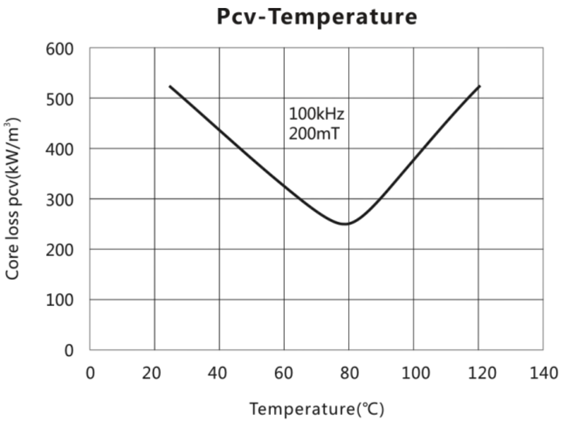
μ_i-Frequency

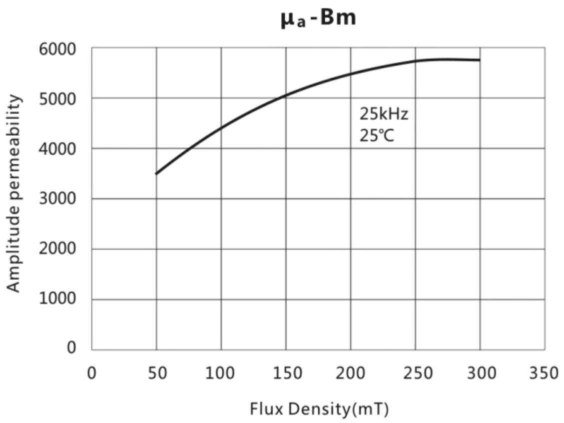


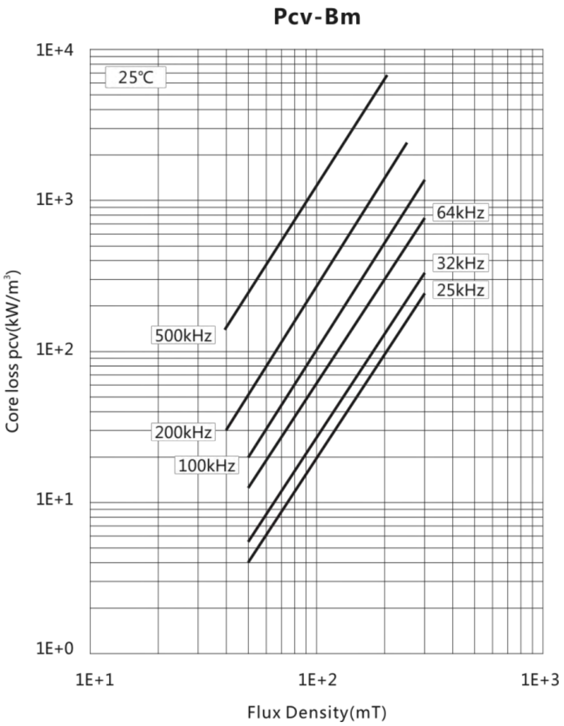
B-H

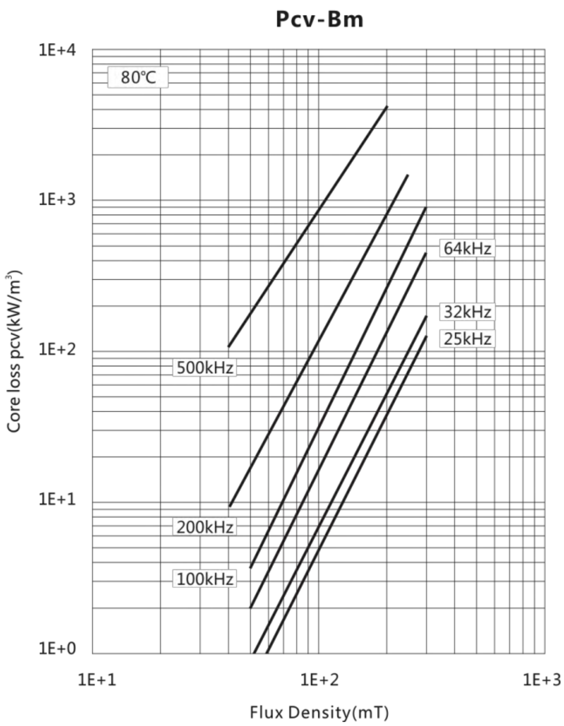


材料 / Material: **TP4B**





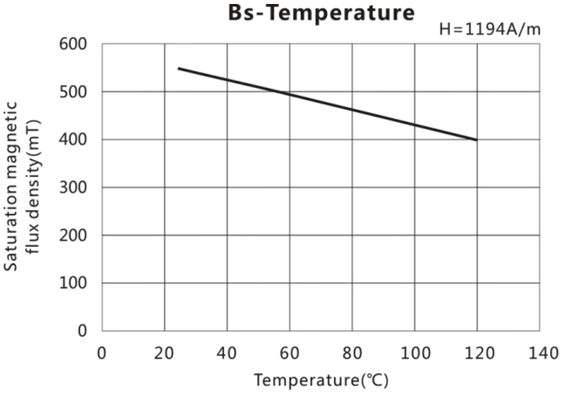




材料 / Material: **TP4C**

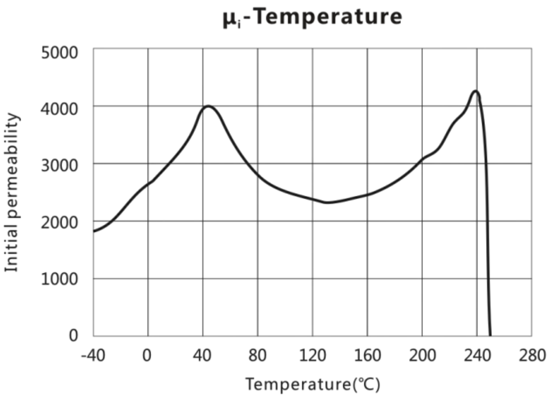
特点 / Features:

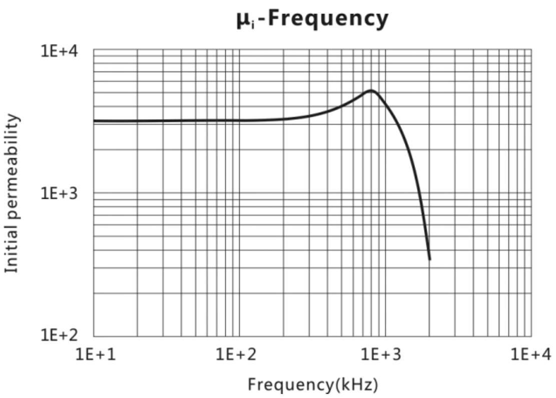
1. 低磁心损耗，高饱和磁感应强度 / Low Core Loss and High Saturation Flux Density
2. 主要应用较低温度(40℃～50℃)和中频段(100kHz到300kHz) / Mostly Used on Lower Temperature (40℃～50℃) and Middle Frequency(100kHz to 300kHz)

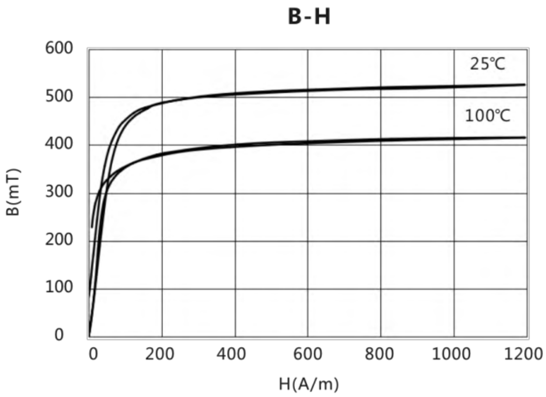


Initial permeability	μ_i	25℃	3200±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	530
		100℃	420
Remanence	Br(mT)	25℃	130
		100℃	80
Coercivity	Hc(A/m)	25℃	11
		100℃	10
Core loss	Pcv(kW/m^3) 100kHz 200mT	25℃	350
		45℃	250
		100℃	660
Curie temperature	Tc(℃)		≥220
Electrical resistivity	ρ(Ω·m)		3
Density	d(kg/m^3)		4.8×10^3

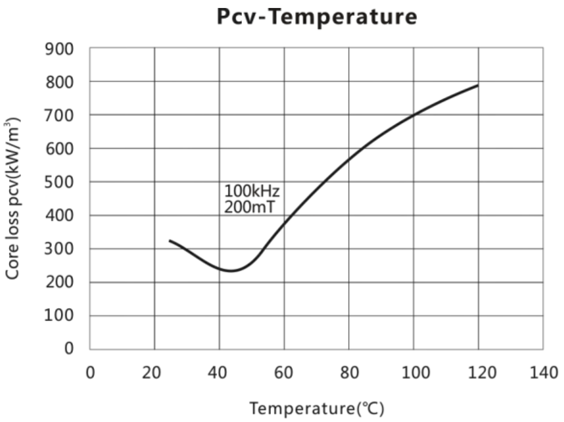
Test core：Toroid(mm)
OD：25
ID：15
H：7.5

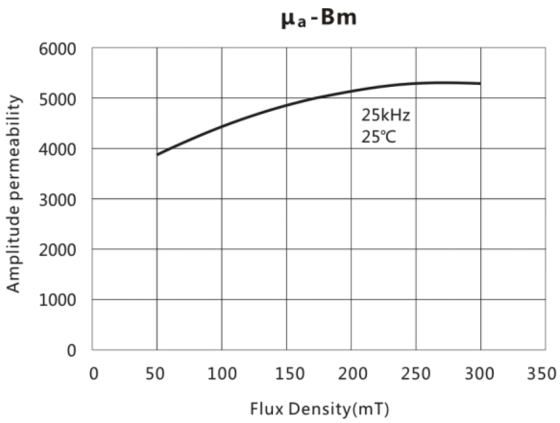


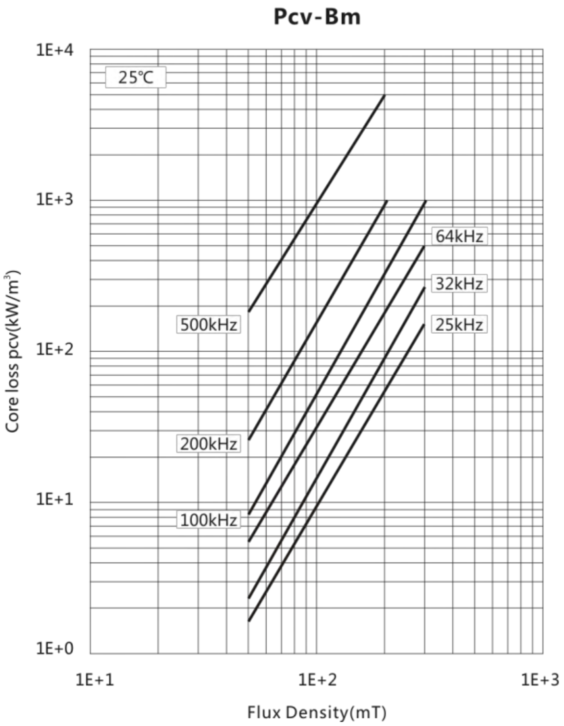


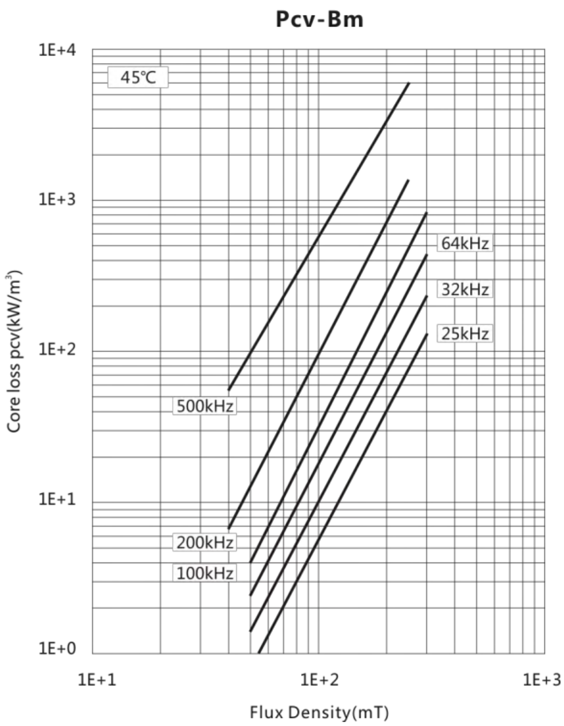


材料 / Material: **TP4C**





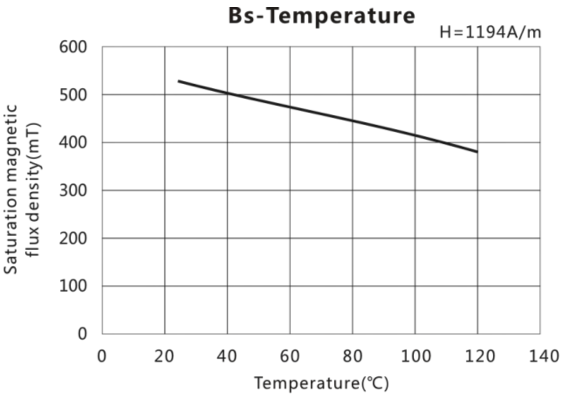




材料 / Material: **TP4D**

特点 / Features:

1. 低磁心损耗，高饱和磁感应强度 / Low Core Loss and High Saturation Flux Density
2. 损耗最低的温度点约在100℃ / The Temperature Point of the Lowest Core Loss is 100℃



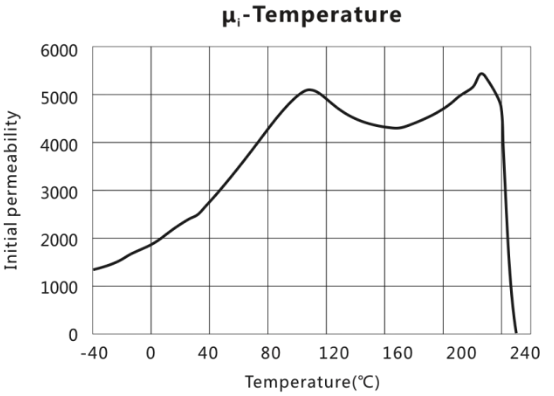
Initial permeability	μ_i	25℃	2500±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	520
		100℃	410
Remanence	Br(mT)	25℃	210
		100℃	60
Coercivity	Hc(A/m)	25℃	14
		100℃	7
Core loss	Pcv(kW/m^3) 100kHz 200mT	25℃	600
		60℃	400
		100℃	250
Curie temperature	Tc(℃)		≥220
Electrical resistivity	ρ(Ω·m)		4
Density	d(kg/m^3)		4.8×10^3

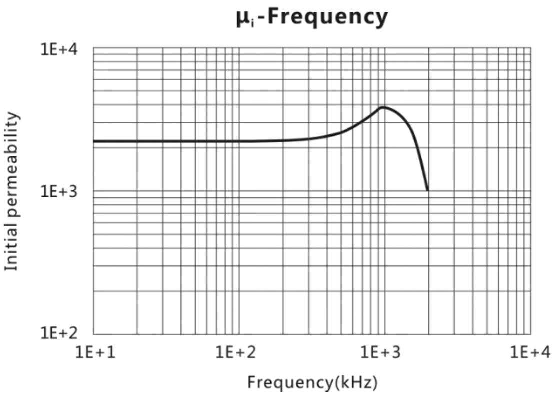
Test core：Toroid(mm)

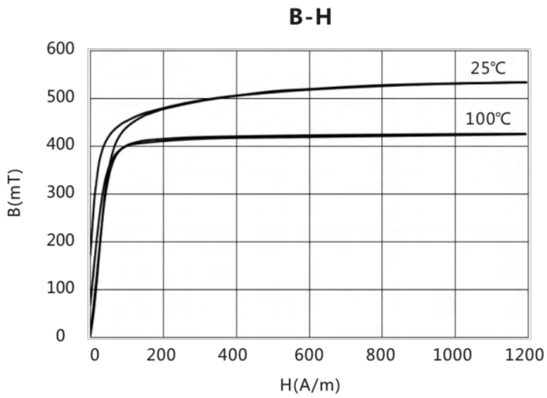
OD：25

ID：15

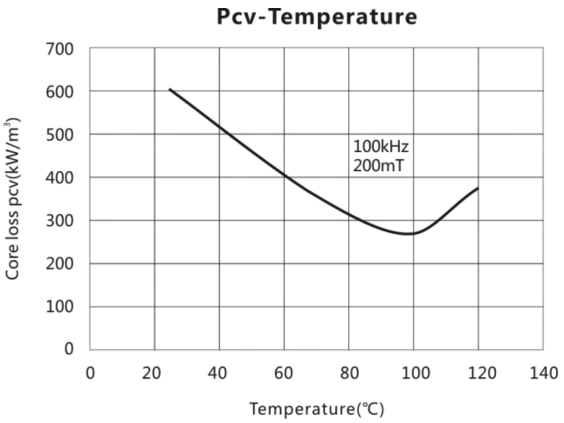
H：7.5

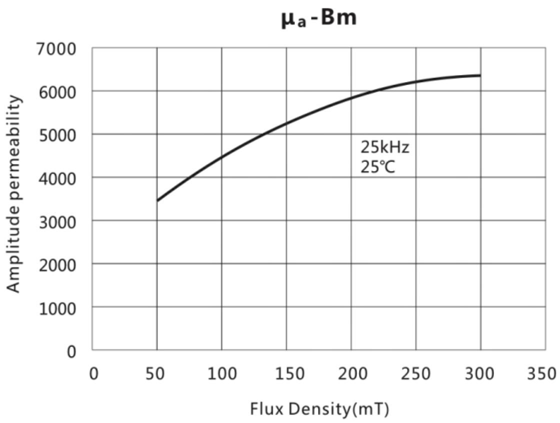


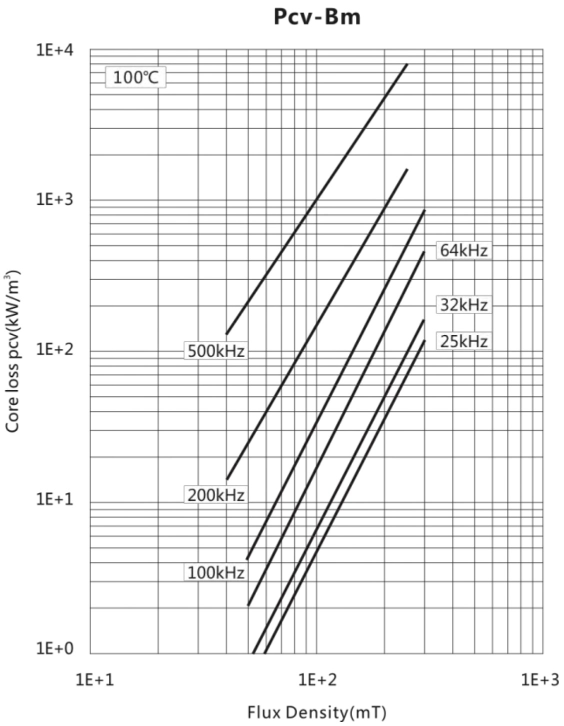


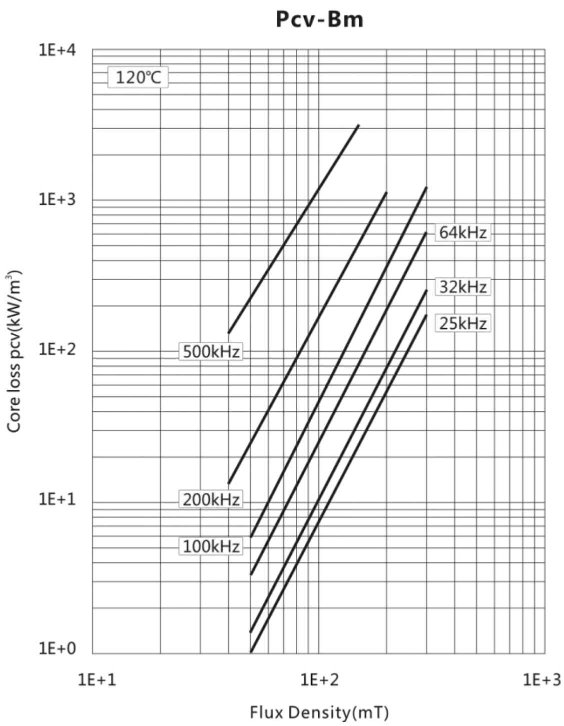


材料 / Material: **TP4D**





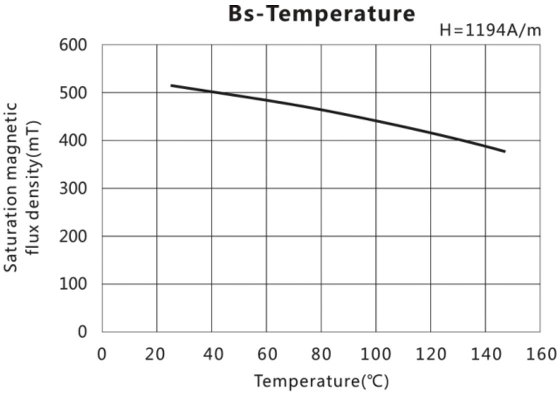




材料 / Material: **TP4E**

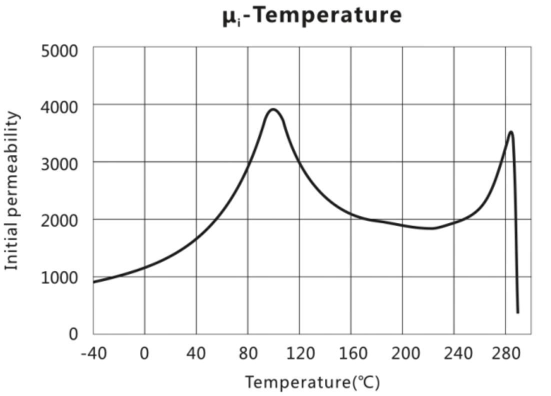
特点 / Features:

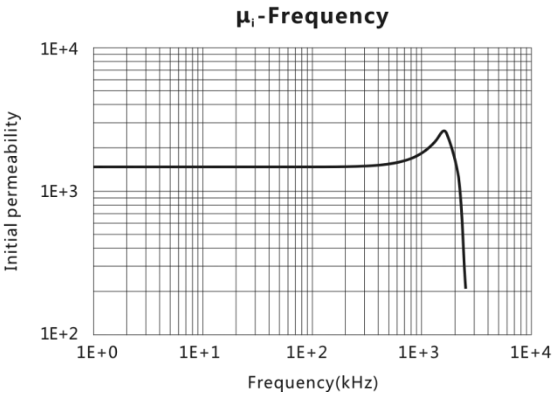
1. 低磁心损耗，高饱和磁感应强度 / Low Core Loss and High Saturation Flux Density
2. 居里温度较高 / Higher Curie Temperature

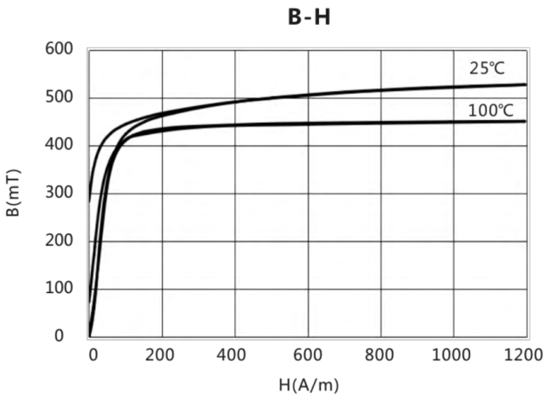


Initial permeability	μ_i	25℃	1500±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	510
		100℃	440
Remanence	Br(mT)	25℃	210
		100℃	70
Coercivity	Hc(A/m)	25℃	24
		100℃	13
Core loss	Pcv(kW/m^3) 100kHz 200mT	25℃	1000
		100℃	480
Curie temperature	Tc(℃)		≥285
Electrical resistivity	ρ(Ω·m)		3
Density	d(kg/m^3)		4.8×10^3

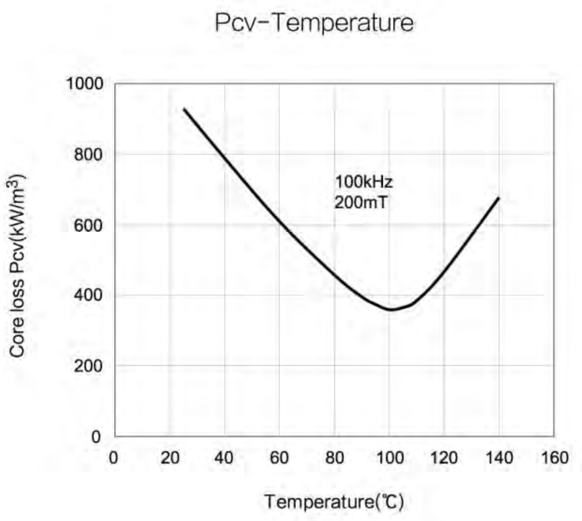
Test core：Toroid(mm)
OD：25
ID：15
H：7.5

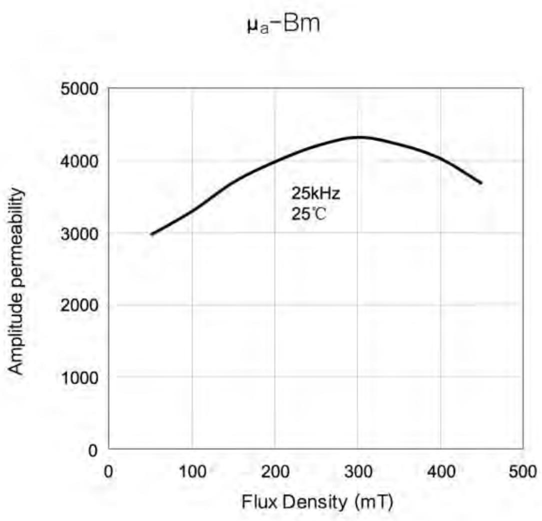


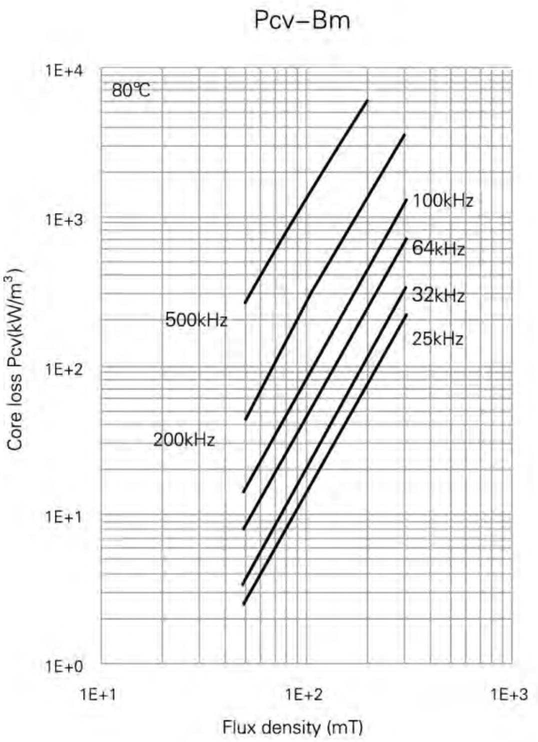


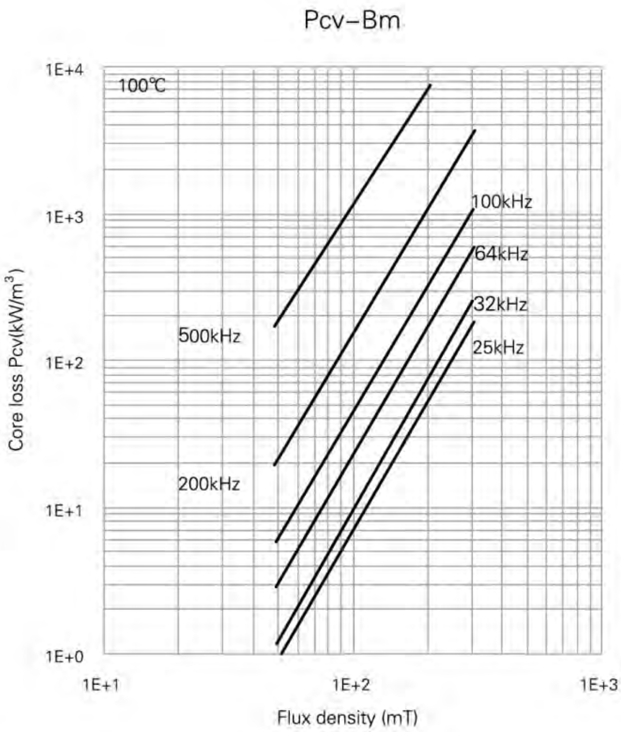


材料 / Material: **TP4E**







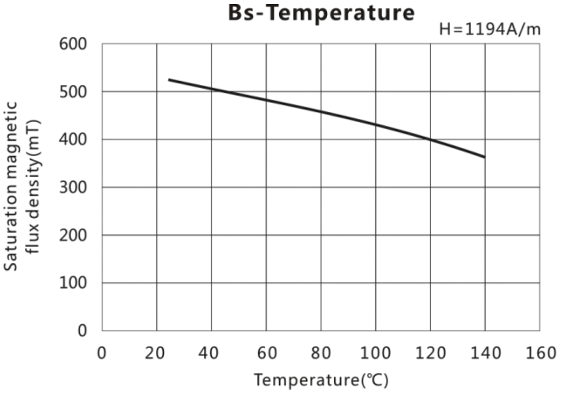


材料 / Material: **TP4F**

特点 / Features:

1. 主要应用于高温领域(120℃～150℃) / Mostly Used at High Temperature(From 120℃ to 150℃)
2. 应用于中频段(小于500kHz) / Used at Middle Frequency(Less than 500kHz)
3. 高温高Bs(140℃时Bs还有360mT) / High Bs at High Temperature(Above 360mT at 140℃)
4. 高温低损耗 / Low Core Loss at High Temperature
5. 功耗最低点在140℃左右 / The Minimum Core Loss is Around 140℃

Bs-Temperature



Initial permeability	μ_i	25℃	1800±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	520
		100℃	430
		140℃	360
Remanence	Br(mT)	25℃	130
		100℃	80
Coercivity	Hc(A/m)	25℃	13
		100℃	9
Core loss	Pcv(kW/m³) 100kHz 200mT	25℃	900
		100℃	500
		140℃	400
Curie temperature	Tc(℃)		240
Electrical resistivity	ρ(Ω·m)		4
Density	d(kg/m³)		4.8×10^3

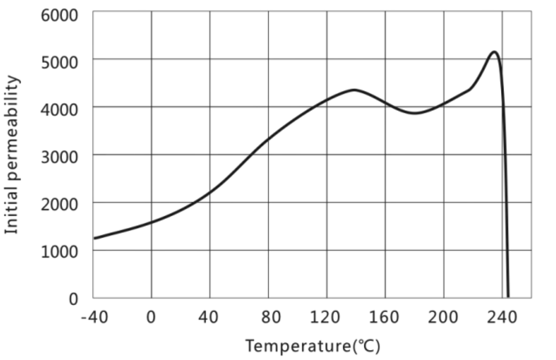
Test core：Toroid(mm)

OD：25

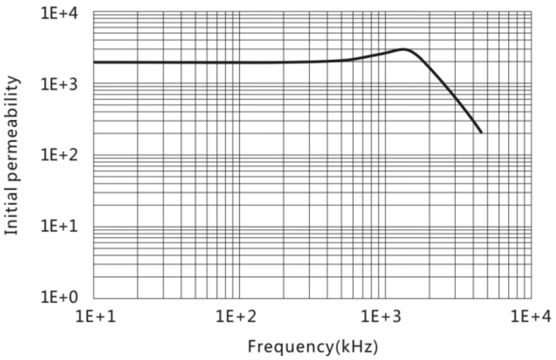
ID：15

H：7.5

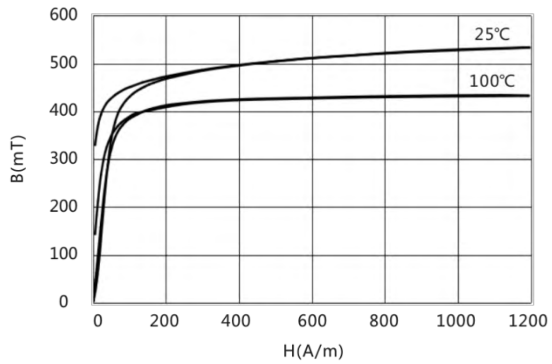
μ_i-Temperature



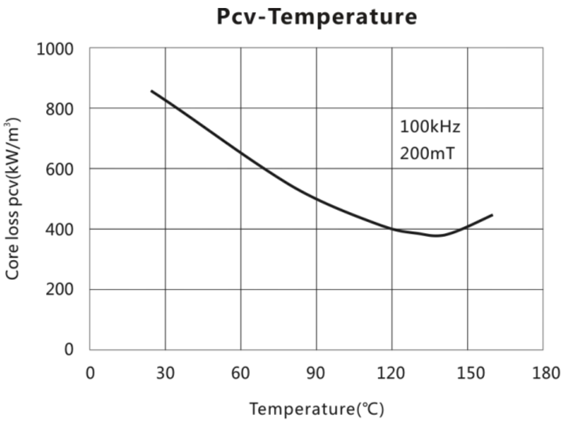
μ_i-Frequency

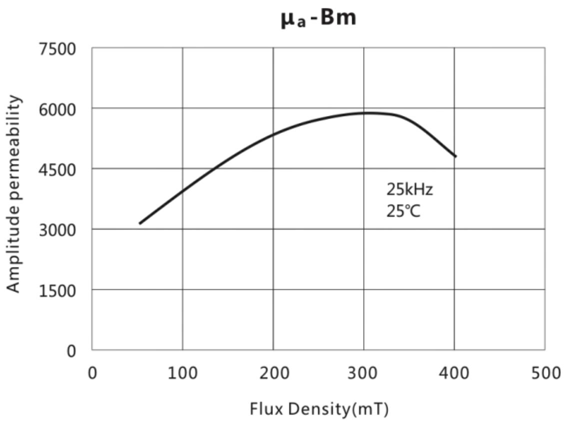


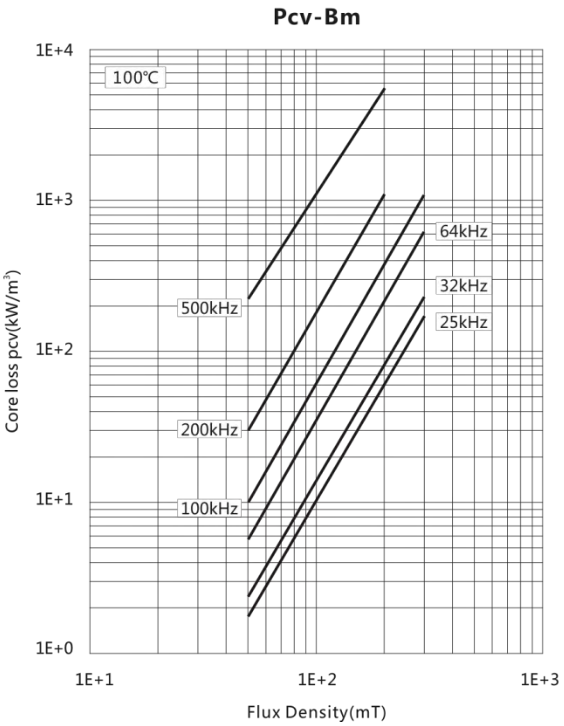
B-H

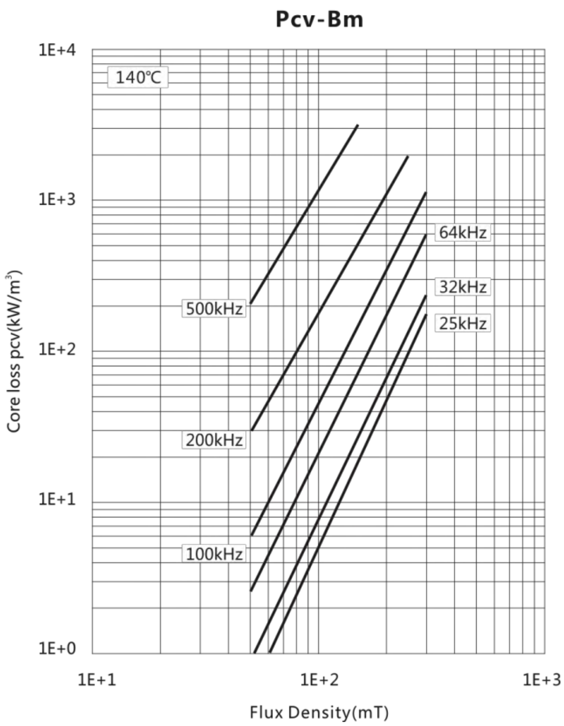


材料 / Material: **TP4F**





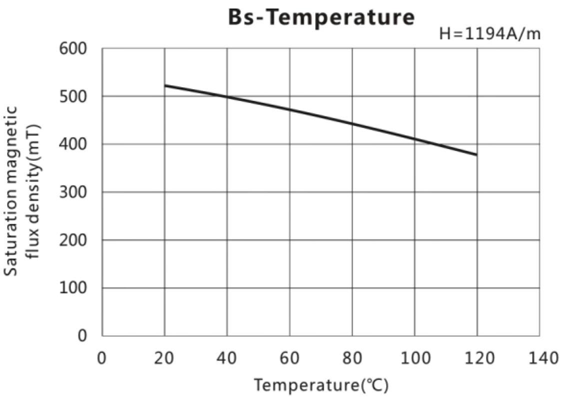




材料 / Material: **TP4S**

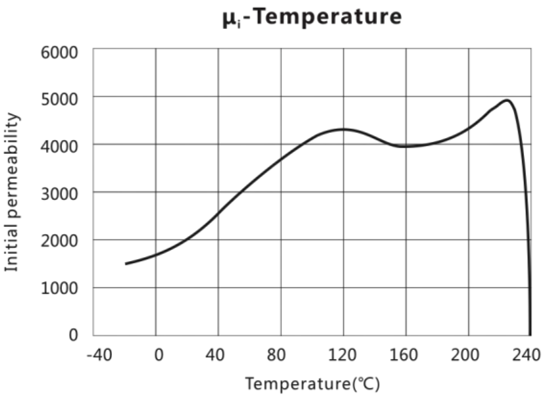
特点 / Features:

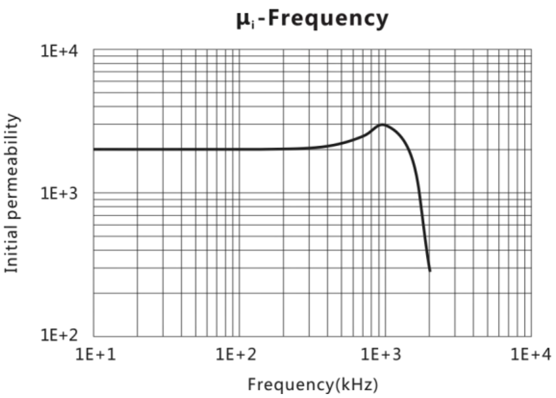
1. 主要应用于中频段(小于300kHz) / Mostly Used at Middle Frequency(Less than 300kHz)
2. 低磁心损耗，高饱和磁感应强度 / Low Core Loss and High Saturation Flux Density
3. 损耗最低的温度点约在100℃～110℃ / The Temperature Point of the Lowest Core Loss is 100℃～110℃

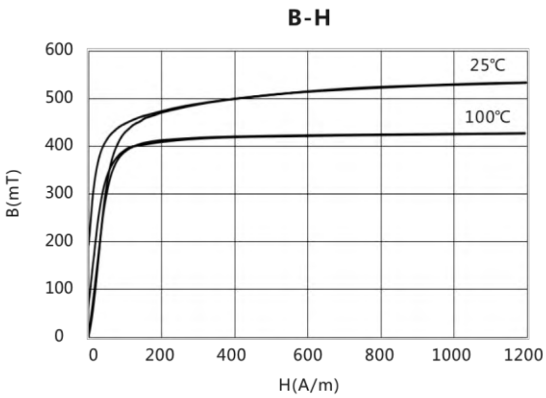


Initial permeability	μ_i	25℃	2000±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	520
		100℃	410
Remanence	Br(mT)	25℃	135
		100℃	60
Coercivity	Hc(A/m)	25℃	13
		100℃	7
Core loss	Pcv(kW/m^3) 100kHz 200mT	25℃	650
		100℃	300
		120℃	350
Curie temperature	Tc(℃)		≥220
Electrical resistivity	ρ(Ω·m)		6.5
Density	d(kg/m^3)		4.8×10^3

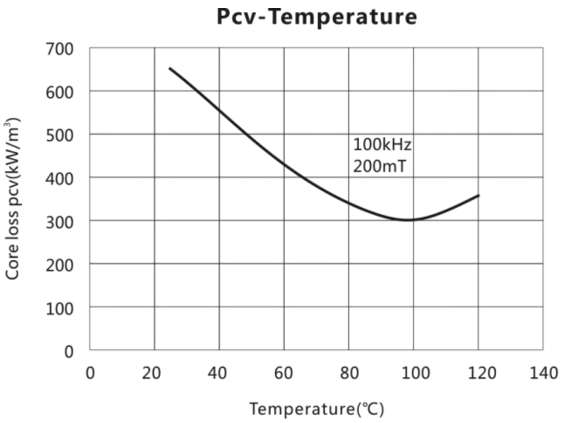
Test core：Toroid(mm)
OD：25
ID：15
H：7.5

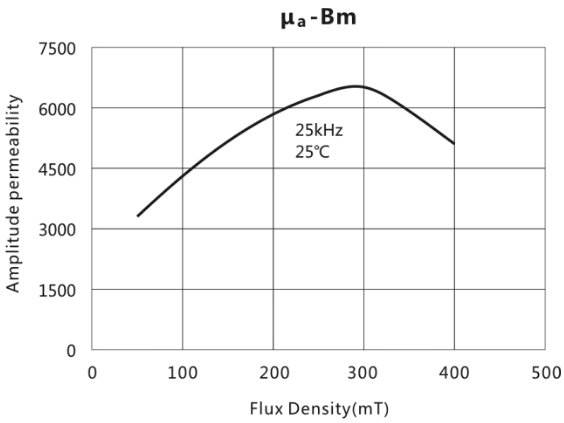


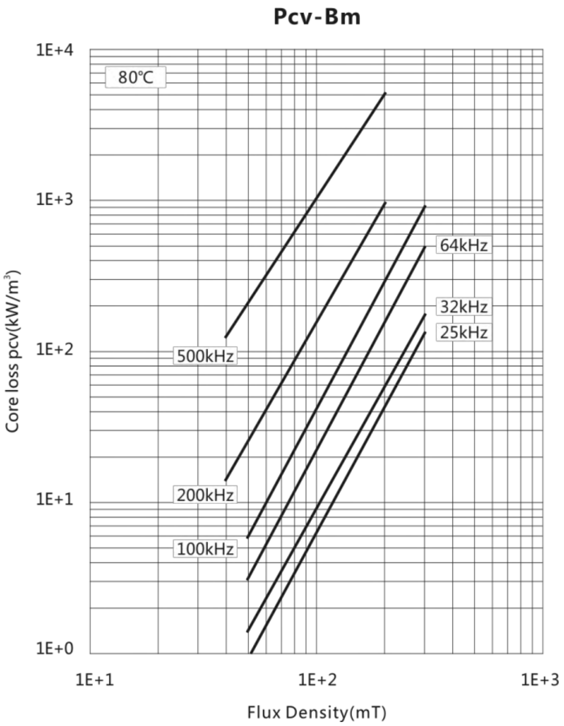


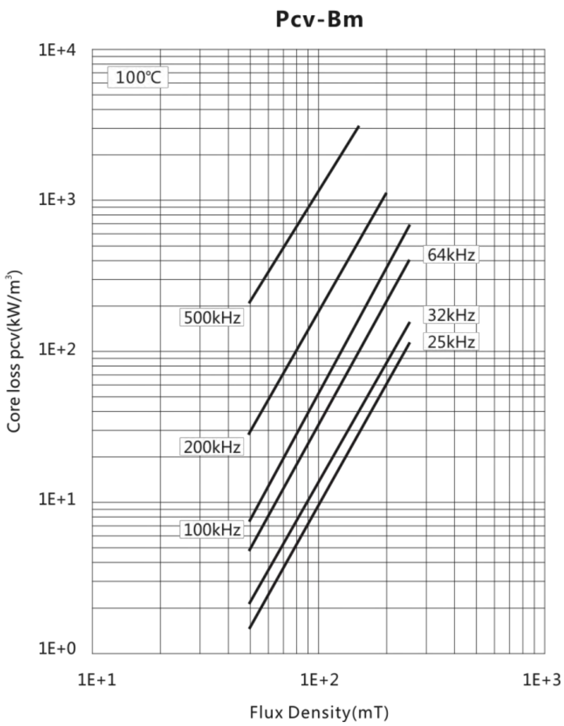


材料 / Material: **TP4S**







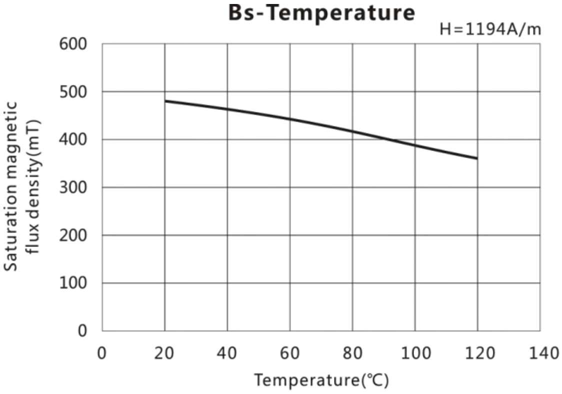


材料 / Material: **TP5**

特点 / Features:

1. 主要应用于高频段(300kHz到1MHz) / Mostly Used at High Frequency(From 300 kHz to 1 MHz)
2. 损耗最低的温度点在80℃ / The Temperature Point of the Lowest Core Loss is 80℃

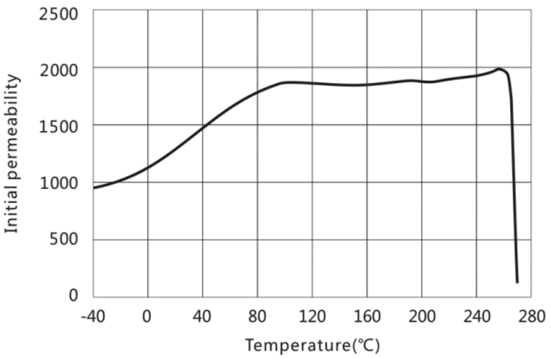
Bs-Temperature



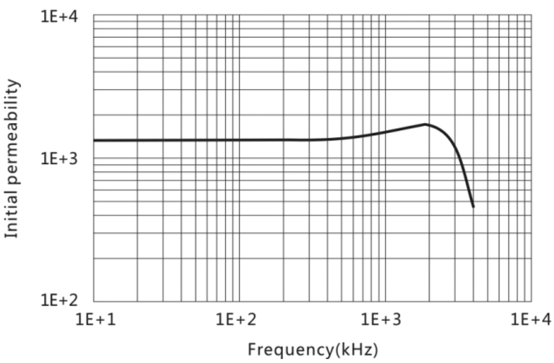
Initial permeability	μ_i	25℃	1400±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	470
		100℃	380
Remanence	Br(mT)	25℃	140
		100℃	98
Coercivity	Hc(A/m)	25℃	36.5
		100℃	27.2
Core loss pcv(kW/m³)	500kHz 50mT	25℃	130
		100℃	80
	1MHz 50mT	60℃	600
		100℃	500
Curie temperature			≥240
Electrical resistivity	ρ(Ω·m)		8
Density	d(kg/m³)		4.7×10^3

Test core：Toroid(mm)
Od：25
ID：15
H：7.5

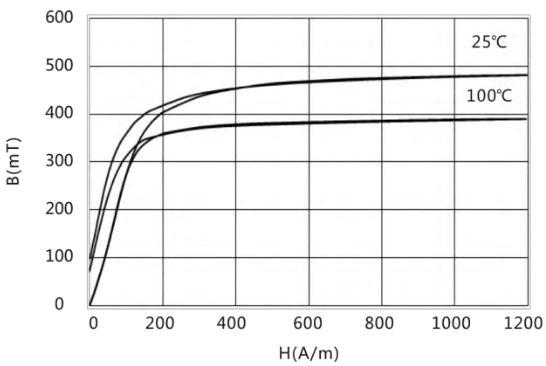
μᵢ-Temperature



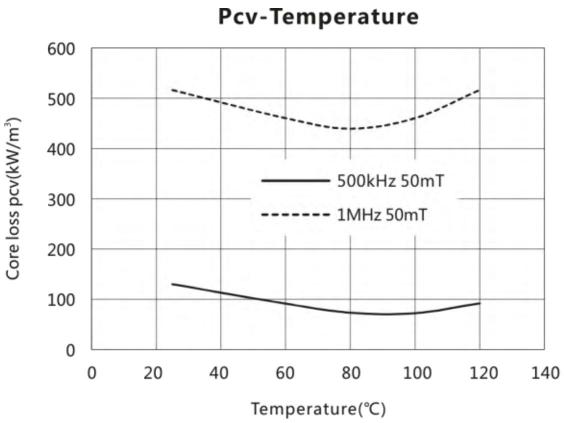
μᵢ-Frequency

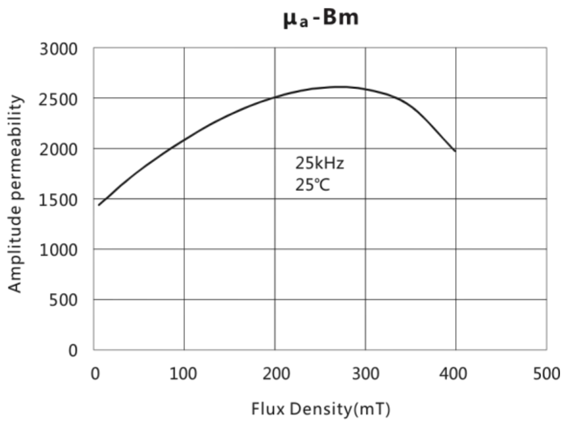


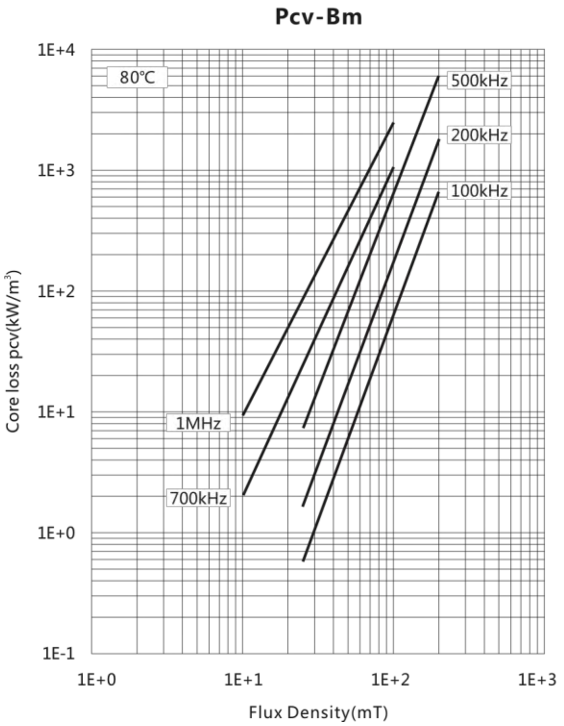
B-H

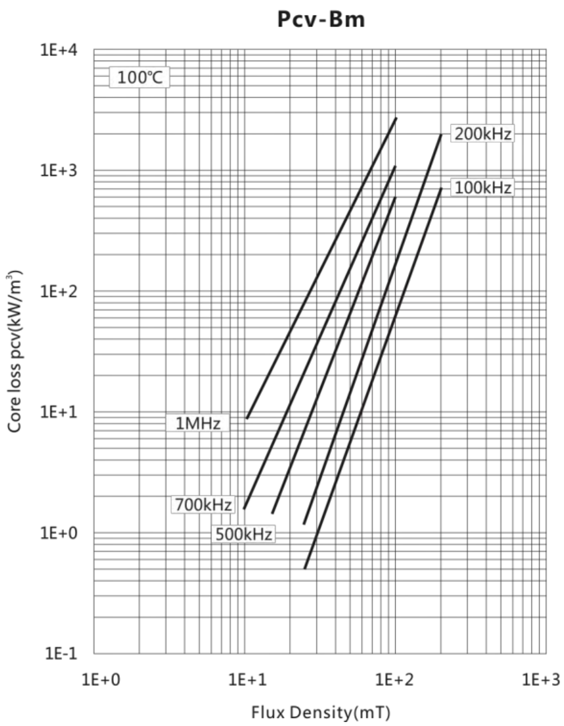


材料 / Material: **TP5**





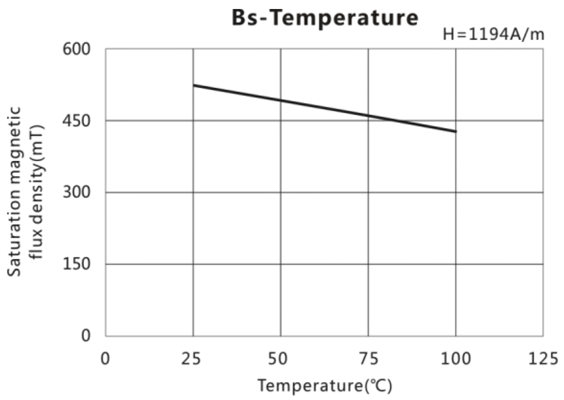




材料 / Material: **TP5E**

特点 / Features:

1. 主要应用于超高频段（1MHz～3MHz) / Mostly Used at High Frequency(From 1MHz to 3MHz)
2. 低磁心损耗，较高的饱和磁感应强度 / Low Core Loss and High Bs
3. 功耗最低点在100℃左右 / The Minimum Core Loss is Around 100℃
4. 居里温度较高 / Higher Curie Temperature



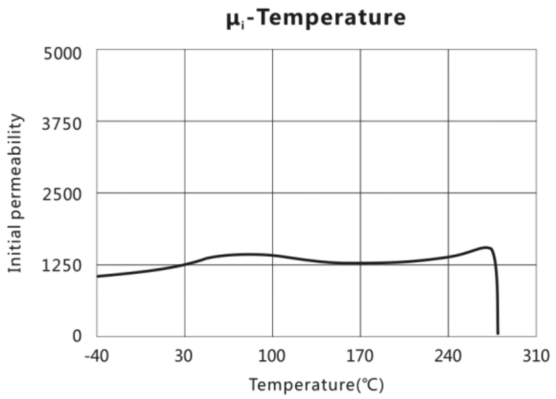
Initial permeability	μ_i	25℃	1200±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	520
		40℃	500
		100℃	420
Remanence	Br(mT)	25℃	100
		100℃	65
Coercivity	Hc(A/m)	25℃	40
		100℃	25
Core loss pcv(kW/m³)	1MHz 30mT	25℃	120
		40℃	100
		100℃	80
	1MHz 50mT	25℃	450
		40℃	400
		100℃	300
	3MHz 10mT	25℃	250
		40℃	225
		100℃	150
Curie temperature	Tc(℃)		270
Electrical resistivity	ρ(Ω·m)		9
Density	d(kg/m³)		4.7×10^3

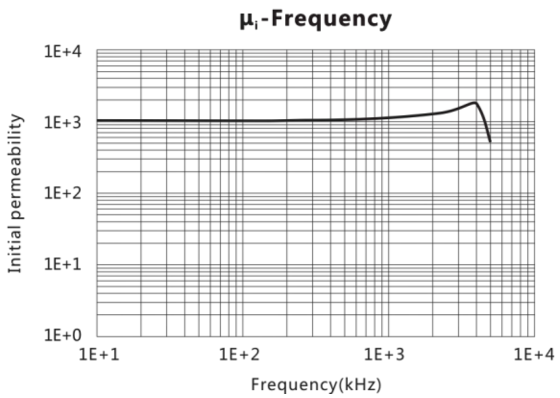
Test core：Toroid(mm)

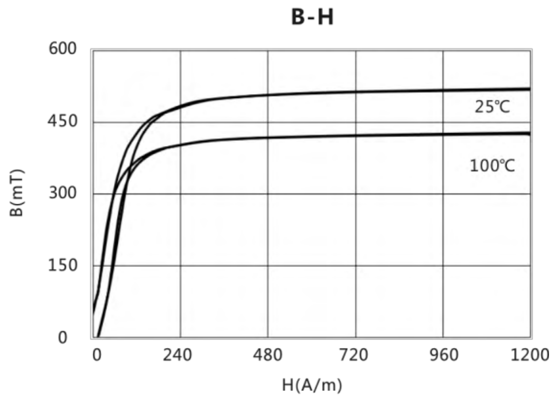
Od：18

ID：8

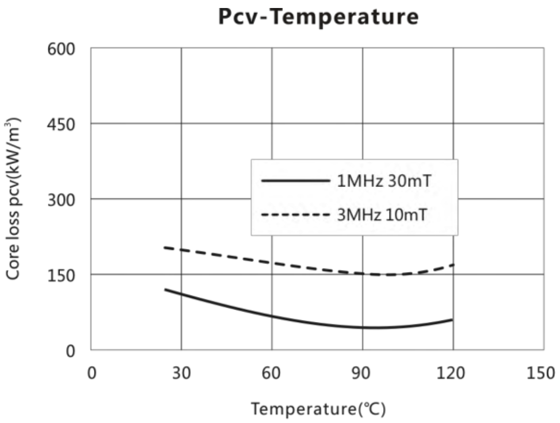
H：5

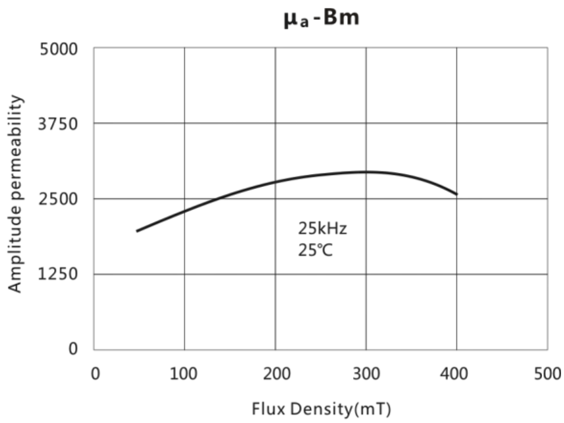


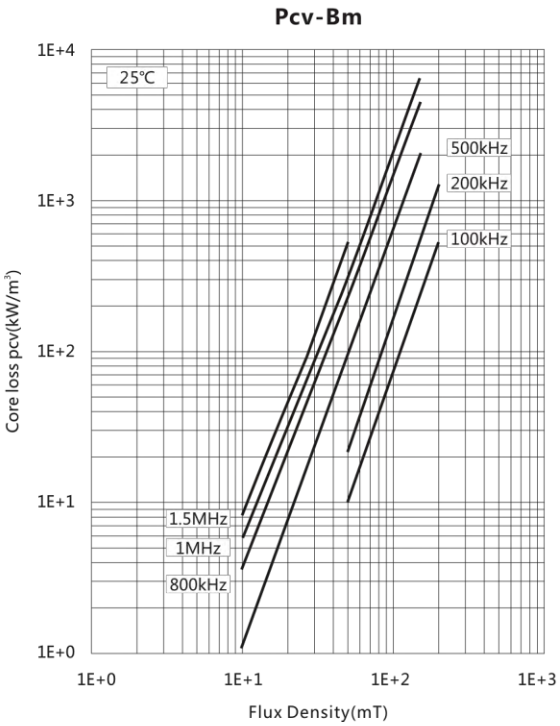


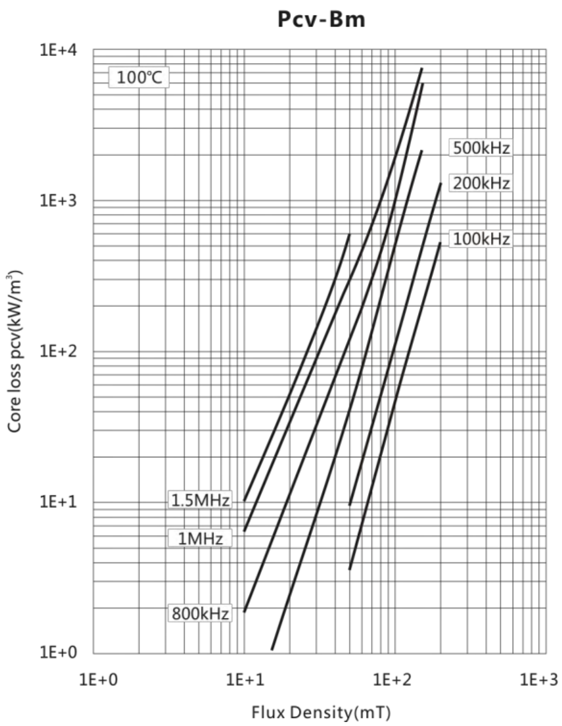


材料 / Material: **TP5E**





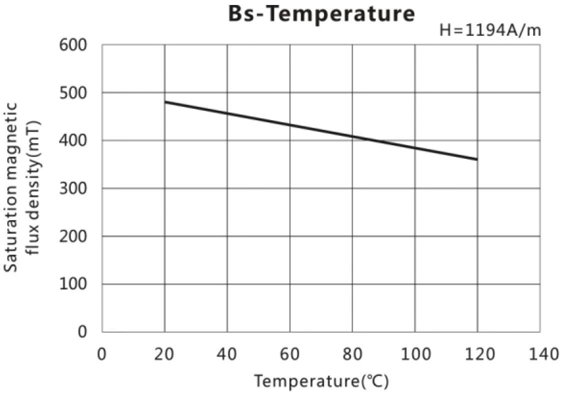




材料 / Material: **TP5i**

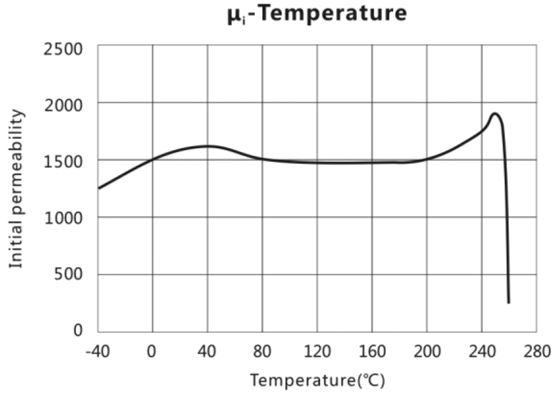
特点 / Features:

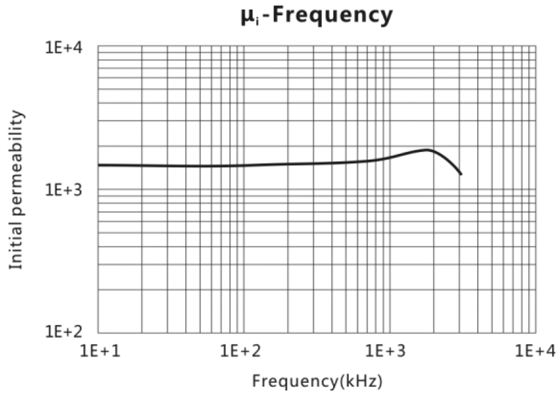
1. 主要应用于高频段(300kHz到500kHz) / Mostly Used at High Frequency(From 300 kHz to 500kHz)
2. 损耗最低的温度点在40℃ / The Temperature Point of the Lowest Core Loss is 40℃

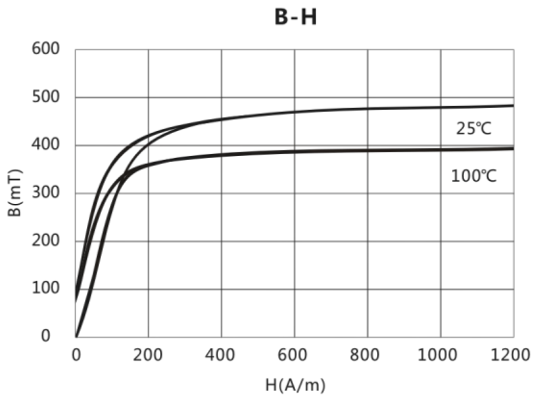


Initial permeability	μ_i	25℃	1500±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	470
		100℃	380
Remanence	Br(mT)	25℃	140
		100℃	98
Coercivity	Hc(A/m)	25℃	36.5
		100℃	27.2
Core loss pcv(kW/m³)	300kHz 100mT	30℃	300
		80℃	330
		100℃	400
	500kHz 50mT	30℃	80
		80℃	100
		100℃	120
Curie temperature	Tc(℃)		≥240
Electrical resistivity	ρ(Ω·m)		8
Density	d(kg/m³)		4.6×10^3

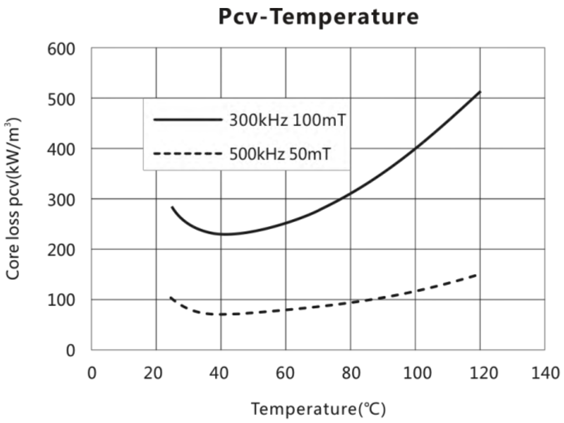
Test core：Toroid(mm)
Od：25
ID：15
H：7.5

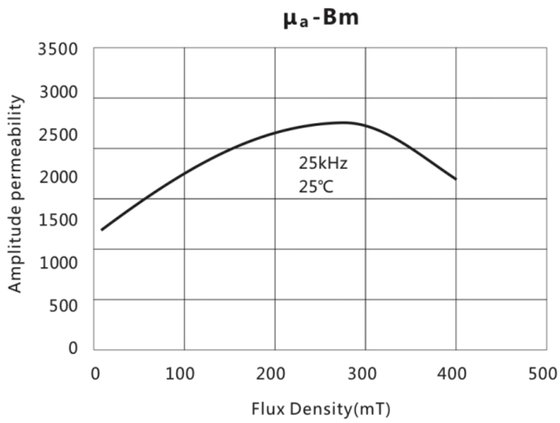


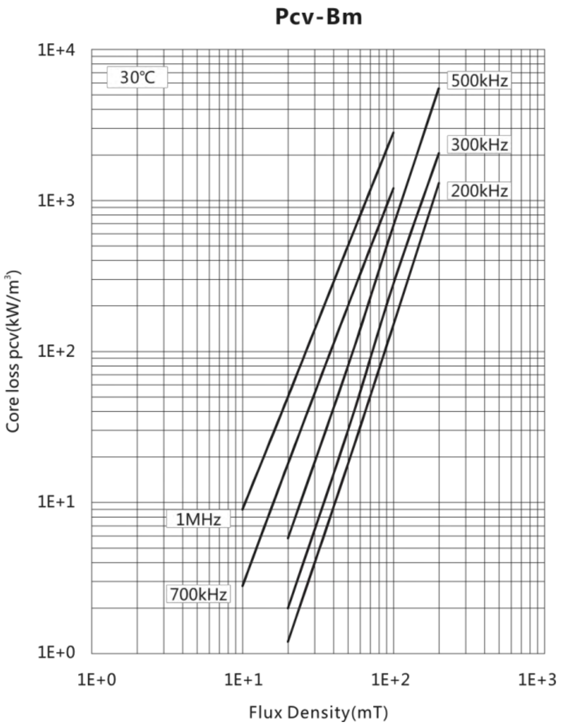


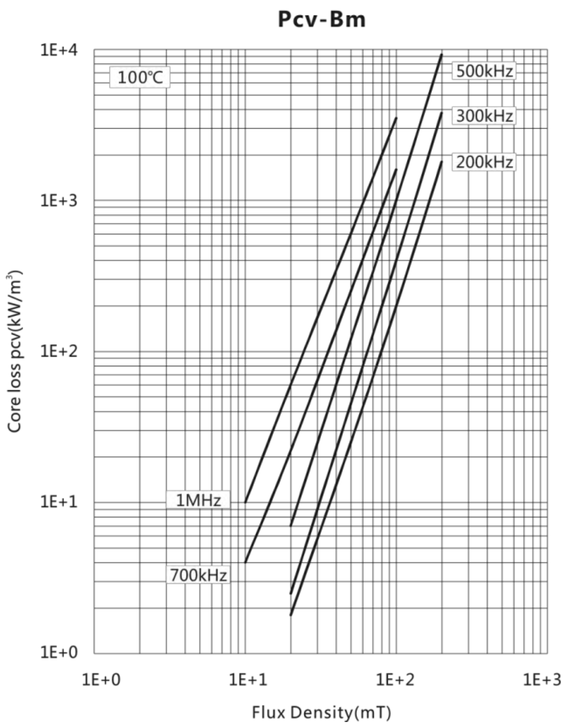


材料 / Material: **TP5i**







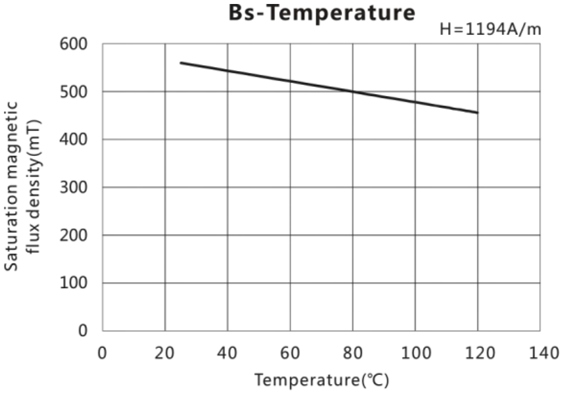


材料 / Material: **TPB12**

特点 / Features:

1. 低磁心损耗，高饱和磁感应强度 / Low Core Loss and High Saturation Flux Density
2. 损耗最低的温度点约在100℃ / The Temperature Point of the Lowest Core Loss is 100℃

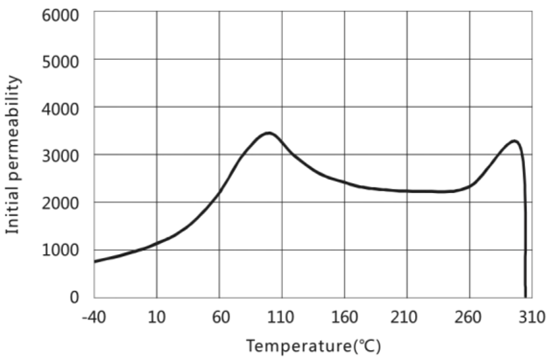
Bs-Temperature



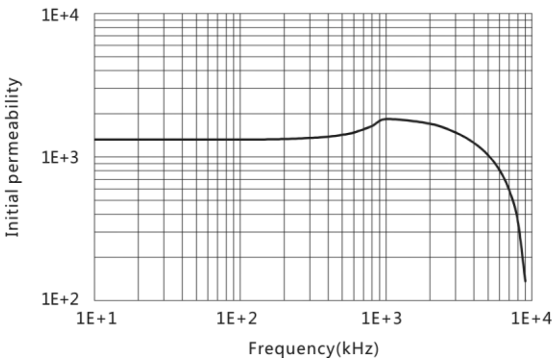
Initial permeability	μ_i	25℃	1200±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	560
		100℃	475
Remanence	Br(mT)	25℃	250
		100℃	100
Coercivity	Hc(A/m)	25℃	20
		100℃	10
Core loss	Pcv(kW/m^3) 100kHz 200mT	25℃	1100
		100℃	500
Curie temperature	Tc(℃)		≥280
Electrical resistivity	ρ(Ω·m)		6
Density	d(kg/m^3)		4.9×10^3

Test core：Toroid(mm)
OD：25
ID：15
H：7.5

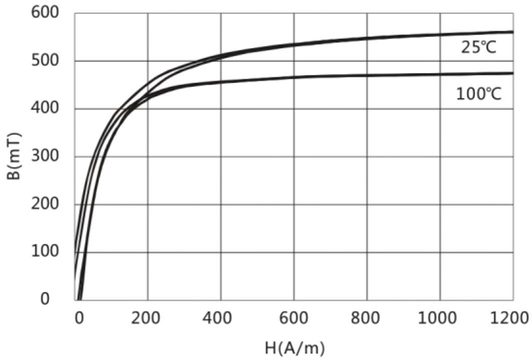
μ_i-Temperature



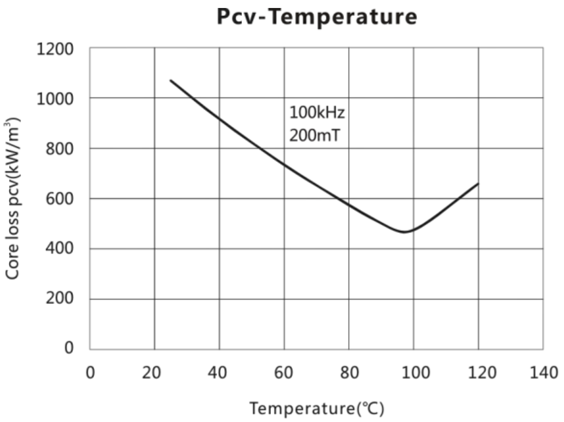
μ_i-Frequency

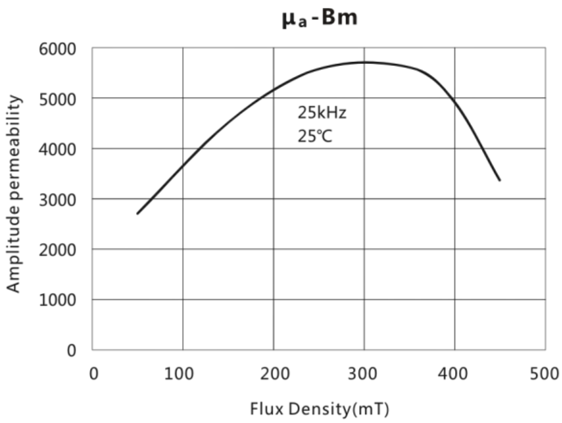


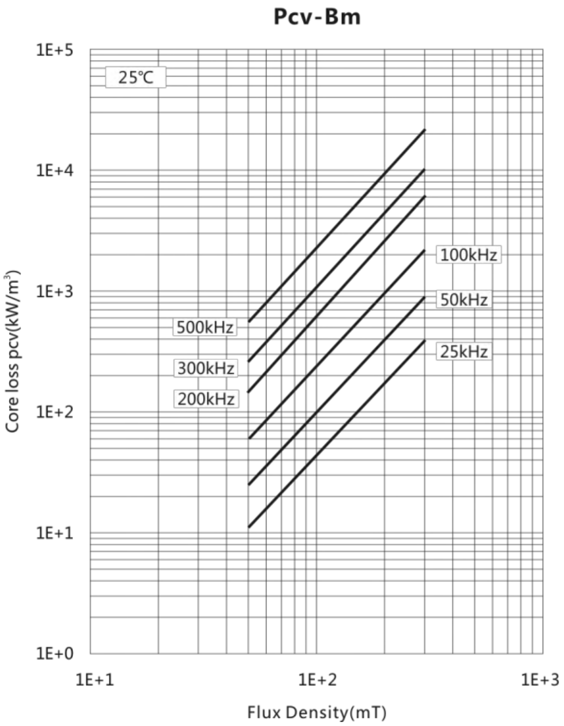
B-H

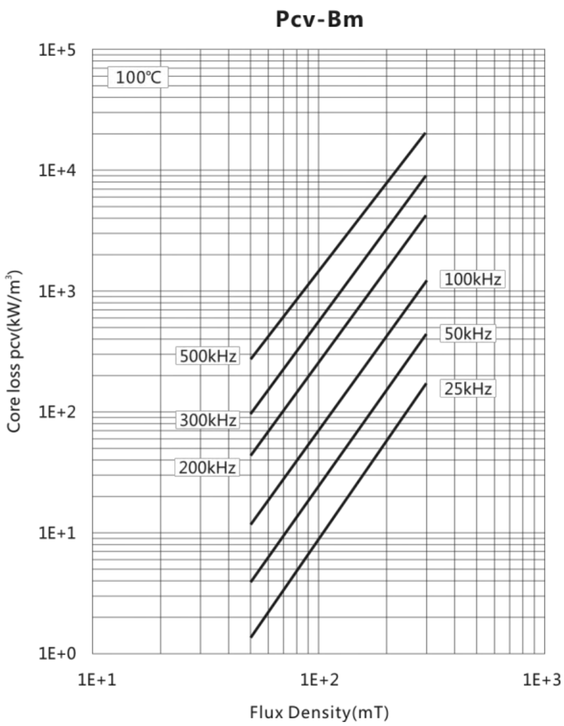


材料 / Material: **TPB12**





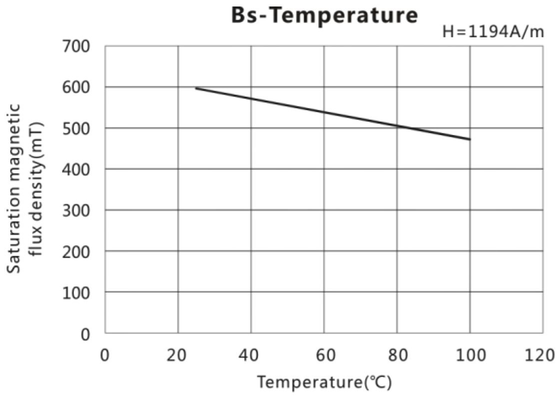




材料 / Material: **TPB16**

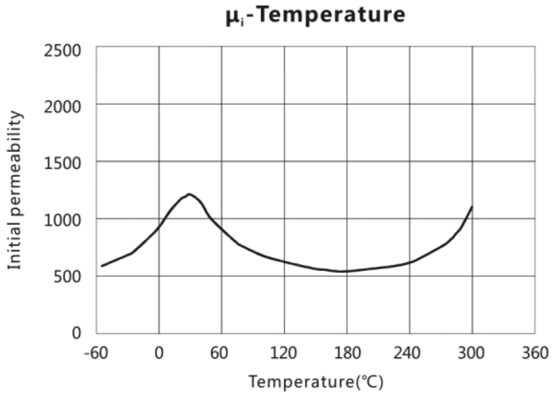
特点 / Features:

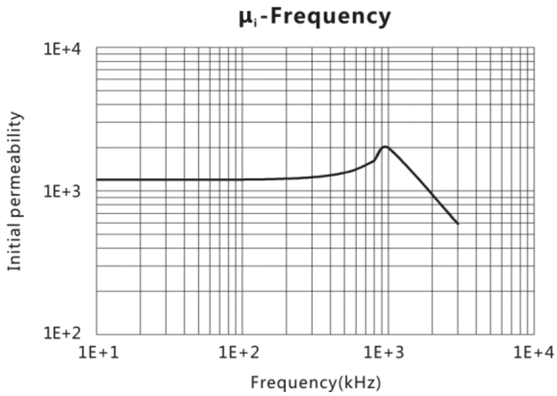
1. 高饱和磁感应强度 / High Saturation Flux Density
2. 居里温度较高 / Higher Curie Temperature

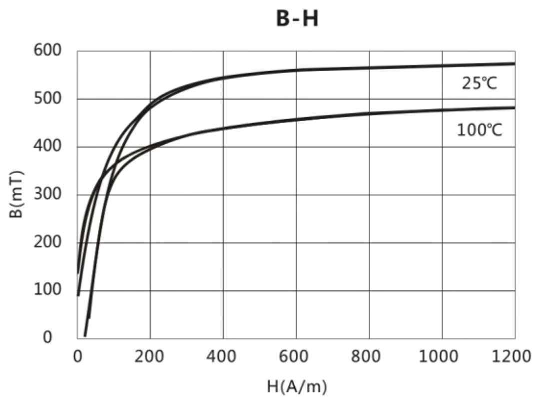


Initial permeability	μ_i	25℃	1600±25%
Saturation magnetic	Bs(mT)	25℃	590
flux density	1194A/m	100℃	480
Remanence	Br(mT)	25℃	150
		100℃	250
Coercivity	Hc(A/m)	25℃	35
		100℃	30
Core loss	Pcv(kW/m³)	25℃	280
	25kHz 200mT	100℃	470
Curie temperature	Tc(℃)		≥280
Electrical resistivity	ρ(Ω·m)		5
Density	d(kg/m³)		4.8×10³

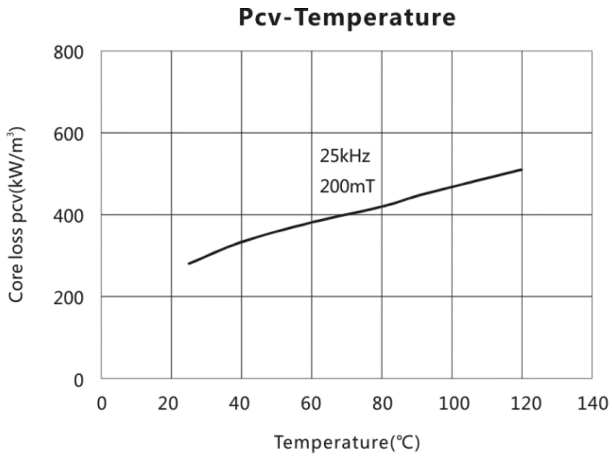
Test core：Toroid(mm)
OD：25
ID：15
H：7.5

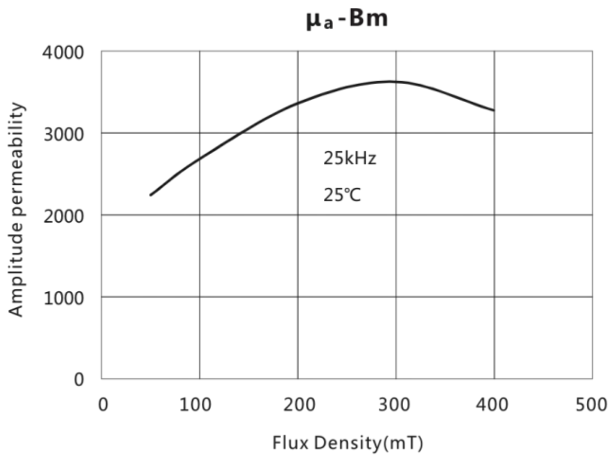


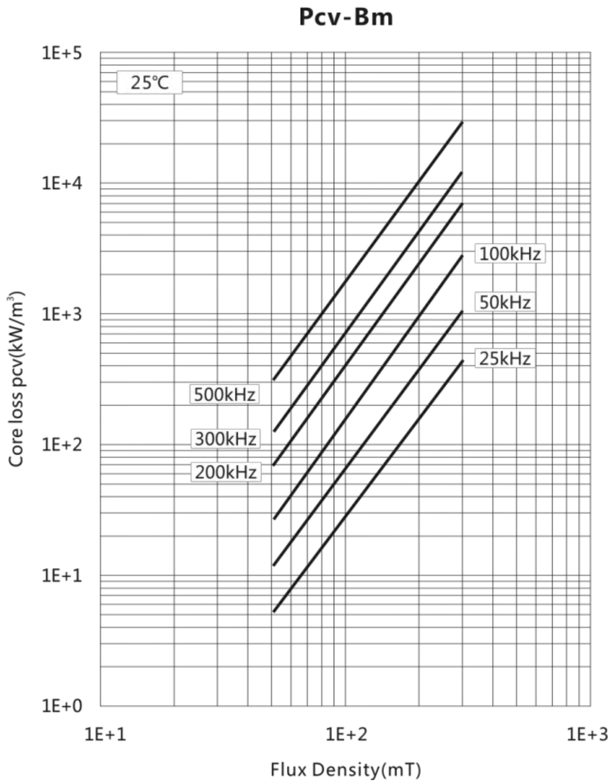


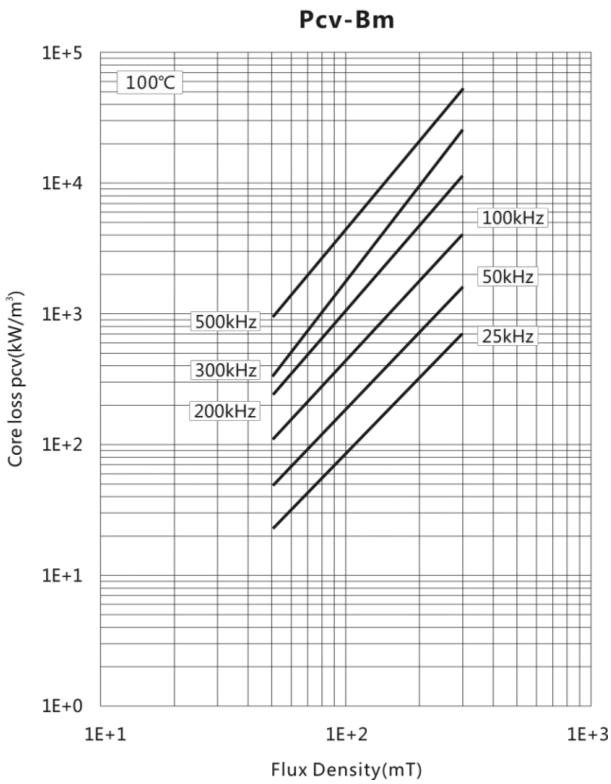


材料 / Material: **TPB16**







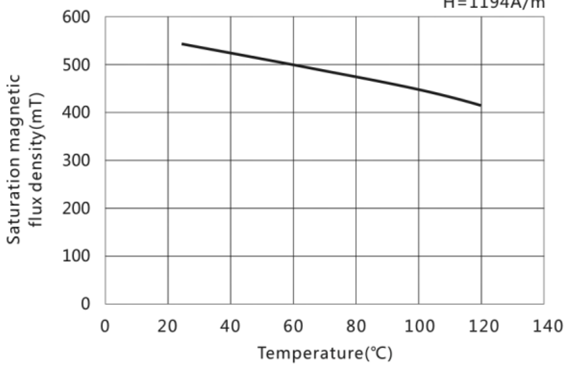


材料 / Material: **TPB22**

特点 / Features:

1. 高饱和磁感应强度，低损耗 / High Saturation Flux Density and Low Core Loss
2. 应用于中频段(小于500kHz) / Used at Middle Frequency(Less than 500kHz)
3. 功耗最低点在100℃左右 / The Minimum Core Loss is Around 100℃

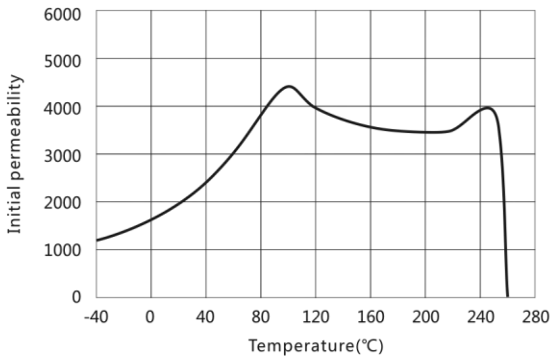
Bs-Temperature



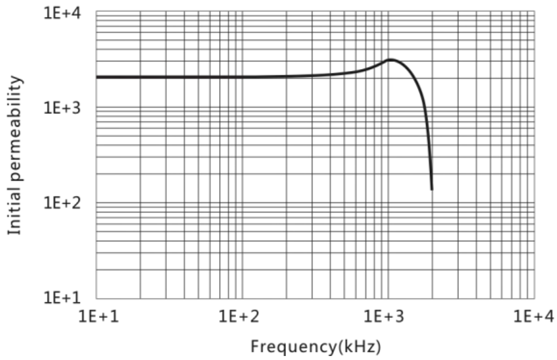
Initial permeability	μ_i	25℃	2200±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	540
		100℃	450
Remanence	Br(mT)	25℃	180
		100℃	70
Coercivity	Hc(A/m)	25℃	14
		100℃	7
Core loss	Pcv(kW/m³) 100kHz 200mT	25℃	700
		100℃	320
Curie temperature	Tc(℃)		≥255
Electrical resistivity	ρ(Ω·m)		4
Density	d(kg/m³)		4.8×10^3

Test core：Toroid(mm)
OD：25
ID：15
H：7.5

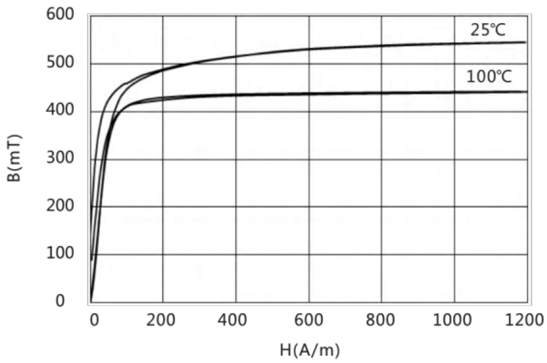
μ_i-Temperature



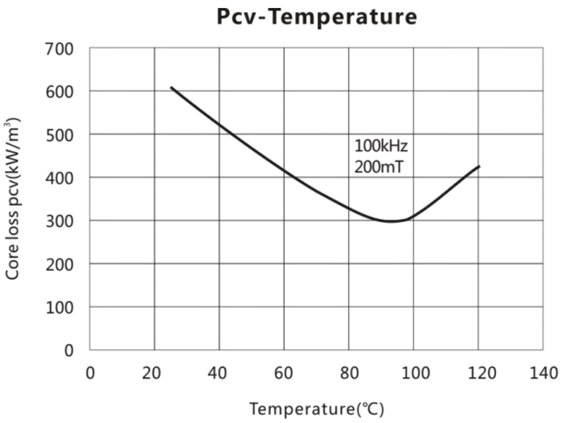
μ_i-Frequency

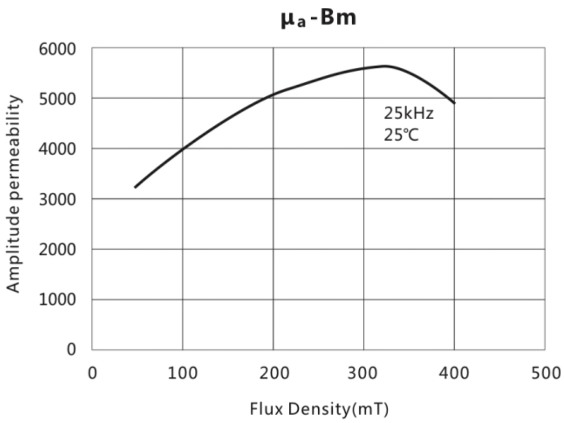


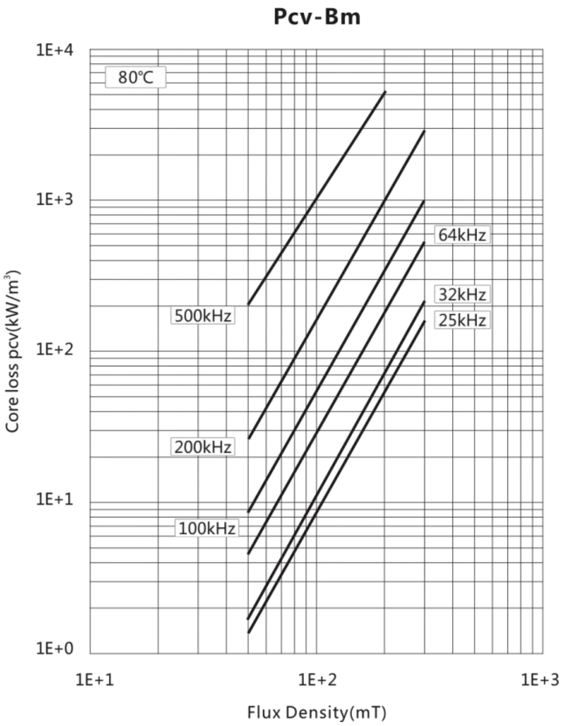
B-H

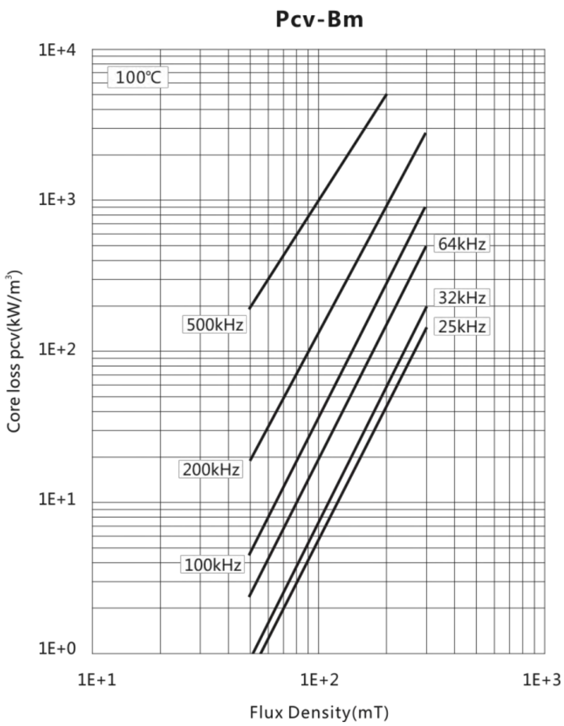


材料 / Material: **TPB22**





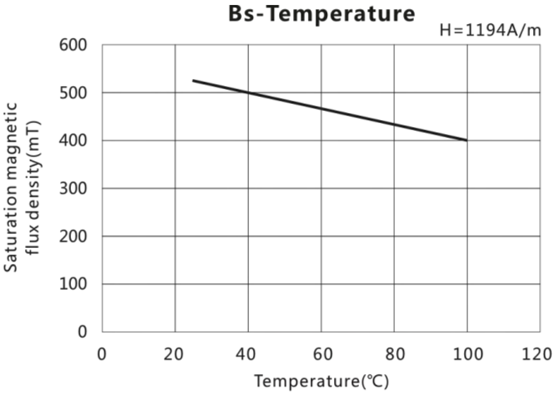




材料 / Material: **TPG30**

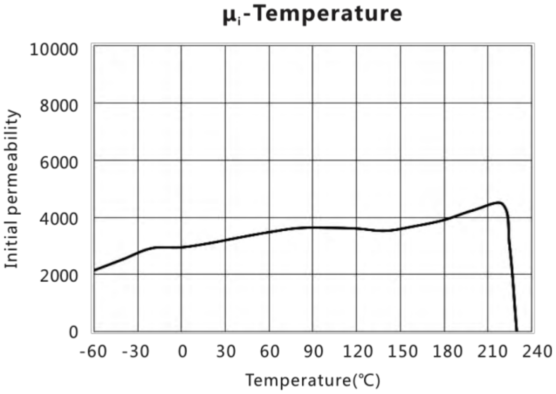
特点 / Features:

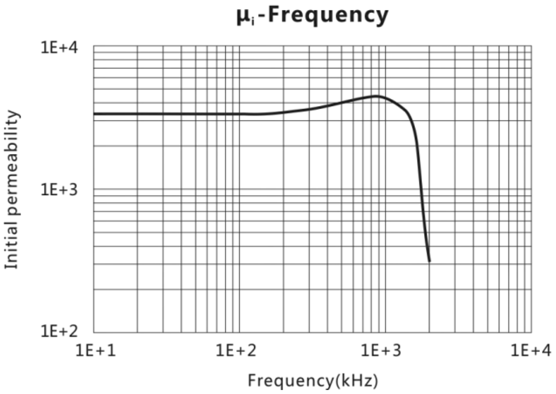
1. 低磁心损耗，高饱和磁感应强度 / Low Core Loss and High Saturation Flux Density
2. 损耗最低的温度点约在80℃ / The Temperature Point of the Lowest Core Loss is 80℃

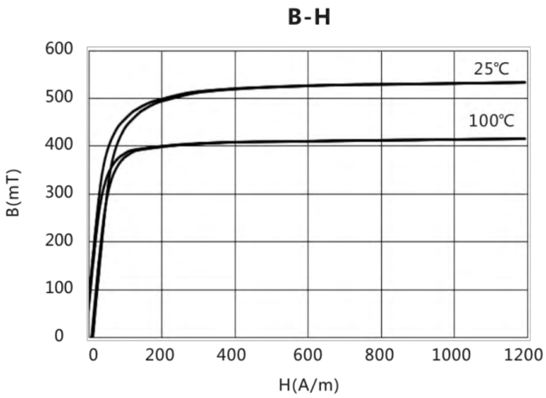


Initial permeability	μ_i	25℃	3000±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	530
		100℃	425
Remanence	Br(mT)	25℃	100
		100℃	75
Coercivity	Hc(A/m)	25℃	15
		100℃	12
Core loss	Pcv(kW/m^3) 100kHz 200mT	0℃	380
		25℃	330
		100℃	350
		120℃	380
Curie temperature	Tc(℃)		≥225
Electrical resistivity	ρ(Ω·m)		4
Density	d(kg/m^3)		4.8×10^3

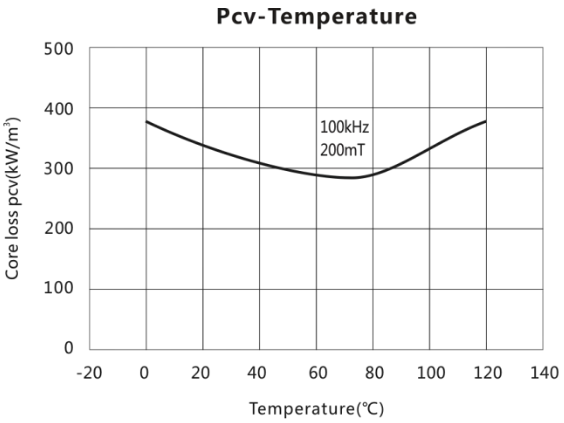
Test core：Toroid(mm)
OD：25
ID：15
H：7.5

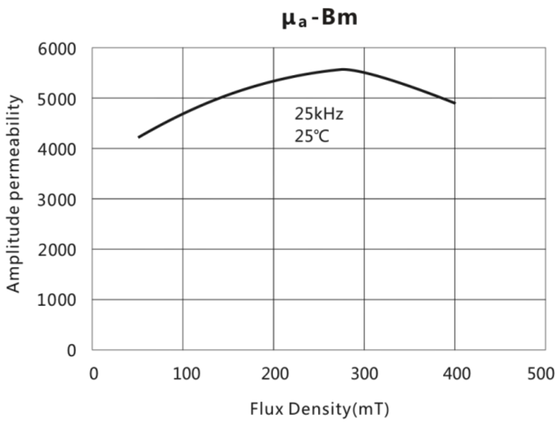


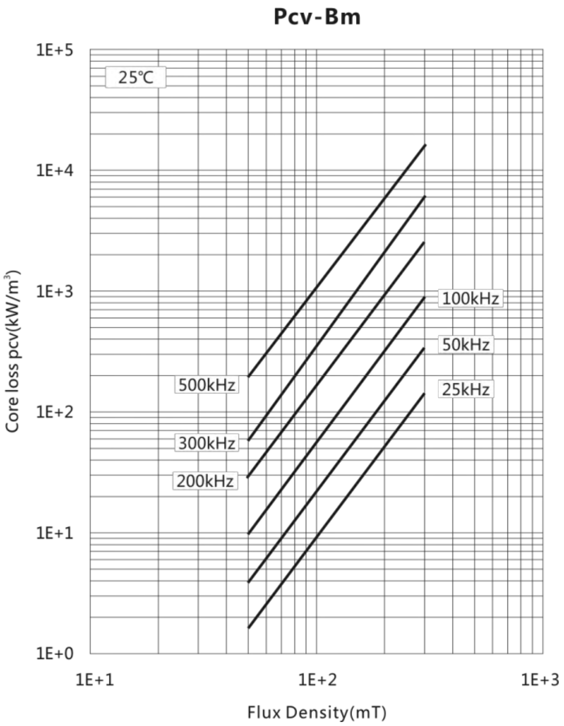


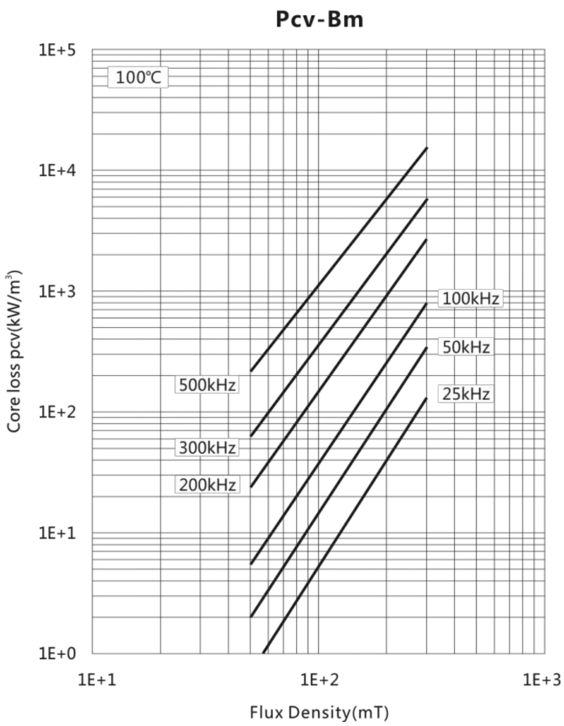


材料 / Material: **TPG30**





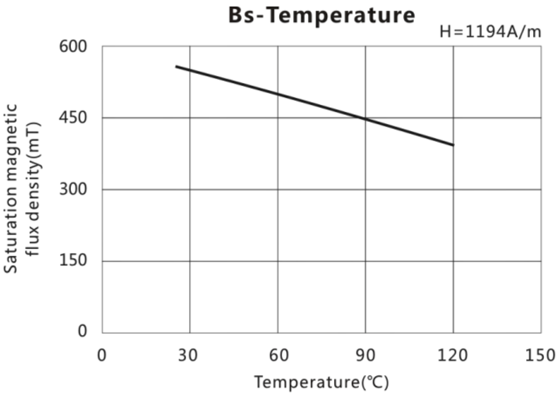




材料 / Material: **TPG33**

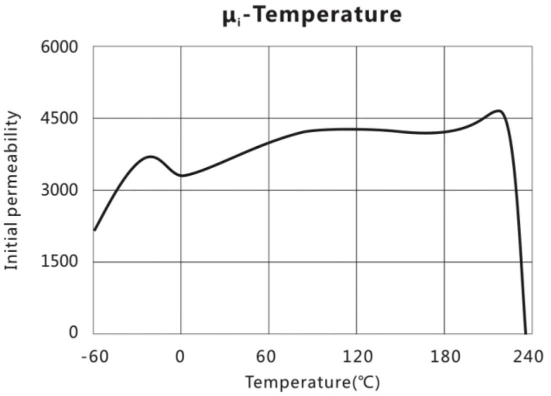
特点 / Features:

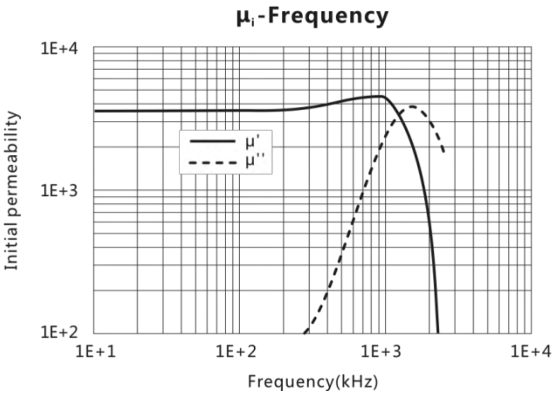
1. 应用于中频段（小于500kHz） / Use at Middle Frequency (Less than 500kHz)
2. 高饱和磁感应强度，宽温度范围低损耗 / High Bs and Low Core Loss in a Wide Temperature Range

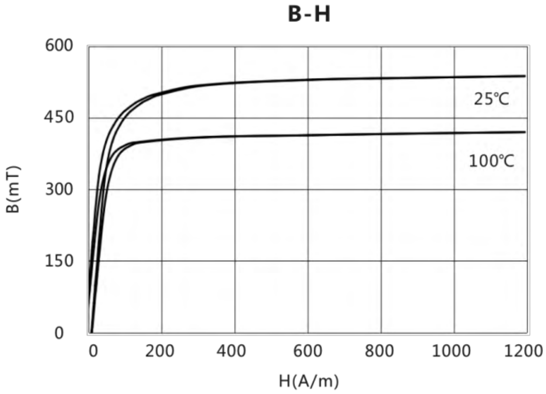


Initial permeability	μ_i	25℃	3300±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	530
		100℃	410
Remanence	Br(mT)	25℃	80
		100℃	60
Coercivity	Hc(A/m)	25℃	10
		100℃	8
Core loss	Pcv(kW/m^3) 100kHz 200mT	25℃	340
		80℃	260
		100℃	270
		120℃	315
Curie temperature	Tc(℃)		≥220
Electrical resistivity	ρ(Ω·m)		4
Density	d(kg/m^3)		4.9×10^3

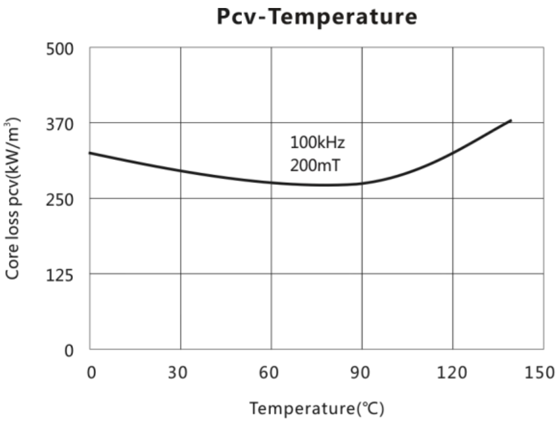
Test core：Toroid(mm)
OD：25
ID：15
H：7.5

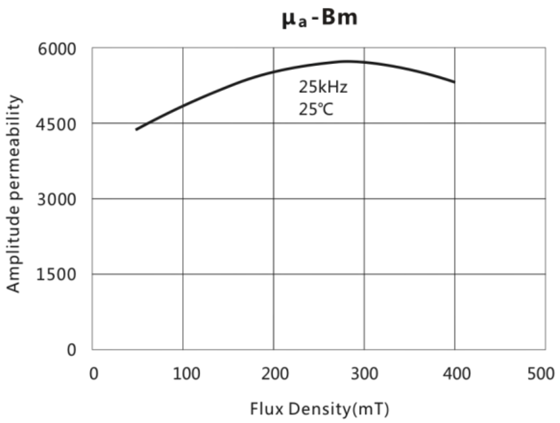


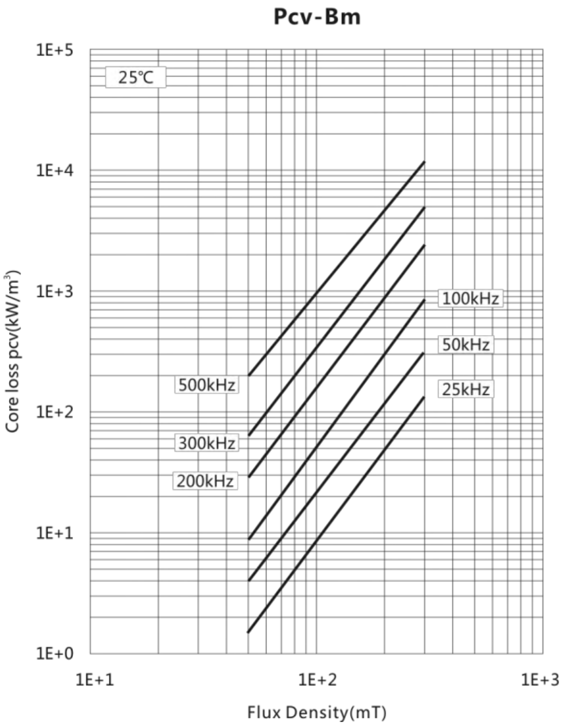


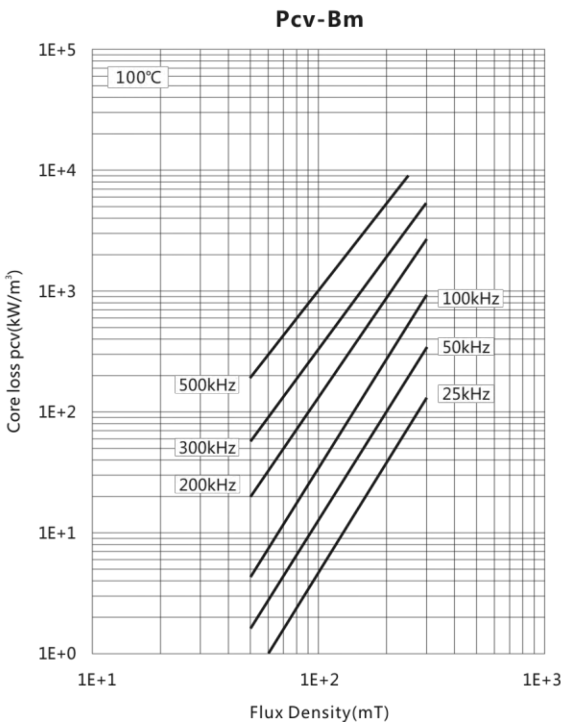


材料 / Material: **TPG33**







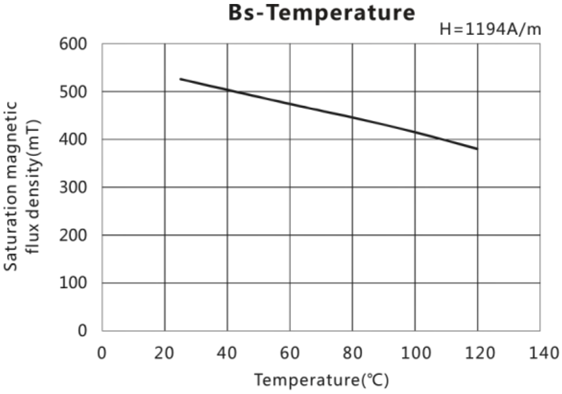


材料 / Material: **TPW30**

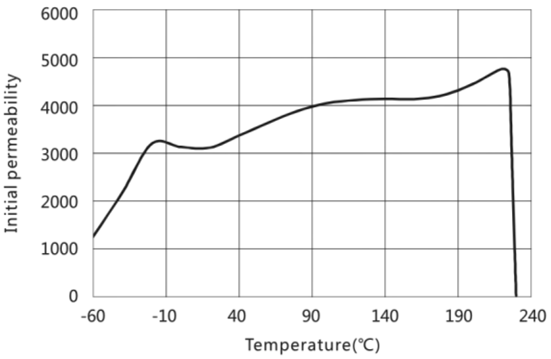
特点 / Features:

1. 低磁心损耗，高饱和磁感应强度 / Low Core Loss and High Saturation Flux Density
2. 损耗最低的温度点约在100℃ / The Temperature Point of the Lowest Core Loss is 100℃

Bs-Temperature



μi-Temperature



Initial permeability	μ_i	25℃	3000±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	530
		100℃	425
Remanence	Br(mT)	25℃	100
		100℃	75
Coercivity	Hc(A/m)	25℃	15
		100℃	12
Core loss	$Pcv(kW/m^3)$ 100kHz 200mT	60℃	320
		120℃	320
		140℃	380
Curie temperature	Tc(℃)		≥220
Electrical resistivity	ρ(Ω·m)		4
Density	$d(kg/m^3)$		4.9×10^3

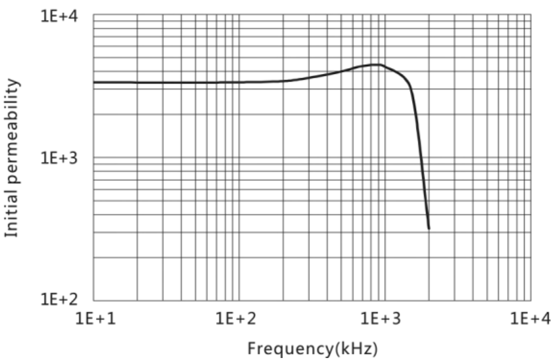
Test core：Toroid(mm)

OD：25

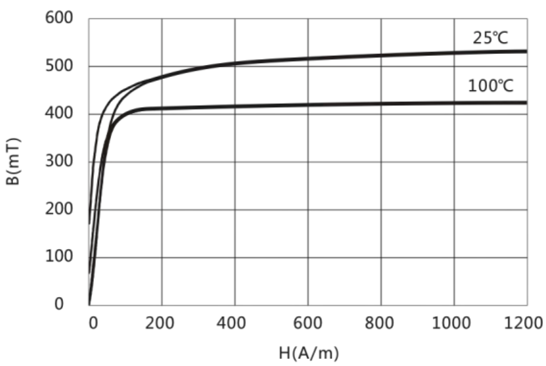
ID：15

H：7.5

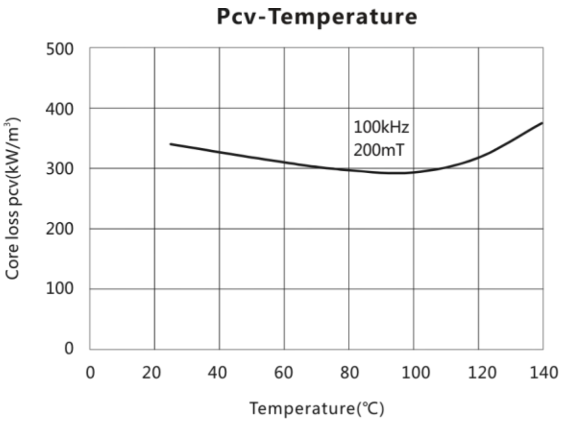
μi-Frequency

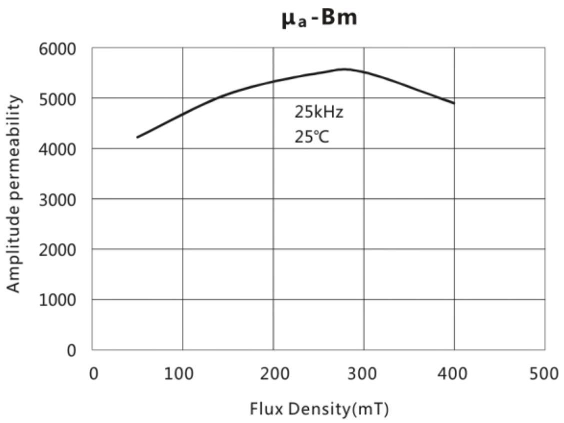


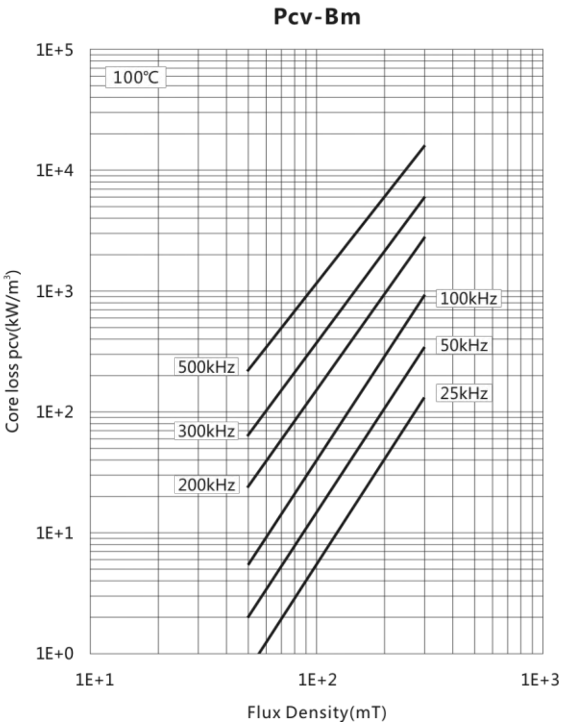
B-H

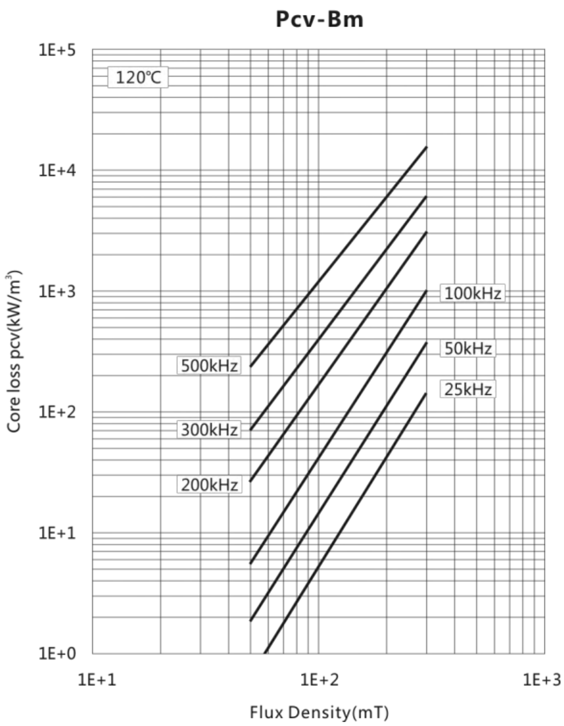


材料 / Material: **TPW30**





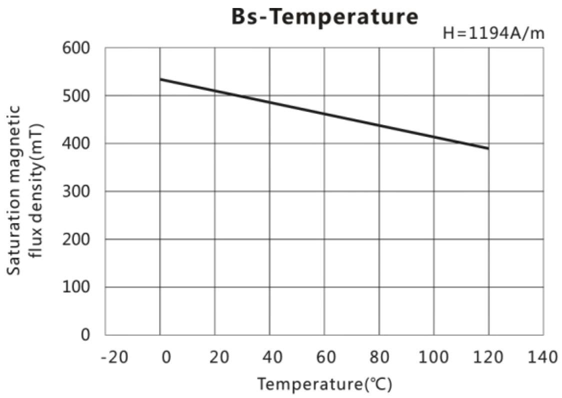




材料 / Material: **TPW33**

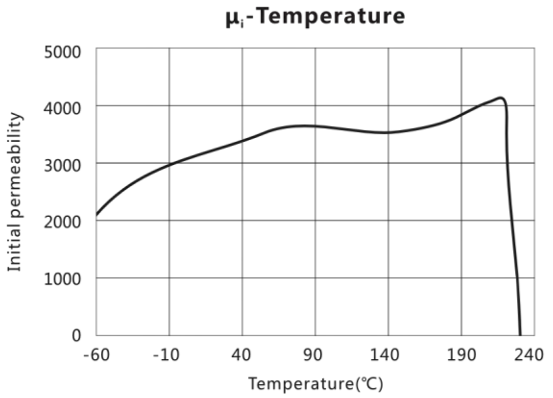
特点 / Features:

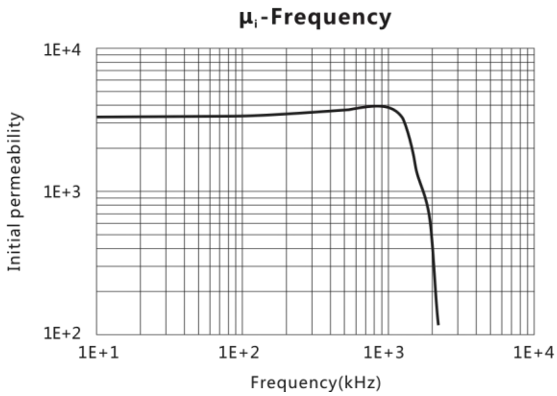
1. 应用于中频段(小于500kHz) / Used at Middle Frequency(Less than 500kHz)
2. 高饱和磁感应强度，宽温度低损耗 / High Saturation Flux Density and Low Core Loss in a Wide Temperature Range

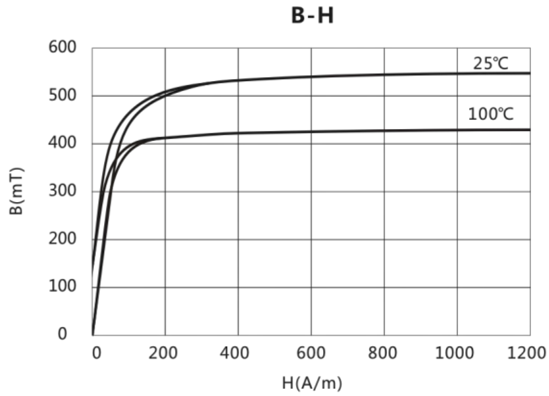


Initial permeability	μ_i	25℃	3300±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	530
		100℃	410
Remanence	Br(mT)	25℃	85
		100℃	60
Coercivity	Hc(A/m)	25℃	12
		100℃	9
Core loss	Pcv(kW/m^3) 100kHz 200mT	25℃	380
		80℃	290
		100℃	300
		120℃	350
Curie temperature	Tc(℃)		≥220
Electrical resistivity	ρ(Ω·m)		4
Density	d(kg/m^3)		4.9×10^3

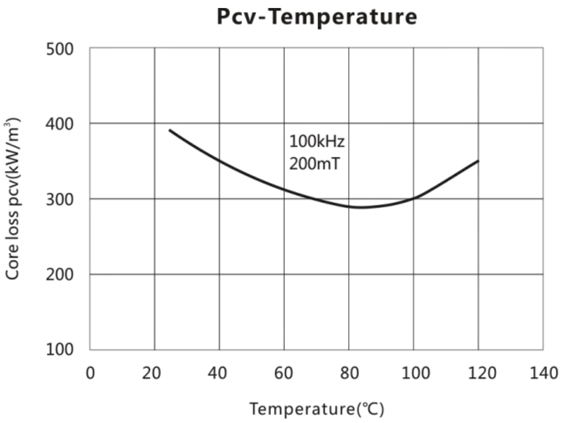
Test core：Toroid(mm)
OD：25
ID：15
H：7.5

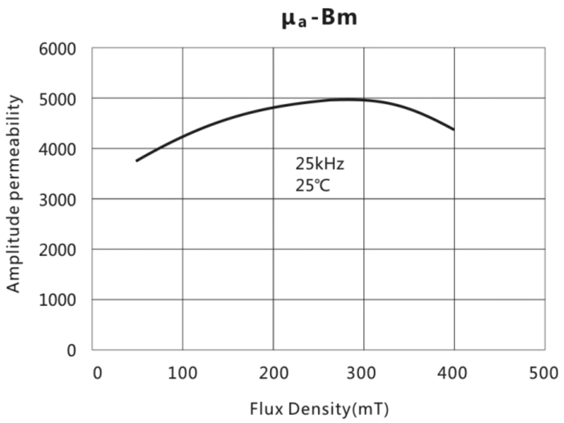


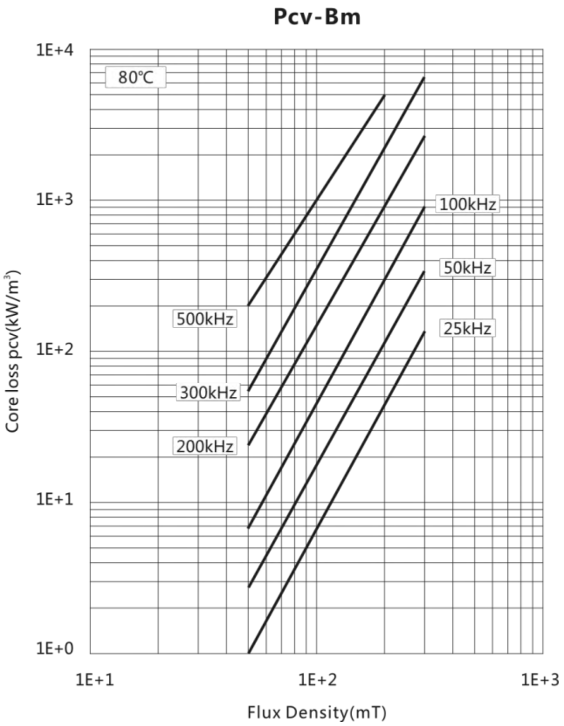


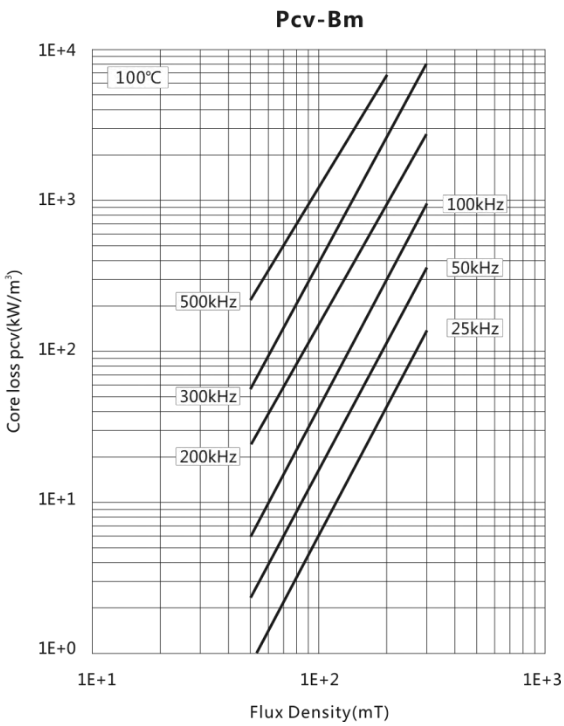


材料 / Material: **TPW33**







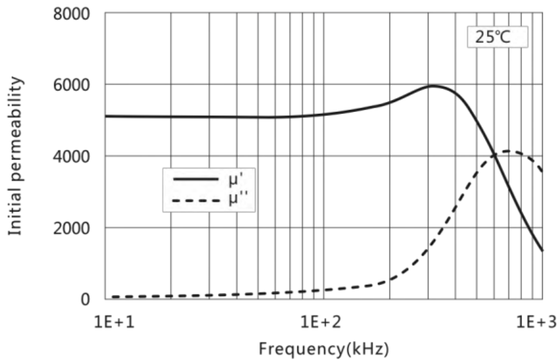


材料 / Material: **TS5**

特点 / Features:

1. 高磁导率(约5500) / High Initial Permeability(About 5500)
2. 低比损耗因子 / Low Relative Loss Factor
3. 频率特性优良 / The Initial Permeability vs Frequency Characteristic is Good

μ'(μ")-Frequency



Initial permeability	μ_i	25℃ 10kHz 25℃ 1MHz	5500±30% 3000
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	430
Remanent	Br(mT)	25℃	70
Coercivity	Hc(A/m)	25℃	6
Relative loss factor	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃ 100kHz	＜10
Relative temperature coefficient	$\alpha_{\mu ir}$ (10^{-6}/℃)	20℃～60℃	-0.5～2.0
Curie temperature	Tc(℃)		≥150
Electrical resistivity	ρ(Ω·m)		1
Density	d(kg/m^3)		4.9×10^3

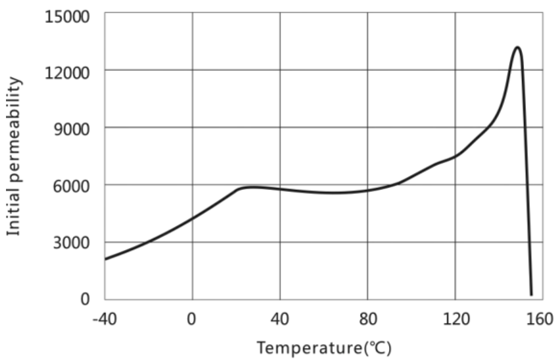
Test core：Toroid(mm)

OD：25

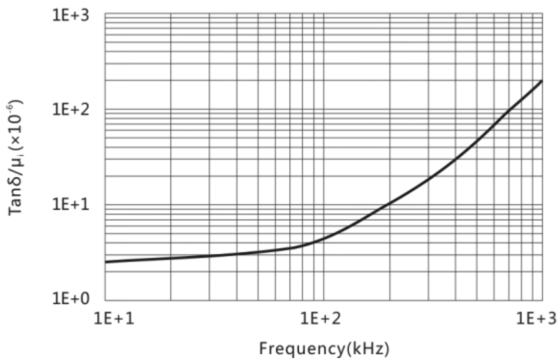
ID：15

H：7.5

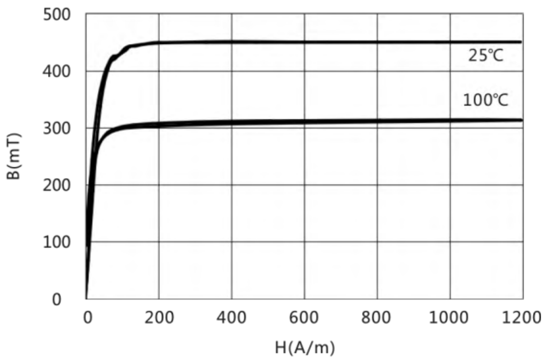
μ_i-Temperature



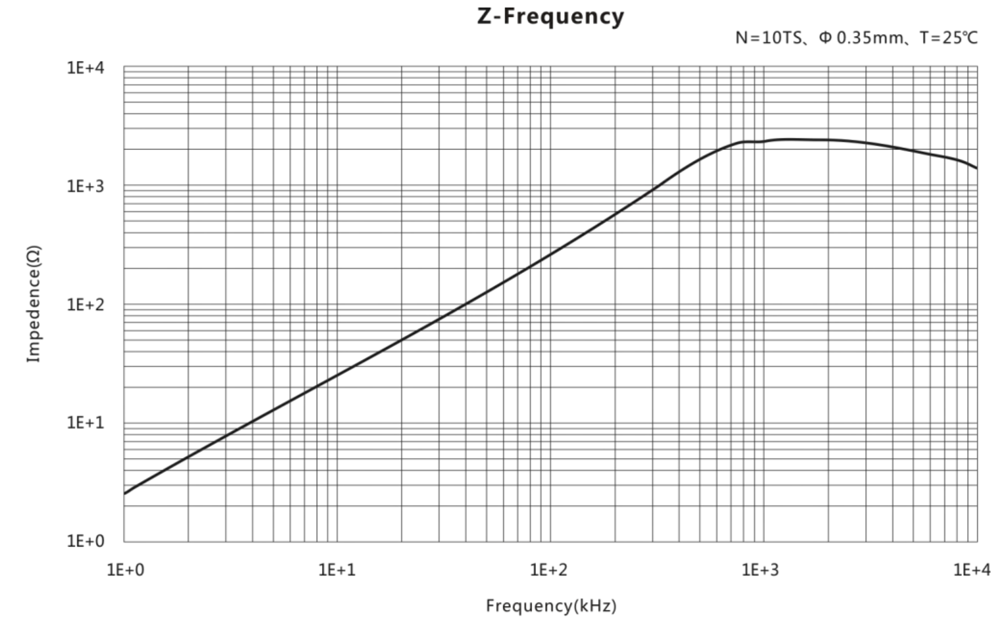
tanδ/μ_i-Frequency

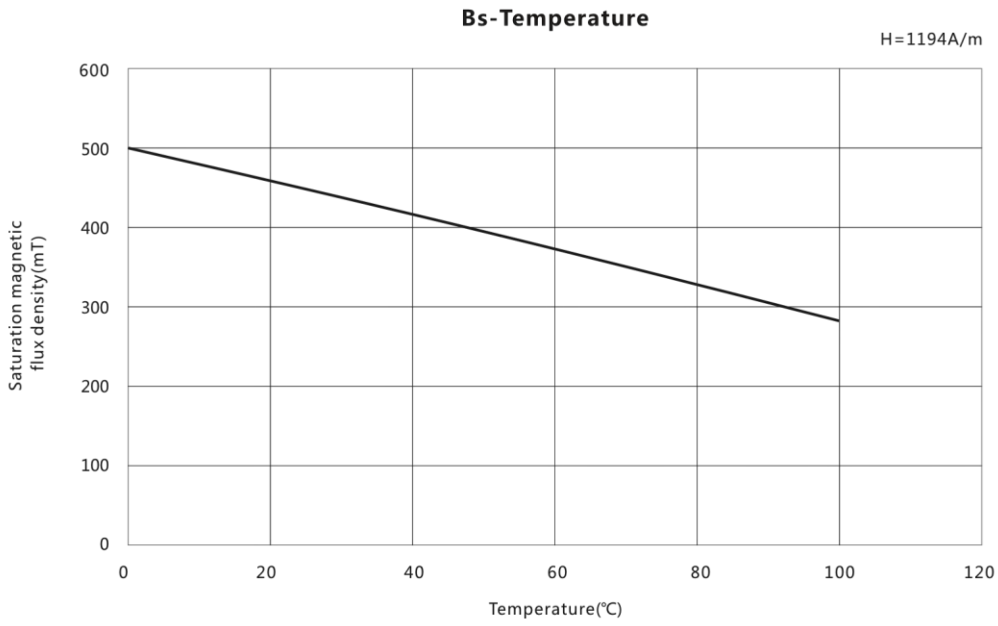


B-H



材料 / Material: **TS5**



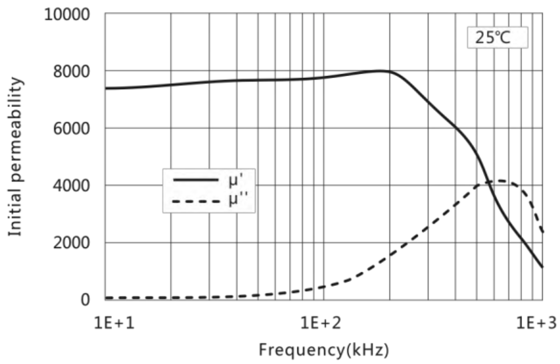


材料 / Material: **TS7**

特点 / Features:

1. 高磁导率(约7500) / High Initial Permeability(About 7500)
2. 低比损耗因子 / Low Relative Loss Factor
3. 频率特性优良 / The Initial Permeability vs Frequency Characteristic is Good

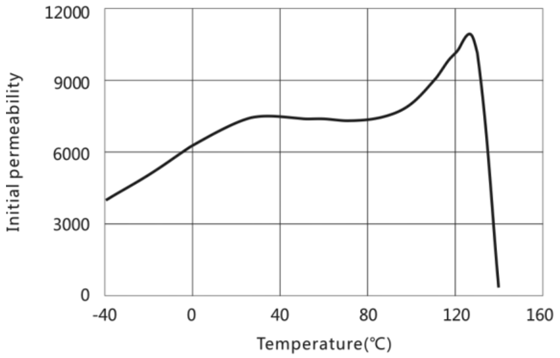
μ'(μ")-Frequency



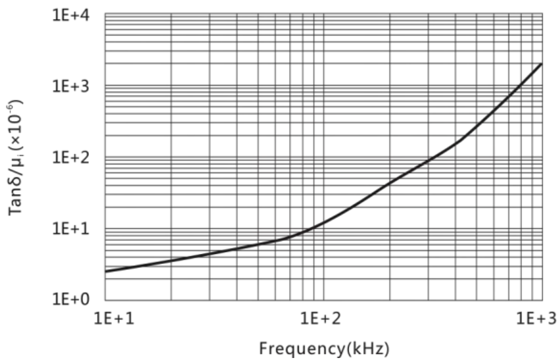
Initial permeability	μ_i	25℃	7500±30%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	410
Remanent	Br(mT)	25℃	80
Coercivity	Hc(A/m)	25℃	6
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)		＜20
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20℃~60℃	-0.5~2.0
Disaccommodation factor	D_F ($\times10^{-6}$)	1~10min	＜2.5
Curie temperature	Tc(℃)		≥125
Electrical resistivity	ρ(Ω·m)		0.3
Density	d(kg/m³)		4.8×10^3

Test core：Toroid(mm)
OD：18
ID：8
H：5

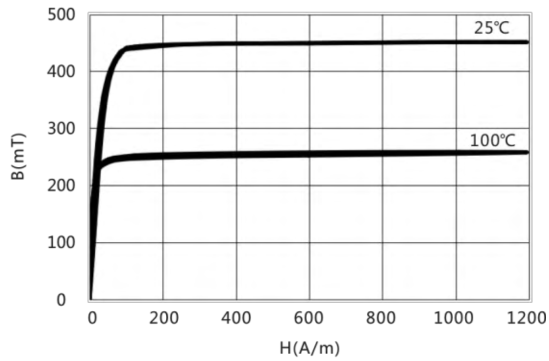
μ_i-Temperature



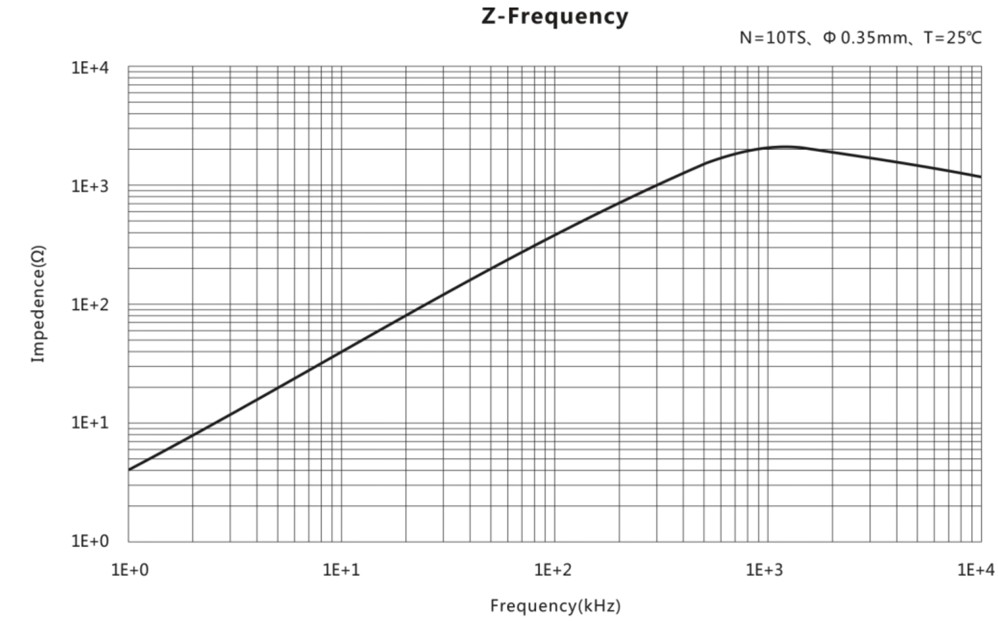
$\tan\delta/\mu_i$-Frequency

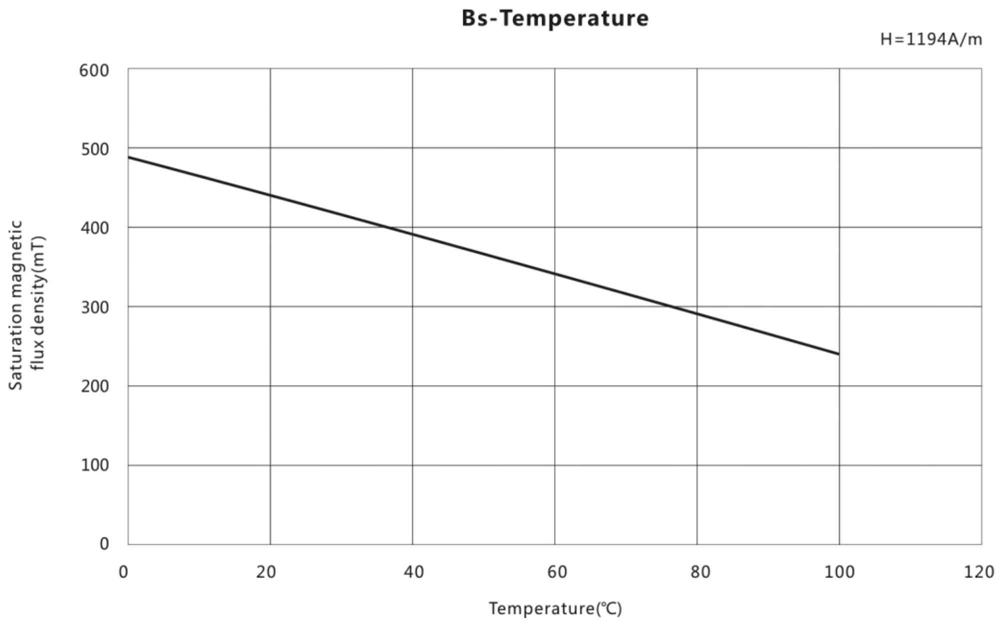


B-H



材料 / Material: **TS7**



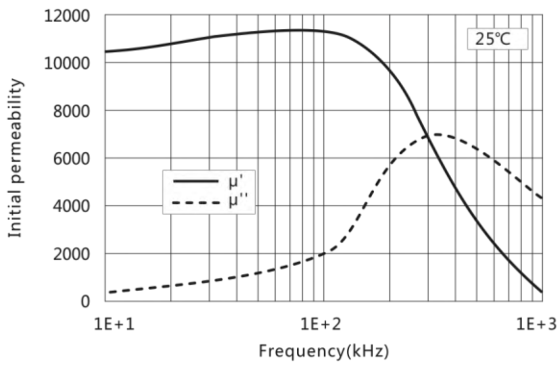


材料 / Material: **TS10**

特点 / Features:

1. 高磁导率(约10000) / High Initial Permeability(About 10000)
2. 低比损耗因子 / Low Relative Loss Factor
3. 频率特性优良 / The Initial Permeability vs Frequency Characteristic is Good

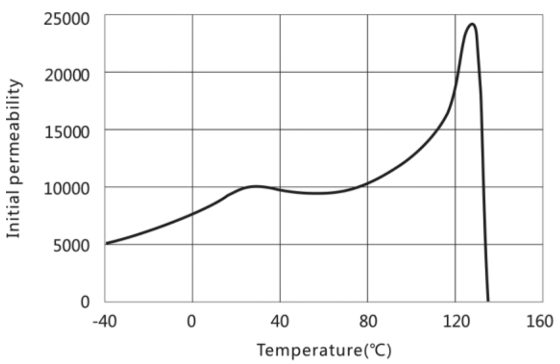
μ'(μ")-Frequency



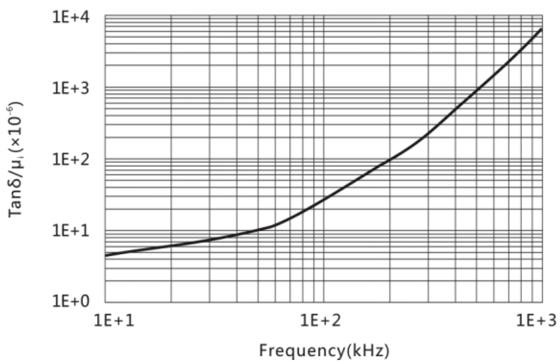
Initial permeability	μ_i	25℃	10000±30%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	380
Remanent	Br(mT)	25℃	120
Coercivity	Hc(A/m)	25℃	6
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)		＜30
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20℃~60℃	-0.5~2.0
Disaccommodation factor	D_F ($\times10^{-6}$)	1~10min	＜2.0
Curie temperature	Tc(℃)		≥125
Electrical resistivity	ρ(Ω·m)		0.2
Density	d(kg/m³)		4.9×10^3

Test core：Toroid(mm)
OD：18
ID：8
H：5

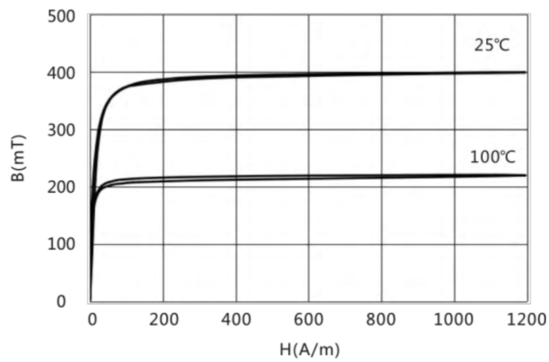
μ_i-Temperature



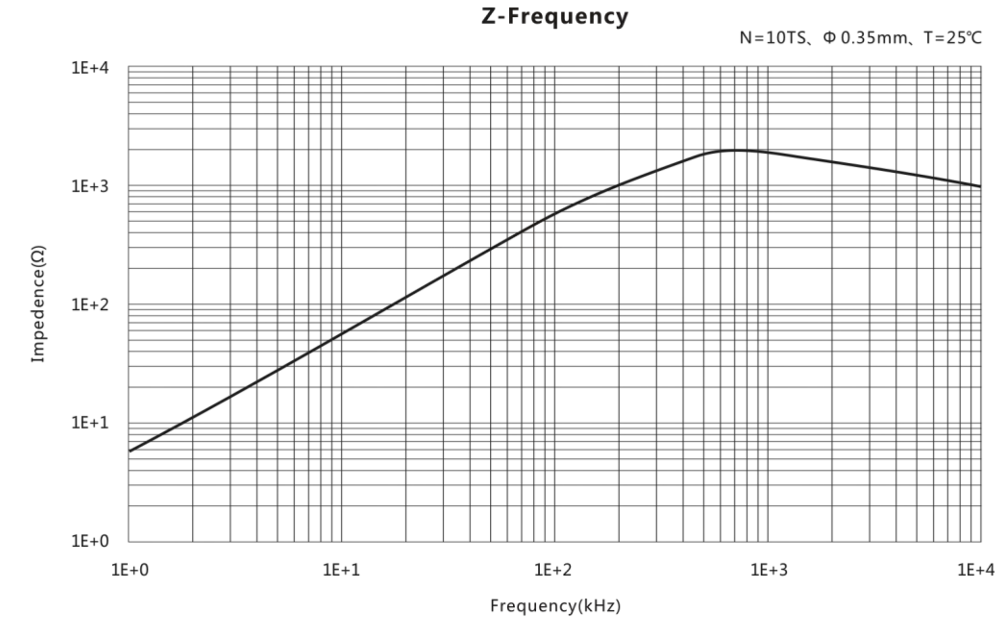
tanδ/μ_i-Frequency

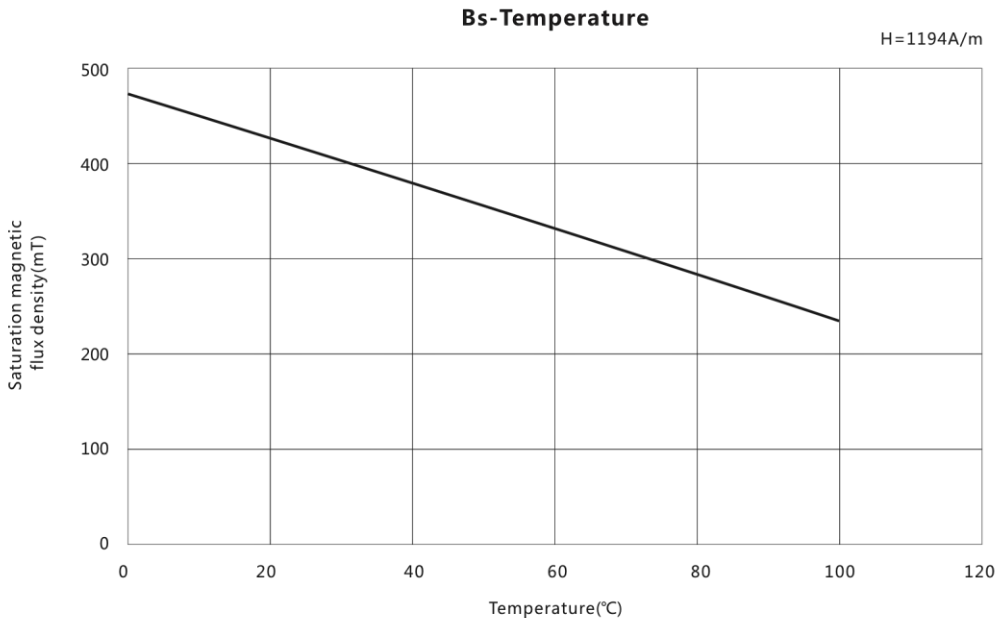


B-H



材料 / Material: **TS10**



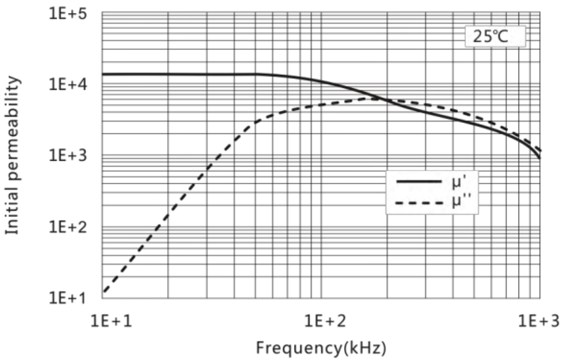


材料 / Material: **TL13**

特点 / Features:

1. 高磁导率(约13000) / High Initial Permeability(About 13000)

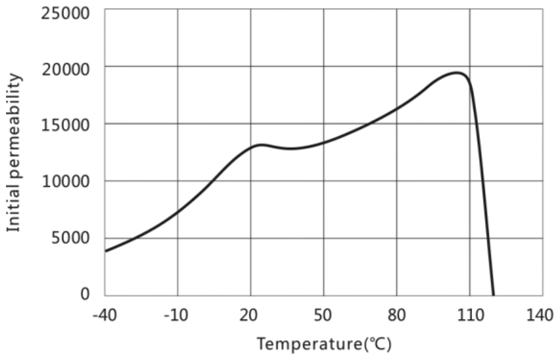
μ'(μ")-Frequency



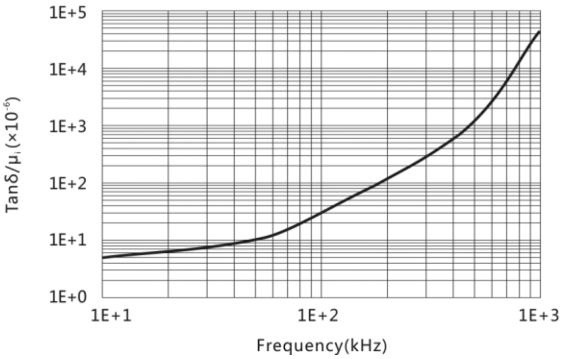
Initial permeability	μ_i	25℃	13000±30%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃ 100℃	360 210
Remanent flux density	Br(mT)	25℃ 100℃	100 70
Coercivity	Hc(A/m)	25℃ 100℃	4.4 3
Relative loss factor	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃ 10kHz	＜7
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20℃~60℃	-0.5~3.0
Disaccommodation factor	D_F (×10-6)	1~10min	＜2.0
Curie temperature	Tc(℃)		≥115
Electrical resistivity	ρ(Ω·m)		0.15
Density	d(kg/m^3)		4.95×10^3

Test core：Toroid(mm)
OD：18
ID：8
H：5

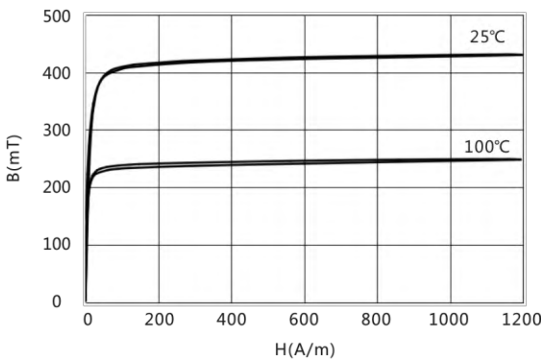
μ_i-Temperature



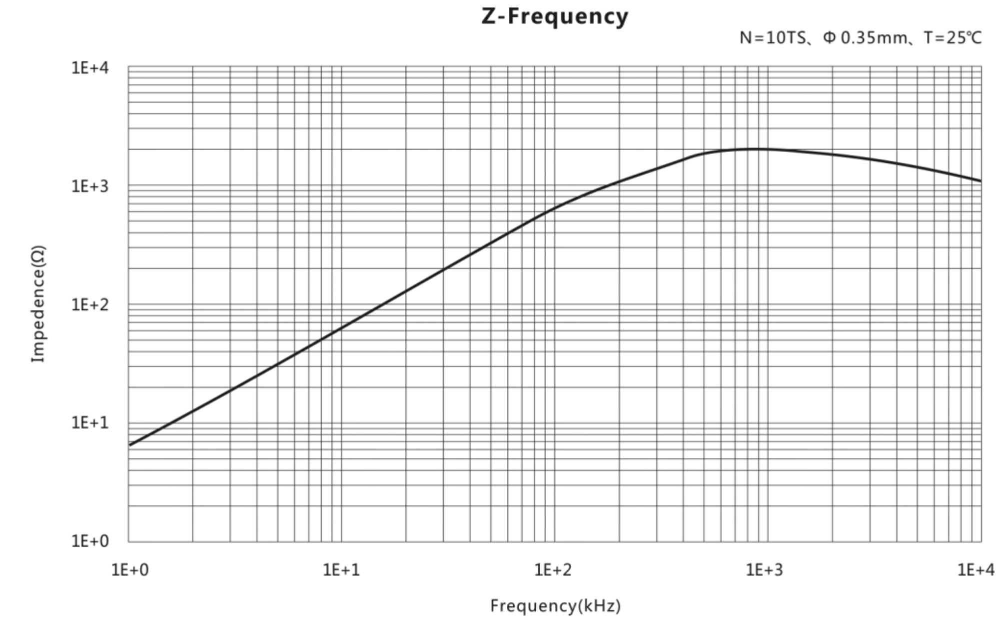
$\tan\delta/\mu_i$-Frequency

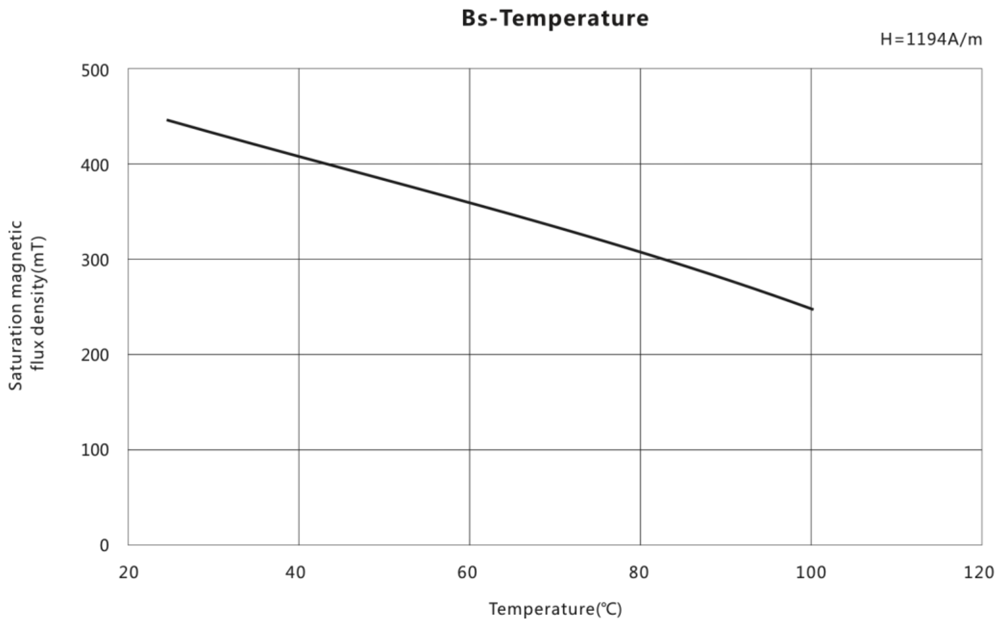


B-H



材料 / Material: **TL13**



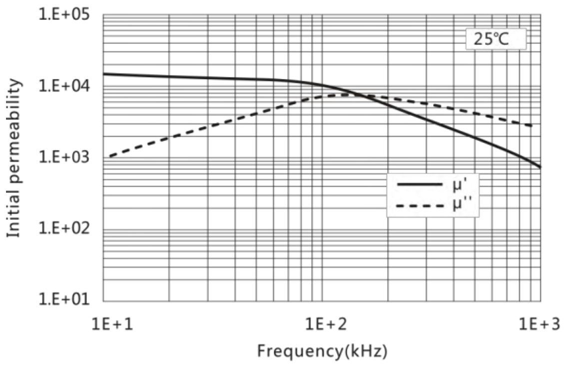


材料 / Material: **TL15**

特点 / Features:

1. 高磁导率(约15000) / High Initial Permeability(About 15000)

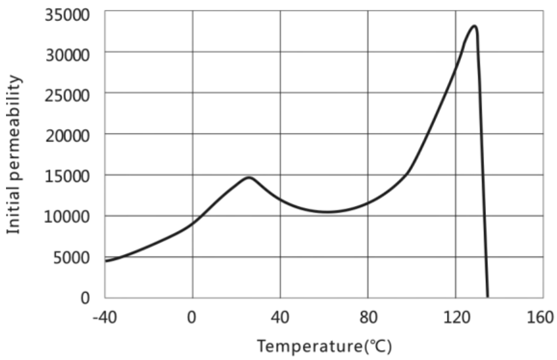
μ'(μ")-Frequency



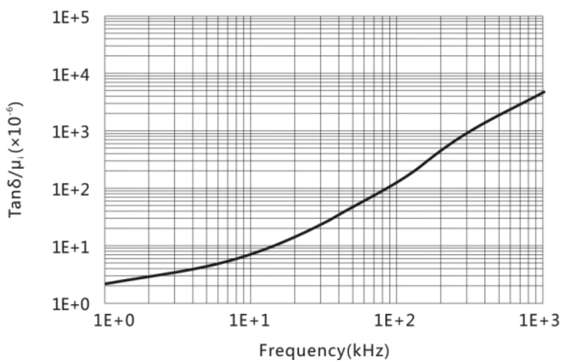
Initial permeability	μ_i	25℃	15000±30%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	360
Remanent flux density	Br(mT)	25℃	100
Coercivity	Hc(A/m)	25℃	4.4
Relative loss factor 10kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)		<7
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20℃~60℃	-0.5~2.0
Disaccommodation factor	D_F (×10-6)	1~10min	<2.0
Curie temperature	Tc(℃)		≥110
Electrical resistivity	ρ(Ω·m)		0.15
Density	d(kg/m^3)		4.95×10^3

Test core：Toroid(mm)
OD：18
ID：8
H：5

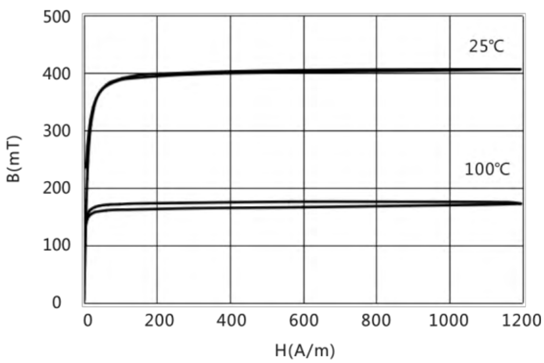
μ_i-Temperature



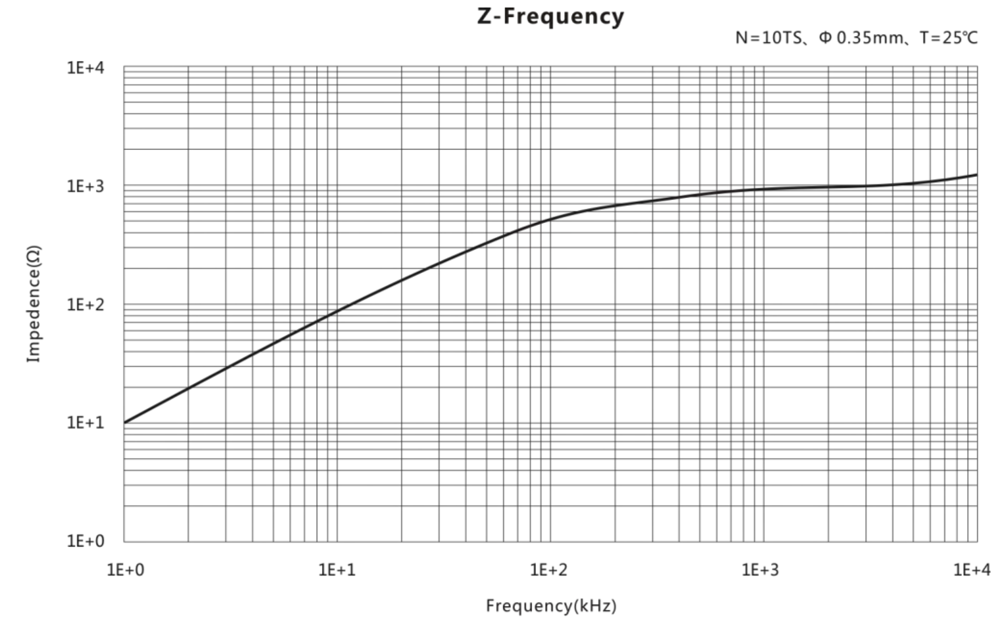
$\tan\delta/\mu_i$-Frequency

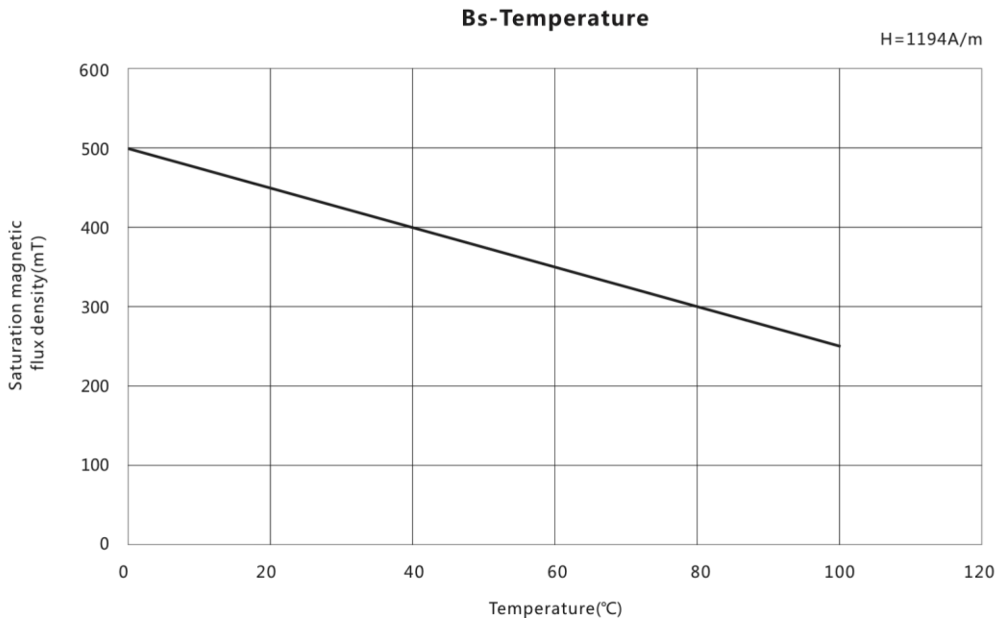


B-H



材料 / Material: **TL15**



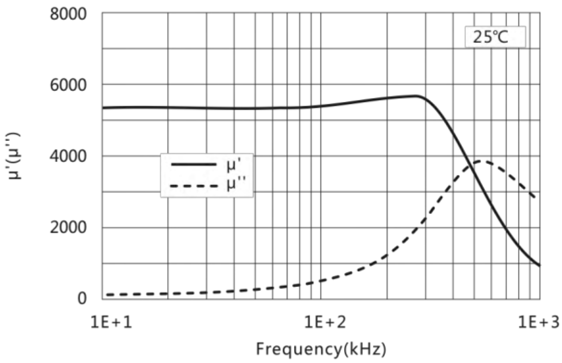


材料 / Material: **TLD5**

特点 / Features:

1. 宽温度高磁导率 / High Initial Permeability in a Wide Temperature Range
2. 温度稳定性好(-40℃～65℃) / Good Temperature Stability(From -40℃ to 65℃)

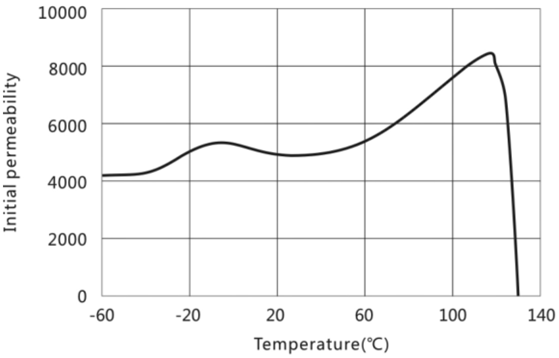
μ'(μ")-Frequency



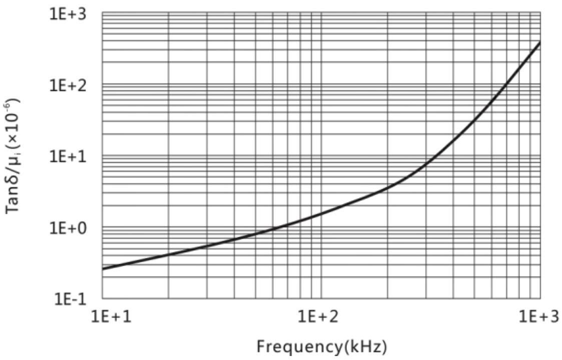
Initial permeability	μ_i	25℃	5000±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	380
Remanence	Br(mT)	25℃	140
Coercivity	Hc(A/m)	25℃	7
Relative loss factor	$\tan\delta/\mu_i$ $(\times10^{-6})$	25℃ 100kHz	＜15
Relative temperature coefficient	$\alpha_{\mu ir}$ $(10^{-6}/℃)$	-35℃～25℃	-0.7～0.7
Cure temperature	Tc(℃)		≥120
Electrical resistivity	ρ(Ω·m)		1
Density	d(kg/m³)		4.85×10^3

Test core：Totoid(mm)
OD：18
ID：8
H：5

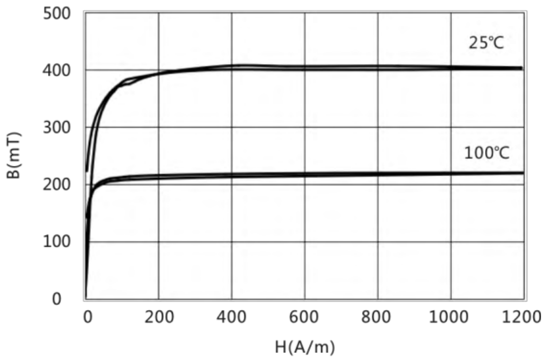
μ_i-Temperature



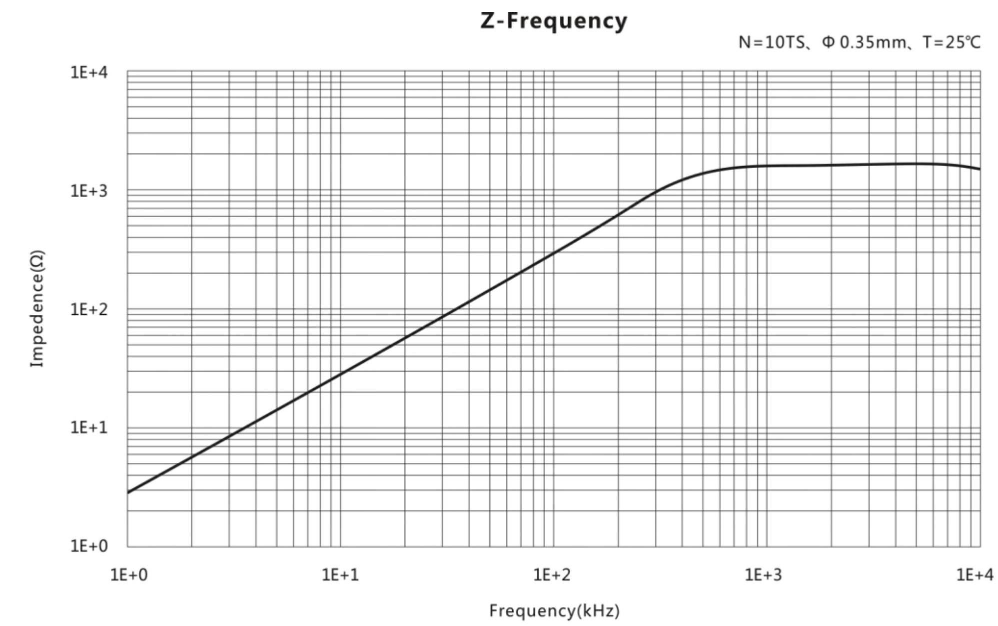
$\tan\delta/\mu_i$-Frequency

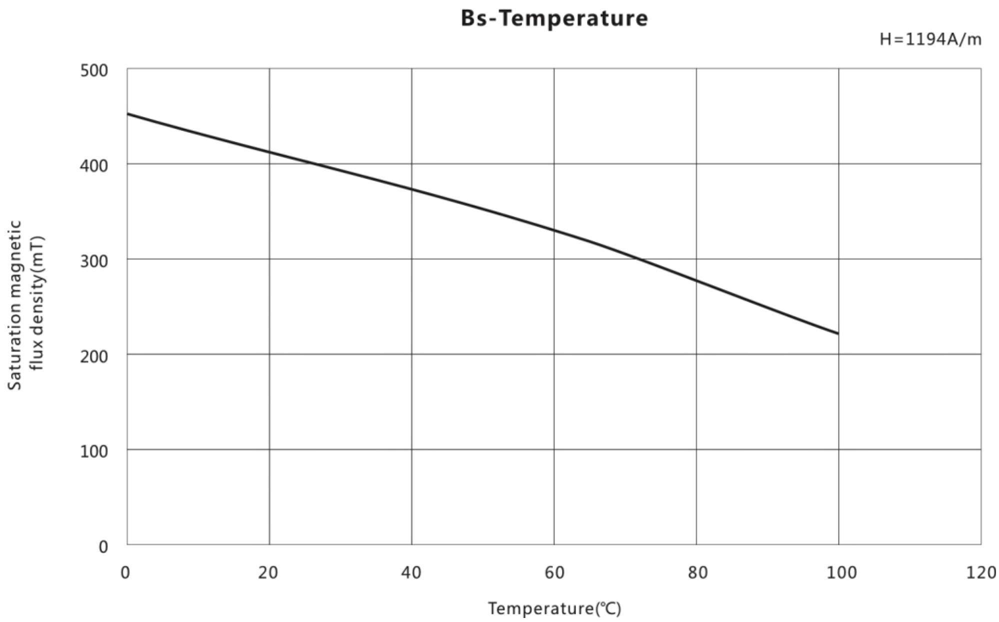


B-H



材料 / Material: **TLD5**



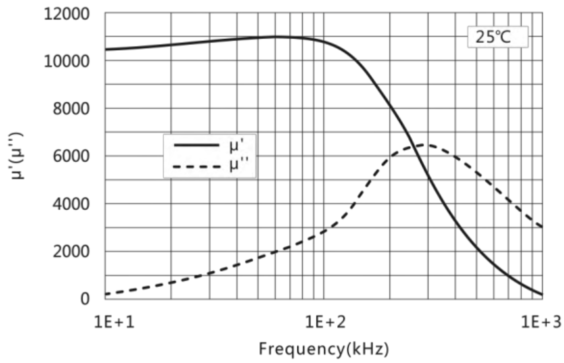


材料 / Material: **TLD10**

特点 / Features:

1. 宽温度高磁导率 / High Initial Permeability in a Wide Temperature Range
2. 温度稳定性好(-40℃～65℃) / Good Temperature Stability(From -40℃ to 65℃)

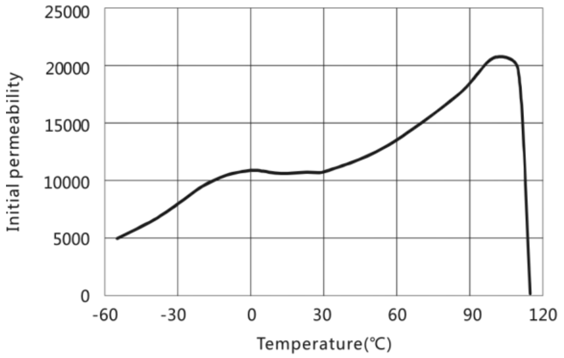
μ'(μ")-Frequency



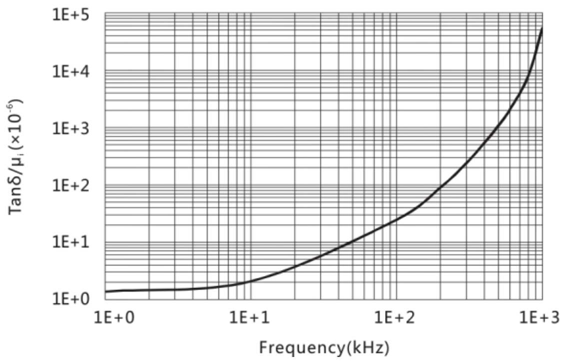
Initial permeability	μ_i	25℃	10000±30%
		-20℃	9000
		-40℃	6500
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	380
Remanent	Br(mT)	25℃	120
Coercivity	Hc(A/m)	25℃	5
Relative loss factor	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃ 10kHz	5
Relative temperature coefficient	$\alpha_{\mu ir}$ (10^{-6}/℃)	-40℃～25℃	-0.7～0.7
		0℃～25℃	-0.2～0.2
Curie temperature	Tc(℃)	/	≥110
Electrical resistivity	ρ(Ω·m)	/	0.1
Density	d(kg/m³)	/	4.95×10^3

Test core：Toroid(mm)
OD：25
ID：15
H：7.5

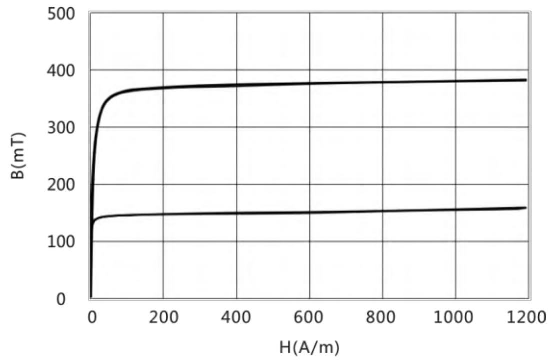
μ_i-Temperature



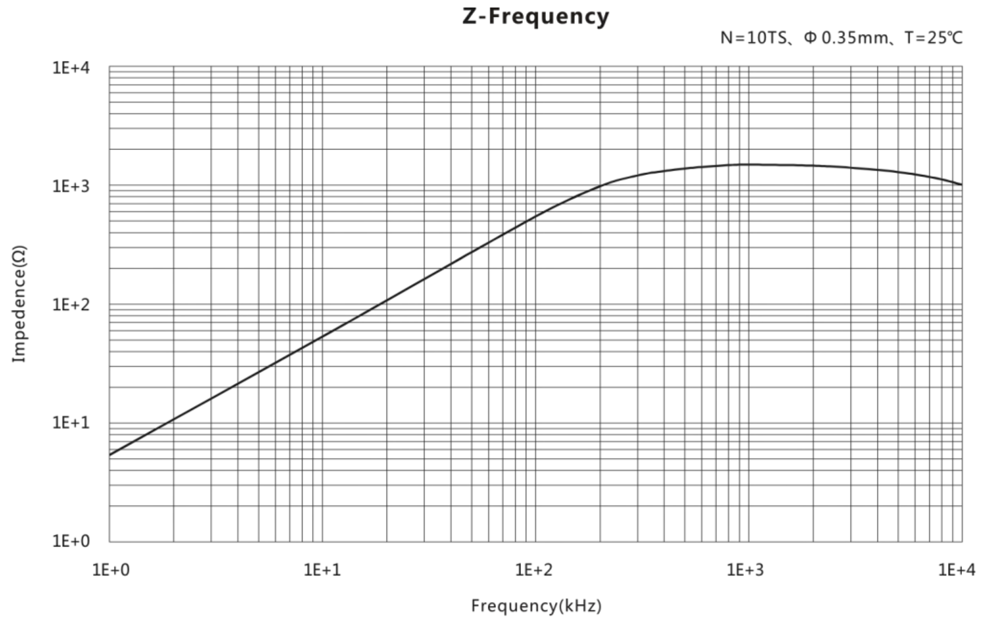
tanδ/μ_i-Frequency

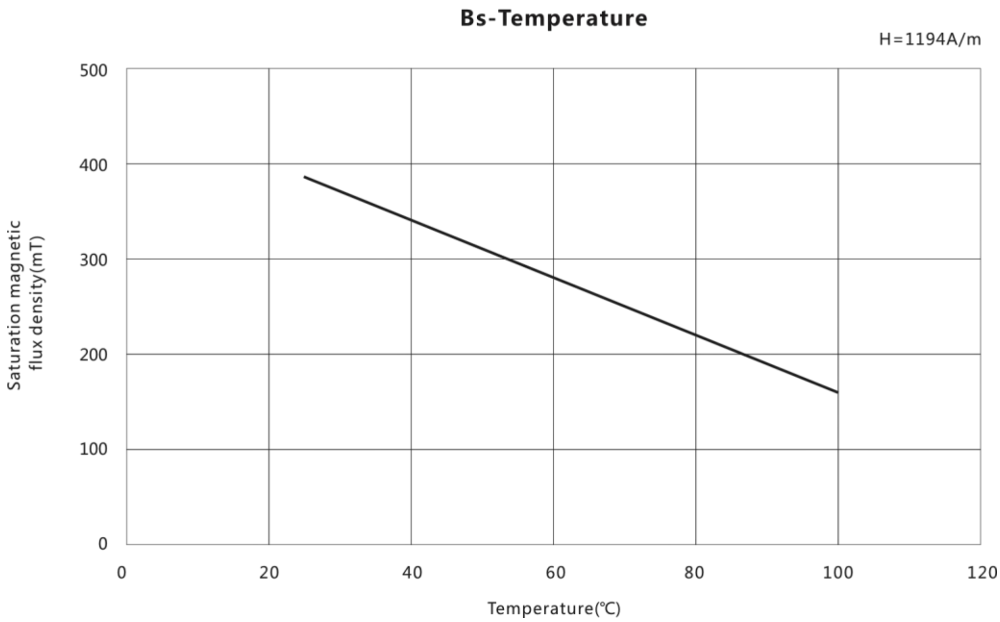


B-H



材料 / Material: **TLD10**



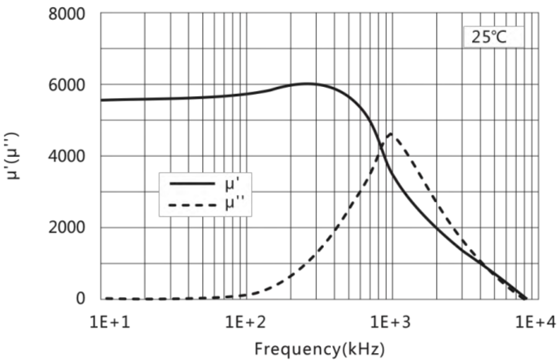


材料 / Material: **TSR5**

特点 / Features:

1. 高磁导率(约5500) / High Initial Permeability(About 5500)
2. 低比损耗因子 / Low Relative Loss Factor
3. 更优的频率特性 / The Initial Permeability Vs Frequency Characteristic is Better

μ'(μ")-Frequency



Initial permeability	μ_i	25℃ 10kHz	5500±30%
		25℃ 1MHz	3000
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	430
Remanent	Br(mT)	25℃	70
Coercivity	Hc(A/m)	25℃	6
Relative loss factor	$\tan\delta/\mu_i$ ($\times 10^{-6}$)	25℃ 100kHz	< 10
Relative temperature coefficient	$\alpha_{\mu ir}$ (10^{-6}/℃)	20℃ ~ 60℃	-0.5 ~ 2.0
Curie temperature	Tc(℃)		≥150
Electrical resistivity	ρ(Ω·m)		1
Density	d(kg/m³)		4.9×10^3

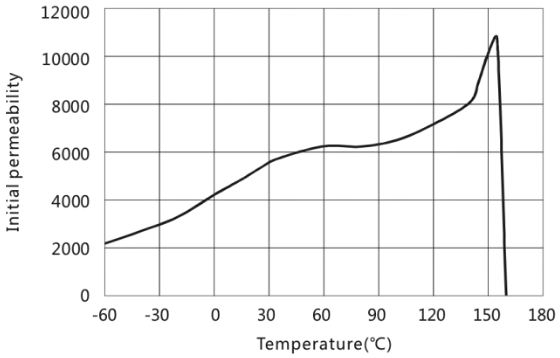
Test core：Toroid(mm)

OD：25

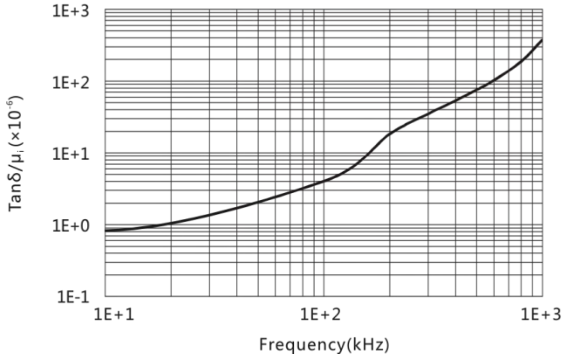
ID：15

H：7.5

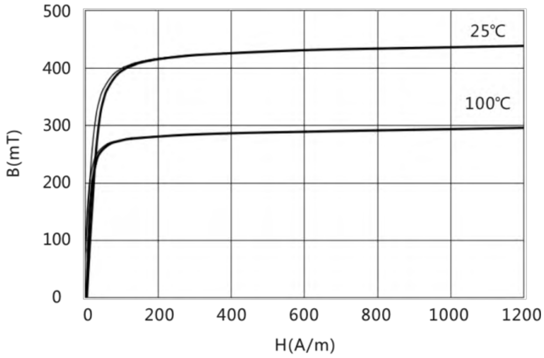
μ_i-Temperature



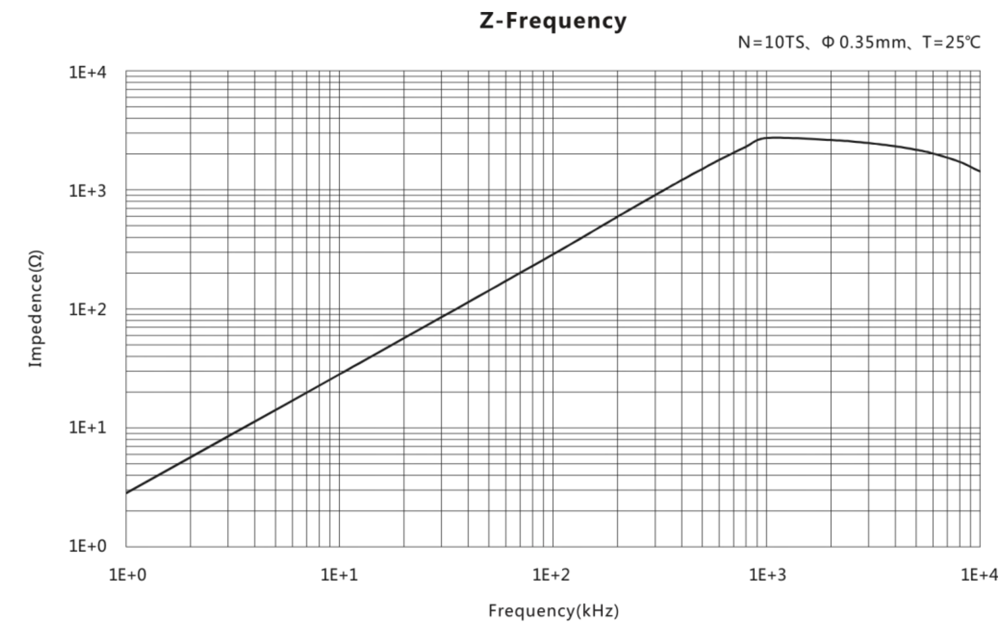
tanδ/μ_i-Frequency

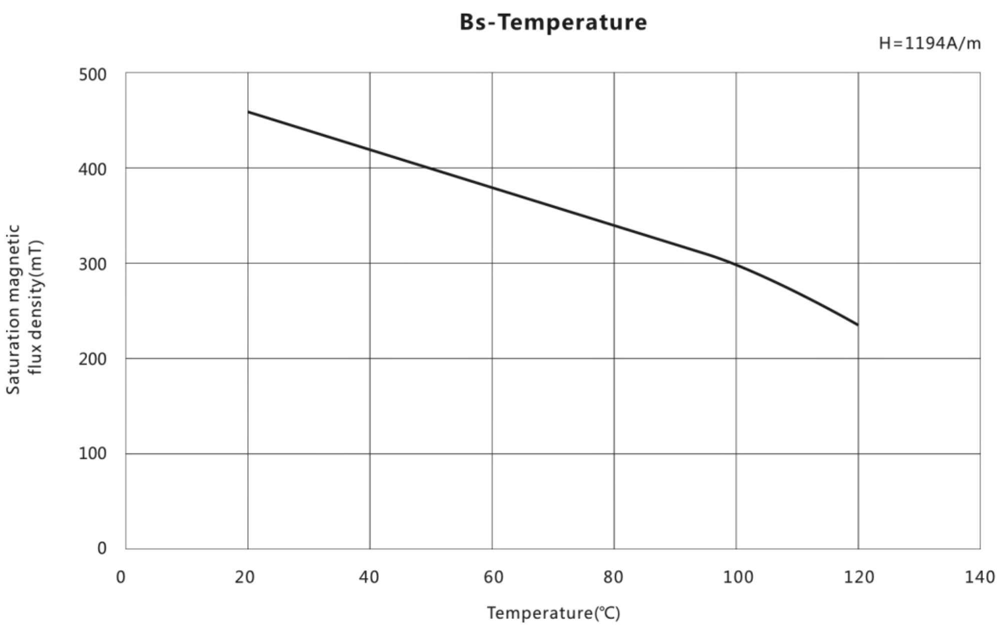


B-H



材料 / Material: **TSR5**



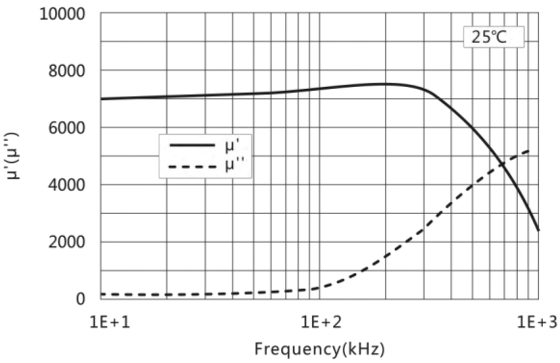


材料 / Material: **TSR7**

特点 / Features:

1. 高磁导率(约7000) /High Initial Permeability(About 7000)
2. 低比损耗因子 / Low Relative Loss Factor
3. 更优的频率特性 / The Initial Permeability Vs Frequency Characteristic is Better

μ'(μ")-Frequency



Initial permeability	μ_i	25℃ 10kHz 25℃ 800kHz	7000±30% 3500
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	430
Remanent	Br(mT)	25℃	80
Coercivity	Hc(A/m)	25℃	6
Relative loss factor	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃ 100kHz	≤15
Relative temperature coefficient	$\alpha_{\mu ir}$ (10^{-6}/℃)	20℃ ~ 60℃	-0.5 ~ 2.0
Curie temperature	Tc(℃)		≥150
Electrical resistivity	ρ(Ω·m)		0.3
Density	d(kg/m^3)		4.9×10^3

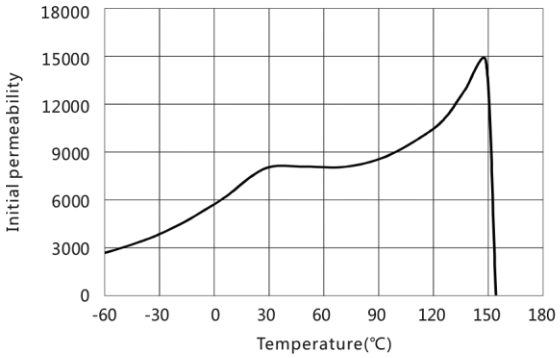
Test core：Toroid(mm)

OD：25

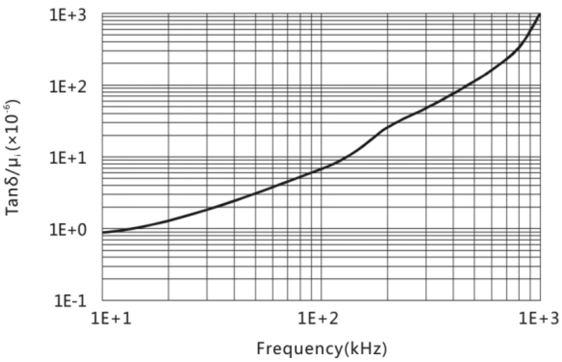
ID：15

H：7.5

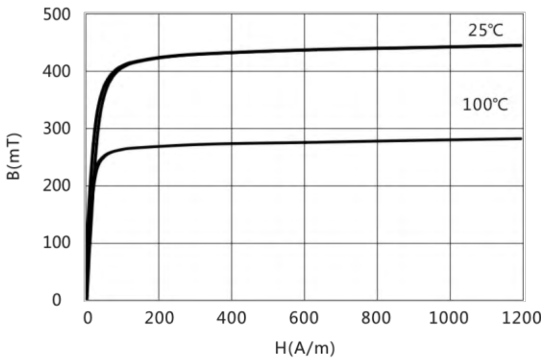
μ_i-Temperature



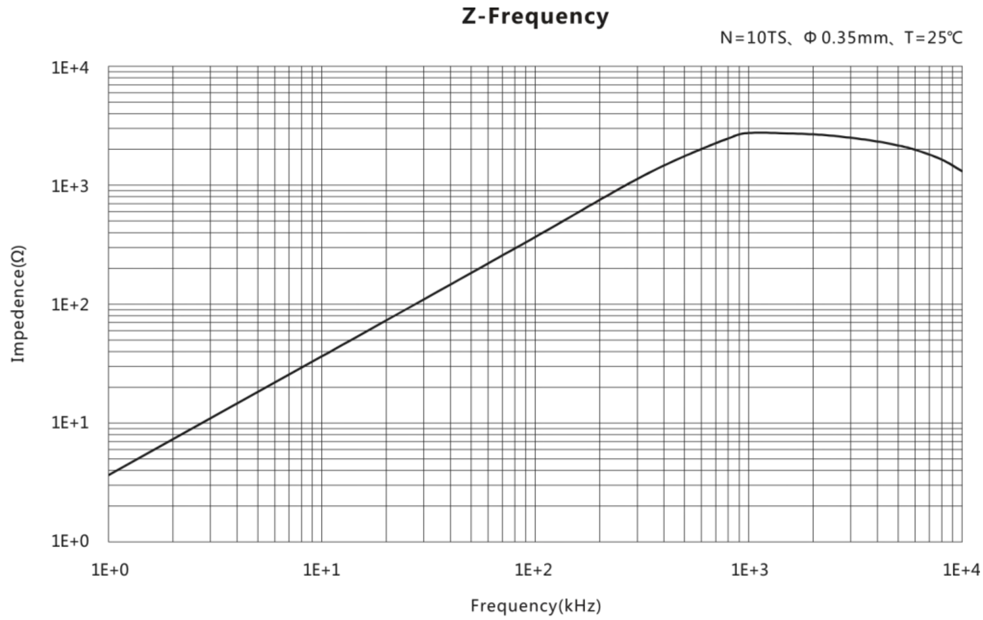
$\tan\delta/\mu_i$-Frequency

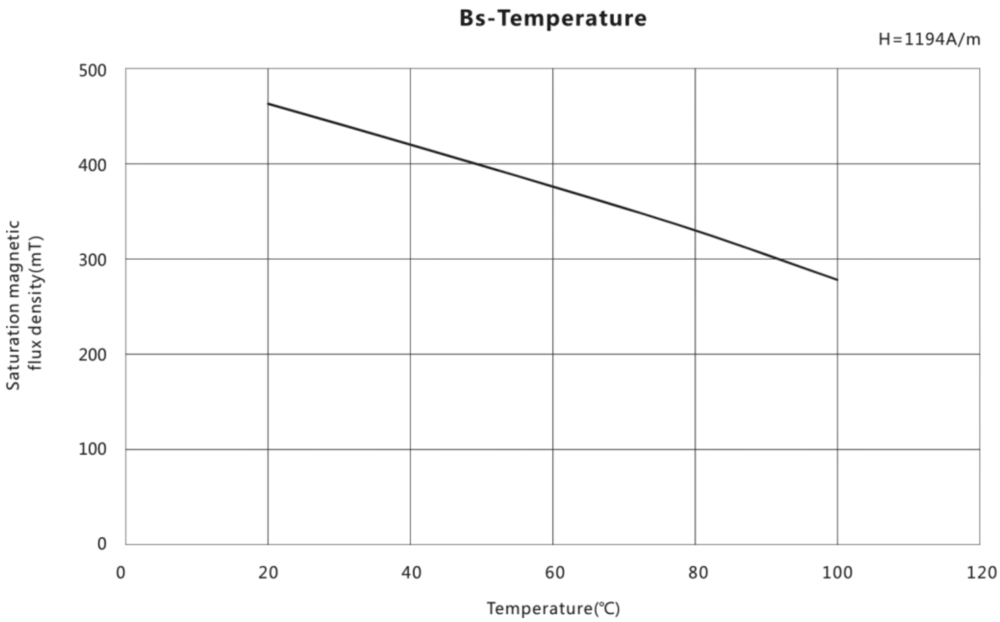


B-H



材料 / Material: **TSR7**



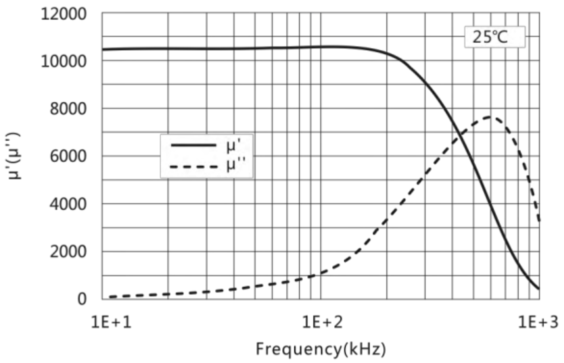


材料 / Material: **TSR10**

特点 / Features:

1. 高磁导率(约10000) / High Initial Permeability(About 10000)
2. 低比损耗因子 / Low Relative Loss Factor
3. 更优的频率特性 / The Initial Permeability Vs Frequency Characteristic is Better

μ'(μ")-Frequency



Initial permeability	μ_i	25℃ 10kHz	10000±30%
		25℃ 200kHz	9500
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	410
Remanent	Br(mT)	25℃	100
Coercivity	Hc(A/m)	25℃	5
Relative loss factor	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃ 100kHz	≤20
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20℃～60℃	-0.3～1.0
Curie temperature	Tc(℃)		≥130
Electrical resistivity	ρ(Ω·m)		0.2
Density	d(kg/m³)		4.95×10^3

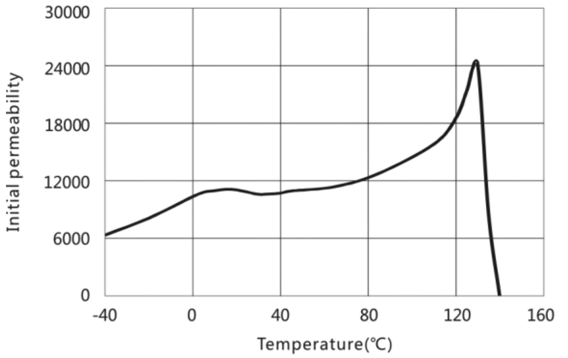
Test core：Toroid(mm)

OD：25

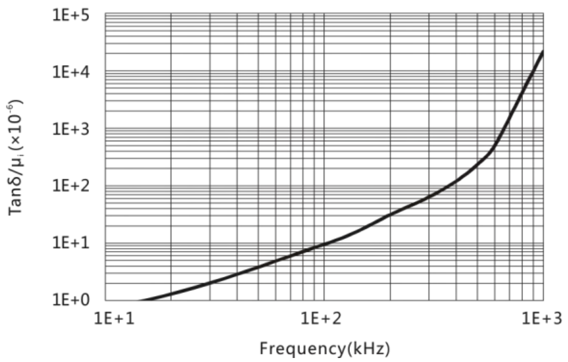
ID：15

H：7.5

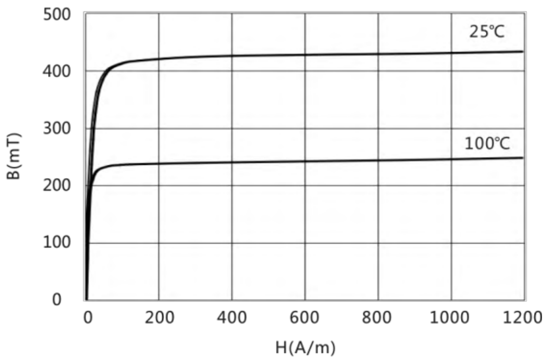
μ_i-Temperature



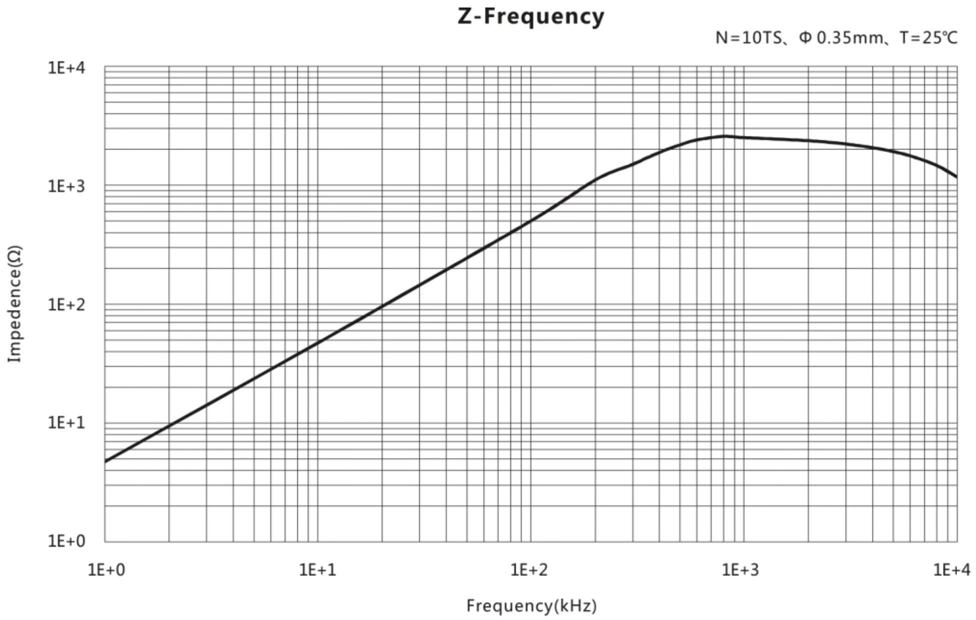
$\tan\delta/\mu_i$-Frequency

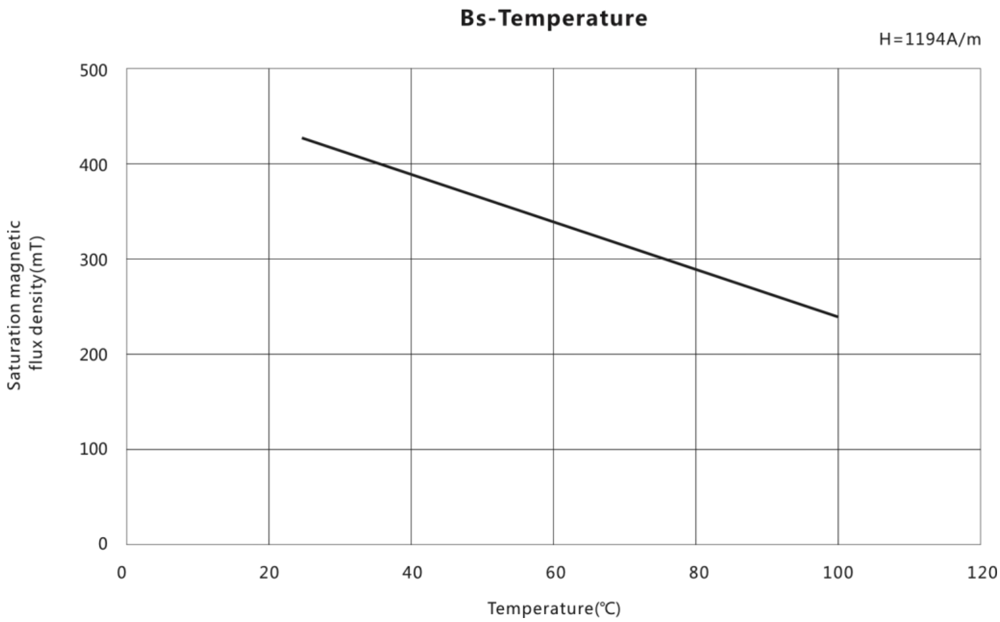


B-H



材料 / Material: **TSR10**



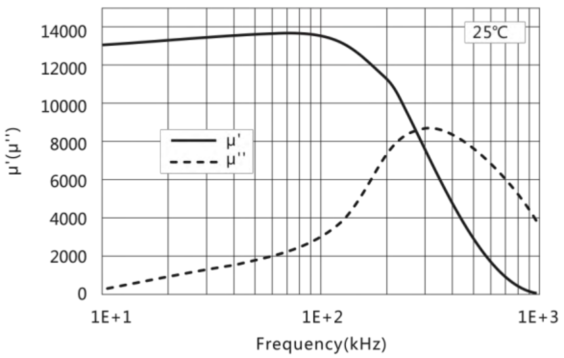


材料 / Material: **TSR13**

特点 / Features:

1. 高磁导率(约13000) / High Initial Permeability(About 13000)
2. 低比损耗因子 / Low Relative Loss Factor
3. 更优的频率特性 / The Initial Permeability Vs Frequency Characteristic is Better

μ'(μ")-Frequency



Initial permeability	μ_i	25℃ 10kHz	13000±30%
		25℃ 200kHz	10000
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	410
Remanent	Br(mT)	25℃	100
Coercivity	Hc(A/m)	25℃	6
Relative loss factor	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃ 100kHz	≤20
Relative temperature coefficient	$\alpha_{\mu ir}$ (10^{-6}/℃)	20℃～60℃	-0.5～2.0
Curie temperature	Tc(℃)		≥130
Electrical resistivity	ρ(Ω·m)		0.15
Density	d(kg/m³)		4.9×10^3

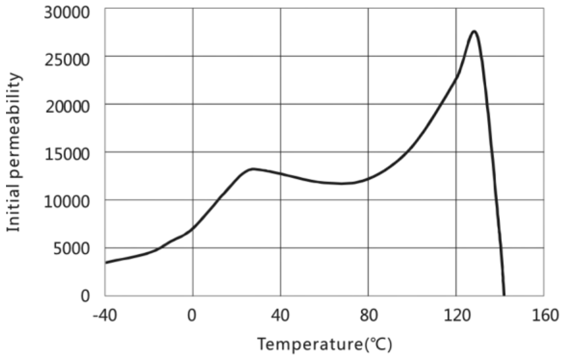
Test core：Toroid(mm)

OD：25

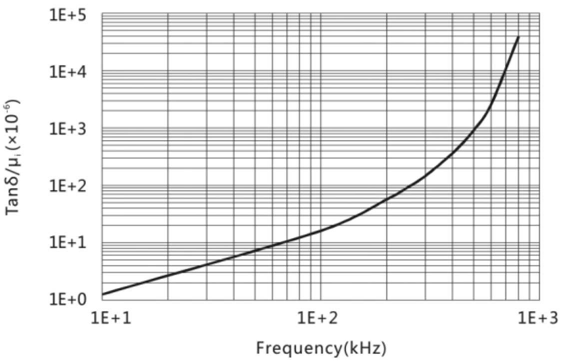
ID：15

H：7.5

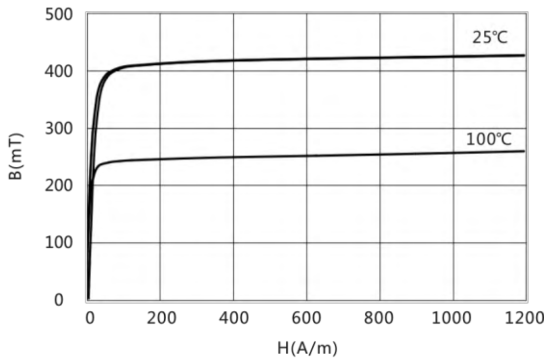
μ_i-Temperature



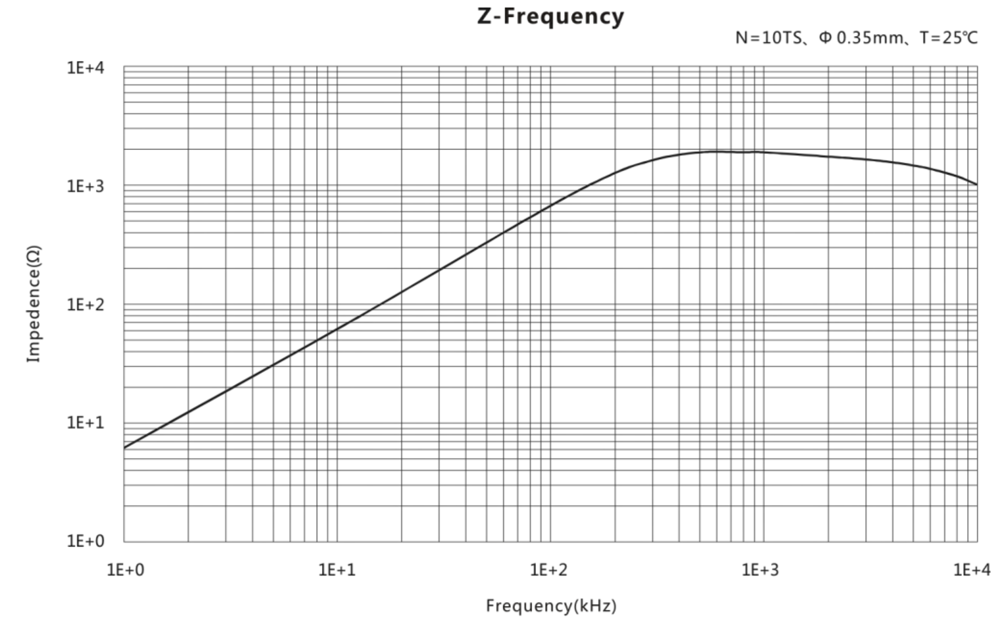
$\tan\delta/\mu_i$-Frequency

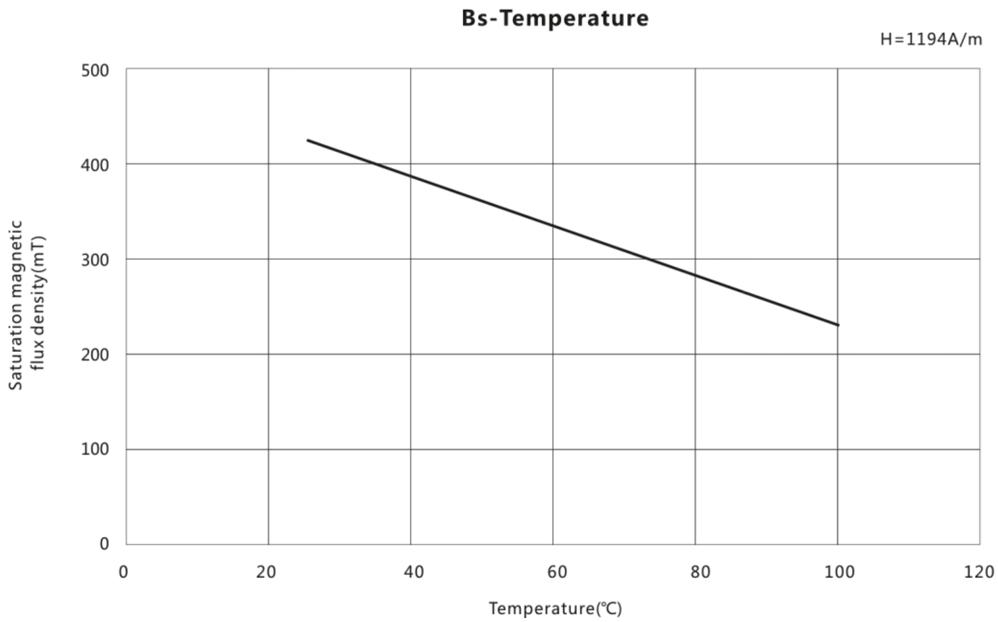


B-H



材料 / Material: **TSR13**



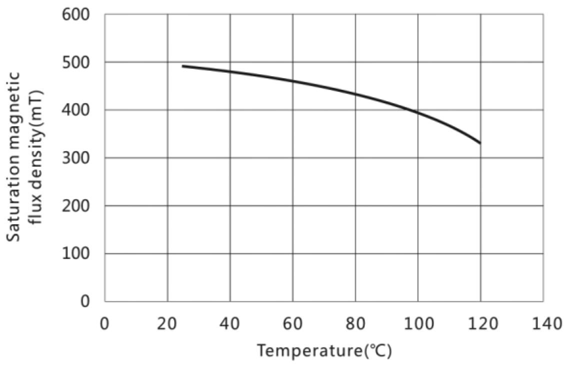


材料 / Material: **TD3**

特点 / Features:

1. 高饱和磁感应强度过 / High Saturation Flux Density
2. 较高的初始磁导率 / High Initial Permeability
3. 低磁心损耗 / Low Core Loss

Bs-Temperature



Initial permeability	μ_i	25℃	3200±25%
Saturation magnetic flux density	Bs(mT)	25℃	490
	1194A/m	100℃	390
Remanent flux density	Br(mT)	25℃	100
		100℃	80
Coercivity	Hc(A/m)	25℃	16
		100℃	12
Relative loss factor	$\tan\delta/\mu_i$	25℃ 10kHz	< 3.0
	$(\times 10^{-6})$	25℃ 10kHz	< 4.5
Core loss	$Pcv(kW/m^3)$	25℃	380
	100kHz 200mT	100℃	660
Curie temperature	Tc(℃)		≥200
Electrial resistivity	ρ(Ω·m)		1
Density	$d(kg/m^3)$		4.8×10^3

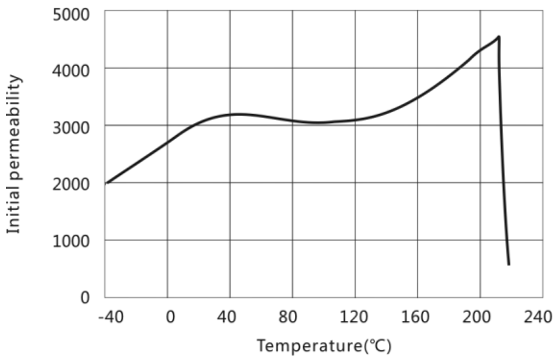
Test core：Toroid(mm)

Od：31

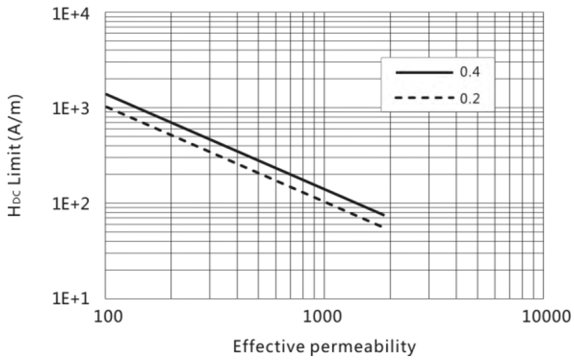
ID：19

H：6

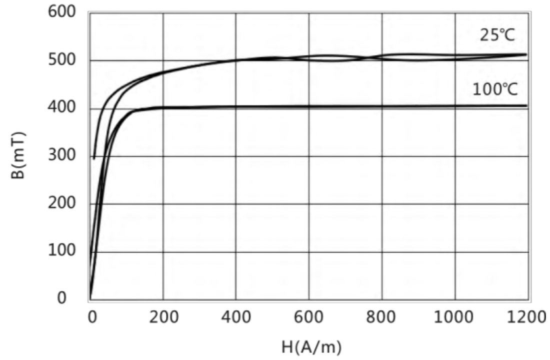
μ_i-Temperature



HDC Limit-μe



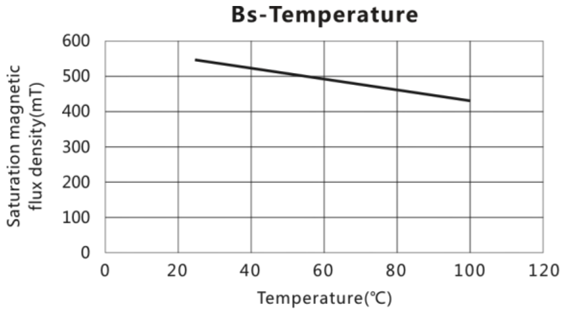
B-H

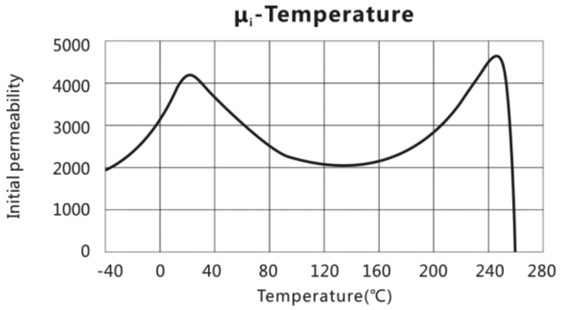


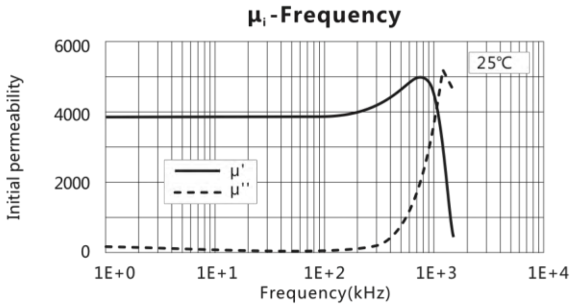
材料 / Material: **TD5B**

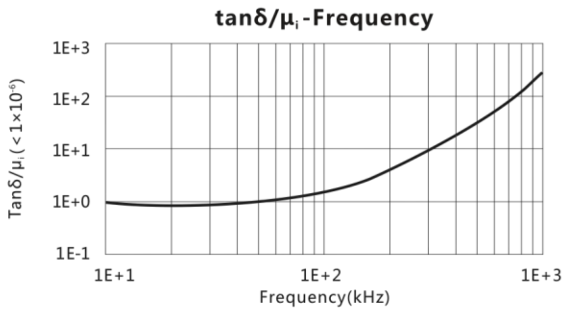
特点 / Features:

1. 高饱和磁感应强度 / High Saturation Flux Density
2. 较高的初始磁导率 / High Initial Permeabiliy
3. 低比损耗因子 / Low Relative Loss Factor
4. 高直流叠加 / High DC-Bias



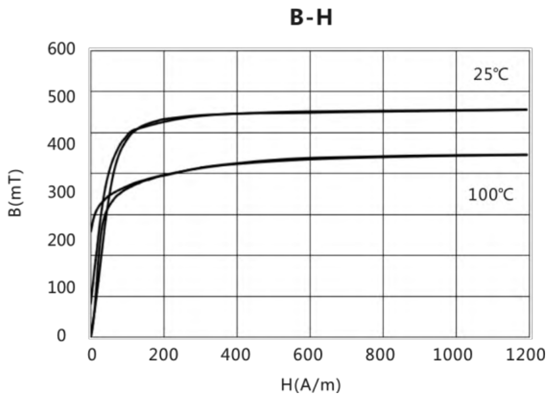






Initial permeability	μ_i	25℃	4000±25%
Saturation magnetic	Bs(mT)	25℃	550
flux density	1194A/m	100℃	435
Remanent flux	Br(mT)	25℃	90
density		100℃	240
Coercivity	Hc(A/m)	25℃	15
		100℃	21
Relative loss factor	$\tan\delta/\mu_i$	10kHz	< 1.0
	$(\times 10^{-6})$	100kHz	< 2.0
Curie temperature	Tc(℃)		≥260
Electrial resistivity	ρ(Ω·m)		1
Density	$d(kg/m^3)$		4.9×10^3

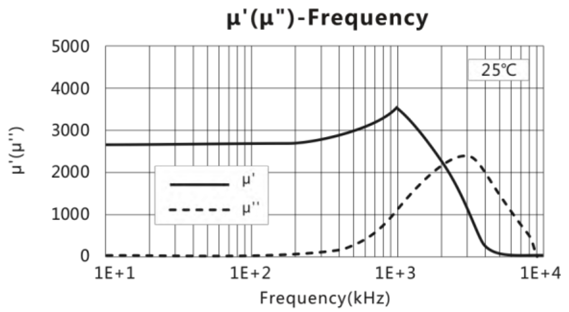
Test core：Toroid(mm)
OD：25
ID：15
H：7.5



材料 / Material: **TH2**

特点 / Features:

1. 低磁滞系数 / Low Magnetic Hysteresis Material Constant
2. 低比损耗因子 / Low Relative Factor



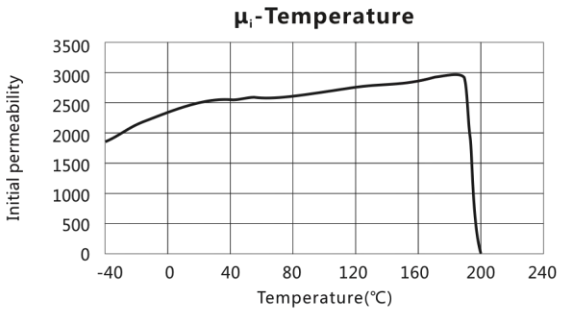
Initial permeability	μ_i	25℃	2300±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	430
		100℃	320
Remanent flux density	Br(mT)	25℃	65
		100℃	60
Coercivity	Hc(A/m)	25℃	26
		100℃	19
Relative loss factor	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃ 10kHz	< 2.7
		25℃ 100kHz	< 4.2
Hysteresis material constant	η_B (10^{-6}/mT) 1.5~3mT	25℃	<0.4
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	5℃~25℃	0.3~1.5
		25℃~55℃	0.3~1.3
Curie temperature	Tc(℃)		≥180
Electrical resistivity	ρ(Ω·m)		3
Density	d(kg/m³)		4.7×10^3

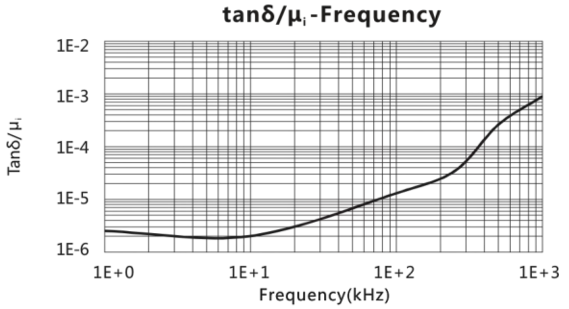
Test core：Toroid(mm)

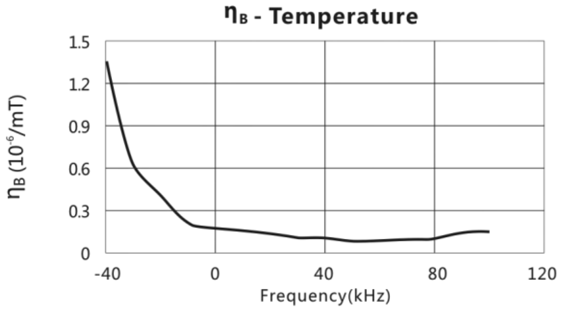
OD：31

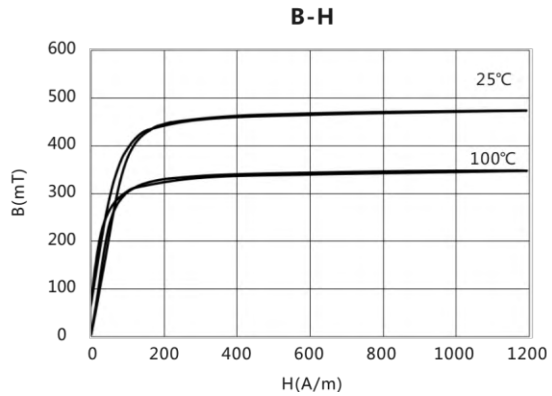
ID：19

H：6





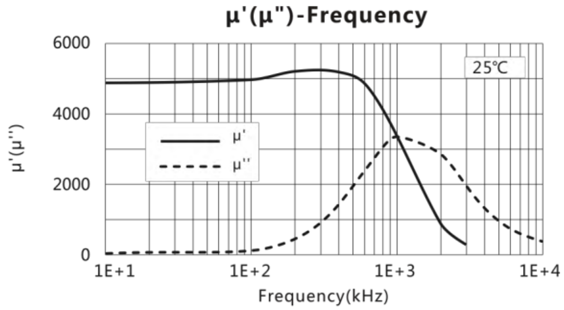


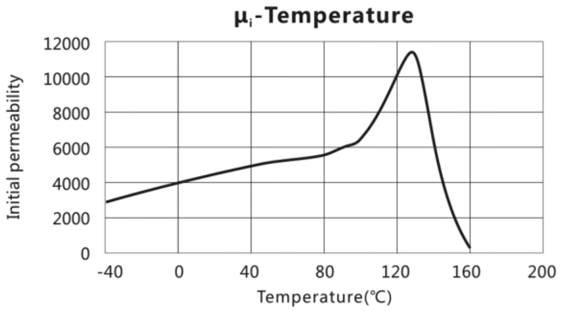


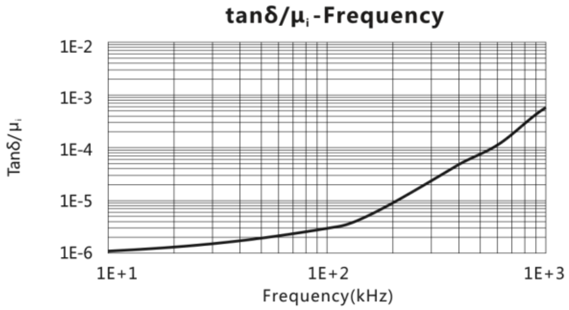
材料 / Material: **TH4**

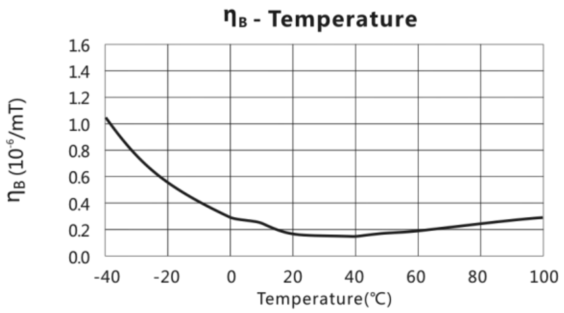
特点 / Features:

1. 宽温(-40℃~85℃)低磁滞损耗系数 / Low Magnetic Hysteresis Material Constantin a Wide Temperature Ranges(-40℃ to 85℃)
2. 低比损耗因子 / Low Relative Loss Factor
3. 较高的初始磁导率 / High Initial Permeability









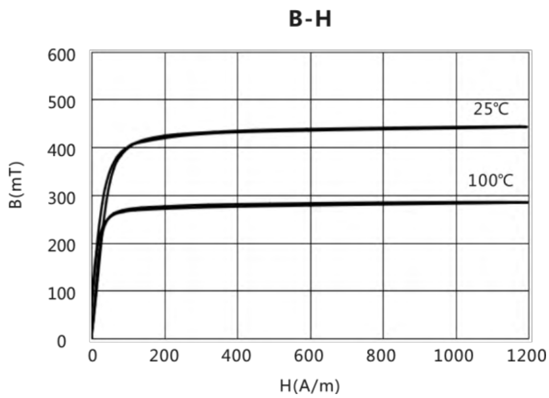
Initial permeability	μ_i	25℃	4000±25%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	430
		100℃	270
Remanent flux density	Br(mT)	25℃	80
		100℃	70
Coercivity	Hc(A/m)	25℃	8
		100℃	6
Relative loss factor	$Tan\delta/\mu_i$ ($\times10^{-6}$)	25℃ 10kHz	<5
		25℃ 500kHz	<70
Hysteresis material constant	η_B (10^{-6}/mT) 1.5~3mT	25℃ 10kHz	<0.3
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	5℃~25℃	0.3~1.5
		25℃~55℃	-0.3~1
Curie temperature	Tc(℃)		≥140
Electrial resistivity	ρ(Ω·m)		0.8
Density	d(kg/m³)		4.9×10^3

Test core：Toroid(mm)

OD：18

ID：8

H：5

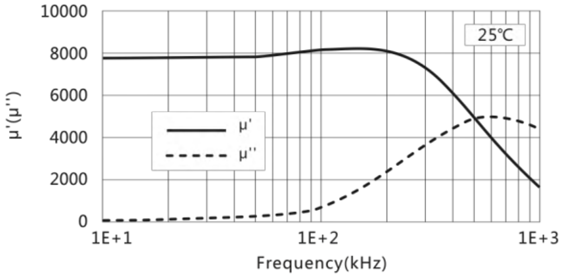


材料 / Material: **TH7**

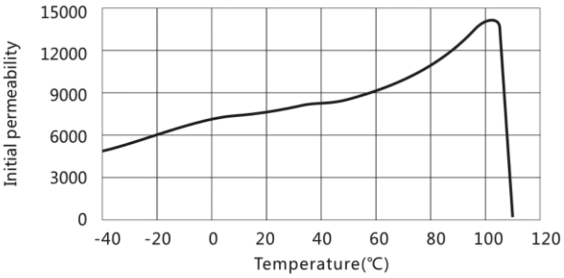
特点 / Features:

1. 低磁滞损耗系数 / Low Magnetic Hysteresis Material Constant
2. 低比损耗因子 / Low Relative Loss Factor
3. 高初始磁导率 / High Initial Permeability

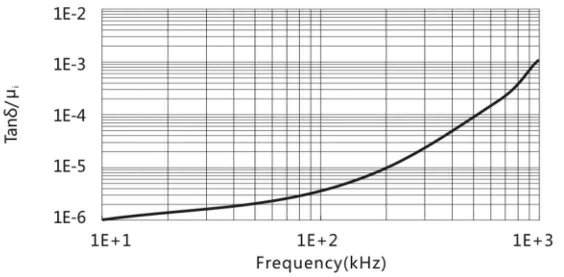
μ'(μ")-Frequency



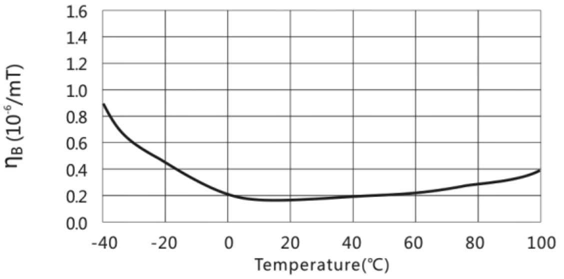
μ_i-Temperature



tanδ/μ_i-Frequency



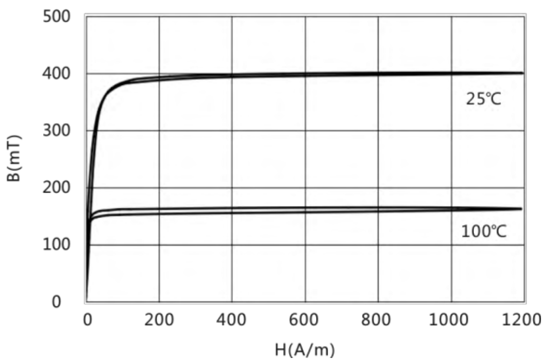
η_B - Temperature



Initial permeability	μ_i	25℃	7500±30%
Saturation magnetic flux density	Bs(mT) 1194A/m	25℃	390
		100℃	160
Remanent flux density	Br(mT)	25℃	90
		100℃	80
Coercivity	Hc(A/m)	25℃	8
		100℃	6
Relative loss factor	Tanδ/μ_i ($\times10^{-6}$)	25℃ 10kHz	< 2
Hysteresis material constant	η_B (10^{-6}/mT) 1.5~3mT	25℃ 10kHz	< 0.2
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	-40℃~25℃	0.5~1.5
		25℃~85℃	0.5~2.0
Curie temperature	Tc(℃)		≥105
Electrical resistivity	ρ(Ω·m)		0.5
Density	d(kg/m^3)		4.95×10^3

Test core：Toroid(mm)
OD：18
ID：8
H：5

B-H

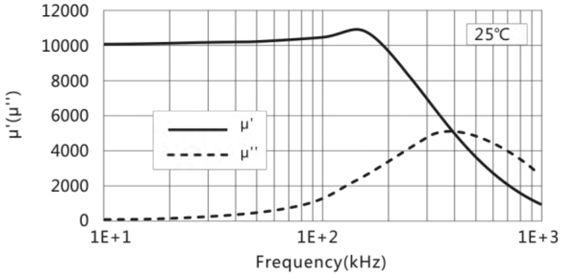


材料 / Material: **TH10**

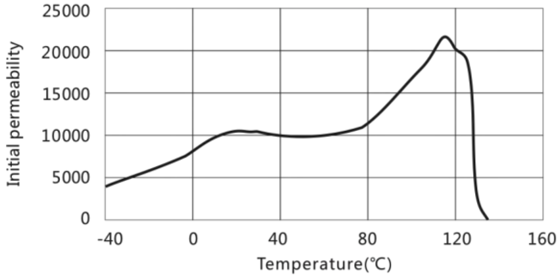
特点 / Features:

1. 低磁滞损耗系数 / Low Magnetic Hysteresis Material Constant
2. 低比损耗因子 / Low Relative Loss Factor
3. 高初始磁导率(约10000) / High Initial Permeability(About 10000)

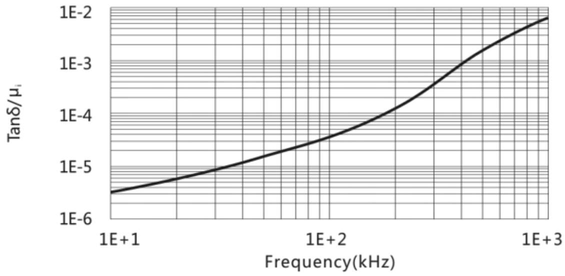
μ'(μ")-Frequency



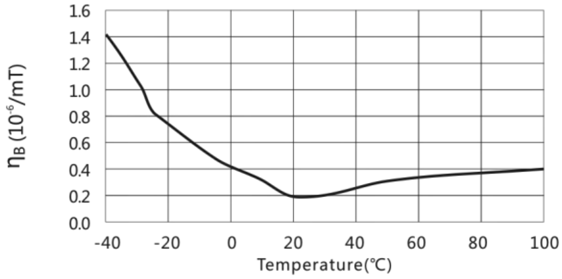
μ_i-Temperature



tanδ/μ_i-Frequency



η_B - Temperature



Initial permeability	μ_i	25℃	10000±30%
Saturation magnetic flux density	Bs(mT)	25℃	420
	1194A/m	100℃	220
Remanent flux density	Br(mT)	25℃	90
		100℃	100
Coercivity	Hc(A/m)	25℃	8
		100℃	7
Relative loss factor	Tanδ/μ_i ($\times10^{-6}$)	25℃ 10kHz	＜3
		25℃ 100kHz	＜20
Hysteresis material constant	η_B (10^{-6}/mT) 1.5~3mT	25℃ 10kHz	＜0.3
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	0℃~20℃	-1~1
		20℃~60℃	-1~1
Curie temperature	Tc(℃)		≥120
Electrial resistivity	ρ(Ω·m)		0.2
Density	d(kg/m^3)		4.9×10^3

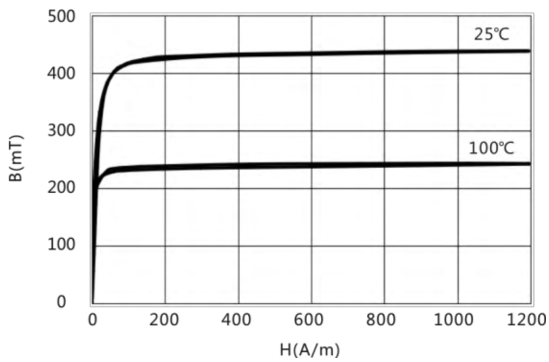
Test core：Toroid(mm)

OD : 18

ID : 8

H : 5

B-H

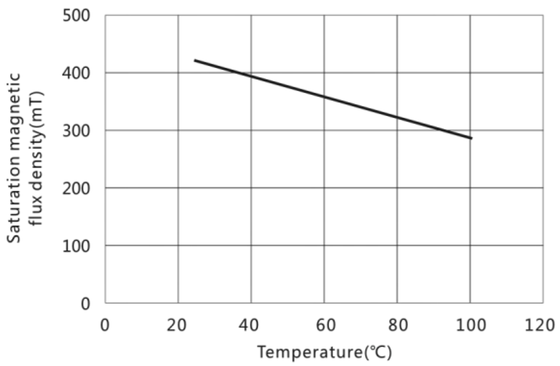


材料 / Material: **Ti1**

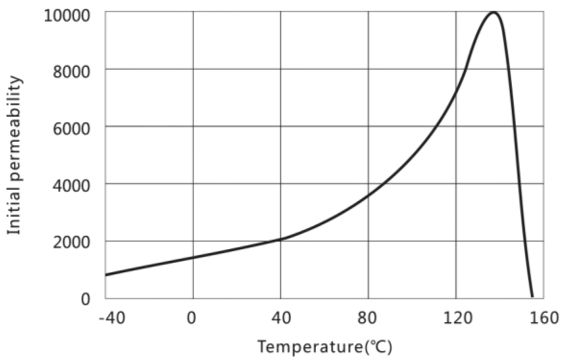
特点 / Features:

1. 使用时不受尺寸共振因素影响 / Does Not Have the Dimensional Resonance Limitations
2. 主要应用频段在1MHz到500MHz范围内 / Applications From as Low as 1MHz Up to 500MH
3. 为EMI抑制器专用设计 / Designed Specifically for EMI Suppression

Bs-Temperature



μ$_i$-Temperature



Initial permeability	μ_i	25℃	1500±25%
Saturation magnetic flux density	Bs(mT) 400A/m	25℃ 100℃	400 230
Remanence	Br(mT)	25℃ 100℃	300 170
Coercivity	Hc(A/m)	25℃ 100℃	25 10
Loss factor	$\tan\delta/\mu_i(\times10^{-6})$ 100Hz	25℃	20
Temperature coefficient	$\alpha_{\mu ir}$ $(\times10^{-2}$/℃)	20℃~70℃	＜10.6
Curie temperature	Tc(℃)		＞130
Electrical resistivity	ρ(Ω·m)		10
Density	d(kg/m³)		4.8×10^3

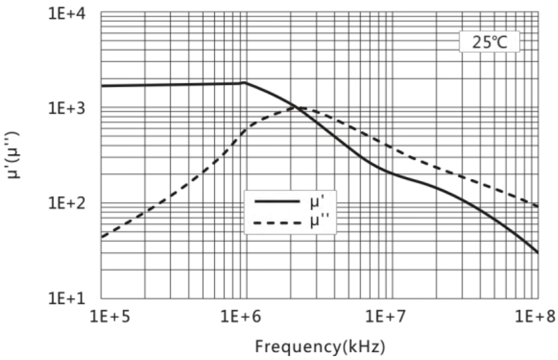
Test core：Toroid(mm)

OD：12.7

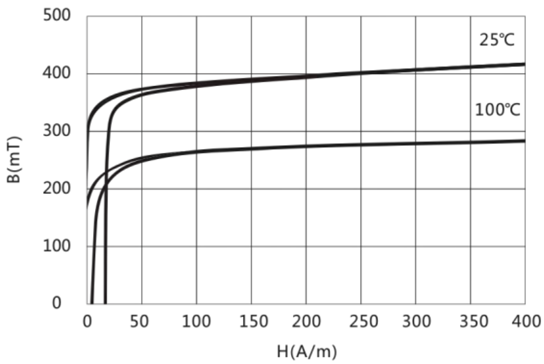
ID：7.9

H：6.5

μ'(μ")-Frequency



B-H



镍锌材料
NiZn Materials

本公司对所生产的镍锌铁氧体材料等作了如下规范:

Naming rule of TDG's Products:

材料命名:
Naming:

T N X Y

Y	表示不同特性的材质系列	Material series with the different characteristic
X	表示起始磁导率	Initial permeability
N	表示NiZn铁氧体材料	NiZn ferrite material
T	公司名称的第一个字母	The first letter of company name

例：
Example :

T N 40 H

H	表示具有抗热冲击特性的材质	The NiZn ferrite material with thermal shock resistance
40	表示40×10，故起始磁导率为400	The initial permeability is 400 (40X10)
N	表示NiZn铁氧体材料	NiZn ferrite material
T	公司名称的第一个字母	The first letter of company name

H — 抗热冲击系列NiZn铁氧体材质	The NiZn ferrite material with thermal shock resistance
D — 抗应力系列NiZn铁氧体材质	The NiZn ferrite material with stress-insensitive
B — 高饱和磁通密度系列NiZn铁氧体材质	The NiZn ferrite material with high saturation magnetic flux density
P — 高磁导率系列NiZn铁氧体材质	The NiZn ferrite material with high initial permeability
L — 低功耗系列NiZn铁氧体材质	The NiZn ferrite material with low core loss
G — 镁铜锌系列铁氧体材质	The MgCuZn ferrite material

镍锌铁氧体典型应用

Application of NiZn Ferrite

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Material Name</th><th>产品一般形状
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Applications</th></tr>
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Thermal shock
resistance</td><td>TN20H \ TN25H
TN35H \ TN40H \ TN41H
TN39H \ TN65H \ TN90H</td><td>DRR \ DRS \ DRC
RI \ R \ T \ P</td><td rowspan="3">功率电感、扼流圈
线性线圈、片式电感
电缆滤波、中周变压器
共模线圈、噪声滤波器
抗EMI 滤波电感
Power inductors
Choke coils
Linearity coils
Chip inductors
filters,IFT
Common mode coils
Noise filters
EMI filter inducotrs</td></tr>
<tr><td>抗应力系列
Stress-insensitive</td><td>TN2D \ TN6D \ TN50D</td><td>DRR \ DRC \ RID \ T</td></tr>
<tr><td>高叠加系列
High
superposition</td><td>TN12B \ TN20B \ TN25B
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TN100B \ TN200B</td><td>DRR \ DRS \ RID
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Anti-
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T \ R</td><td>高电压变压器
DC/DC转换器
LCD背光源变压器
High voltage transformer
DC/DC converter
LCD backlight transformers</td></tr>
</table>

镍锌铁氧体材料特性
Characteristics of NiZn Ferrite Material

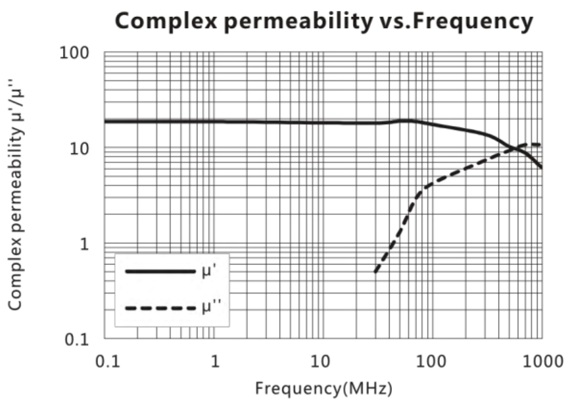
材质 Material	起始磁导率 μ_i Initial Permeability	饱和磁通密度 Bs Saturation Magnetic Flux Density		相对损耗因数 $\tan\delta/\mu_i$ Relative Loss Factor		比温度系数 $\alpha_{\mu ir}$ Relative Temperature Coefficient of μi	居里温度 Tc Curie Temperature	密度 d Density	电阻率 ρ Electrical Resistivity
	/	mT	kA/m	$\times 10^{-6}$	MHz	$\times 10^{-6}$/℃ (20～60℃)	℃	g/cm^3	Ω•m
TN2D	18±20%	320	16.0	≤200	20	70	>300	5.1	10^6
TN6D	55±20%	350	4.0	≤120	20	60	>300	5.1	10^6
TN12B	120±20%	430	4.0	≤65	0.1	65	>300	5.2	10^6
TN20H	200±20%	430	4.0	≤45	0.1	45	>300	5.1	10^6
TN20B	200±20%	500	8.0	≤50	0.1	40	>300	5.2	10^6
TN25B	250±20%	475	4.0	≤40	0.1	24	>300	5.2	10^6
TN25H	250±20%	420	4.0	≤30	0.5	30	>300	5.1	10^6
TN35B	350±20%	460	4.0	≤35	0.1	25	>260	5.2	10^6
TN35H	350±20%	450	4.0	≤25	0.1	20	>260	5.2	10^6
TN40H	400±20%	410	4.0	≤25	0.1	25	>250	5.1	10^6
TN41H	400±20%	430	4.0	≤25	0.1	13	>230	5.1	10^6
TN39H	500±20%	410	4.0	≤25	0.1	15	>190	5.1	10^6
TN50D	500±20%	350	4.0	≤18	0.1	1	>160	5.1	10^6
TN65B	650±20%	400	4.0	≤17	0.1	18	>190	5.2	10^6
TN65H	650±20%	400	4.0	≤15	0.1	15	>185	5.1	10^6
TN80L	800±20%	410	4.0	≤13	0.1	13	>190	5.1	10^6
TN80G	800±20%	270	4.0	≤30	0.1	15	>130	4.9	10^6
TN90H	900±20%	340	4.0	≤20	0.1	15	>140	5.1	10^6
TN100B	1000±20%	320	4.0	≤10	0.05	5	>130	5.2	10^6
TN120L	1200±20%	360	1.6	≤18	0.1	13	>160	5.1	10^6
TN130G	1300±20%	240	4.0	≤15	0.01	8	>85	4.8	10^6
TN150P	1500±20%	300	1.6	≤20	0.1	5	>110	5.2	10^6
TN200B	2000±20%	290	4.0	≤10	0.01	2	>100	5.2	10^6

注：通常特性指标的测试温度为25℃，特别标注除外；
Note：Except the special marks，the test temperature is 25℃.

材料 / Material: **TN2D**

特点 / Features:

1. 抗应力 / Stress-Insensitive



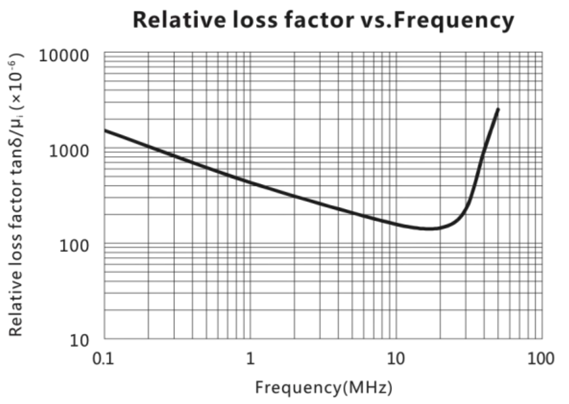
Initial permeability	μ_i	25℃	18±20%
Saturation magnetic flux density	Bs(mT) 16000A/m	25℃	320
Relative loss factor 20MHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤200
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	70
Curie temperature	Tc(℃)		＞300
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.1×10^3

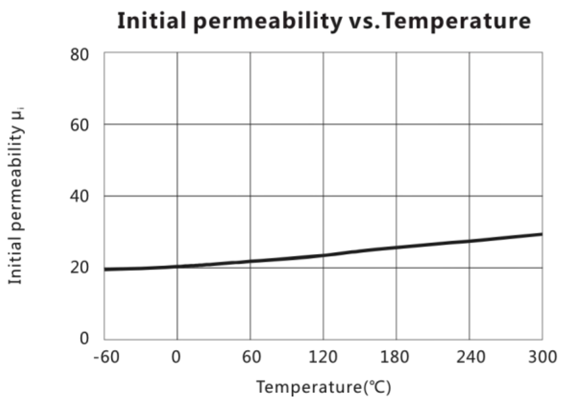
Test core：Toroid(mm)

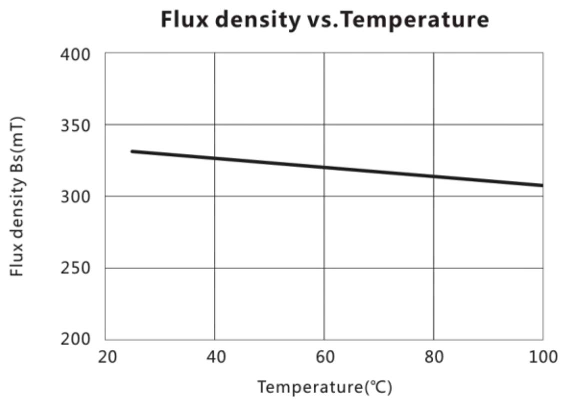
OD：12.7

ID：7.9

H：6.5





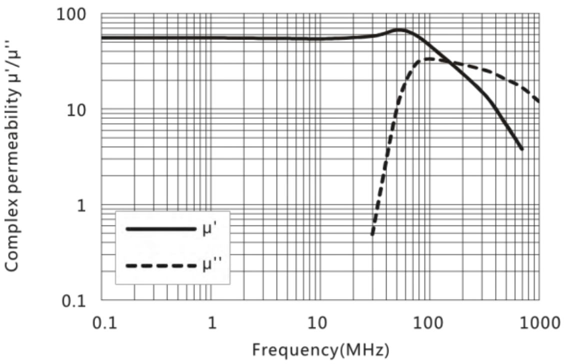


材料 / Material: **TN6D**

特点 / Features:

1. 抗应力 / Stress-Insensitive

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	55±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	350
Relative loss factor 20MHz	$\tan\delta/\mu_i$ ($\times 10^{-6}$)	25℃	≤120
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times 10^{-6}$/℃)	20～60℃	60
Curie temperature	Tc(℃)		＞300
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.1×10^3

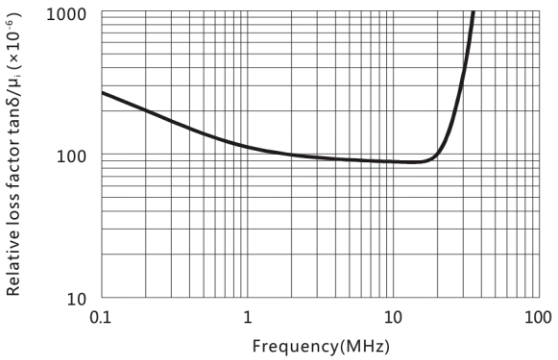
Test core：Toroid(mm)

OD：12.7

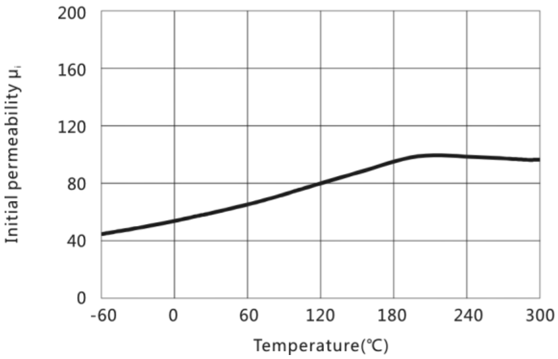
ID：7.9

H：6.5

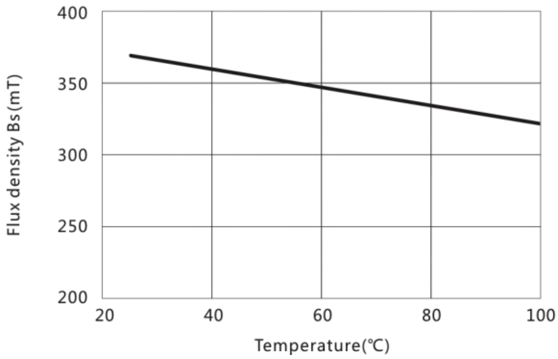
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature

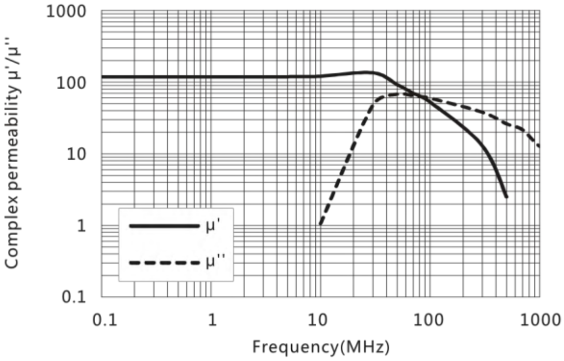


材料 / Material: **TN12B**

特点 / Features:

1. 高饱和磁通密度 / High Bs

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	120±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	430
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times 10^{-6}$)	25℃	≤65
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times 10^{-6}$/℃)	20～60℃	65
Curie temperature	Tc(℃)		＞300
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.2×10^3

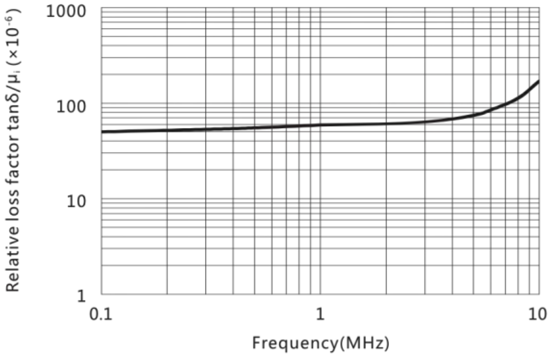
Test core：Toroid(mm)

OD：12.7

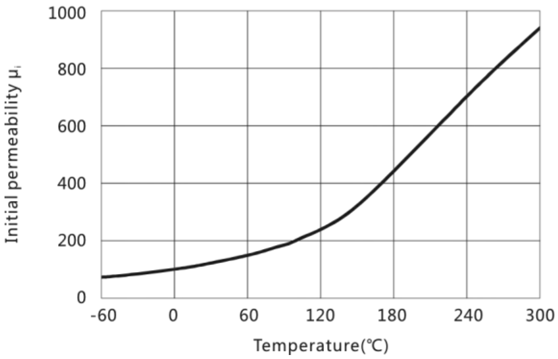
ID：7.9

H：6.5

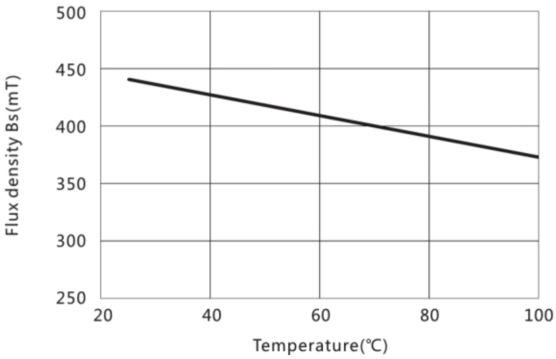
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature

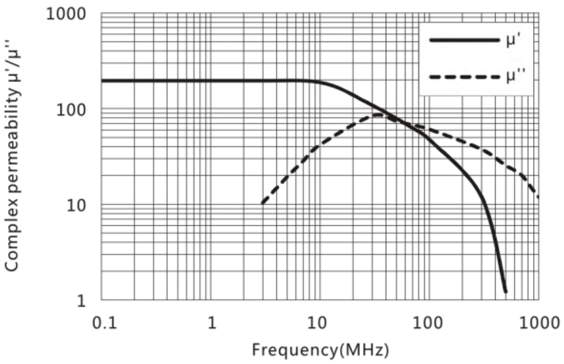


材料 / Material: **TN20H**

特点 / Features:

1. 耐热冲击 / Thermal Shock Resistance

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	200±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	430
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤45
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	45
Curie temperature	Tc(℃)		＞300
Electrical resistivity	ρ(Ω·m)		10^{6}
Density	d(kg/m^{3})		5.1×10^{3}

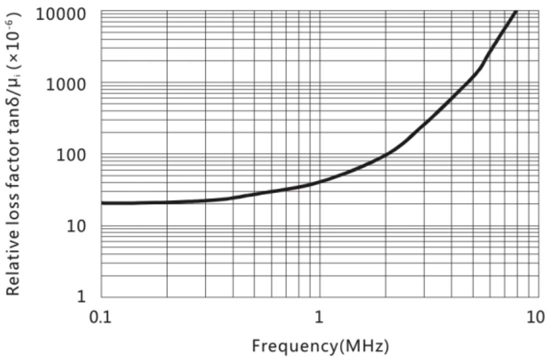
Test core：Toroid(mm)

OD：12.7

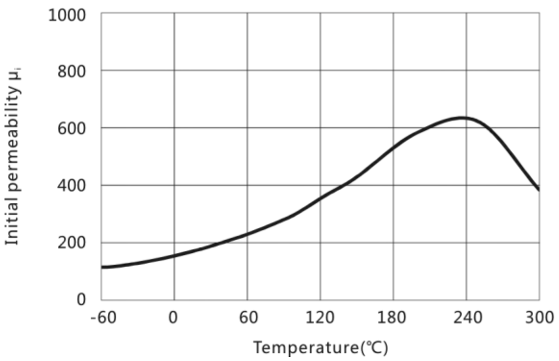
ID：7.9

H：6.5

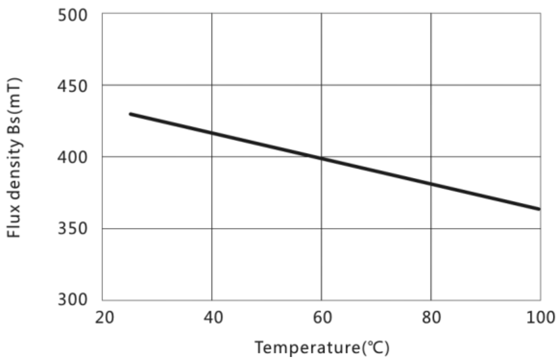
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature

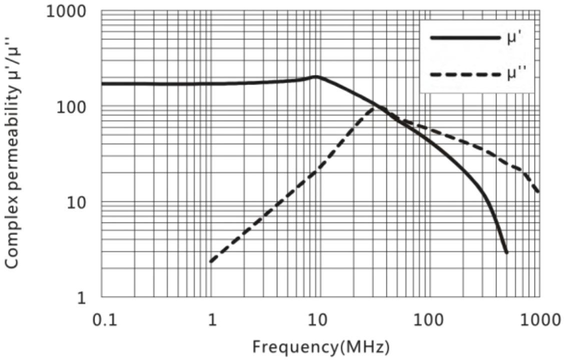


材料 / Material: **TN20B**

特点 / Features:

1. 高饱和磁通密度 / High Bs

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	200±20%
Saturation magnetic flux density	Bs(mT) 8000A/m	25℃	500
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤50
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	40
Curie temperature	Tc(℃)		＞300
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.2×10^3

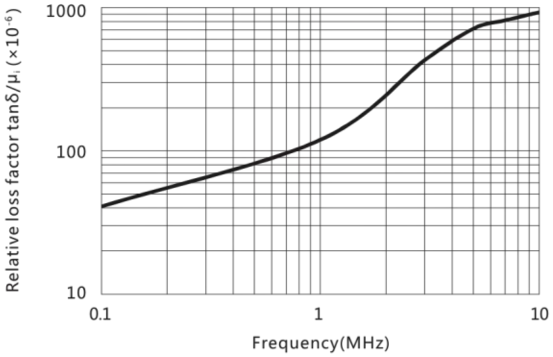
Test core：Toroid(mm)

OD：12.7

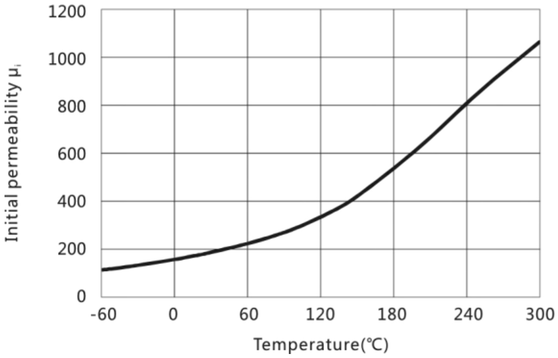
ID：7.9

H：6.5

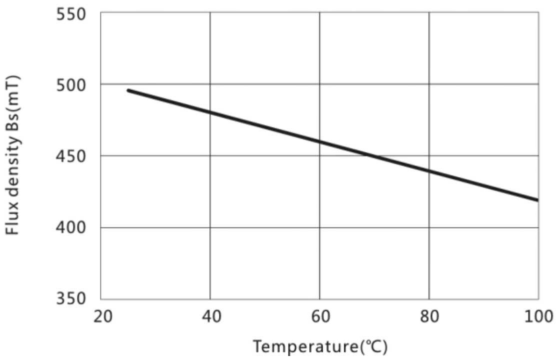
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



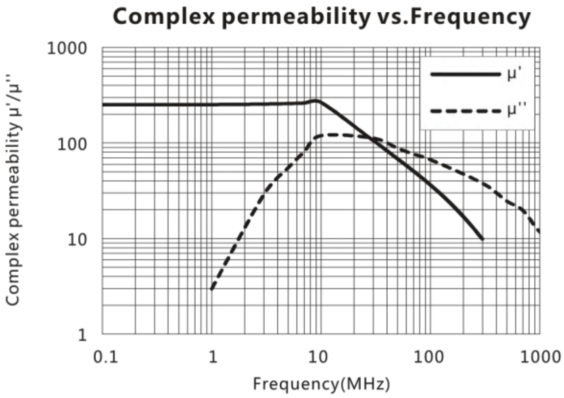
Flux density vs.Temperature



材料 / Material: **TN25B**

特点 / Features:

1. 高饱和磁通密度 / High Bs



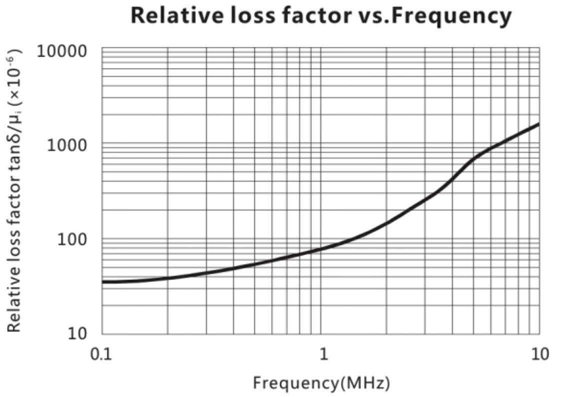
Initial permeability	μ_i	25℃	250±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	475
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤40
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	24
Curie temperature	Tc(℃)		＞300
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m³)		5.2×10^3

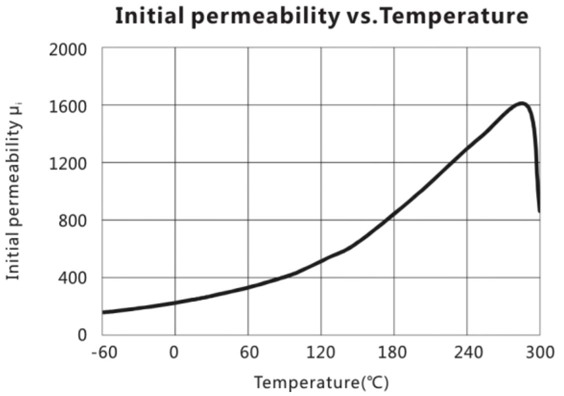
Test core：Toroid(mm)

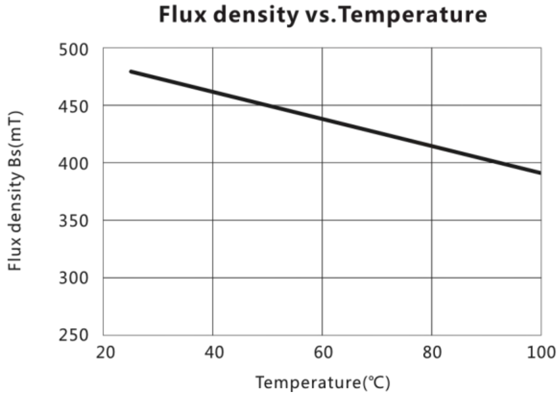
OD：12.7

ID：7.9

H：6.5





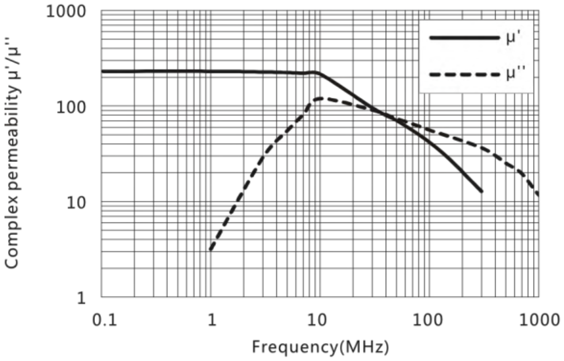


材料 / Material: **TN25H**

特点 / Features:

1. 耐热冲击 / Thermal Shock Resistance

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	250±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	420
Relative loss factor 500kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤30
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	30
Curie temperature	Tc(℃)		＞300
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.1×10^3

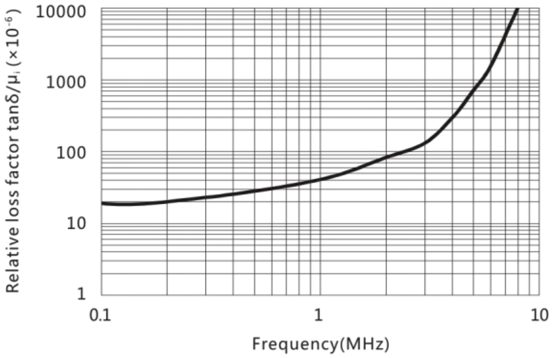
Test core：Toroid(mm)

OD：12.7

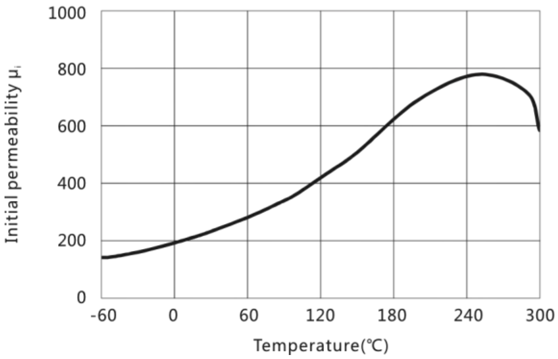
ID：7.9

H：6.5

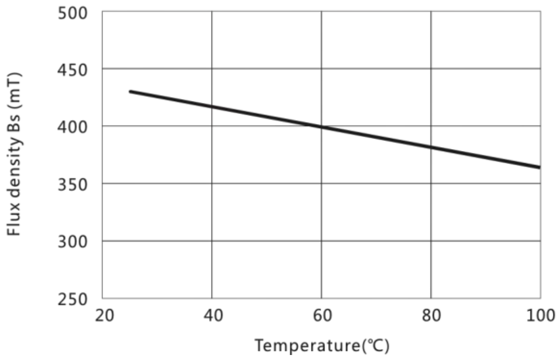
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature



材料 / Material: **TN35B**

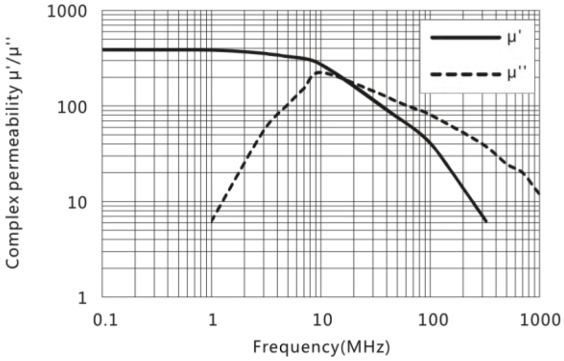
特点 / Features:

1. 高饱和磁通密度 / High Bs

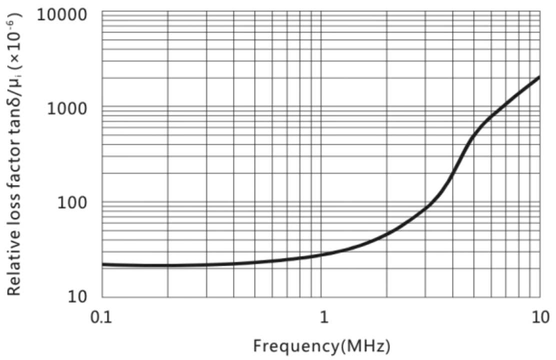
Initial permeability	μ_i	25℃	350±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	460
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤35
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	25
Curie temperature	Tc(℃)		＞260
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.2×10^3

Test core：Toroid(mm)
OD：12.7
ID：7.9
H：6.5

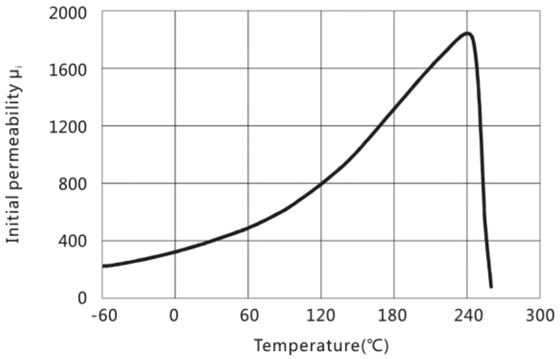
Complex permeability vs.Frequency



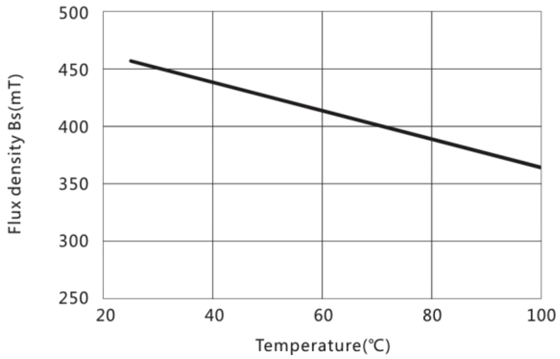
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature

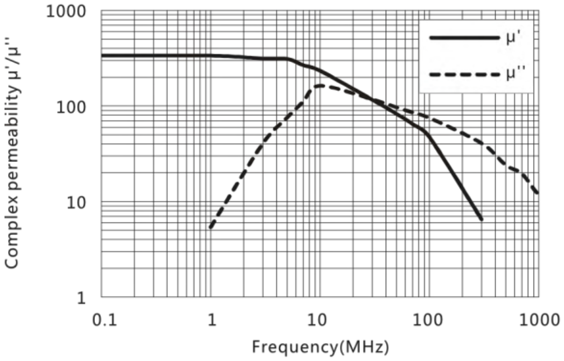


材料 / Material: **TN35H**

特点 / Features:

1. 高饱和磁通密度 / High Bs
2. 耐热冲击 / Thermal Shock Resistance

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	350±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	450
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤25
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	20
Curie temperature	Tc(℃)		＞260
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.2×10^3

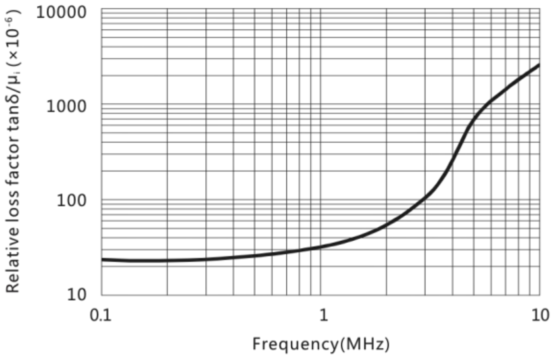
Test core：Toroid(mm)

OD：12.7

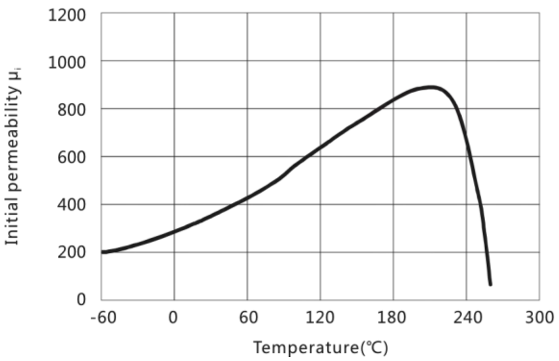
ID：7.9

H：6.5

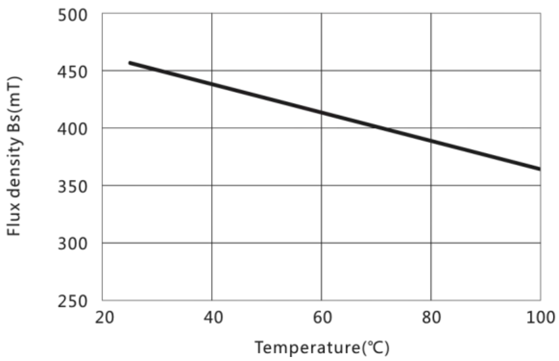
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature

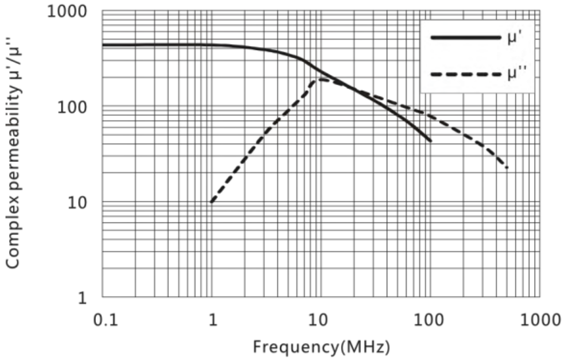


材料 / Material: **TN40H**

特点 / Features:

1. 耐热冲击 / Thermal Shock Resistance

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	400±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	410
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤25
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	25
Curie temperature	Tc(℃)		＞250
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.1×10^3

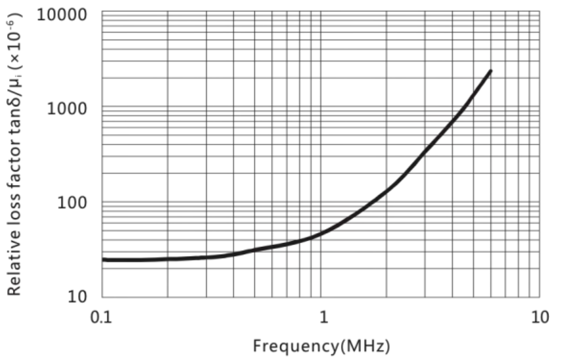
Test core：Toroid(mm)

OD：12.7

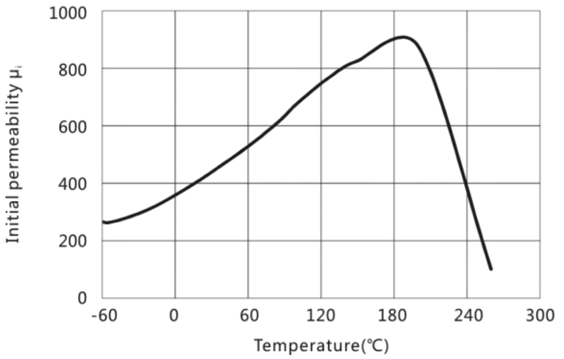
ID：7.9

H：6.5

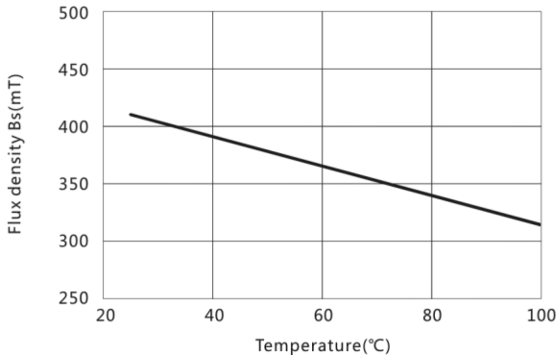
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



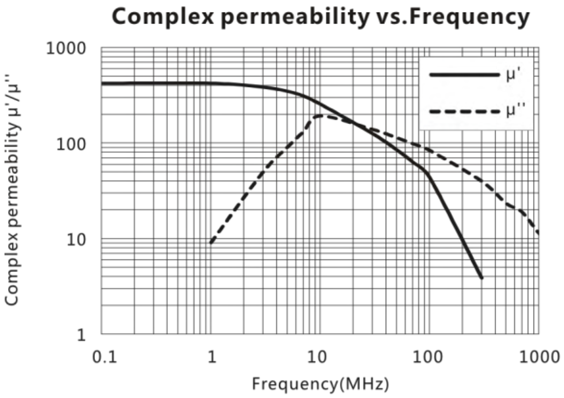
Flux density vs.Temperature



材料 / Material: **TN41H**

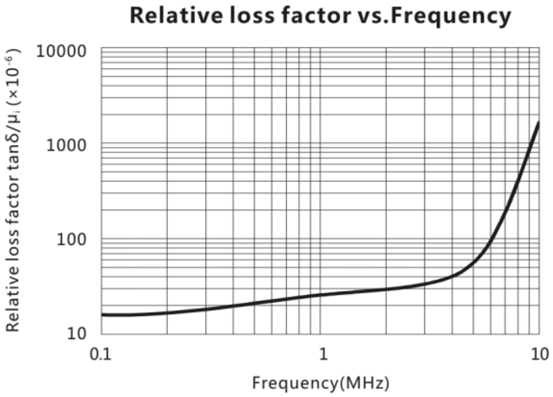
特点 / Features:

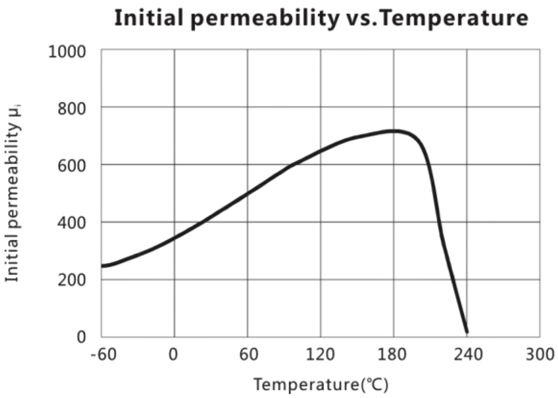
1. 耐热冲击 / Thermal Shock Resistance

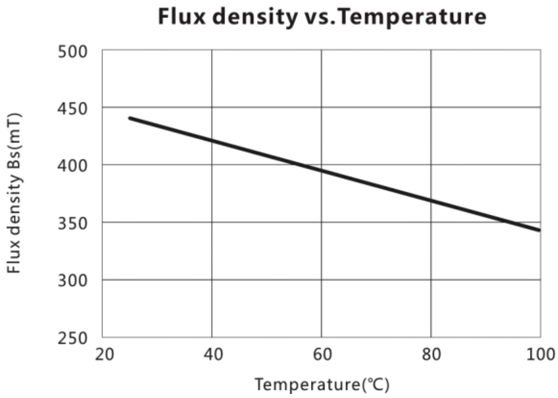


Initial permeability	μ_i	25℃	400±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	430
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤25
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	13
Curie temperature	Tc(℃)		>230
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.1×10^3

Test core：Toroid(mm)
OD：12.7
ID：7.9
H：6.5





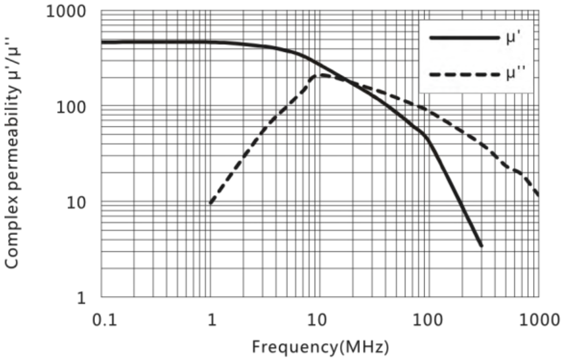


材料 / Material: **TN39H**

特点 / Features:

1. 耐热冲击 / Thermal Shock Resistance

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	500±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	410
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤25
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	15
Curie temperature	Tc(℃)		>190
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m³)		5.1×10^3

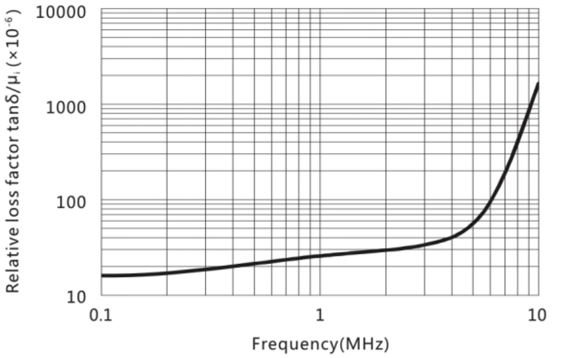
Test core：Toroid(mm)

OD：12.7

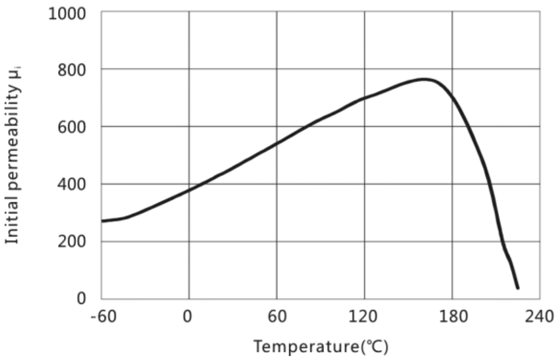
ID：7.9

H：6.5

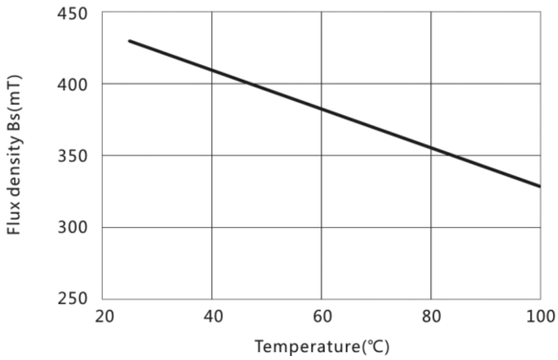
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature

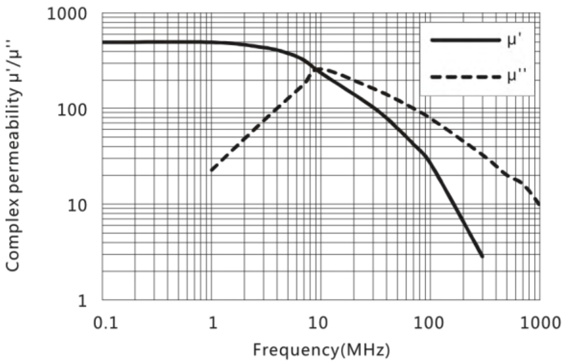


材料 / Material: **TN50D**

特点 / Features:

1. 抗应力 / Stress-Insensitive
2. 低比温度系数 / Low Relative Temperature Coefficient

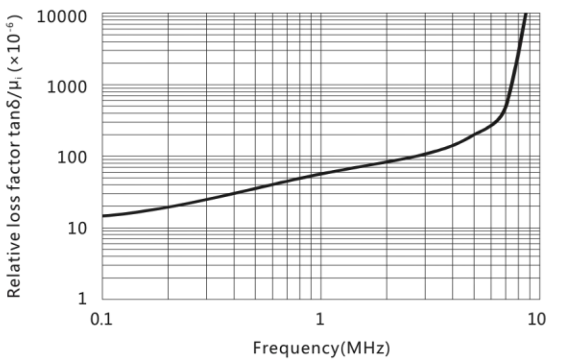
Complex permeability vs.Frequency



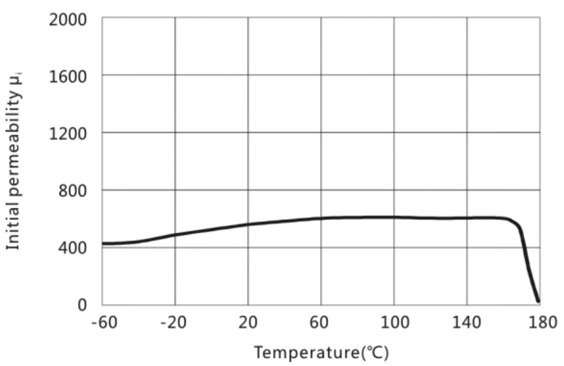
Initial permeability	μ_i	25℃	500±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	350
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤18
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	1
Curie temperature	Tc(℃)		>160
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.1×10^3

Test core：Toroid(mm)
OD：12.7
ID：7.9
H：6.5

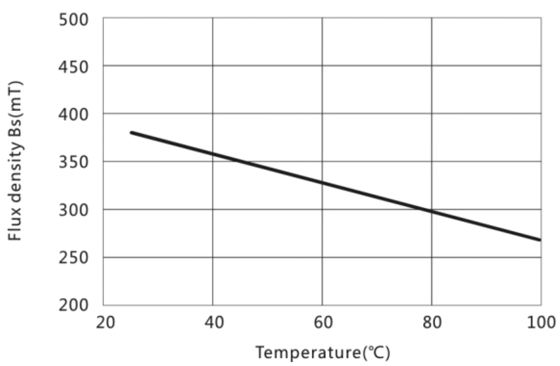
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature

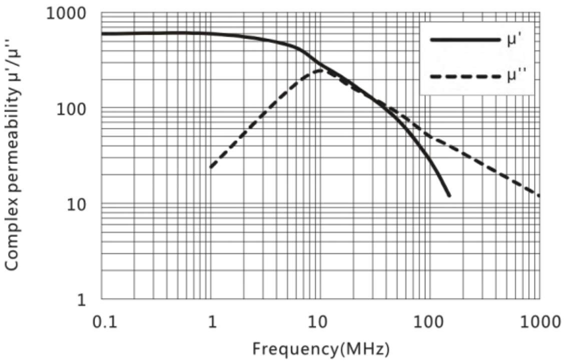


材料 / Material: **TN65B**

特点 / Features:

1. 高饱和磁通密度 / High Bs

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	650±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	400
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤17
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	18
Curie temperature	Tc(℃)		>190
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.2×10^3

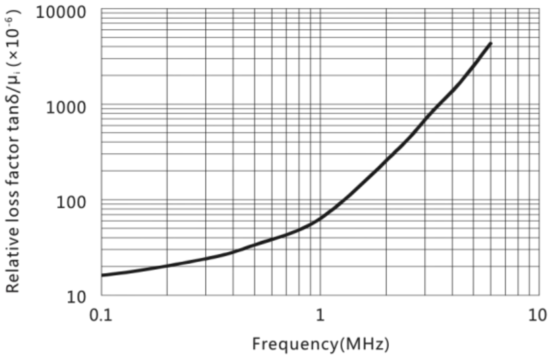
Test core：Toroid(mm)

OD：12.7

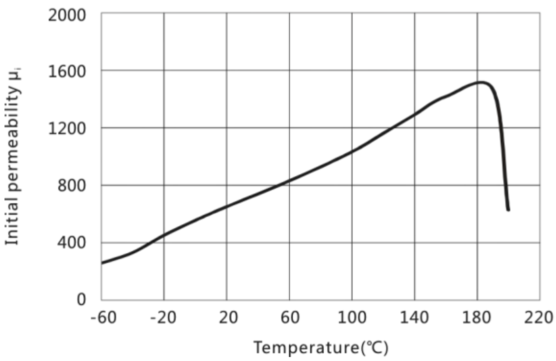
ID：7.9

H：6.5

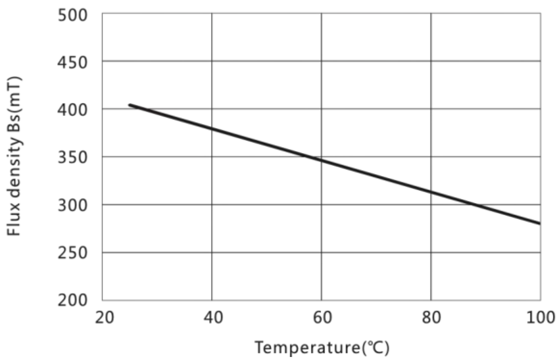
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature

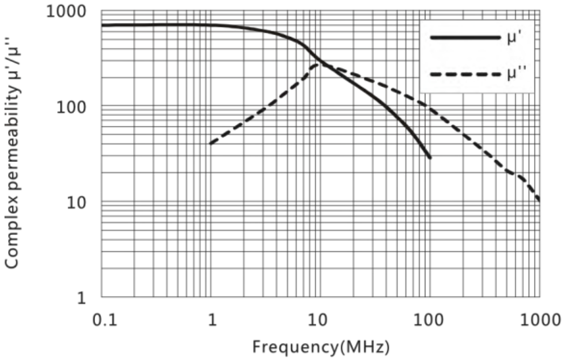


材料 / Material: **TN65H**

特点 / Features:

1. 耐热冲击 / Thermal Shock Resistance

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	650±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	400
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤15
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	15
Curie temperature	Tc(℃)		>185
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.1×10^3

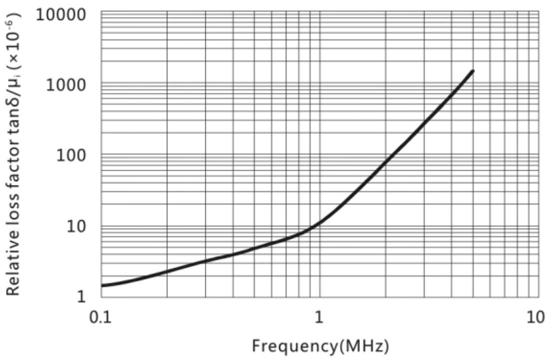
Test core：Toroid(mm)

OD：12.7

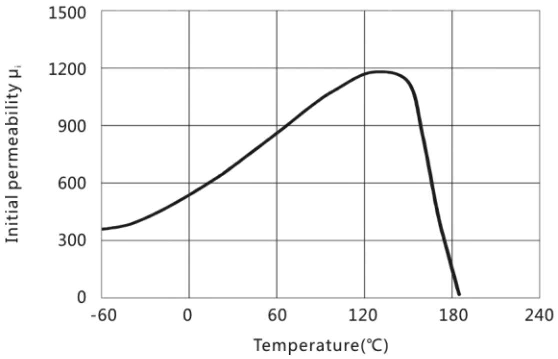
ID：7.9

H：6.5

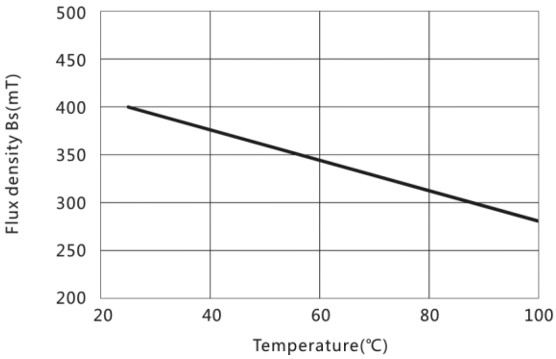
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature



材料 / Material: **TN80L**

特点 / Features:

1. 低功耗 / Low Power Loss

Initial permeability	μ_i	25℃	800±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	410
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤13
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	13
Curie temperature	Tc(℃)		>190
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.1×10^3

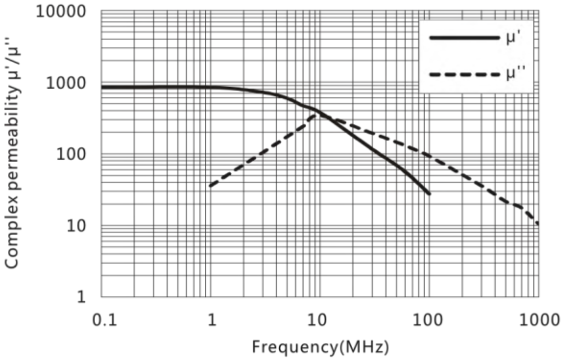
Test core：Toroid(mm)

OD：12.7

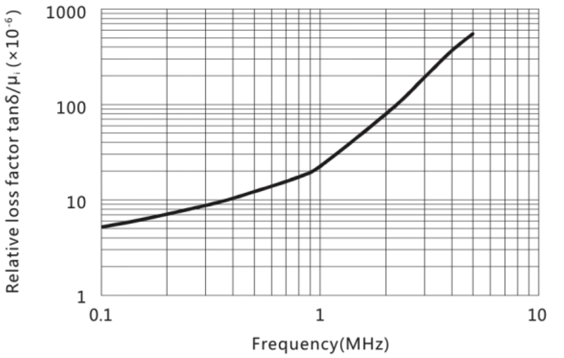
ID：7.9

H：6.5

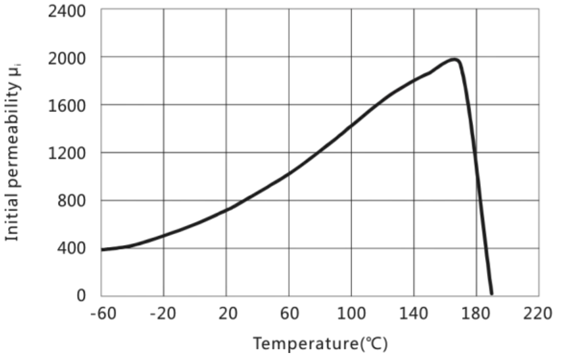
Complex permeability vs.Frequency



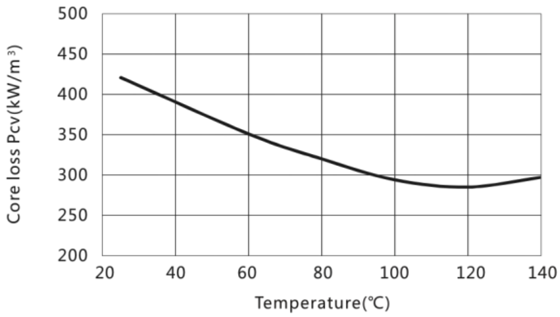
Relative loss factor vs.Frequency



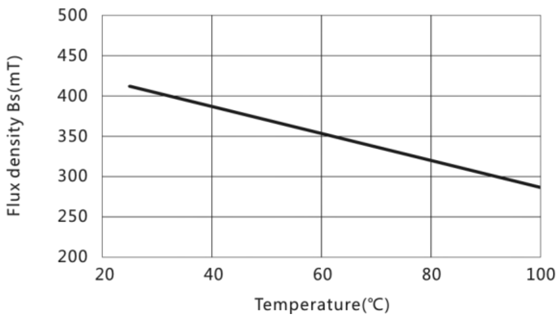
Initial permeability vs.Temperature



Core loss vs.Temperature(50kHz,150mT)

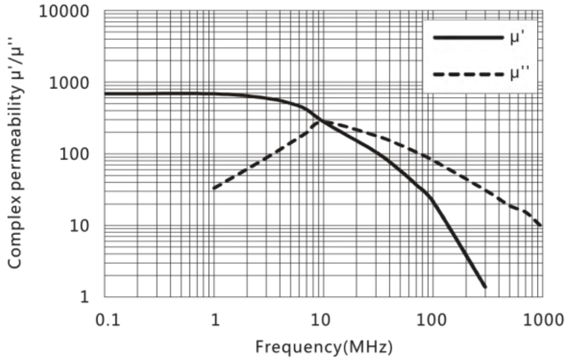


Flux density vs.Temperature



材料 / Material: **TN80G**

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	800±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	270
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤30
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	15
Curie temperature	Tc(℃)		>130
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		4.9×10^3

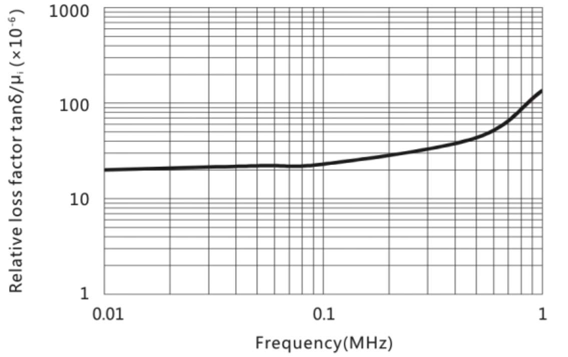
Test core：Toroid(mm)

OD：12.7

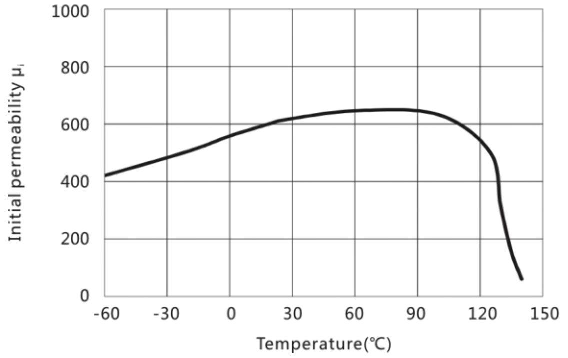
ID：7.9

H：6.5

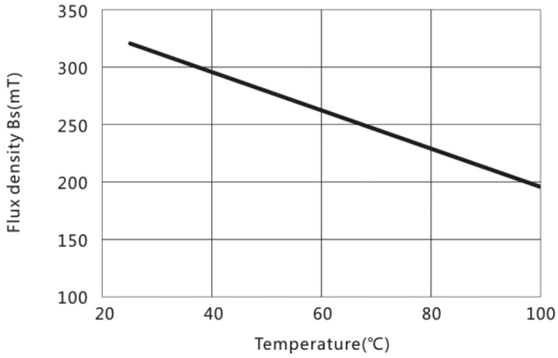
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



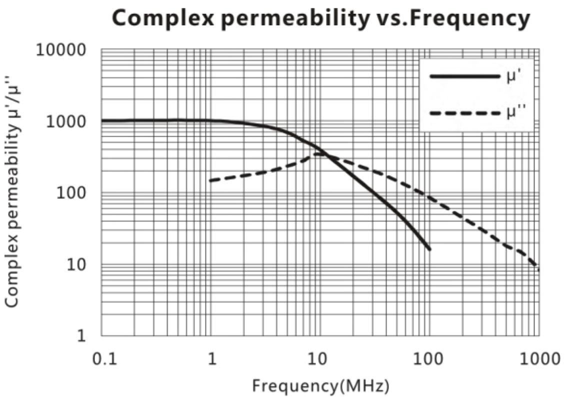
Flux density vs.Temperature



材料 / Material: **TN90H**

特点 / Features:

1. 耐热冲击 / Thermal Shock Resistance



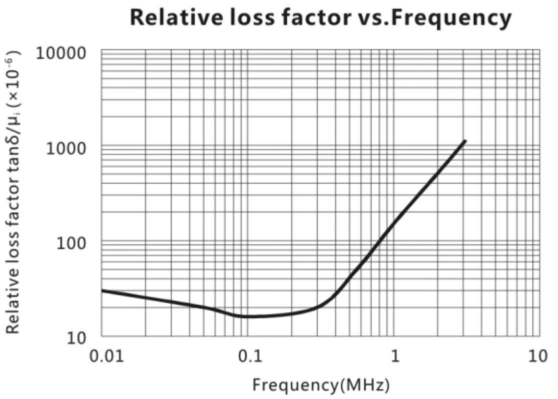
Initial permeability	μ_i	25℃	900±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	340
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤20
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	15
Curie temperature	Tc(℃)		＞140
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.1×10^3

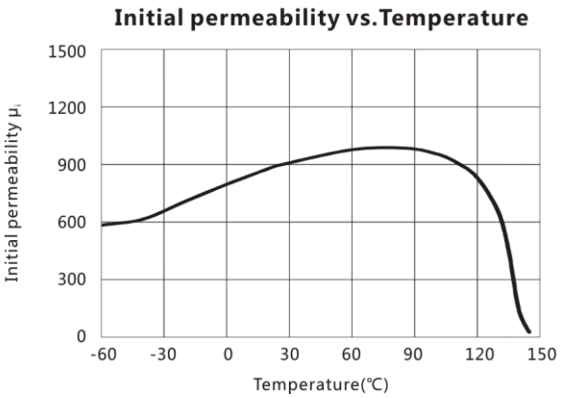
Test core：Toroid(mm)

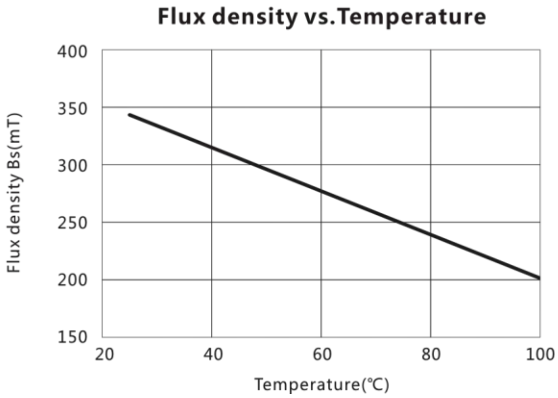
OD：12.7

ID：7.9

H：6.5





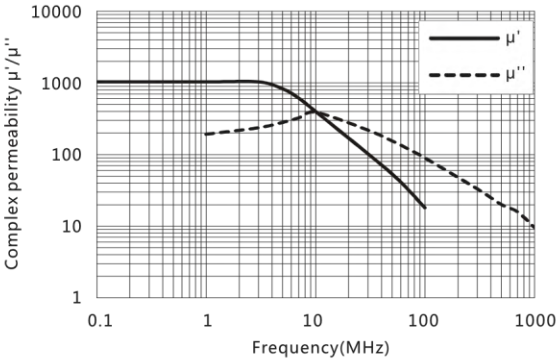


材料 / Material: **TN100B**

特点 / Features:

1. 高饱和磁通密度 / High Bs

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	1000±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	320
Relative loss factor 50kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤10
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	5
Curie temperature	Tc(℃)		>130
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.2×10^3

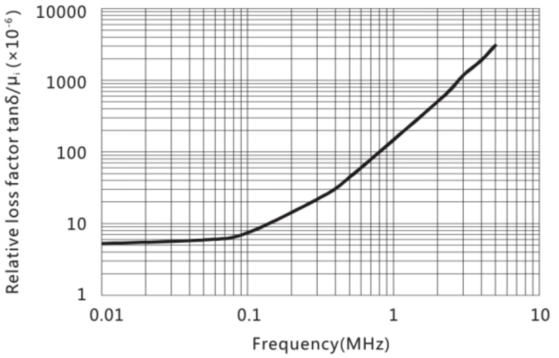
Test core：Toroid(mm)

OD：12.7

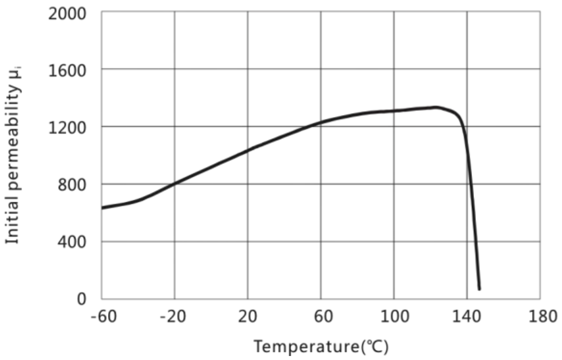
ID：7.9

H：6.5

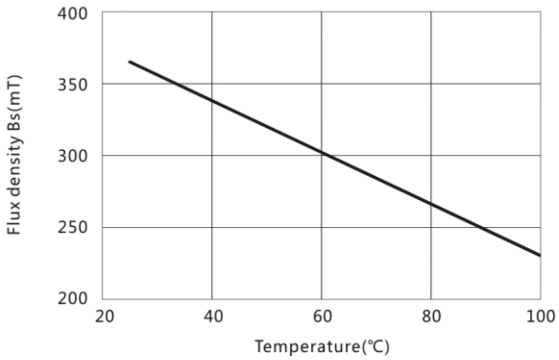
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature



材料 / Material: **TN120L**

特点 / Features:

1. 低功耗 / Low Power Loss

Initial permeability	μ_i	25℃	1200±20%
Saturation magnetic flux density	Bs(mT) 1600A/m	25℃	360
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤18
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	13
Curie temperature	Tc(℃)		>160
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.1×10^3

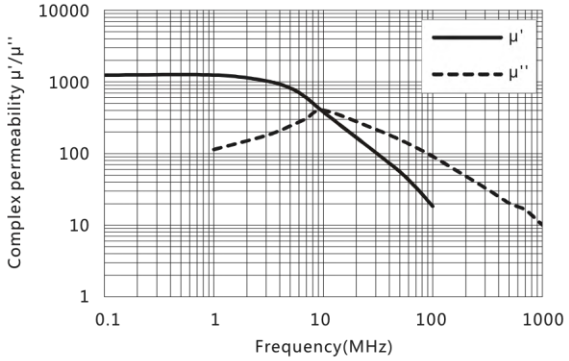
Test core：Toroid(mm)

OD：12.7

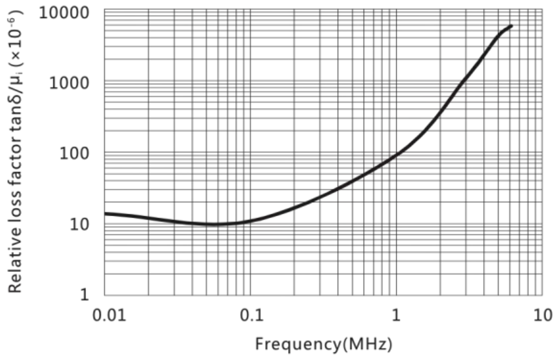
ID：7.9

H：6.5

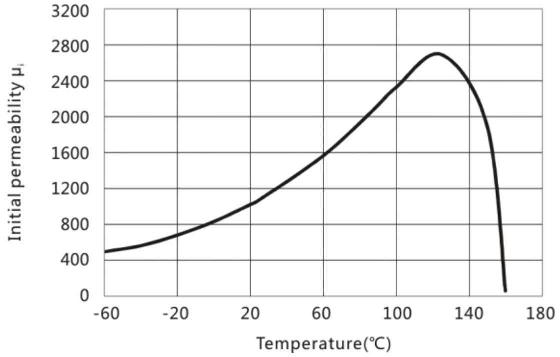
Complex permeability vs.Frequency



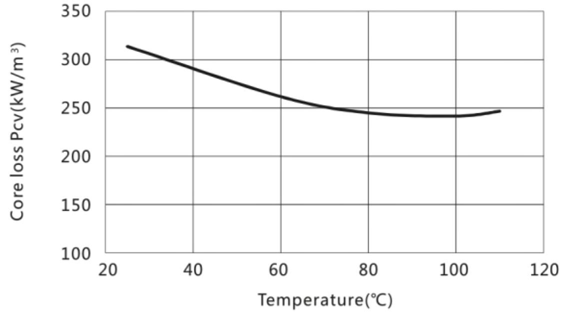
Relative loss factor vs.Frequency



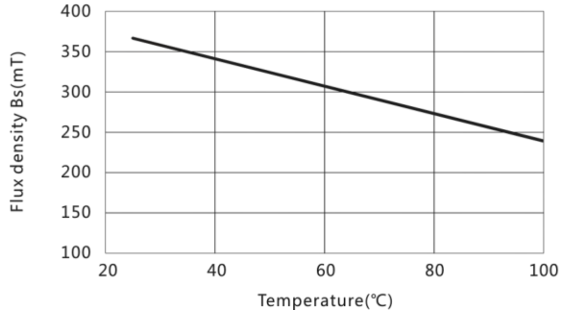
Initial permeability vs.Temperature



Core loss vs.Temperature(50kHz,150mT)



Flux density vs.Temperature

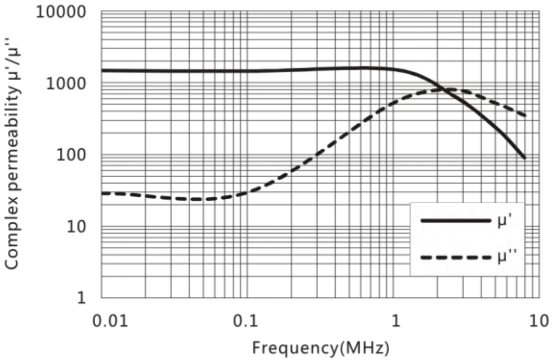


材料 / Material: **TN130G**

特点 / Features:

1. 高磁导率 / High Initial Permeability

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	1300±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	240
Relative loss factor 10kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤15
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	8
Curie temperature	Tc(℃)		>85
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m³)		4.8×10^3

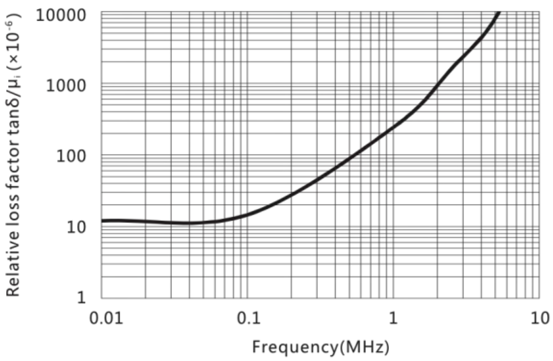
Test core：Toroid(mm)

OD：12.7

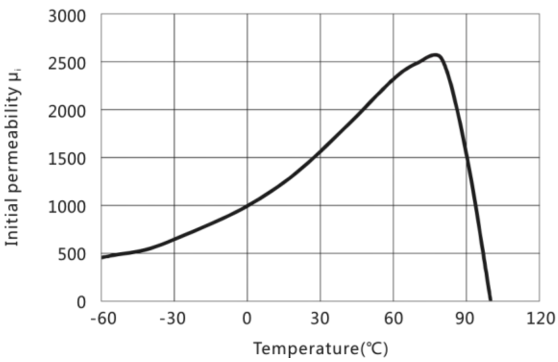
ID：7.9

H：6.5

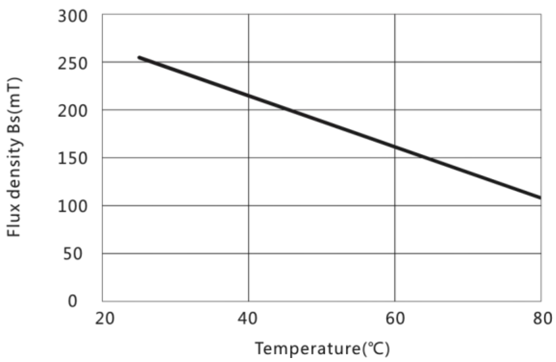
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature

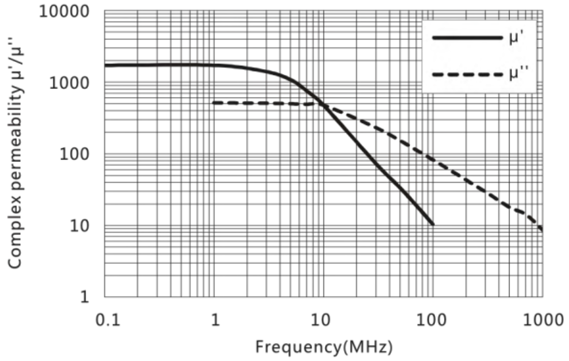


材料 / Material: **TN150P**

特点 / Features:

1. 高磁导率 / High Initial Permeability

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	1500±20%
Saturation magnetic flux density	Bs(mT) 1600A/m	25℃	300
Relative loss factor 100kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤20
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	5
Curie temperature	Tc(℃)		>110
Electrical resistivity	ρ(Ω·m)		10^6
Density	d(kg/m^3)		5.2×10^3

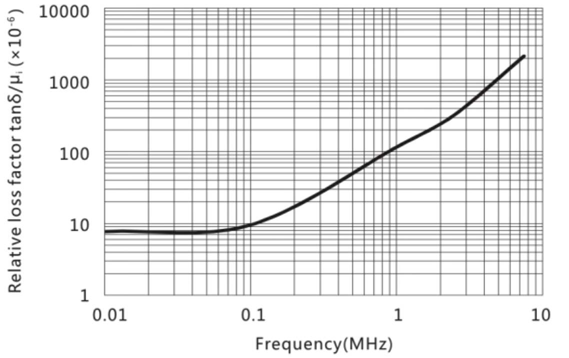
Test core：Toroid(mm)

OD：12.7

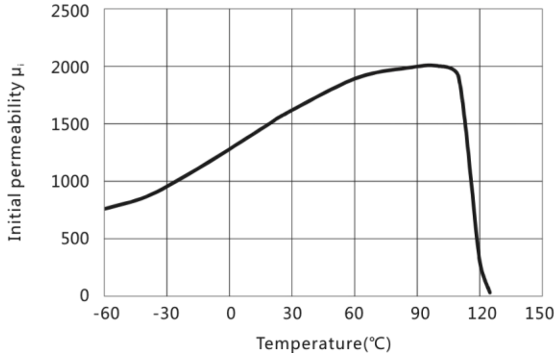
ID：7.9

H：6.5

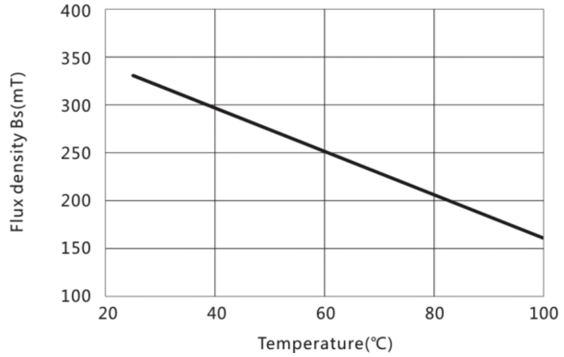
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature

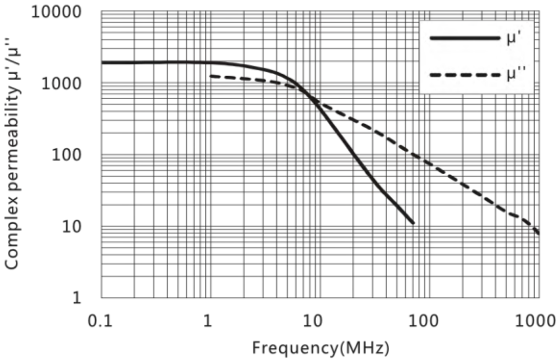


材料 / Material: **TN200B**

特点 / Features:

1. 高饱和磁通密度 / High Bs
2. 高磁导率 / High Initial Permeability

Complex permeability vs.Frequency



Initial permeability	μ_i	25℃	2000±20%
Saturation magnetic flux density	Bs(mT) 4000A/m	25℃	290
Relative loss factor 10kHz	$\tan\delta/\mu_i$ ($\times10^{-6}$)	25℃	≤10
Relative temperature coefficient	$\alpha_{\mu ir}$ ($\times10^{-6}$/℃)	20～60℃	2
Curie temperature	Tc(℃)		＞100
Electrical resistivity	ρ(Ω·m)		10^{6}
Density	d(kg/m^3)		5.2×10^{3}

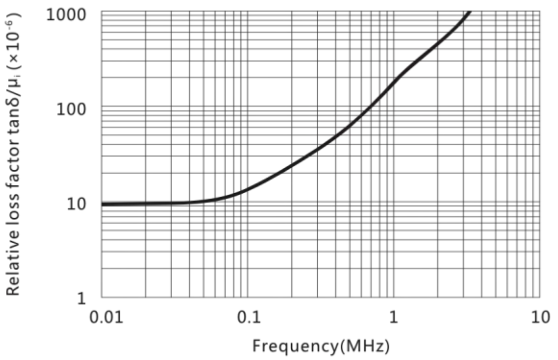
Test core：Toroid(mm)

OD：12.7

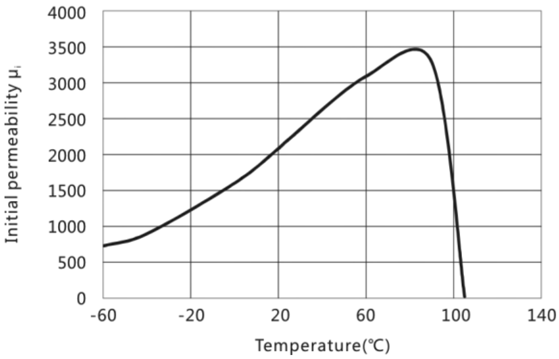
ID：7.9

H：6.5

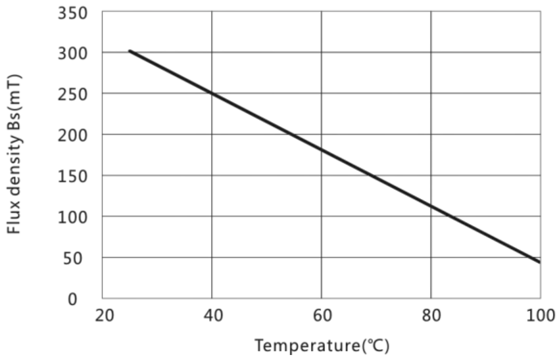
Relative loss factor vs.Frequency



Initial permeability vs.Temperature



Flux density vs.Temperature



概念

主要概念与定义

1 、磁场

电流产生磁场，在螺线管中，或在磁路中电流的产生的磁场为：

$$H=\frac{NI}{l}$$

在这一个表式中，采用国际单位制，H单位为安培/米(A/m)，N为匝数，I为电流，单位安培(A)，l为螺线管或磁路长度，单位为米(m)。

在磁心中，加正弦波电流，可用有效磁路长度 l_e 来计算磁场强度：

$$H=\frac{\sqrt{2}IN}{l_e}\ (A/m)$$

$$1O_e=\frac{1\times10^3}{4\pi}\approx79.58A/m$$

2、磁通密度、磁极化强度、磁化强度

在磁性材料中，加强磁场H时，引起磁通密度变化，其表现为：$B=\mu_0H+J$ 或 $B=\mu_0(H+M)$

B为磁通密度，亦称磁感应强度，J称磁极化强度，M称磁化强度，μ_0 为真空磁导率，其值为 $4\pi\times10^{-7}$ 亨利/米(A/m)。

B、J单位T，H、M单位为A/m，$1T=10^4Gs$。

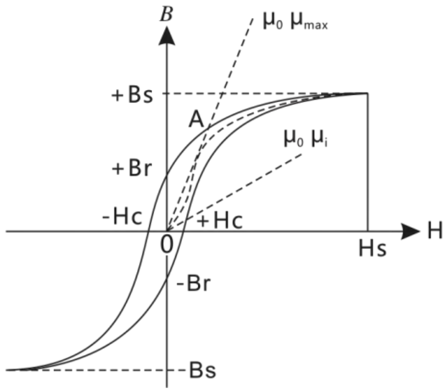
在磁心中可用有效面积 A_e 来计算磁通密度：

正弦波为：$\hat{B}=\frac{0.225V}{fNA_e}$

电压单位V，频率单位为Hz，N为匝数，B单位为T，A_e 单位为 m^2。

3、饱和磁通密度、剩余磁化强度、矫顽力

B和H的关系除在真空中和在磁性材料中小磁化场下具有线性关系外，一般具有非线性关系，即具有所谓磁滞回线性质：



Bs为饱和磁化强度，Br为剩余磁化强度，Hc为矫顽力。
Hs为饱和磁化场，不同磁性材料产生的磁滞回线表现形式不一样，Bs、Br、Hc、Hs都不一样。

4、磁导率

(1) $\frac{B}{H}=\mu_0(1+\frac{B}{H})=\mu_{absolute}$ 称绝对磁导率，是有量纲的。

(2) $\frac{B}{H}=\mu_0\,\mu_r$，μ_r 称相对磁导率，是无量纲的，是一个数值。

我们平常用的大都是相对磁导率，且把脚标r省去。

(3) $\frac{1}{\mu_0}\frac{\Delta B}{\Delta H_{(\Delta H\to 0)}}=\mu_i$ 称初始磁导率，它与温度、频率有关。测量时在一定温度、一定频率、很低的磁通密度（或很小的磁场）、闭合磁路中进行。在实际测量中，规定：磁场H所产生的磁通密度应小于1mT，一般B为0.1mT，但亦有许多特殊情况，应加以注意。

(4) 在磁路中存在气隙，即非闭合磁路条件下，测得的磁导率为有效磁导率：

$$\frac{\mu_i}{1+g\mu_i/l_e}=\mu_e$$

g是气隙长度，l_e 是有效磁路长度。这一表示，仅是小气隙g下的一种近似。在大气隙下，磁通要穿过气隙的外部，其有效磁导率将大于按上式计算所得之值。

(5) 在没有偏置磁场的情况下，磁场H较大时，该磁场H产生磁通密度B，则这时，

$\mu_a=\frac{1}{\mu_0}\frac{B}{H}$，称振幅磁导率。

(6) 在具有直流偏置磁场时，再加上一个交流磁场，这时测得的磁导率 $\mu_\Delta=\frac{1}{\mu_0}\left[\frac{\Delta B}{\Delta H}\right]_{H_{DC}}$

称为增量磁导率。在直流迭加状态下测得的电感，计算出的磁导率近似于增量磁导率。

(7) 上述 (1) -(6) 的磁导率都是频率较低，或接近直流状态下测得的磁导率，在频率较高时，其磁导率表现为复数磁导率。

在串联电路中为 $\mu=\mu'_s-j\mu''_s$

在并联电路中为 $\frac{1}{\mu}=\frac{1}{\mu_p}-\frac{1}{j\mu_p}$

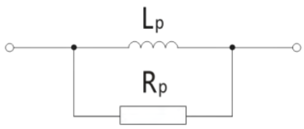
μ'_s，μ''_s，μ'_p，μ''_p 都是频率的函数。

5、阻抗

电感产生感抗$X_L=j\omega L$，电容产生容抗$X_c=\frac{1}{j\omega C}$，二者总称为电抗，纯电阻R。

三者总称阻抗，在磁性器件讨论中，相对低的频率下，我们忽略容抗，只讨论电阻和感抗，且有串联电路和并联电路之分。

串联电路



并联电路

串联电路中阻抗$Z_s=R_s+j\omega L_s$　　并联电路中阻抗$Z_p=\frac{1}{1/(j\omega L_p)+1/R_p}$

Z_s、Z_p都与频率有关，其特性称为阻抗频率特性，它与磁性材料频率特性有关。另外，它们与绕组参数有关。在复数磁导率中，其频率特性表现为μ'，μ"的频率特性。阻抗频率特性，实际上是磁性器件的特性，并非是材料的特性。

6、损耗因子

表示小信号下材料的损耗特性。由于磁心损耗，引起信号相移，其表示为：

$$tg\delta_m=\frac{R_s}{\omega L_s}=\frac{\mu'_s}{\mu''_s}\quad or\quad tg\delta_m=\frac{\omega L_p}{R_p}=\frac{\mu'_p}{\mu''_p}$$

$Tg\delta_m$称为损耗因子，表示的是损耗功率与贮能的比值。因磁心损耗包括磁滞损耗，涡流损耗、剩余损耗，所以损耗因子可表示为：

$tg\delta_m = tg\delta_h + tg\delta_e + tg\delta_r$，分别称为磁滞、涡流、剩余损耗因子。

7、比损耗因子

$\frac{tg\delta_m}{\mu_i}$ 或 $\frac{tg\delta}{\mu_i}$ 称比损耗因子，与材料几何尺寸无关，表示小信号下材料的损耗特性。

8、气隙的影响

当磁路中有气隙时，其损耗因子为带气隙损耗因子，$(tg\delta)_{gap}$它与无气暇时损耗因子的关系为：

$$\frac{(tg\delta)_{gap}}{\mu_e-1}=\frac{tg\delta}{\mu_i-1}$$

因μ_e、$\mu_i>>1$，所以有：$\frac{(tg\delta)_{gap}}{\mu_e}=\frac{tg\delta}{\mu_i}$，即有 $(tg\delta)_{gap}=\frac{tg\delta\cdot\mu_e}{\mu_i}$

由于$\mu_e<\mu_i$，所以开气隙后，损耗因子减小，Q值增加。

磁心开制气隙后，磁心内部磁场强度H_i大大减小，由$H_i=H_e-H_d=H_e-NM$可以看出，退磁因子N越大，H_i越小。

这里H_e是绕组通以电流后产生的磁场（$H_e=\frac{NI}{le}$），M是磁化强度。退磁因子为0-4π，对闭路磁心N=0，气隙越大， N越大，反之亦然。开制气隙可增加磁场和温度的稳定性。

9、品质因数Q

磁性器件作滤波器的电感时，通常用品质因数(Q) 来表示它的质量，品质因数 $Q=\frac{1}{tg\delta}=\frac{\omega L}{R_{tot}}$，
R_{tot} 表示总电阻，它是线圈和磁心的总电阻。
R_{tot} 表示损耗，包括磁心损耗、铜钱损耗。Q与频率和绕组参数有关。

10、大信号场下的功率损耗

大信号场下，磁心损耗用下式表示:
$P_m=P_h+P_e+P_r$，P_h、P_e、P_r，分别表示磁滞损耗、涡流损耗、剩余损耗。

11、温度系数与比温度系数

温度系数为：$\alpha_{\mu i}=\frac{\mu_{i2}-\mu_{i1}}{\mu_{i1}}\times\frac{1}{T_2-T_1}$

μ_{i1}，μ_{i2} 分别表示温度 T_1，T_2 时的初始磁导率。

比温度系数：$\alpha_{\mu ir}=\frac{\alpha_{\mu i}}{\mu_{i1}}=\frac{\mu_{i2}-\mu_{i1}}{(\mu_{i1})^2}\times\frac{1}{T_2-T_1}$

$\alpha_{\mu i}$，$\alpha_{\mu ir}$ 均表示磁导率的温度稳定性。

12、减落因子与比减落因子

减落因子为　$D_A=\frac{\mu_{i1}-\mu_{i2}}{\mu_{i1}}\times\frac{1}{\lg(t_1/t_2)}$

μ_{i1}，μ_{i2} 表示同一温度下，t_1，t_2 时刻的初始磁导率。

比减落因子　$D_F=\frac{D_A}{\mu_{i1}}=\frac{\mu_{i1}-\mu_{i2}}{\mu_{i1}^2}\times\frac{1}{\lg(t_1/t_2)}$

D_A，D_F 都表示μ_i经磁扰动或机械冲击后的经时变化。比减落因子，一般用 D_F 表示，有时简称减落因子。

13、电感系数 AL

一个电感器或变压器，绕有N匝线圈，其电感值为L，则定义AL $\frac{L}{N^2}$，当AL单位为 $\frac{nH}{N^2}$ 时。$AL=\frac{1}{N^2}\cdot 10^9$
这里L的单位为亨利，一般N取100，当N取得很大磁心又是闭路时，不宜采用AL来表达，因可能进入谐振区或接近饱和区。
在设计中，知道 AL 值和设定要求的电感 (nH)，则导线圈数：$T_S=\left[\frac{\text{Set }L(nH)}{AL\,(nH/N)^2}\right]^{1/2}$

在无隙情况下，$\mu_i=\frac{C_1}{0.4\pi}AL$，这里C为磁心常数，单位为$mm^{-1}$，AL 为 $\frac{nH}{N^2}$。
AL值与气隙大小有关、磨削面精度有关。

14、静磁场影响-直流迭加

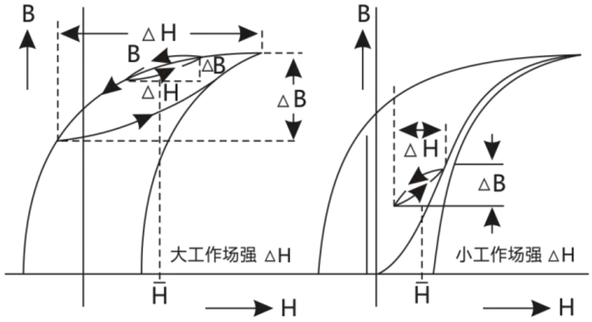
当交流磁场与直流磁场同时作用于磁心时，称为静磁场的影响，有时，简单地称为直流迭加。当磁心有一个恒定的直流磁场 H_{DC}，并在其上迭加一个幅度为 $\frac{\Delta H}{2}$ 的正弦磁场时，则表示为：

$$H = H_{DC} + \frac{\Delta H}{2}\sin\omega t$$

当正弦磁场作用时，磁通密度形成小磁滞回线时，其峰值用△B/2表示，此时小磁滞回线在大磁滞回线内变化，小磁滞回线的平均斜率叫增量磁导率（前已述过）。

$$\mu_\Delta = \frac{1}{\mu_0}\left[\frac{\Delta B}{\Delta H}\right]_{H_{DC}}$$

这里，正弦场叫工作场，直流场叫偏磁化场或偏置场。增量磁导随偏置场而改变。测直流迭加特性，就是在一定偏置场下加工作场，测其增量磁导率，并与无直流场时的磁导率作比较。
由于交流磁场值大小不同，小回线有二种代表性的状态，如：

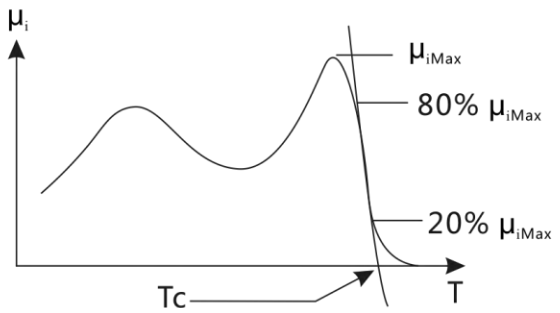


直流磁场H叠加一个幅度为△H/2的交流磁场后的磁滞回线

从中可推知迭加特性与材料特性的关系。
由于许多电路中，往往存在直流电成份，这相当于加了一个直流偏置场，而它会影响增量磁导率的大小，所以迭加特性很重要。

15、居里温度

居里温度是磁性材料从铁磁性（亚铁磁性）到顺磁性的转变温度，或称磁性消失温度，表示方式有多种。天通材料标准中规定的确定居里温度的方法如下图：



随温度升高，磁导率下降到最大值的80%，20% 时，这二点联线，延长到与温度轴的交点，即为居里温度。

Main concepts and definitions

1、Magnetic field

Current induces magnetic field. In spiral coils, the magnetic field (H) induced by current can be expressed as :

$$H=\frac{NI}{l}$$

Where all parameters, are in SI unit system and N is turn number, I (A) is current, l(m) is the length of the spiral coils. In magnetic core, the field strength H induced by alternate current can be calculated in term of the effective length le of the spiral coils :

$$H=\frac{\sqrt{2}IN}{l_e}\ (A/m)$$

$$1O_e=\frac{1\times10^3}{4\pi}\approx79.58A/m$$

2、Magnetic flux density, magnetic polarizability, magnetization.

In magnetic material, the magnetic flux density varies as applied field H. It behaviors as :

$$B=\mu_0H+J \quad or \quad B=\mu_0(H+M)$$

Where B is magnetic flux density also called magnetic induction, J magnetic polarization, M magnetization, and μ_0 vacuum permeability with the value of $4\pi\times10^{-7}$ H/m. The units of B and J are Tesla (T) and those of H and M are A/m.

1 Tesla = 10^4 Gauss

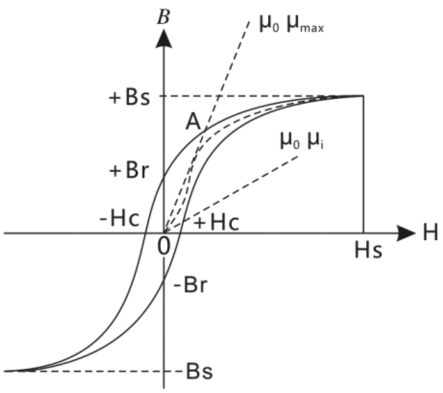
In magnetic cores, the magnetic flux density can be calculated using effective area Ae:

$$\hat{B}=\frac{0.225V}{fNA_e}\ \text{For sine wave}$$

Where V is electric potential in volt , f frequency in H_z , N turn number , B in mT and A_e in m^2.

3、Saturation magnetization, remanent magnetization, and coercivity.

Besides the linear relation between B and H in vacuum , B behaviors a nonlinear relation as H in magnetic materials displaying the hysteresis shown in the figure.



In the figure. Bs is saturation induction, Br residual induction, Hc coercivity and Hs saturation field. Differem magnetic materials display various hysreresis leading to different Bs, Br, Hc, and Hs.

4、Permeability

(1) $\frac{B}{H}=\mu_0(1+\frac{B}{H})=\mu_{absolute}$ called absolute permeability with dimension.

(2) $\frac{B}{H}=\mu_0\,\mu_r$, μ_r where μ_r is called relative permeability, which is a pure number without dimension.

Usually we use the relative permeability, neglecting the footnote r.

(3) $\frac{1}{\mu_0}\frac{\Delta B}{\Delta H_{(\Delta H\rightarrow 0)}}=\mu_i$ is called initial permeabilifty. It depends on temperature and frequency.

The measurement of μ_i should be made in a closed magnetic circuit at certain temperature and frequency in a very weak applied field. In measurement, it requires that the change of magnetic flux density (ΔB) induced by ΔH should be less than 1mT, generally B=0.1mT.

(4) For unclosed magnetic circuit with a gap, measured permeability is called effective permeability expressed as:

$$\frac{\mu_i}{1+g\mu_i/l_e}=\mu_e$$

Where g is the length of the gap. And l_e the effective length of the magnetic circuit. It notes that this equation only an approximation of μ_e for the small gap. For large gap. the effective permeability will larger than calculated using above equation.

(5) When an applied field H is larger without a DC bias field, it induces the magnetic flux density B, in which

$\mu_a=\frac{1}{\mu_0}\frac{B}{H}$, is called amplitiude permeability.

(6) When an alternate field with a DC bias field, the permeability. $\mu_\Delta=\frac{1}{\mu_0}\left[\frac{\Delta B}{\Delta H}\right]_{H_{DC}}$

is called incremental permeability, For the electric inductance measured in the AC field superposed with a bias DC field, the permeability is probably also the incremental permeability.

(7) The permeability in above (1) -(6) are all obtained in the low frequency or near to DC situation. When the frequency is high, the permeability is complex.

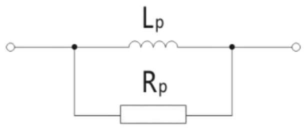
In serial circuit , $\mu=\mu'_s-j\mu''_s$

In parallel circuit , $\frac{1}{\mu}=\frac{1}{\mu_p}-\frac{1}{j\mu_p}$

μ'_s , μ''_s , μ'_p , μ''_p , are all the functions of frequency

5、Impedance

Inductive impedance in an electric inductance is $X_L = j\omega L$, and condenser impedance in a condenser is $X_C = \frac{1}{j\omega C}$, These two are generally called electrical impedance. Adding pure resistance R , they are in all called impedance. In magnetic devices, we only consider inductive impedance and pure resistance for the issue of relative low frequency, neglecting condenser impedance. There is the difference between serial and parallel circuit.



Series representation

Parallel reparesentation

Series reparesentation $Z_s = R_s + j\omega L_s$

Parallel reparesentation $Z_p = \frac{1}{1/(j\omega L_p) + 1/R_p}$

Z_s and Z_p depend on frequency, and their characteristics are called impedance frequency characteristics and related to the frequency characteristics of magnetic materials, and they are connected with winding parameters. In complex permeability, its frequency characteristics is determined by the frequency characteristics of both μ' and μ" actually, the impedance frequency characteristic is the characteristic of the magnetic device but the characteristic of material.

6、Loss factor

Loss factor indicates the loss property of material in small signal. It induces phase shift of signal due to magnetic core loss, which can be expressed as :

$$tg\delta_m = \frac{R_s}{\omega L_s} = \frac{\mu'_s}{\mu''_s} \quad \text{or} \quad tg\delta_m = \frac{\omega L_p}{R_p} = \frac{\mu'_p}{\mu''_p}$$

Where $tg\delta_m$ is called loss factor indicating the ratio of loss power and input power. Because magnetic core loss induces hysteresis loss, eddy loss, and residual loss, the loss factor can be expressed as : $tg\delta_m = tg\delta_h + tg\delta_e + tg\delta_r$, where $tg\delta_h$, $tg\delta_e$, and $tg\delta_r$ is called hysteresis loss factor, eddy loss factor, and residual loss factor respectively (see the following figure).

7、Specific loss factor

$\frac{tg\delta_m}{\mu_i}$ or $\frac{tg\delta}{\mu_i}$ is called specific loss factor, which is independent of geometrical size of material, indicating small signal loss characteristic of the material.

8、The influence of gap

When the magnetic circuit is unclosed with a gap, the loss factor is called gap loss factor $(tg\delta)_{gap}$, the relation brtween gap loss factor and loss factor without the gap is:

$$\frac{(tg\delta)_{gap}}{\mu_e - 1} = \frac{tg\delta}{\mu_i - 1}$$

Because μ_e、$\mu_i >> 1$, the above equation becomes $\frac{(tg\delta)_{gap}}{\mu_e} = \frac{tg\delta}{\mu_i}$, i.e $(tg\delta)_{gap} = \frac{tg\delta \cdot \mu_e}{\mu_i}$

Where $\mu_e < \mu_i$, It is clear that $(tg\delta)_{gap} > tg\delta$, Q value increasing

After the gap is made, the internal magnetic intensity of core decreases in large scale, form the formula $H_i = H_e - H_d = H_e - NM$, we could see when demagnetizing factor N increases, H_i will decrease on the contrary.

Here he is the magnetic field produced by the, winding witlz current ($He=\frac{NI}{le}$), m is intensity of magnetization, demagnetising factor is 0-4π, if magnetic circuit is closed, N=0, when the gap is bigger, demagnetising factor is bigger, and it is the same on the contrary. Gap-making will increase the stability of magnetic field and temperature.

9、Quality factor Q

When magnetic device is used as electric inductance in wave filter, its property is usually characteriaed , using quality factor Q .

$$Q=\frac{1}{tg\delta}=\frac{\omega L}{R_{tot}}$$

When Rtot is total resistance including coil and core resistance. Rtot indicates loss including magnetic core loss and copper wire loss. Q value is cloesly related to frequency and coil parameters.

10、Power loss in large signal field

In large singnal field , magnetic core loss can be expressed as: $P_m=P_h+P_e+P_r$,

When P_h , P_e , and P_r indicate hysteresis loss, eddy loss and residual loss respectively. In power ferrite, P_m is often used to analyze power loss, interpreted as dividing the total power loss and then analysing the cause and cores of power loss.

11、Temperature coefficient and specific temperature coefficient.

Temperatuer factor is: $\alpha_{\mu i}=\frac{\mu_{i2}-\mu_{i1}}{\mu_{i1}}\times\frac{1}{T_2-T_1}$ Where μ_{i1}, μ_{i2} indicate initial permeability at T_1 , T_2 respectively.

Sepcific temperature factor is: $\alpha_{\mu ir}=\frac{\alpha_{\mu i}}{\mu_{i1}}=\frac{\mu_{i2}-\mu_{i1}}{(\mu_{i1})^2}\times\frac{1}{T_2-T_1}$

$\alpha_{\mu i}$ and $\alpha_{\mu ir}$ all indicate temperature stability of permeability.

12、Dropping coefficient and specific dropping coefficient.

Dropping coefficient is: $D_A=\frac{\mu_{i1}-\mu_{i2}}{\mu_{i1}}\times\frac{1}{\lg(t_1/t_2)}$

Where μ_{i1}, μ_{i2} indicate initial permeability at the same temperature at different time t_1 , t_2 respectively.

Sepcific dropping coefficient is: $D_F=\frac{D_A}{\mu_{i1}}=\frac{\mu_{i1}-\mu_{i2}}{\mu_{i1}^2}\times\frac{1}{\lg(t_1/t_2)}$

Both D_A and D_F indicates the change under the influence of magnetic interference and mechanical lash.

13、Electric inductance factor AL

The inductance value of an electric inductance or a transformer with N turn coils is L. It defines that $AL=\frac{1}{N^2}$

When the unit AL is $\frac{nH}{N^2}$, taking N=100 commonly, but sometimes the parameter of AL is not used, because when the turns of winding are too many and in circumstance of closed magnetic circuit the magaetic flied is likely to enter resonance area or approach saturation area.

$$T_s=\left[\frac{\text{Set } L(nH)}{AL\,(nH/N)^2}\right]^{1/2}$$

When without the gap, $\mu_i=\frac{C_1}{0.4\pi}AL$, where C_1 of core parameter is mm^{-1}, AL is $\frac{nH}{N^2}$

AL value is related to the size and surface roughness of the gap. If known AL value and magnetic core size, one can easily obtain permeability mi used material.

14、Static field effect -DC superposition

When an alternate field and a DC field act on a magnetic core simultaneously, it is called static magnetic influence. Sometimes it is call DC superposition.

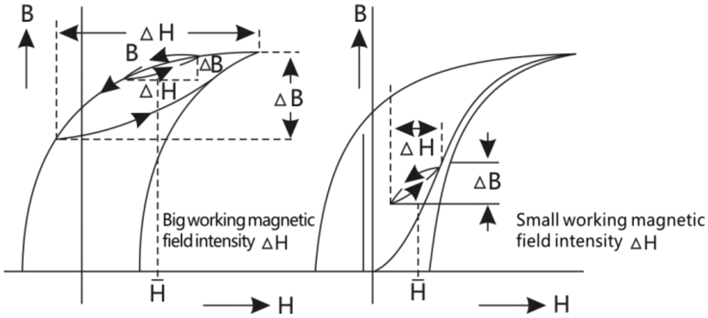
When there is a sine field with the amplify of $\Delta H/2$ acting on a DC field in the magnetic core, the applied fields is

$$H = H_{DC} + \frac{\Delta H}{2}\sin\omega t$$

Due to sine field, the change of magnetic flus density shows a small hysteresis loop in the large one and its peak value is $\Delta B/2$ (See the following figures). The average slope of the small hysteresis loop is incremental permeability (as mentioned above):

$$\mu_{\Delta} = \frac{1}{\mu_0}\left[\frac{\Delta B}{\Delta H}\right]_{H_{DC}}$$

Where the sine field is called applied and field DC field called displacing field or bias field. The incremental permeability changes as displacing field. The measurement of DC superposition characteristic is to measure the incremental permeability in DC displacing field and to compare it to that measured without DC displacing field. There are two typical small hysteresis loops for different alternate fields (shown in the following figures) .

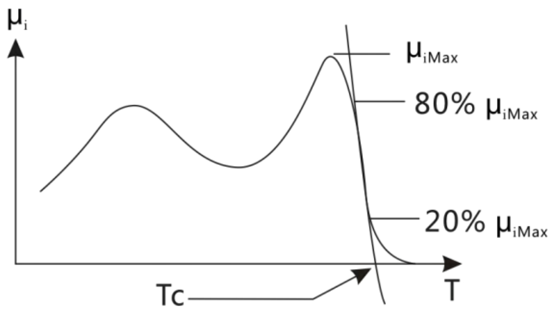


Where is the hysteresis loop, After folding between DC magnetic field and AC field with ΔH/2

From them one can know the relationship between the superposing characteristic and material property. The superposing characteristic is very important due to the existence of DC in many electric circuits.

15、Curie temperature

Curie temperature is the transition temperaure of magnetic materials from ferromagnetism to paramag-netism. There are several methods to determine Curie temperature. The method used by TDG is shown as the following figure.



As temperature increases, one can find the two points with the perme-ability falling down to 80% μ_{iMax} and 20% μ_{iMax} respectively. Connecting the two points and extrapolating the line to T axis, the point of intersection is curie temperature.

原料检测 Raw Material Test

ICP 等离子发射光谱仪
ICP-OES

X 荧光分析仪
X-ray Fluorescence Analyzer

性能测试 Performance Test

HP 4284A 精密LCR测试仪
HP 4284A Precision LCR Meter

B-H 分析仪
B-H Analyzer

网络频谱阻抗分析仪
Network/Spectrum/Impedance Analyzer

ATS-1 THD测试仪
THD Analyzer

MATS 软磁直流测试仪
MATS Soft Magnetic DC Tester

可靠性实验测试 Reliability Test

电动振动台
Electric Vibrator

高低温试验箱
High-Low Temperature Test-Box

金相显微镜
Metallographic Microscope

高低温冷热冲击箱
High-Low Temperature Thermal Shock Box

高低温交变湿热箱
High-Low Temperature Alternating Test-Box

磁心雕刻机
Carving