浙江三钛科技有限公司
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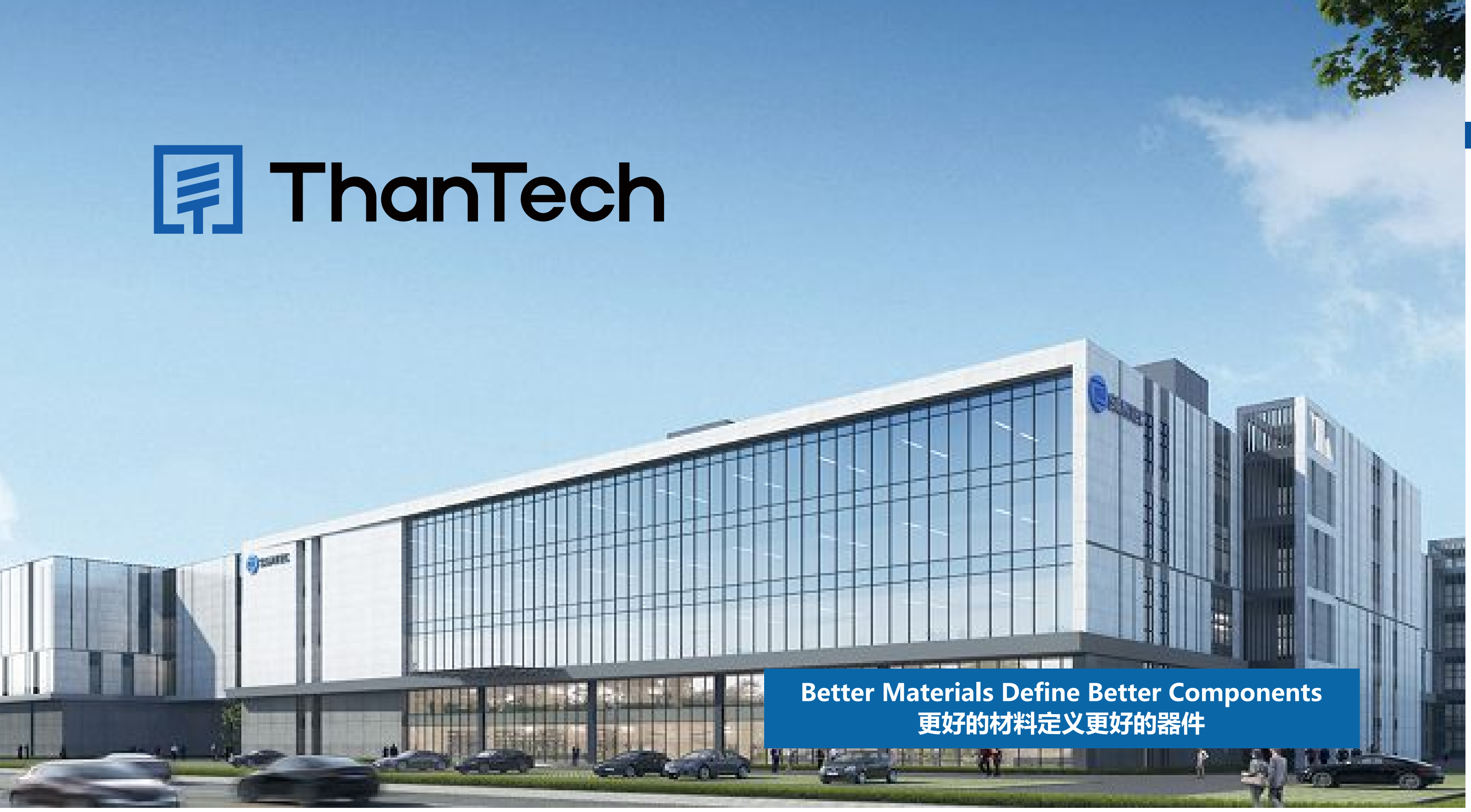
EXPERT OF MAGNETIC POWDER CORES & SOLUTIONS

金属磁粉芯及应用方案专家

ThanTech 三钛科技

Catalogue-2026



公司简介
COMPANY PROFILE

浙江三钛科技有限公司成立于2020年，位于浙江省莫干山国家高新技术开发区，是一家集磁性材料、磁性器件研发、生产及销售的科技型公司，通过新材料技术的持续创新打造磁性器件的竞争力。公司已获得授权发明专利7项、实用新型11项、外观专利1项。

2022年4月通过ISO9001:2015质量体系认证，2023年通过IATF 16949质量体系认证。

Zhejiang ThanTech Technology Co., Ltd Was Founded in 2020 and Locates in Zhejiang Province, China. ThanTech Manufactures Soft Magnetic Powder, Soft Magnetic Powder Cores and Special Magnetic Components. ThanTech Has Got 7 National Invention Patents, 11 Utility Model Patents, 1 Appearance Design Patent by 2024.

ThanTech Passed ISO9001:2015 Quality System Certification In 2022 and IATF 16949 Quality System Certification In 2023.

Contents

目录

基本资料 General Information

环形磁粉芯 Standard Toroidal Cores

特殊形状磁粉芯 Special Shape Cores

其他 Others

APPLICATION FIELD
应用领域

新能源 Green Energy

光伏逆变器，储能变流器，电动车充电桩
Photovoltaic Inverter,PCS, EV Charging Pile

电池化成
Battery Formation

新能源车载 Green Energy Vehicles

DC-DC Converter
OBC+ DC-DC

Electric Vehicle
MCU/PDU/VCU

燃料电池汽车升压器
Fuel Cell Vehicle
Boost Converter

轨道交通
Rail Transit

开关电源 Switching Mode Power Supply

PC电源
PC Power Supply

不间断电源
UPS

通讯电源
Telecom Power Supply

服务器
Server

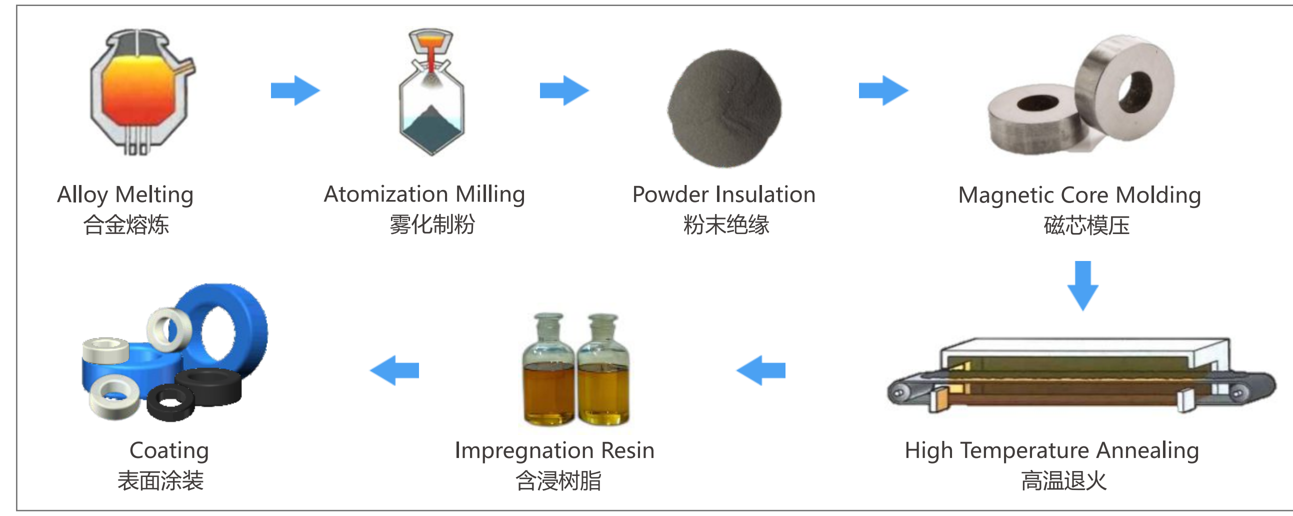
家电及其他 Household Electrical appliances And Others

空调
Air Conditioner

洗衣机
Washing Machine

医疗
Medical

TYPICAL PROCESS AND MAIN CHARACTERISTICS
金属磁粉芯典型工艺及主要特点



金属磁粉芯的主要特点:

金属合金磁粉芯是将磁性材料粉末表面做绝缘处理后，再和粘结剂等复合物混合在一起通过模压、热处理等工艺制程的粉末金属磁芯。其微观结构粉末颗粒之间为非导磁分布式气隙。相较于硅钢片，磁粉芯有较低的磁芯损耗及更易加工的优点；相较于铁氧体，磁粉芯具有更高Bs和更好温度稳定性的优点。因此金属合金磁粉芯是功率转换和储能电感的理想材料。

目前主流市场使用的磁粉芯材料有铁硅铝磁粉芯、铁硅磁粉芯、铁镍高磁通量磁粉芯、铁镍钼坡莫合金磁粉芯。

铁硅铝磁粉芯(Sendust)的损耗较低且成本低廉，但抗饱和能力相对中等。是目前使用最为广泛的材料，其主要运用于光伏逆变器，新能源车载，充电桩，家电，及各类电源等。

铁硅磁粉芯(FeSi)的抗饱和能力较高且成本低廉，但损耗相对较高。目前在大电流场景中使用较为普遍，其主要运用于光伏逆变器，新能源汽车，充电桩，及各类大型电感器等。

高磁通磁粉芯(High Flux)的抗饱和能力较高且损耗相对较低，但由于含有较多的贵金属镍，其成本较高且受期货市场影响较大。目前主要用在高端市场，例如军工，服务器，钛金电源以及部分新能源汽车。

三钛科技具有独立自主的制粉及制品技术，能根据客户所需定制专门的材料及产品形状。

Magnetic Powder Core Main Characteristics:

Magnetic powder core is made of surface insulated granules, which are then evenly mixed with in-organic binder & other compounds. Molding the powder into optimal core shapes and then annealing and etc. to obtain magnetic cores afterwards. There are non-magnetic conductive distributed air gaps among the granules in the microstructure. Compared with silicon steel laminated sheets, magnetic powder cores have the advantage of lower core loss and easier manufacturing process; compared with ferrite, it has the advantage of higher Bs and better temperature stability. Therefore, magnetic powder cores are ideal material options for power convention and storage inductors.

Magnetic powder core materials widely used in market nowadays are Sendust, FeSi, High Flux, and MPP.

Sendust possesses low core losses and low cost, related moderate DC Bias performance. It is the most widely used material currently, mainly in photovoltaic inverters, green energy vehicles, charging piles, household electrical appliances, and various power supplies.

FeSi acts high DC Bias suppression ability and low cost, but relatively higher core losses. It is presently used commonly in high current occasions, mainly in photovoltaic inverters, green energy vehicles, charging piles, and various large inductors.

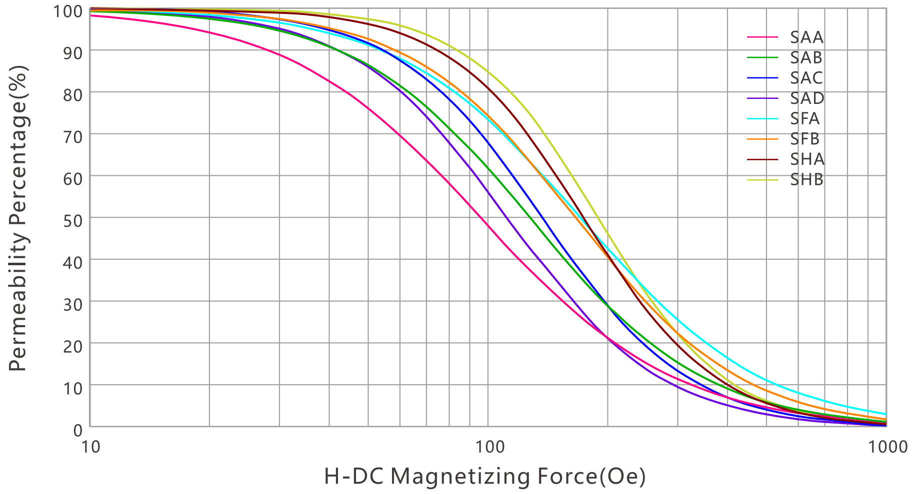
High Flux has the highest DC Bias performance and relatively low losses, but it costs high because of containing more precious metal, nickel, which price is much high and greatly affected by futures market. At present, it is mainly used in high-end markets, such as military, servers, titanium power supplies and partial green energy vehicles.

ThanTech self-owns powder milling and core manufacturing technology, and can customize special materials and core shapes according to client demands.

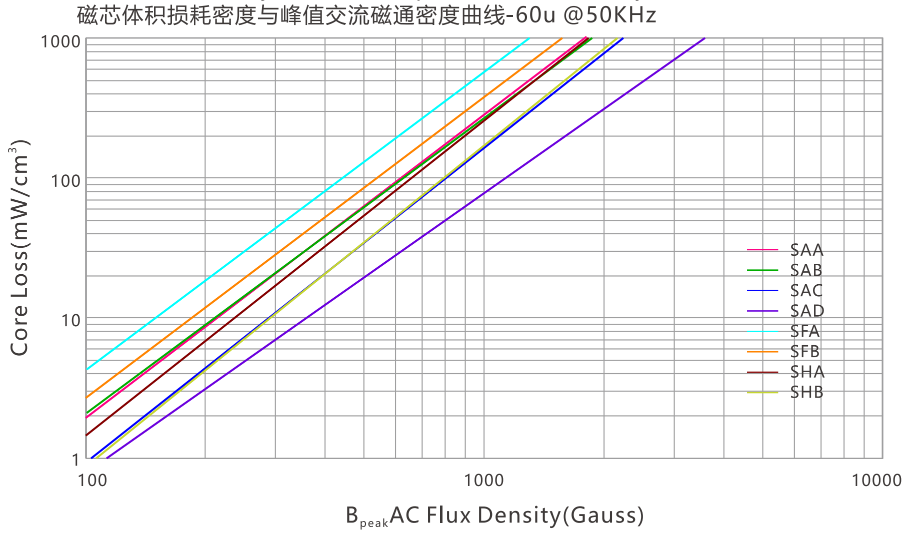
MATERIAL CROSS REFERENCE
磁芯材料性能对照表

Material	Samtec Material Code	Available Permeability	60μ Core Loss (mW/Cm³) @50KHz 100mT	60μ Core Loss (mW/Cm³) @100KHz,100mT	60μ DC Bias (%μ) @100Oe	Bs(T)	Temperature Stability	T_{curie} (°C)
Sendust Gen I	SAA	26-125	250	660	47	1.05	Good	600
Sendust Gen II	SAB	26-125	300	630	60	1.2	Good	650
Sendust Gen III	SAC	26-75	150	440	66	1.2	Best	500
Sendust Gen IV	SAD	19-60	70	160	55	1.0	Better	500
Sendust Gen V	SAE	26-60	110	310	70	1.2	Best	500
FeSi Gen I	SFA	19-125	550	1250	76	1.6	Better	700
FeSi Gen II	SFB	26-75	360	850	74	1.6	Best	700
FeSi Gen III	SFC	26-75	345	800	81	1.6	Best	700
High Flux Gen I	SHA	26-125	200	630	80	1.5	Best	500
High Flux Gen II	SHB	26-60	145	360	85	1.5	Best	600
High Flux Gen III	SHC	26-60	100	280	88	1.5	Best	600

Percentage of Initial Permeability Change Versus DC Bias Curves - 60μ
初始磁导率百分比与直流偏置曲线-60μ



Core Loss Density Pcv Versus Bpeak AC Flux Density- 60μ @50KHz
磁芯体积损耗密度与峰值交流磁通密度曲线-60u @50KHz

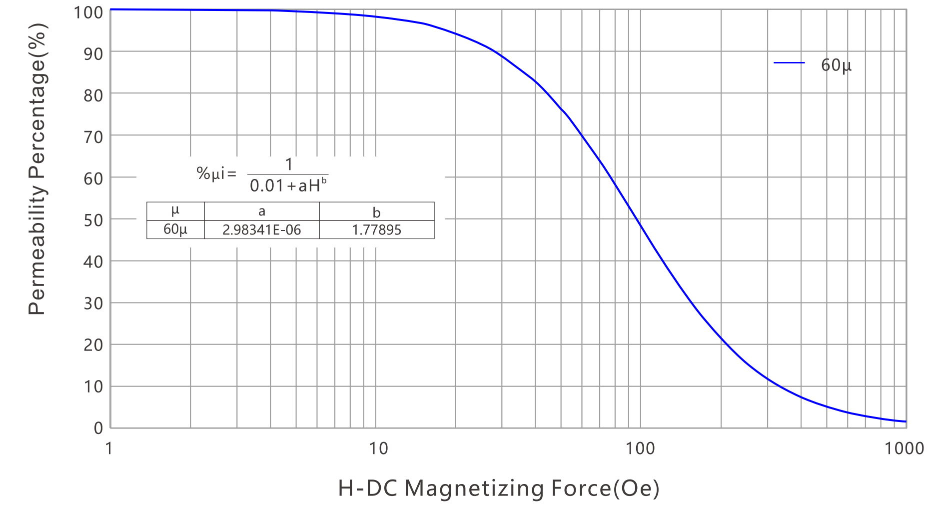


SENDUST GEN I
SAA
铁硅铝一代

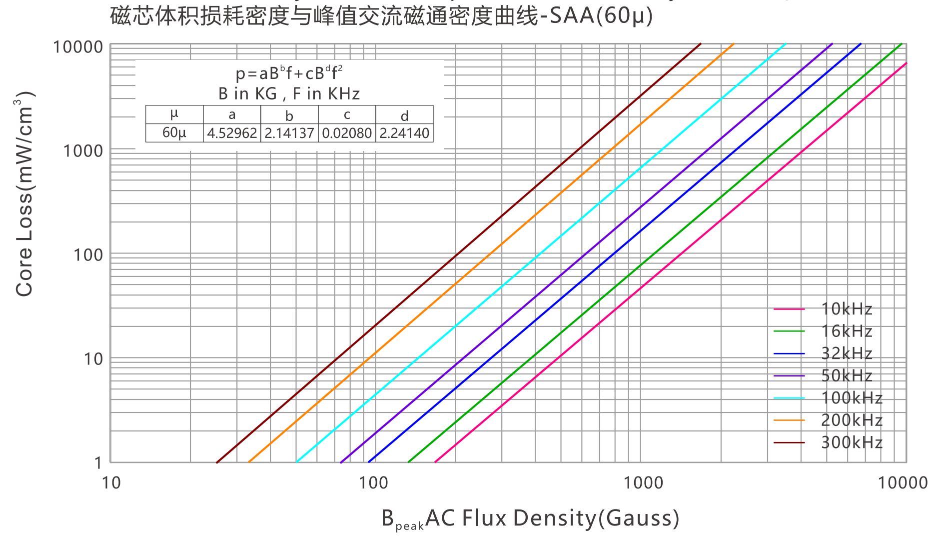
SAA(铁硅铝一代)在高频下具有低损耗特性，只有铁粉芯的五分之一，接近于零的磁致伸缩系数，是滤波电感器的理想材料。饱和磁感应强度在1.05T，比铁氧体磁芯有更高的储能能力，从而可以大幅度减小电感器尺寸。磁导率可从14到125,可用于功率因数矫正PFC电感，开关电源扼流圈，输出滤波电感，UPS，PV逆变器等。

SAA (Sendust Gen I) material has low loss characteristics at high frequency, only one-fifth of iron powder cores. The magnetostriction coefficient close to zero and relatively high saturation magnetic induction strength up to 1.05T make it an ideal material for filter inductors. The high saturation ability offers a higher energy storage capacity than ferrite cores, so that inductor size can be greatly reduced. The permeability goes from 14 to 125. Widely used in power factor correction Boost PFC inductors, current smoothing chokes, filter inductors in SPS and UPS, PVinverters, etc.

Percentage of Initial Permeability Change Versus DC Bias Curves - SAA
初始磁导率百分比与直流偏置曲线-SAA



Core Loss Density Pcv Versus Bpeak AC Flux Density -SAA (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SAA(60μ)

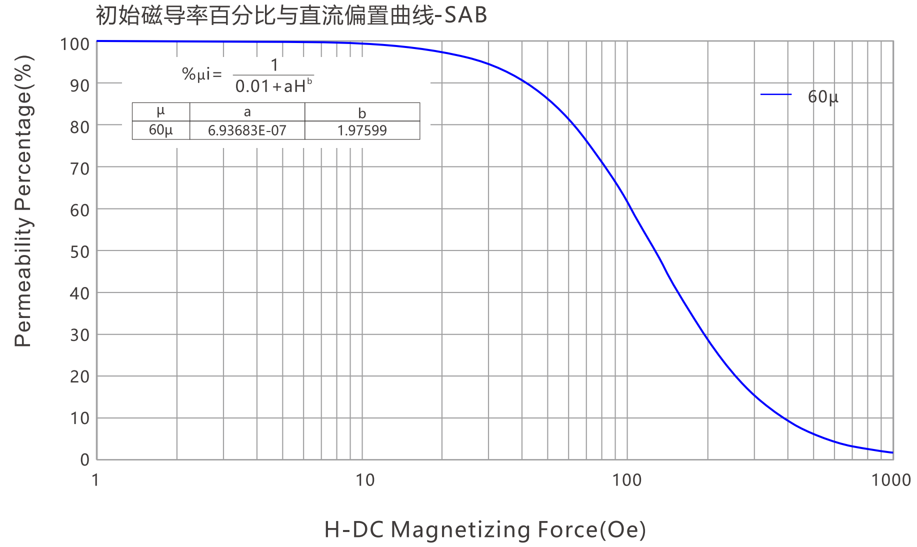


SAB

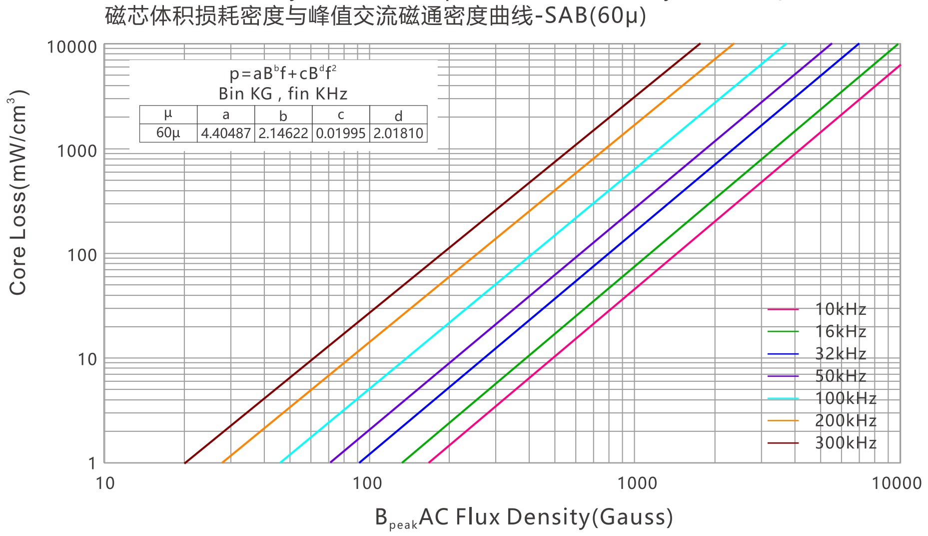
SAB(铁硅铝二代)在SAA材料基础上提高了13%左右的抗直流能力，损耗只高了20%。磁导率可从14到125。在66KHz以下开关频率是性价比最高的功率转换用途电感材料，可采用相对高的磁导率而减小铜线的用量和绕组DCR，因而在10KW以上的新能源领域得到广泛应用，堪称超级铁硅铝。

SAB (Sendust Gen II) has about 13% more DC suppression capability than SAA but only around 20% more losses. Permeability ranges relatively high from 14 to 125 makes it excellent reduce the copper usage and lower DCR for winding. SAB is the most cost-effective material for power convention inductor, which has a switching frequency below 66KHz mostly like the use in green energy field with power above 10KW, and so called Super Sendust.

Percentage of Initial Permeability Change Versus DC Bias Curves - SAB
初始磁导率百分比与直流偏置曲线-SAB



Core Loss Density Pcv Versus Bpeak AC Flux Density -SAB (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SAB(60μ)

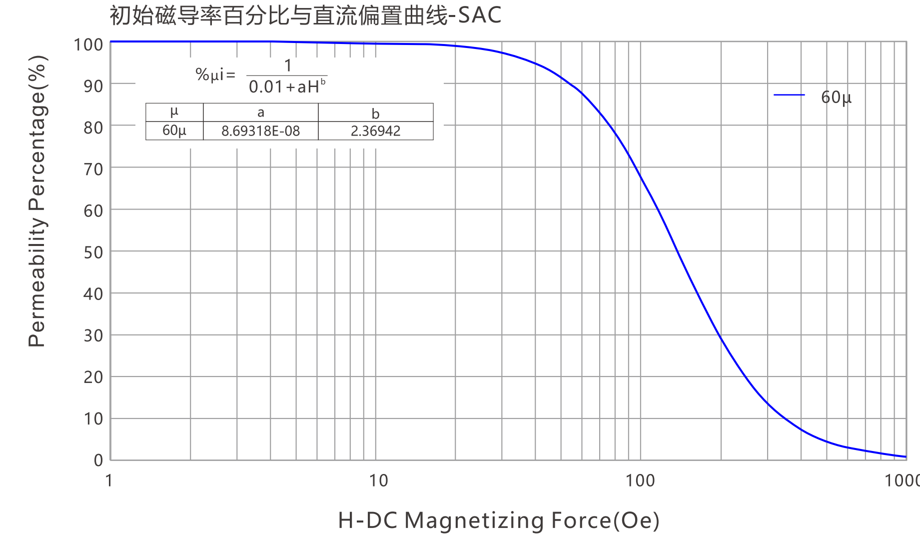


SAC

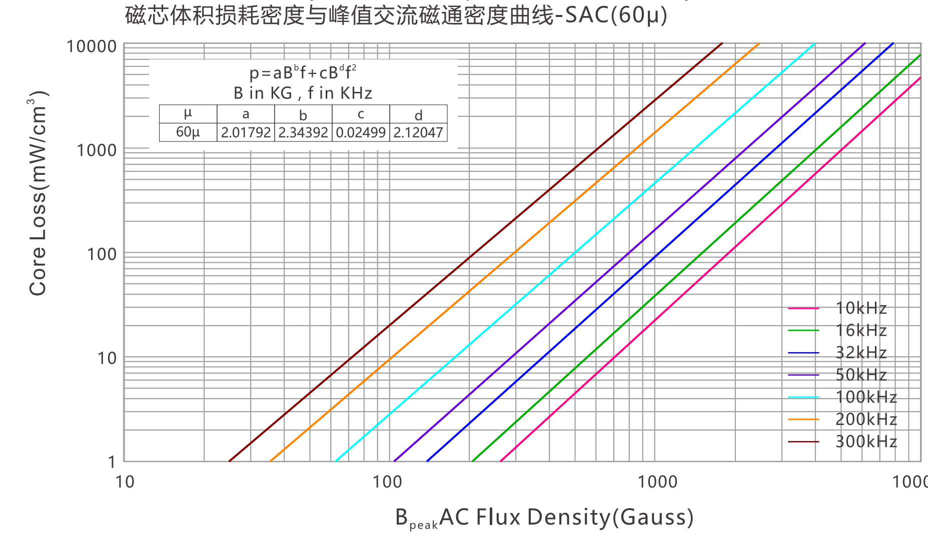
SAC(铁硅铝三代)是新一代具有分布式气隙的铁硅铝合金磁粉芯材料。相比SAA和SAB有更好的直流偏置能力和很低的磁芯损耗，可用于反激式变压器，200KHz以下的功率电感器，扁平化电感器，功率因数矫正PFC电感，PV MPPT BOOST电感等。堪称钛级铁硅铝，是SiC开关电路电感的有力支持者。

SAC (Sendust Gen III) is a new generation Sendust magnetic powder material with distributed air gaps. Comparing with SAA and SAB, it performs better DC bias suppression and exceptional low losses for better power handling, which is well developed for SiC related circuit applications in Flyback transformers, power inductors below 200KHz, planar inductors, higher frequency PFC inductors, PVMPPTBOOSTinductors, etc., so called Titanium Grade Sendust.

Percentage of Initial Permeability Change Versus DC Bias Curves - SAC
初始磁导率百分比与直流偏置曲线-SAC



Core Loss Density Pcv Versus Bpeak AC Flux Density -SAC (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SAC(60μ)

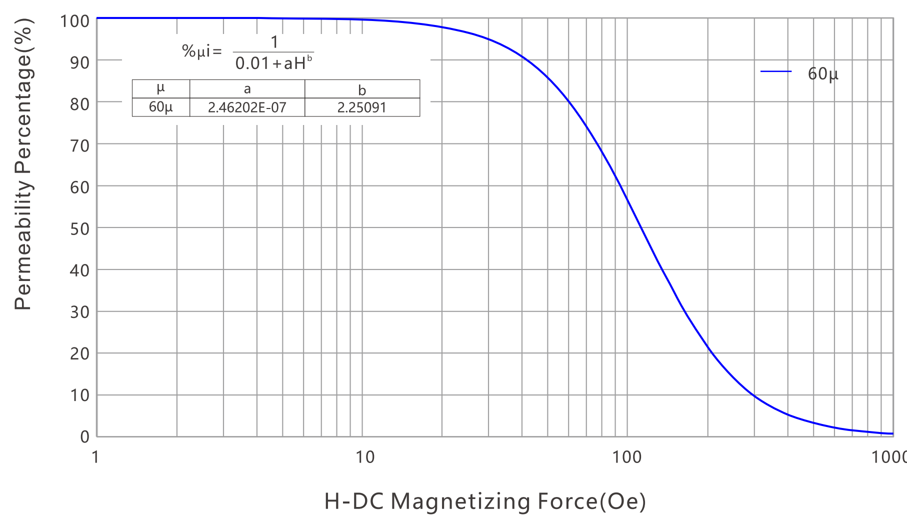


SENDUST GEN IV
铁硅铝四代
SAD

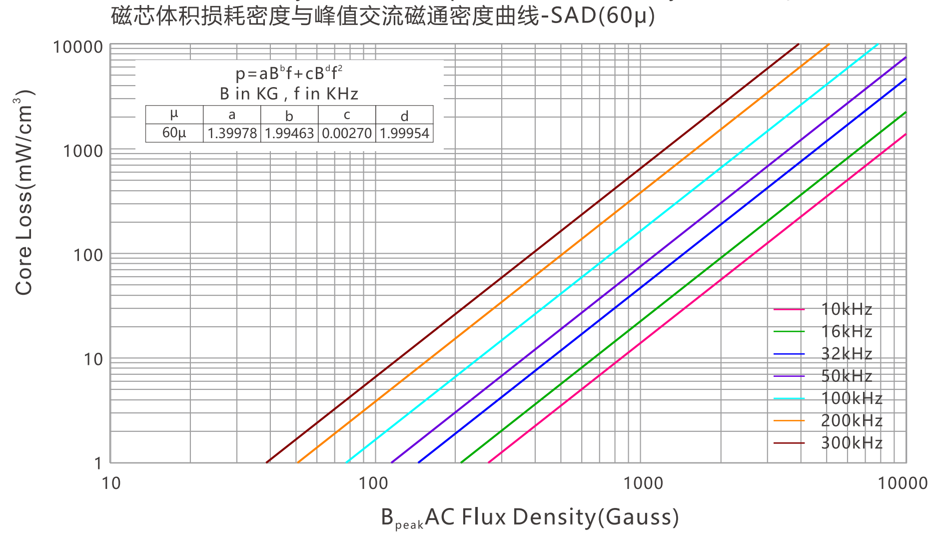
SAD(铁硅铝四代)是金属磁粉芯中损耗最低的一款材料，损耗只有SAA的30%，抗直流比SAA高5~8%。对于通讯电源，服务器电源，反激式变压器，特别是SiC或GaN主宰的开关电路，是理想的磁芯应用材料，特别在50KHz~300KHz开启了金属粉末芯功率用途的先河。

SAD (Sendust Gen IV) is best improved on losses among the magnetic powder materials. Loss is only 30% comparing to SAA, and DC bias suppression is 5~8% higher than SAAmake it an ideal magnetic core material for Datacom and Telcom power supply, server power supply and Flyback transformer. SAD has pioneeringly promoted the use of alloy powder cores in the switching circuit dominated by SiC or GaN, especially working at 50KHz~300KHz.

Percentage of Initial Permeability Change Versus DC Bias Curves - SAD
初始磁导率百分比与直流偏置曲线-SAD



Core Loss Density Pcv Versus Bpeak AC Flux Density -SAD (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SAD(60μ)

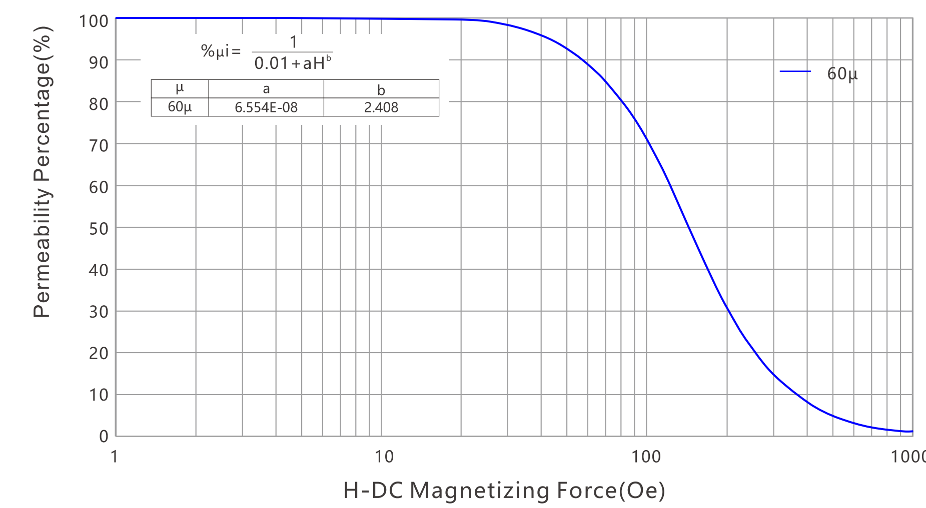


SENDUST GEN V
铁硅铝五代
SAE

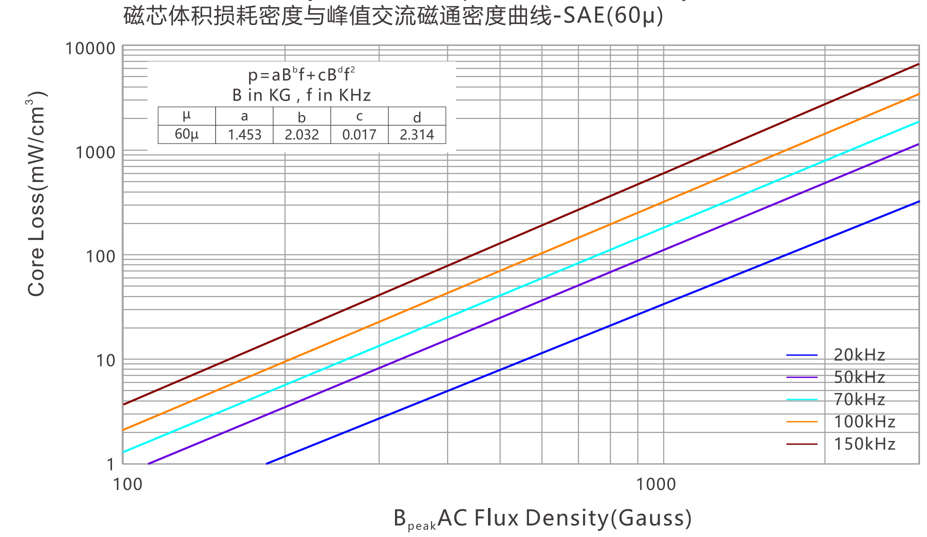
SAE(铁硅铝五代)在SAC的基础上提高了6%的抗直流能力，损耗下降了26%，磁导率可从26到60，可用于反激式变压器，200KHz以下的功率电感器，扁平化电感器，功率因数矫正PFC电感，PV MPPT BOOST电感等。堪称钛级铁硅铝，是SiC开关电路电感的有力支持者。

SAE(Sendust Gen V) has increased the anti-DC capability by 6% on the basis of SAC, reduced the loss by 26%, and the magnetic permeability can range from 26 to 60. It can be used in flyback transformers, power inductors below 200KHz, flat inductors, power factor correction PFC inductors, PV MPPT BOOST inductors, etc. It can be regarded as titanium-grade iron-silicon-aluminum and is a strong supporter of SiC switch circuit inductors.

Percentage of Initial Permeability Change Versus DC Bias Curves - SAE
初始磁导率百分比与直流偏置曲线-SAE



Core Loss Density Pcv Versus Bpeak AC Flux Density -SAE (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SAE(60μ)

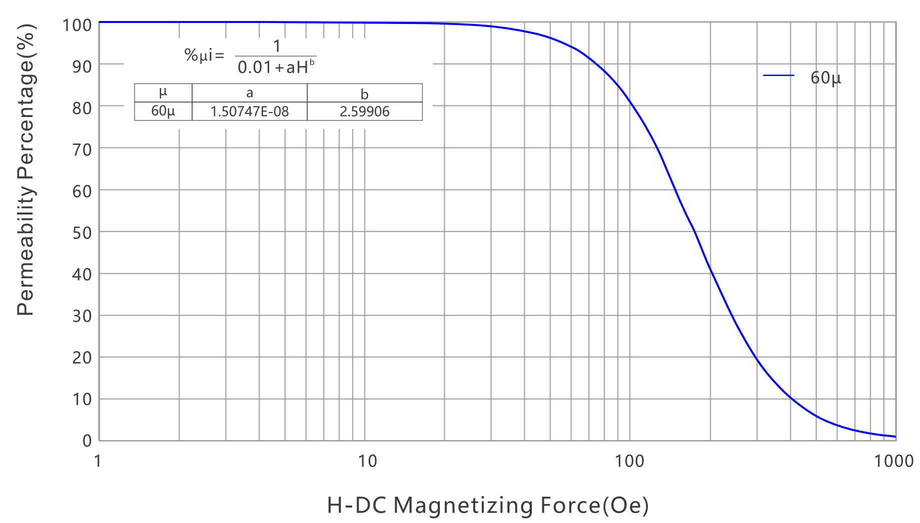


HIGH FLUX GEN I
铁镍高磁通一代
SHA

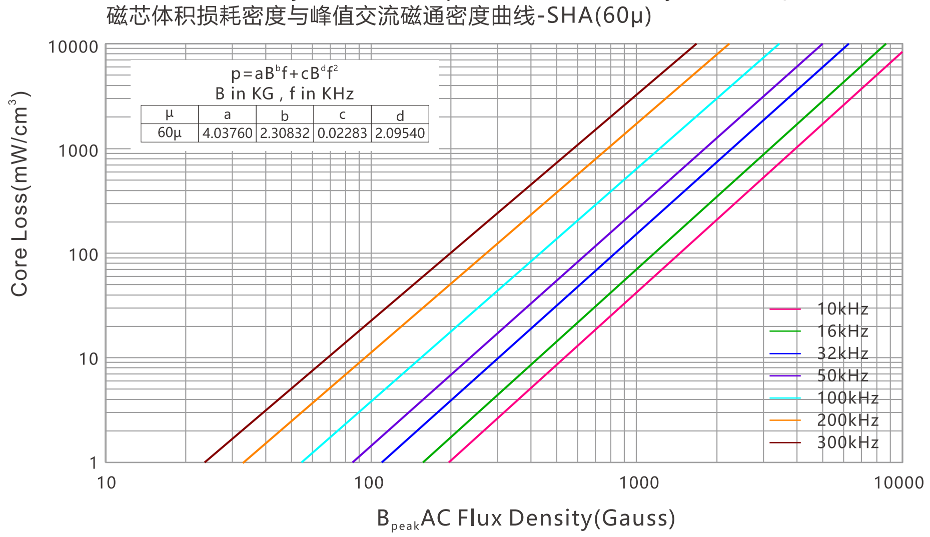
SHA (High Flux，铁镍高磁通一代)简称铁镍50，在高直流偏置，较大的交流磁通密度应用中具有极大优势，饱和磁感应强度是MPP的两倍，铁氧体的3倍。是空间受限场合如车载，航空航天，服务器开关电感的较好选择。

SHA (High Flux Gen I) is abbreviated as FeNi50 and has great advantages in high DC bias and large AC magnetic flux density applications. The saturation magnetic induction strength is twice that of MPPand 3 times that of ferrite. It is a better choice for volume concerned occasions such as automotive, aerospace, and server switching power inductors.

Percentage of Initial Permeability Change Versus DC Bias Curves - SHA
初始磁导率百分比与直流偏置曲线-SHA



Core Loss Density Pcv Versus Bpeak AC Flux Density -SHA (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SHA(60μ)

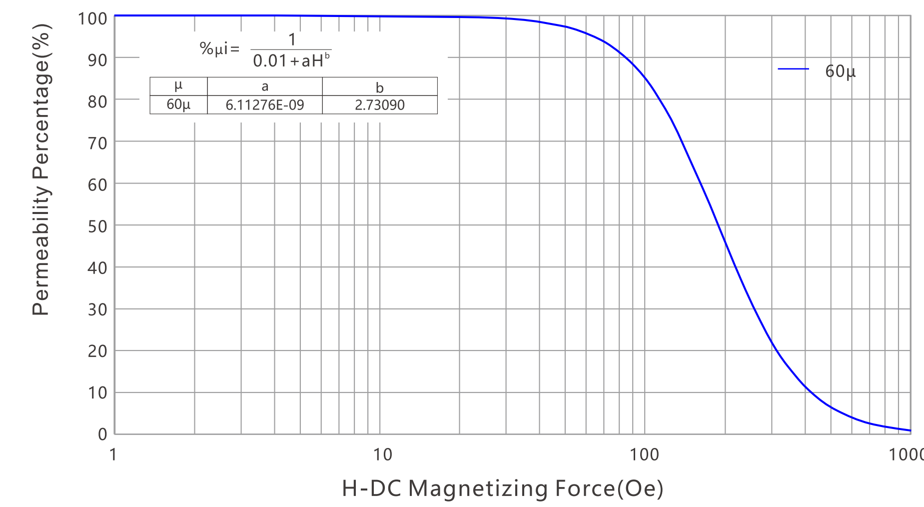


HIGH FLUX GEN II
铁镍高磁通二代
SHB

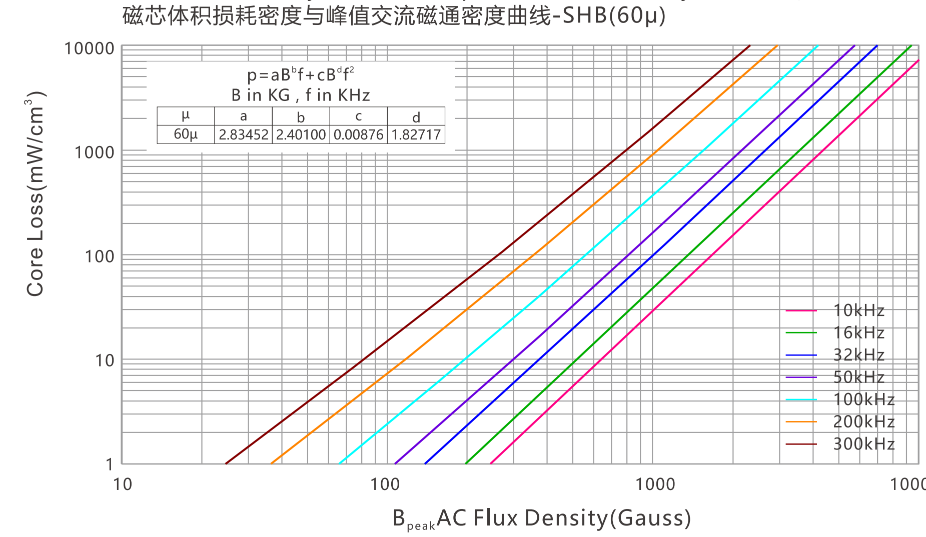
SHB (High Flux，铁镍高磁通二代)具有最高的直流偏置能力，在高交流磁通密度应用中具有最大优势；磁芯损耗相比SHA降低了20%，和SAC损耗持平，但比SAC抗直流饱和能力提高了20%。是空间受限场合如车载，航空航天，服务器开关电感器的最理想选择。堪称钛级高磁通。

SHB (High Flux Gen II) has the best DC bias suppression ability and the greatest advantage in high AC flux density applications. Core loss is 20% lower than SHA, and the same as that of SAC, but 20% higher DC Bias performance. SHB is the most ideal material for space-restricted occasions such as automotive, aerospace, and server switching circuit power inductors and socalled Titanium Grade High Flux.

Percentage of Initial Permeability Change Versus DC Bias Curves - SHB
初始磁导率百分比与直流偏置曲线-SHB



Core Loss Density Pcv Versus Bpeak AC Flux Density -SHB (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SHB(60μ)



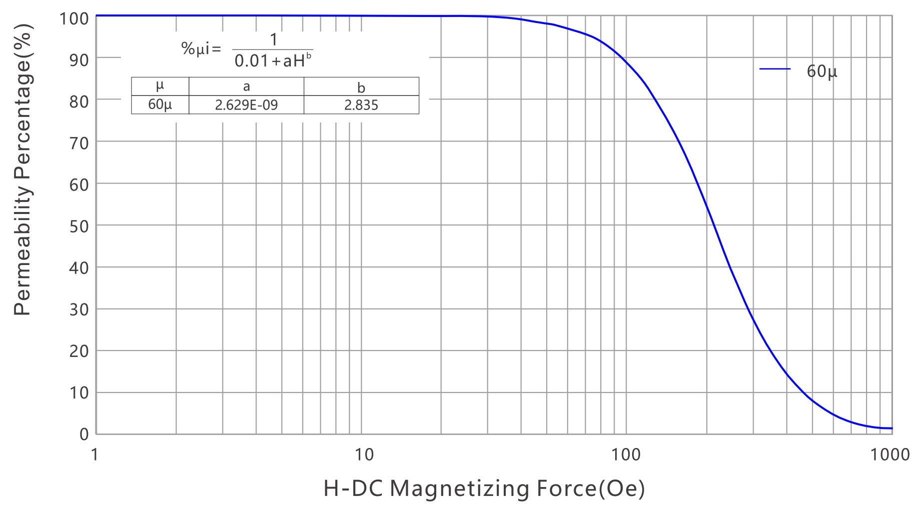
HIGH FLUX GEN III
铁镍高磁通三代

SHC

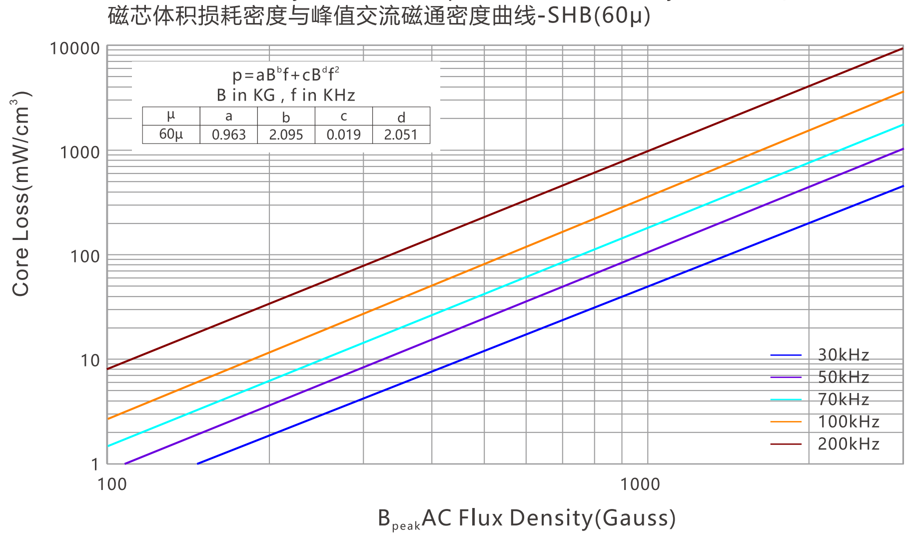
SHC(High Flux,铁镍高磁通三代)具有最高的直流偏置能力，在高交流磁通密度应用中具有最大优势；磁芯损耗相比SHB降低了31%,和SAE损耗持平，但比SAE抗直流饱和能力提高了26%。是空间受限场合如车载，航空航天，服务器开关电感器的最理想选择。堪称钛级高磁通。

SHC(High Flux, iron-nickel high Flux third-generation) has the highest DC bias capability and has the greatest advantage in applications with high AC flux density. The core loss has decreased by 31% compared with SHB, is on par with SAE loss, but has increased the DC saturation resistance capacity by 26% compared with SAE. It is the most ideal choice for space-constrained occasions such as vehicle-mounted, aerospace, and server switch inductors. It can be called titanium-grade high magnetic flux.

Percentage of Initial Permeability Change Versus DC Bias Curves - SHC
初始磁导率百分比与直流偏置曲线-SHC



Core Loss Density Pcv Versus Bpeak AC Flux Density -SHB (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SHB(60μ)



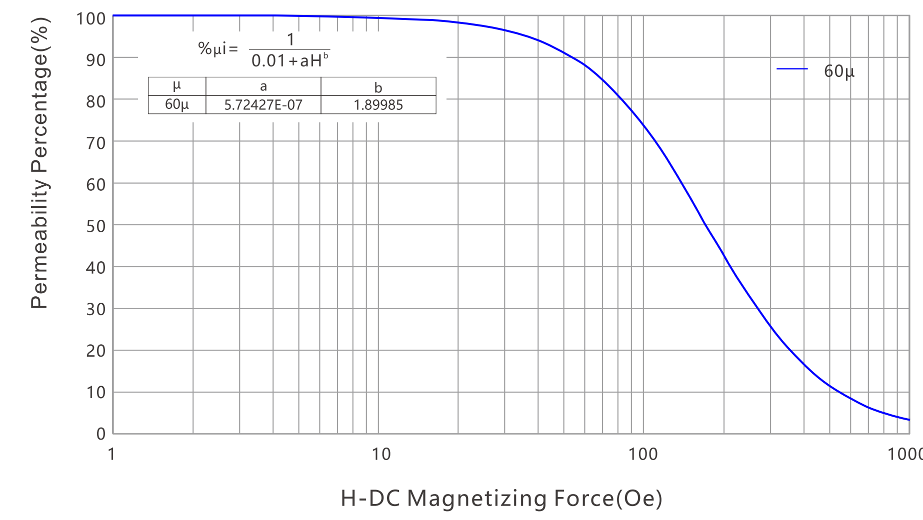
FESI GEN I
铁硅一代

SFA

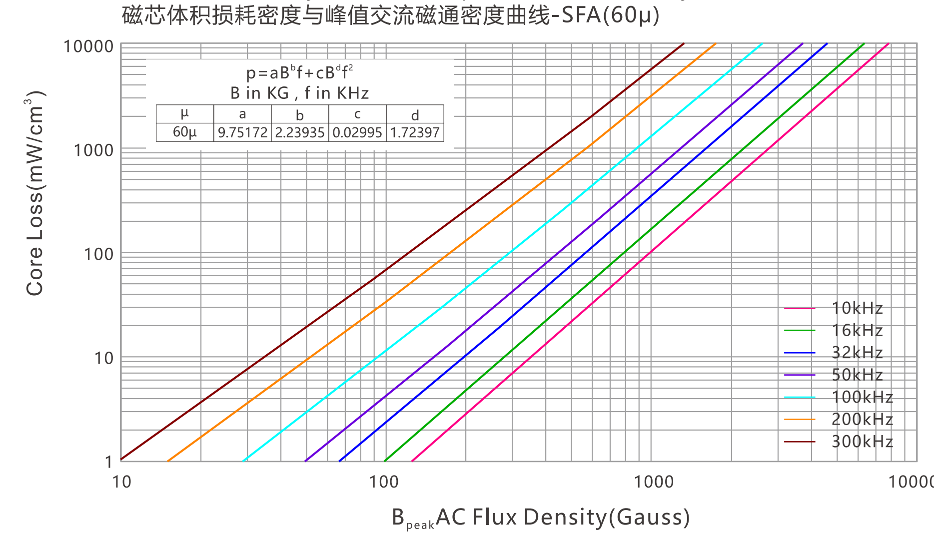
SFA(铁硅一代)，磁感应强度在16000高斯左右，完全可以成为50KHz以下中低频率为减小体积的最优选择，同时也减少了铜线用量和绕组DCR，甚至可以替代硅钢片而获得更高的效率和更低的温升。磁导率从14到125。

SFA(FeSi Gen I) , and magnetic induction strength is about 16,000 Gauss, which becomes the optimal choice for reducing volume at medium and low frequencies below 50KHz. At the same time, it also reduces the amount of copper wire and winding DCR, and can even replace silicon steel laminations with higher efficiency and lower temperature rise. Permeability ranges from 14 to 125.

Percentage of Initial Permeability Change Versus DC Bias Curves - SFA
初始磁导率百分比与直流偏置曲线-SFA



Core Loss Density Pcv Versus Bpeak AC Flux Density -SFA (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SFA(60μ)



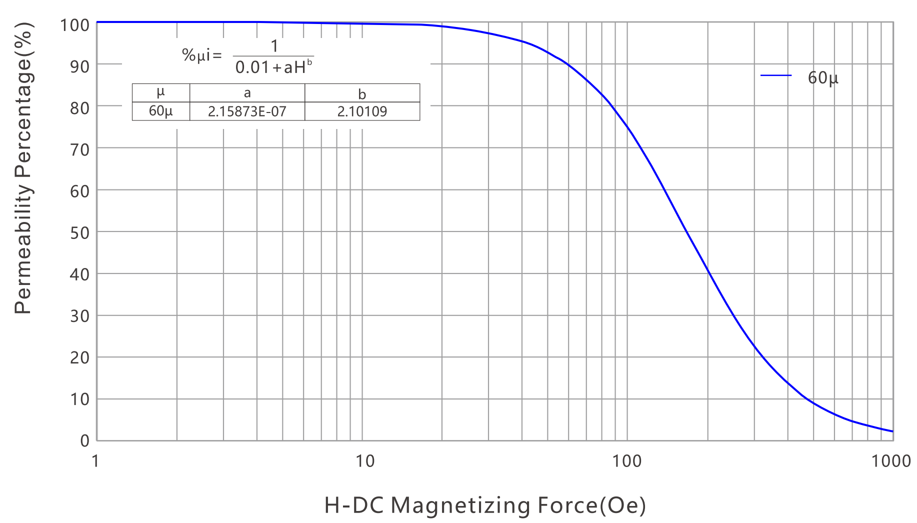
FESI GEN II
铁硅二代

SFB

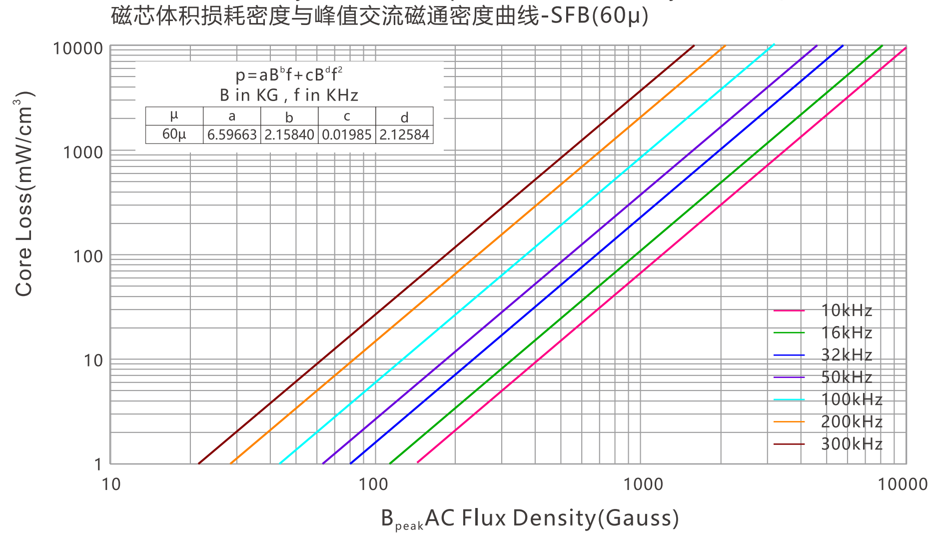
SFB(铁硅二代)具有和标准铁硅SFA相同的高抗直流饱和特性，损耗降低了30%，这对散热不太好的场合如PV灌胶电感，或是50KHz以下中低频率既要减小体积，又要相对高的低负载效率和低的温升是一个理想的材料。

SFB (FeSi Gen II) has the same high DC saturation characteristics as standard FeSi SFA, and loss is reduced by 30%, which is an ideal material for situations with poor heat dissipation, such as PV potted inductors, applications at low-to-medium frequencies below 50KHz, or occasions with not only volume concerned, but also relatively better low load efficiency and relatively lower temperature rise concerned.

Percentage of Initial Permeability Change Versus DC Bias Curves - SFB
初始磁导率百分比与直流偏置曲线-SFB



Core Loss Density Pcv Versus Bpeak AC Flux Density -SFB (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SFB(60μ)



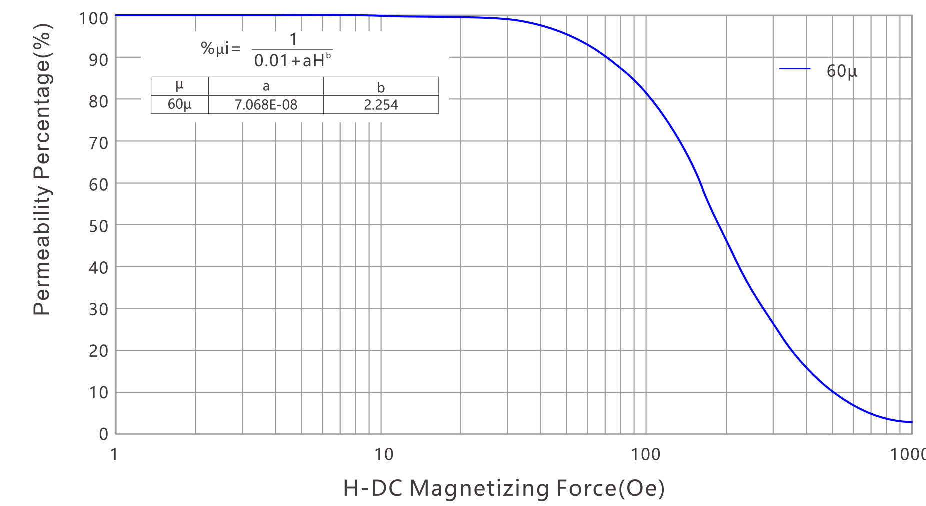
FESI GEN III
铁硅三代

SFC

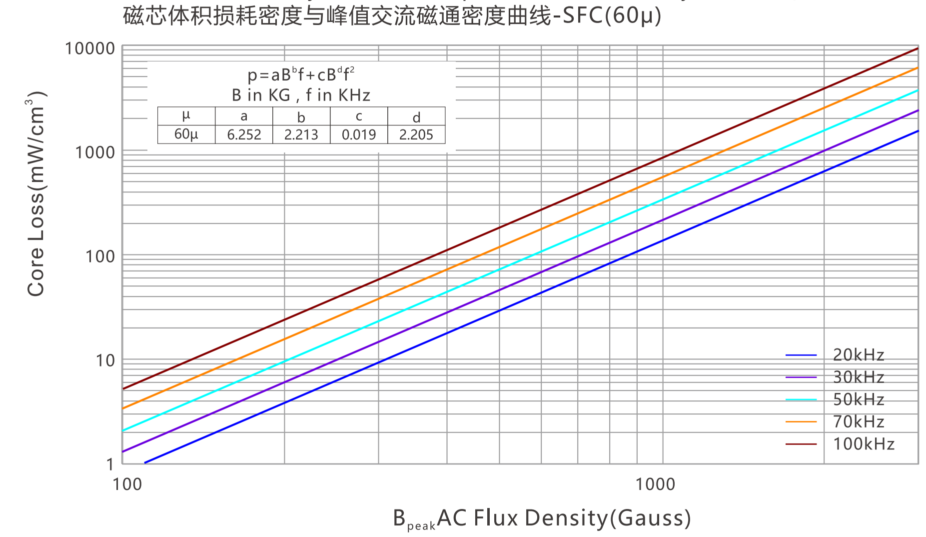
SFC(铁硅三代)极大的提高了抗直流能力接近Hign Flux Ⅰ代的材料性能，损耗上相比SFB材料作了一定的优化，这对散热不太好的场合如PV灌胶电感，或是50KHz以下中低频率既要减小体积，又要相对高的低负载效率和低的温升是一个理想的材料。

SFC(FeSi Gen III) has greatly enhanced the anti-DC capability, approaching the material performance of Hign Flux I. In terms of loss, it has been optimized to a certain extent compared to SFB materials. This is suitable for occasions with poor heat dissipation, such as PV potting inductors, or for medium and low frequencies below 50KHz, where the volume needs to be reduced. It is an ideal material that requires relatively high low-load efficiency and low temperature rise.

Percentage of Initial Permeability Change Versus DC Bias Curves - SFC
初始磁导率百分比与直流偏置曲线-SFC



Core Loss Density Pcv Versus Bpeak AC Flux Density -SFC (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SFC(60μ)

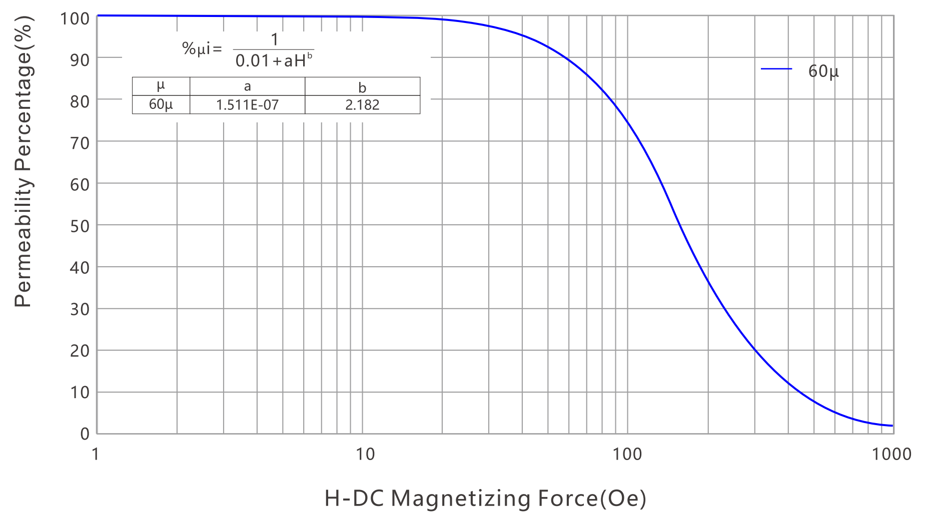


SFD

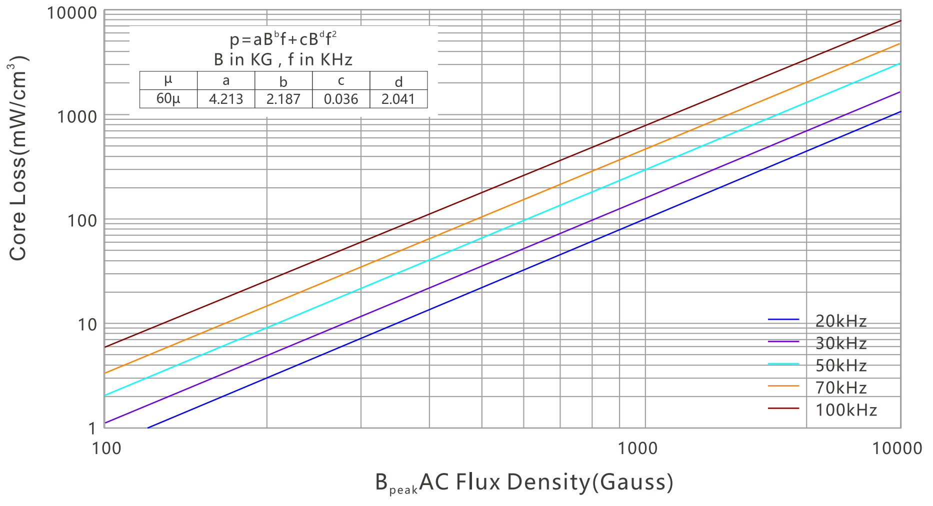
SFD（第四代）是在SFB基础上继续优化了损耗，其具有和SFB一样的抗饱和能力，但损耗比SFB还降低了20%。同时，由于材料不含贵重金属，其成本也相对不高。是一款比较理想的材料。

SFD (fourth generation) is an optimized version of SFB with reduced losses. It retains the same anti-saturation capability as SFB, but its losses are reduced by 20% compared to SFB. Additionally, since the material does not contain precious metals, its cost is relatively low. It is an ideal material.

Percentage of Initial Permeability Change Versus DC Bias Curves - SFD
初始磁导率百分比与直流偏置曲线-SFD



Core Loss Density Pcv Versus Bpeak AC Flux Density -SFD (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SFD(60μ)

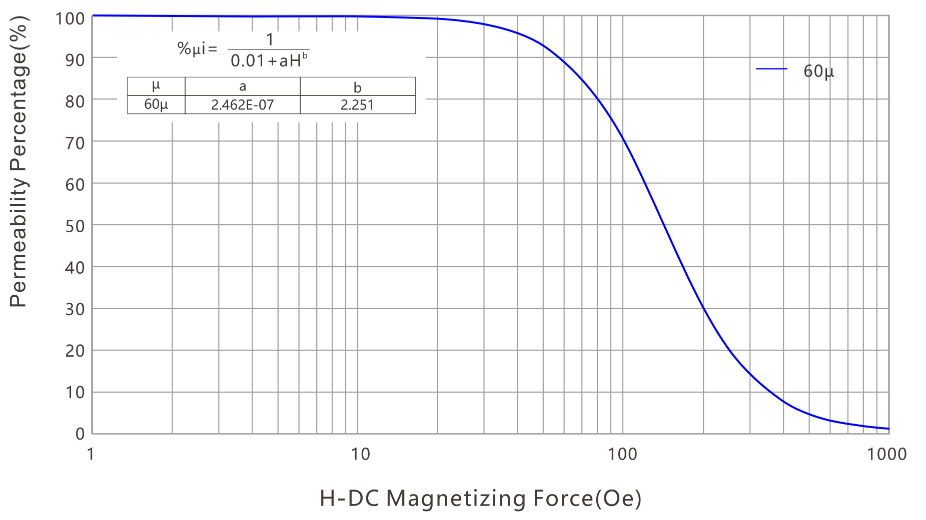


SAT

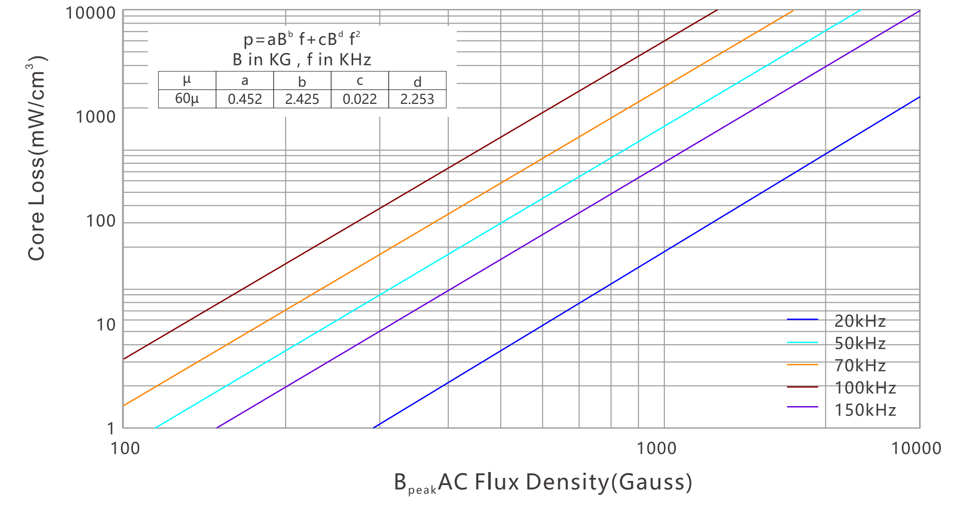
SAT是在SAE基础上继续优化了损耗，其在100Oe情况下的磁导率仍有初始的70%，具有和SAE一样的抗饱和能力，但其损耗比SAE还降低了32%。能极大幅度的降低产品的损耗，为客户减少铜线或降低电感的温升提供了材料支持。

SAT is an optimized version of SAE with reduced loss. Its magnetic permeability at 100 Oe remains at 70% of the initial value, exhibiting the same anti-saturation capability as SAE, but with a 32% reduction in loss compared to SAE. It can significantly reduce the loss of products, providing material support for customers to reduce copper wire usage or lower the temperature rise of inductors.

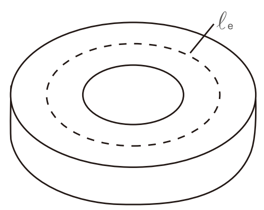
Percentage of Initial Permeability Change Versus DC Bias Curves - SAT
初始磁导率百分比与直流偏置曲线-SAT

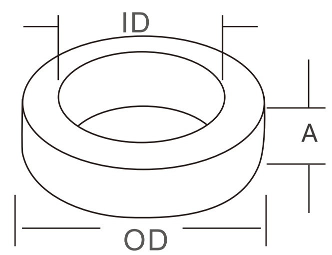


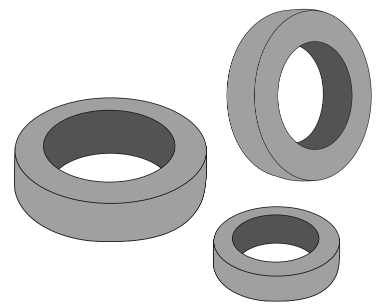
Core Loss Density Pcv Versus Bpeak AC Flux Density -SAT (60μ)
磁芯体积损耗密度与峰值交流磁通密度曲线-SAT(60μ)



STANDARD TOROIDAL CORES
环形磁芯







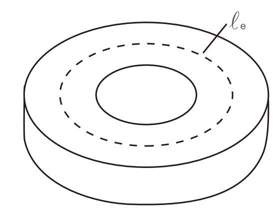
典型产品名称 Typical Product Name：SAA 106 060 A

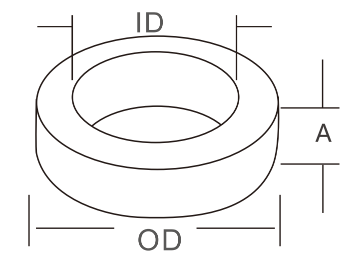
- 标准品 TRC
- 磁导率 Permeability:60μ
- 外径 Outside Diameter: 1.06 inches
- 磁芯材料 Core Material

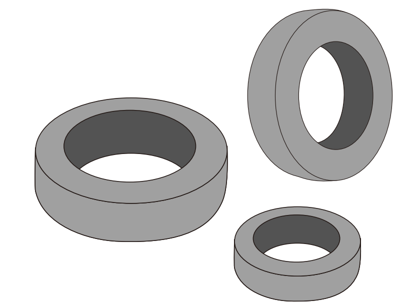
产品名称 Part Number	磁芯尺寸 Dimensions(mm) OD (max)×ID(min) ×HT(max)		有效磁路长度 Path Length (cm)	有效横截面积 Cross Section Area (cm^2)	磁芯体积 Volume (cm^3)	A_L(nH/N²)±8%					
	Before Coating	After Coating				026μ	040μ	060μ	075μ	090μ	125μ
106	26.9×14.7×11.2	27.7×14.1×11.99	6.35	0.654	4.15	32	50	75	94	113	157
130	33.0×19.9×10.7	33.83×19.3×11.61	8.15	0.672	5.48	28	41	61	76	91	127
133	33.27×18.0×11.52	34.08×17.36×12.05	7.809	0.844	6.871	36	55	83	104	125	173
135	34.3×23.4×8.89	35.1×22.56×9.83	8.95	0.454	4.06	16	25	38	47	57	79
141	35.8×22.4×10.5	36.63×21.54×11.28	8.98	0.678	6.088	24	37	56	70	84	117
157	39.9×24.1×14.5	40.72×23.30×15.37	9.84	1.072	10.5	35	54	81	101	121	168
158	40.13×22.08×17.0	40.94×21.27×17.89	9.51	1.5372	15.043	53	81	122	152	183	254
168	42.9×24.2×16.26	44.0×23.3×17.16	10.216	1.475	15.741	47	72	108	135	161	224
184	46.7×24.1×18.0	47.63×23.32×18.92	10.74	1.99	21.3	59	90	135	169	202	281
185	46.7×28.7×15.2	47.63×27.89×16.13	11.63	1.34	15.53	37	57	86	107	128	178
200	50.8×31.8×13.5	51.69×30.94×14.35	12.73	1.251	15.93	32	49	73	91	109	152

Customized sizes are optional
可提供客制化定制
Materials:FeSi,FeSiAl,FeNi and etc.
材质：铁硅、铁硅铝、铁镍等

STANDARD TOROIDAL CORES
环形磁芯







典型产品名称 Typical Product Name：SAA 106 060 A

- 标准品 TRC
- 磁导率 Permeability:60μ

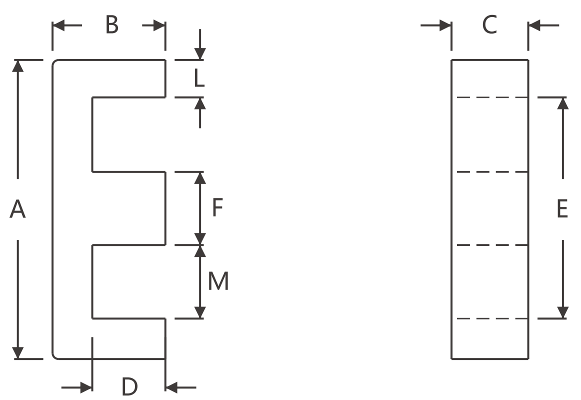
- 外径 Outside Diameter:1.06 inches

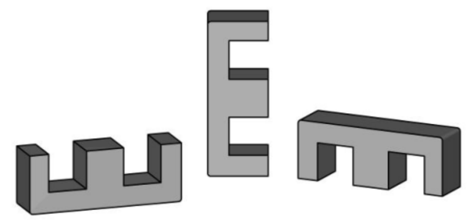
- 磁芯材料 Core Material

产品名称 Part Number	磁芯尺寸 Dimensions(mm) OD (max)×ID(min) ×HT(max)		有效磁路长度 Path Length (cm)	有效横截面积 Cross Section Area (cm^2)	磁芯体积 Volume (cm^3)	A_L(nH/N²)±8%					
	Before Coating	After Coating				026μ	040μ	060μ	075μ	090μ	125μ
225	57.2×35.6×14.0	58.0×34.7×14.86	14.3	1.444	20.65	33	50	75	94	112	156
226	57.2×26.4×15.2	58.0×25.6×16.1	12.5	2.29	28.6	60	92	138	175	207	287
250	62.0×32.6×25.0	63.1×31.37×26.27	14.37	3.675	52.81	83	128	192	240	288	400
268	68.0×36.0×20.0	69.34×34.7×21.4	16.33	3.104	50.69	62	95	143	179	215	298
290	74.1×45.3×35.0	75.2×44.07×36.2	18.38	5.04	92.64	89	137	206	257	309	429
300	77.8×49.2×12.7	78.9×48.2×13.84	20.0	1.77	34.7	30	45	68	85	102	142
301	77.8×49.2×15.9	78.9×48.2×17.02	19.95	2.27	45.3	37	57	85	107	128	178
400	101.6×57.15×16.51	103.12×55.75×17.78	24.271	3.5226	85.495	48	75	112	137	164	228
401	101.6×57.15×13.59	103.12×55.75×14.86	24.271	2.9716	72.122	40	61	92	115	139	192
520	132.54×78.59×20.32	133.96×77.04×21.72	32.428	5.3471	173.4	54	83	124	155	187	259
521	132.54×78.59×25.4	133.96×77.04×26.8	32.429	6.71	217.58	67.6	104	156	195	234	325
650	165.0×88.9×25.4	167.2×86.9×27.31	38.65	9.48	365.0	80	123	185	231	277	385

Customized sizes are optional
可提供客制化定制
Materials:FeSi,FeSiAl,FeNi and etc.
材质：铁硅、铁硅铝、铁镍等

E CORES
E形磁芯





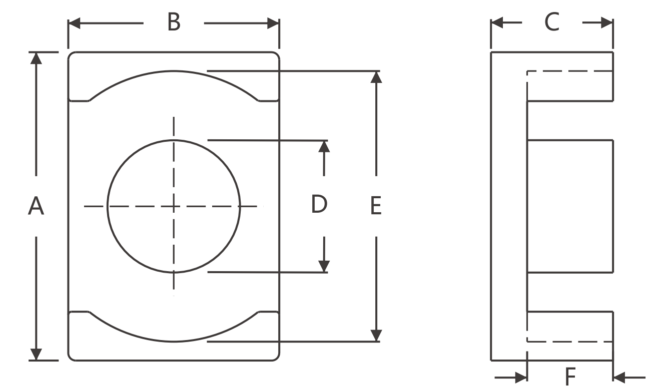
典型产品名称 Typical Product Name：SAA 43 21 E 060 A H15

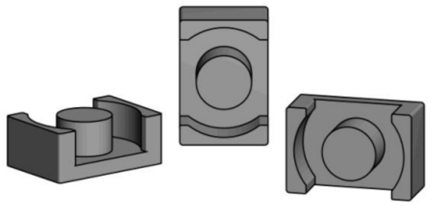
- 高度 Height:15mm
- 标准品 TRC
- 磁导率 Permeability:60μ
- E形磁芯 E Cores
- 宽度 Width:21mm
- 长度 length:43mm
- 磁芯材料 Core Material

产品名称 Part Number	磁芯尺寸 Dimensions(mm)								有效磁路长度 Path Length (cm)	有效横截面积 Cross Section Area (cm^2)	磁芯体积 Volume (cm^3)	A_L(nH/N^2)±8%			
	A	B	C	D (min)	E (min)	F	L (nom)	M (min)				026μ	040μ	060μ	090μ
E4117A	40.9	16.5	12.5	10.4	28.3	12.5	6.0	7.9	77.5	152	11800	88	119	163	234
E4321A	42.8	21.1	10.8	15.0	30.4	11.9	5.95	9.27	98.4	128	12600	56	76	105	151
E4321B	42.8	21.1	15.4	15.0	30.4	11.9	5.95	9.27	98.4	183	18000	80	108	150	217
E4321C	42.8	21.1	20.0	15.0	30.4	11.9	5.95	9.27	98.4	237	23300	104	140	194	281
E5528A	54.9	27.6	20.6	18.5	37.5	16.8	8.38	10.3	123	350	43100	116	157	219	
E5528B	54.9	27.6	24.6	18.5	37.5	16.8	8.38	10.3	123	417	51400	138	187	261	
E6533A	65.1	32.5	27.0	22.2	44.2	19.7	10.0	12.1	147	540	79400	162	230	300	
E7228A	72.39	27.94	19.05	17.78	52.63	19.05	9.52	16.89	137	368	50300	130	173	236	
E8038A	80.01	38.1	19.81	28.14	59.28	19.81	9.91	19.81	185	389	72100	103	145	190	

Customized sizes are optional
可提供客制化定制
Materials:FeSi,FeSiAl,FeNi and etc.
材质：铁硅、铁硅铝、铁镍等

EQ CORES
EQ形磁芯





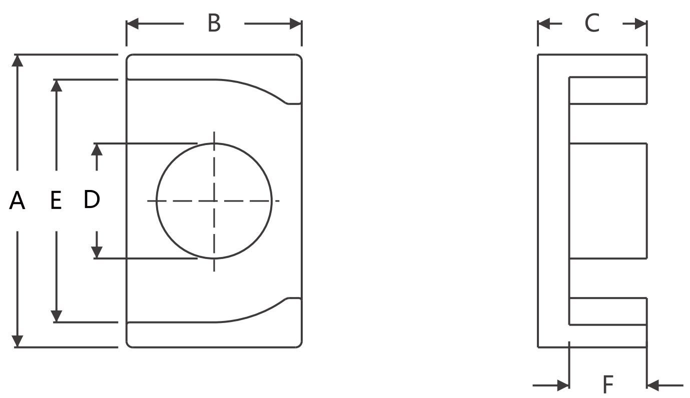
典型产品名称 Typical Product Name：SAA 50 32 EQ 060 A H25

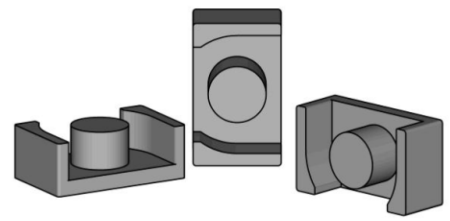
- 高度 Height:25mm
- 标准品 TRC
- 磁导率 Permeability:60μ
- EQ形磁芯 EQ Cores
- 宽度 Width:32mm
- 长度 length:50mm
- 磁芯材料 Core Material

产品名称 Part Number	磁芯尺寸 Dimensions(mm)						有效磁路长度 Path Length (cm)	有效横截面积 Cross Section Area (cm^2)	磁芯体积 Volume (cm^3)	A_L(nH/N^2)±8%		
	A	B	C	D	E	F				026μ	040μ	060μ
EQ2014A	20.5	14.0	8.1	8.8	18.0	5.7	45.2	60.8	2750	44	68	101
EQ2014B	20.5	14.0	10.0	8.8	18.0	7.7	53.2	60.8	3230	37	57	85
EQ2619A	26.5	19.0	10.1	12.0	22.6	6.8	54.7	119.8	6550	72	110	165
EQ2619B	26.5	19.0	12.4	12.0	22.6	9.1	63.9	119.8	7660	61	94	141
EQ3222A	32.0	22.0	10.3	13.5	27.6	6.6	60.3	152.3	9180	83	127	190
EQ3222B	32.0	22.0	15.2	13.5	27.6	11.5	79.9	152.3	12170	62	96	144
EQ3626A	36.0	26.0	17.4	14.4	32.0	13.4	94.7	180.8	17120	62	96	144
EQ4128A	41.5	28.0	19.9	14.9	36.5	15.4	115.2	199.7	23010	57	87	131
EQ5032A	50.0	32.0	25.0	20.0	44.0	19.5	133.4	314.1	41900	77	118	178

Customized sizes are optional
可提供客制化定制
Materials:FeSi,FeSiAl,FeNi and etc.
材质：铁硅、铁硅铝、铁镍等

RH CORES
RH形磁芯





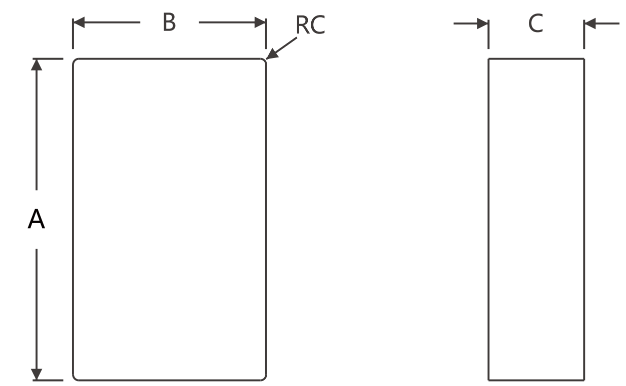
典型产品名称 Typical Product Name：SAA 30 20 RH 060 A H8.5

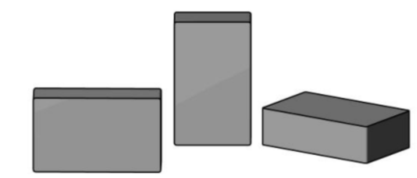
- 高度 Height:8.5mm (H8.5)
- 标准品 TRC (A)
- 磁导率 Permeability:60μ (060)
- RH形磁芯 RH Cores (RH)
- 宽度 Width:20mm (20)
- 长度 length:30mm (30)
- 磁芯材料 Core Material (SAA)

产品名称 Part Number	磁芯尺寸 Dimensions(mm)						有效磁路长度 Path Length (cm)	有效横截面积 Cross Section Area (cm^2)	磁芯体积 Volume (cm^3)	A_L(nH/N^2)±8%		
	A	B	C	D	E	F				026μ	040μ	060μ
RH2314A	23.4	14.0	8.7	9.2	19.4	6.2	118	491	670	45	69	103
RH2518A	25.0	18.0	8.4	11.0	21.0	5.4	171	497	960	63	97	146
RH2518B	25.0	18.0	10.8	11.0	21.0	7.8	204	593	960	53	81	122
RH3020A	30.0	20.0	9.2	12.0	25.6	5.9	237	581	1140	64	99	148
RH3020B	30.0	20.0	11.8	12.0	25.6	8.5	279	685	1140	54	84	125
RH3222A	32.0	22.0	10.3	13.5	27.0	6.6	320	625	1430	75	115	172
RH3222B	32.0	22.0	13.4	13.5	27.6	9.7	382	749	1430	62	94	144
RH3222C	32.0	22.0	15.2	13.5	27.0	11.5	420	821	1430	57	88	131
RH3624A	36.2	24.0	11.2	15.0	30.4	7.2	430	678	1770	85	131	197
RH3624B	36.2	24.0	14.4	15.0	30.4	10.4	511	806	1770	72	110	166
RH4225A	42.0	25.0	12.3	16.2	35.2	7.9	561	761	2060	88	136	204
RH4225B	42.0	25.0	15.8	16.2	35.2	11.4	664	901	2060	75	115	172

Customized sizes are optional
可提供客制化定制
Materials:FeSi,FeSiAl,FeNi and etc.
材质：铁硅、铁硅铝、铁镍等

BLOCK CORES
方形磁芯





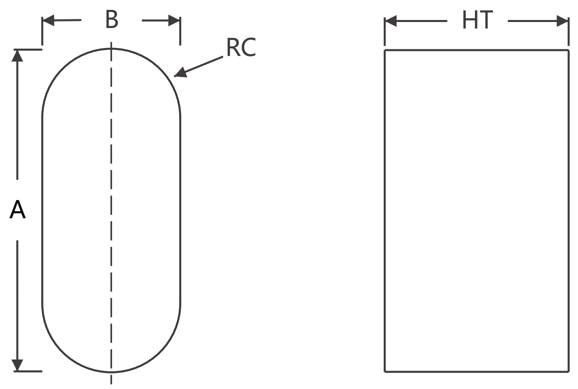
典型产品名称 Typical Product Name：SAA 70 30 B 060 A H12

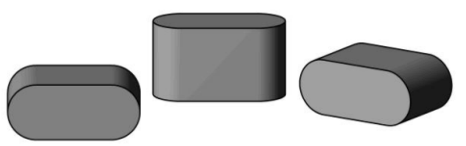
- 高度 Height:12mm (H12)
- 标准品 TRC (A)
- 磁导率 Permeability:60μ (060)
- 方形磁芯 Block Cores (B)
- 宽度 Width:30mm (30)
- 长度 length:70mm (70)
- 磁芯材料 Core Material (SAA)

产品名称 Part Number	磁芯尺寸 Dimensions(mm)			
	A	B	C	RC
B5028A	50.0	28.0	20.0	1.50
B5030A	50.5	30.3	15.0	1.50
B5030B	50.5	30.3	20.0	1.50
B5035A	50.0	35.0	20.0	1.50
B5035B	50.0	35.0	20.0	8.00
B6020A	60.5	20.2	20.0	1.50
B6030A	60.5	30.0	20.0	1.50
B6030B	60.5	50.5	20.0	1.50
B6050A	60.5	50.5	20.0	1.50
B7020A	70.6	20.2	20.0	1.50
B7030A	70.6	20.2	20.0	1.50
B7030B	70.6	30.3	20.0	1.50
B7035A	70.0	35.0	20.0	1.50
B8020A	80.7	20.2	20.0	1.50
B8030A	80.7	30.3	15.0	1.50
B8030B	80.7	30.3	20.0	1.50
B9023A	90.5	23.2	20.0	1.50
B10050A	100	50.0	20.0	3.00

Customized sizes are optional
可提供客制化定制
Materials:FeSi,FeSiAl,FeNi and etc.
材质：铁硅、铁硅铝、铁镍等

ELLIPSE CORES
椭圆形磁芯





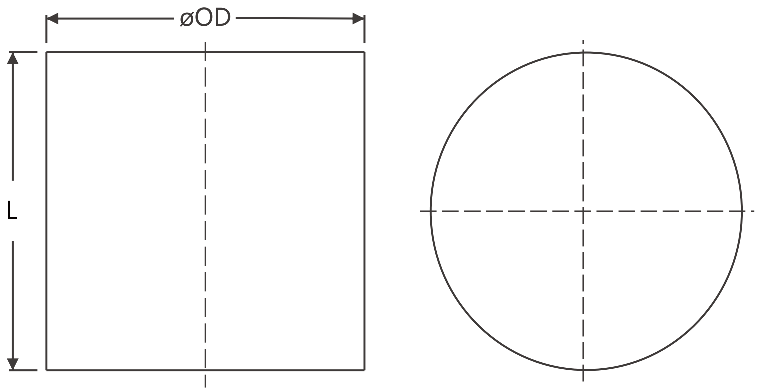
典型产品名称 Typical Product Name：SAA 30 20 L 060 A H25

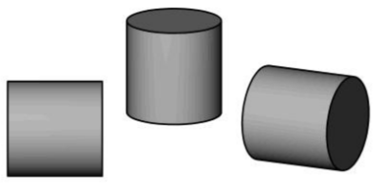
- 高度 Height:25mm
- 标准品 TRC
- 磁导率 Permeability:60μ
- 椭圆形磁芯 Ellipse Cores
- 宽度 Width:20mm
- 长度 length:30mm
- 磁芯材料 Core Material

产品名称 Part Number	磁芯尺寸 Dimensions(mm)			
	A	B	RC	HT
L3515A	35	15	7.5	20
L3515B	35	15	7.5	25
L3520A	35	20	7.5	20
L3520B	35	20	7.5	25
L5020A	50	20	10	20.25
L5035A	50	35	7.5	13.5
L5035B	50	35	7.5	18.5
L5528A	55	28	14	10
L6030A	60	30	15	14
L6034A	60	34	17	10
L6035A	60	35	7.5	13.5
L6035B	60	35	7.5	18.5
L6560A	65	50	51	21
L6637A	66	37	8.5	11
L6842A	68	42	21	8.5
L7035A	70	35	7.5	13.5
L7035B	70	35	7.5	18.5
L7040A	70	40	20	12
L8030A	80	30	15	23.5
L8430A	84	30	15	20
L9055A	90	55	27.5	15

Customized sizes are optional
可提供客制化定制
Materials:FeSi,FeSiAl,FeNi and etc.
材质：铁硅、铁硅铝、铁镍等

CYLINDER CORES
圆柱形磁芯





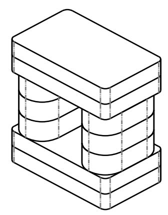
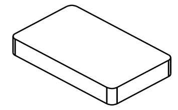
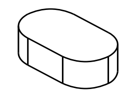
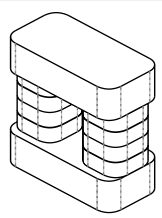
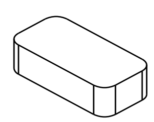
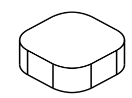
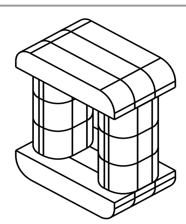
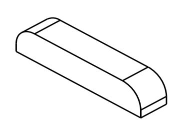
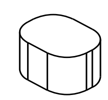
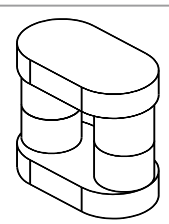
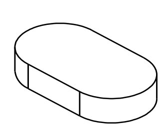
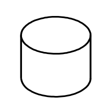
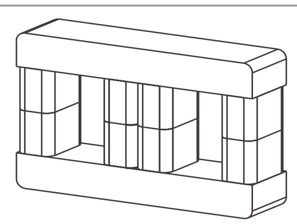
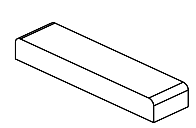
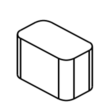
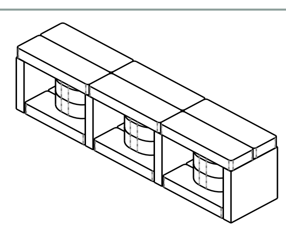
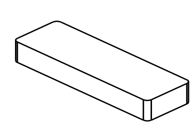
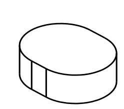
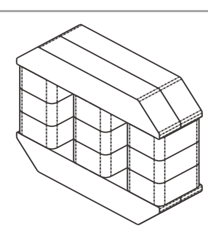
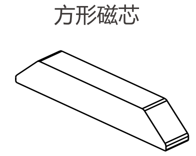
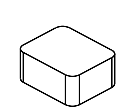
典型产品名称·Typical Product Name：C 30 30 -060

- 磁导率 Permeability:60μ
- 高度 Height:30mm
- 直径 OD:30mm
- 圆柱形磁芯 Cylinder Cores

产品名称 Part Number	磁芯尺寸 Dimensions(mm)	
	OD	L
C1030	10	30
C1430	14	30
C1930	19	30
C2020	20	20
C2021	20	21
C2130	21	30
C2338	23	38
C2424	24	24
C2520	25	20
C2525	25	25
C2532	25	32
C2728	27.5	28
C2828	28	28
C3030	30	30
C3035	30	35
C3225	32	25
C3328	33	28
C3631	36	31
C4020	40	20
C5530	55	30

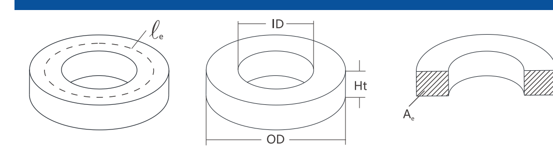
Customized sizes are optional
可提供客制化定制
Materials:FeSi,FeSiAl,FeNi and etc.
材质：铁硅、铁硅铝、铁镍等

ILLUSTRATION OF CORE ASSEMBLY
组合磁芯图示

	Block Core 方形磁芯 	Ellipse Core 椭圆形磁芯 
	Block Core 方形磁芯 	Block Core 方形磁芯 
	Block Core 方形磁芯 	Block Core 方形磁芯 
	Ellipse Core 椭圆形磁芯 	Cylinder Core 圆柱形磁芯 
	Block Core 方形磁芯 	Block Core 方形磁芯 
	Block Core 方形磁芯 	Ellipse Core 椭圆形磁芯 
	Block Core 方形磁芯 	Block Core 方形磁芯 

TERMS DEFINITIONS AND EXPLANATIONS
术语及解释

环形磁粉芯的有效面积与有效磁路长度



$$A_e=\frac{OD-ID}{2}\times HT \qquad l_e=\frac{(OD-ID)\times\pi}{\ln(\frac{OD}{ID})} \qquad V_e=l_e\times A_e$$

OD：磁芯外径(mm)

A_e：有效磁粉芯面积(mm^2)　　ID：磁芯内径(mm)

l_e：有效磁路长度(mm)　　HT：磁芯高度(mm)

1英寸(inches)=1000 mil=25.4 mm　　V_e：磁芯体积(mm^3)

有效磁导率

$$\mu_{ec}=\frac{B}{H}$$

μ_{ec}：有效磁导率(无量纲)　　B：磁通量密度(Gauss)

H：磁场强度(Oe)

1Gauss/Oe=$4\pi10^{-7}$　Tm/A =$4\pi10^{-7}$　H/m=μ_0

额定电感量

磁芯额定电感量与磁芯材料的磁导率成正比，磁导率是材料对磁场的导通响应能力，环型磁芯的电感测试是依均匀布满的单层绕组作测试依据。

金属合金磁粉芯Alloy Powder Core的电感常数值可以依据电感测试值进行推算，其中电感常数偏差通常在±8%。

$$L=\frac{\mu_o\times\mu_{ec}\times N^2\times A_e}{l_e}\times10^4=\frac{4\pi\times10^{-3}\mu_{ec}\times N^2\times A_e}{l_e}$$

$$A_L=\frac{L\times10^3}{N^2}=\frac{4\pi\times\mu_{ec}\times A_e}{l_e}$$

$\mu_0=4\pi10^{-7}$ H/m　　L：电感量(μH)

A_L：电感常数(nH/N^2)　　A_e：磁芯的有效截面积(cm^2)

μ_{ec}：相对磁导率(无量纲)　　l_e：有效磁路长度(cm)

N：线圈匝数(无量纲)　　1H=10mH^3=10μH^6=10nH^9

磁场强度和安培定律

安培定律是磁作用的基本实验定律，它决定了磁场的性质，揭示了磁场强度与电流、圈数和磁路长度之间的关系。

$$H\times l=NI$$

H：磁场强度(A/m)　　N：圈数

I：电流(A)　　l：磁路长度(m)

根据安培定律，由于磁粉芯内径磁路长度短，所以磁场强度在靠近磁粉芯内径位置强，引入有效磁路长度 l_e 可以提供穿过磁粉芯整个截面上磁场强度平均值(H_{avg})

$$1A/m=4\pi\times10^{-3}Oe$$

$$1Oe=\frac{10^3}{4\pi}A/m=79.577A/m$$

$$H_{avg}=\frac{0.4\pi NI}{l_e}=\frac{1.257NI}{l_e}$$

H_{avg}：穿过磁粉芯(从内径到外径)整个截面的平均值磁场强度(Oe)

N：圈数　　l_e：有效磁路长度(cm)

I：电流(A)除非另有说明，在本目录中使用的都是有效磁路长度。

组合磁芯电感量

总磁阻等效于磁芯磁阻与气隙磁阻串联，假定所有磁芯单元材质相同，额外气隙宽度比较小，可以忽略边缘磁通。

$$L=\frac{N^2}{R}=\frac{N^2}{R_c+R_g}$$

$$V_e=l_e\times A_e$$

$$=\frac{N^2}{\frac{l_c\times10^{-2}}{4\pi\times10^{-7}\times\mu_{ec}\times A_e\times10^{-4}}+\frac{l_g\times10^{-2}}{4\pi\times10^{-7}\times1\times A_e\times10^{-4}}}\times10^6$$

$$=\frac{4\pi\times10^{-3}\times A_e\times N^2}{\frac{l_c}{\mu_{ec}}+l_g}$$

$$L=\frac{4\pi\times10^{-3}\times\mu_{ec}\times A_e\times N^2}{l_c\times\left(1+\frac{\mu_{ec}l_g}{l_c}\right)}=\frac{L_0}{1+\frac{\mu_{ec}l_g}{l_c}}\quad(当l_g<l_c时)$$

$$l_g=\left(\frac{L_0}{L}-1\right)\times\frac{l_c}{\mu_{ec}}=\frac{(L_0-L)\times l_c}{\mu_{ec}L}\quad(当l_g<l_c时)$$

L：电感量(μH)

L_0：无气隙时的电感量 (μH)

A_e：磁芯的有效截面积(cm^2)

l_c：磁芯的总磁路长度(cm)

R_c：磁芯的总磁阻(1/μH)

l_g：磁芯粘接位置引入的气隙总长度(cm)

R_g：磁芯粘接位置引入的气隙总磁阻(1/μH)

μ_{ec}：磁芯的有效磁导率(无量纲)

N：绕线匝数(无量纲)

材料磁滞损耗系数η_B

是表示磁性材料在瑞利区域工作时磁滞损耗的常数，用下式表示：

$$\eta_B=\frac{\tan\delta_h}{\mu_r B_m}$$

$\tan\delta_h$: 磁滞损耗系数

μ_r: 在瑞利区域工作时的相对磁导率

B_m: 最大磁通密度(T)

对于同一种磁性材料，随着气隙的加入，磁导率下降，磁滞损耗增加，比例关系大约表现为$(1/\mu)^{3/2}$。

绕组直流电阻(R_{dc})的计算公式

$$R_{dc}=MTL\times N\times r\times10^{-3}$$

MTL : 绕组平均每匝长度(mm)　　N : 圈数

r : 绕组导线的电阻系数(Ω/ Km)　　R_{dc} : 直流电阻(mΩ)

磁通密度和法拉第定律

磁通密度是通过垂直于磁场方向的单位面积的磁通量，它等于该处磁场磁感应强度的大小B。磁通密度精确地描述了磁力线的疏密。直流磁通密度大小影响磁粉芯的有效磁导率，交流磁通密度大小影响磁粉芯的损耗大小。

$$B_m=\frac{E_{rms}\times 10^8}{\frac{\omega}{\sqrt{2}}\times A_e\times N}=\frac{E_{rms}\times 10^8}{\frac{2\times\pi\times f}{\sqrt{2}}\times A_e\times N}=\frac{E_{rms}\times 10^8}{4.44\times f\times A_e\times N}$$

B_m：最大交流磁通密度峰值(Gauss)

E_{rms}：通过绕组正的弦电压有效值(V_{rms})

N：圈数

A：有效磁粉芯截面积(cm^2)

f：正弦波形电压频率(Hz)

对于方波电压利用傅里叶级数展开有：

$$V(t)=\frac{4\times V_m}{\pi}\times\cos\omega t-\frac{4\times V_m}{3\times\pi}\times\cos 3\omega t+\frac{4\times V_m}{5\times\pi}\times\cos 5\omega t$$

$$-\frac{4\times V_m}{7\times\pi}\times\cos 7\omega t\ \ldots\ldots+\frac{4\times V_m}{n\times\pi}\times\cos n\omega t$$

$$B_m=\frac{E_{rms}\times 10^8}{\frac{4}{\sqrt{2}\times\pi}\times\frac{\omega}{\sqrt{2}}\times A_e\times N}=\frac{E_{rms}\times 10^8}{\frac{4}{\sqrt{2}\times\pi}\times\frac{2\times\pi\times f}{\sqrt{2}}\times A_e\times N}=\frac{E_{rms}\times 10^8}{4\times\pi\times f\times A_e\times N}$$

B_m指穿过磁粉芯横截面各部分平均磁通密度值的最大值。事实上，通过磁粉芯内径附近的磁通密度值高，而磁粉芯外径附近的磁通密度值低。

1特斯拉(T)=10^4高斯(Gauss)=10^3mT

磁芯损耗

磁芯损耗是由磁芯材料的磁滞、涡流和剩余损耗引起的。所以磁芯损耗是磁滞损耗、涡流损耗和剩磁损耗的总和。

$$P_V=P_h+P_e+P_r=hB_m{}^{a}f+eB_m{}^{2}f^2+rB_m{}^{1.5}f^{1.5}$$

P_h:磁滞损耗　　P_e:涡流损耗

P_r:剩磁损耗　　h:磁滞损耗系数

B_m:磁通密度峰值　　r:剩磁损耗系数

f:频率　　e:涡流损耗系数

在高频条件下，涡流损耗是主要损耗，而低频下磁滞损耗则是主要损耗。而各种损耗形式在总损耗中所占的比例也会受到磁通密度和工作频率的影响，磁芯损耗中的涡流损耗部分决定了磁芯的高温热老化。

磁芯损耗系数tanδ

是表示磁芯损耗的损耗角的正切，用下式表示：

$$\tan\delta=\frac{R_m}{\omega L}=\frac{R_{eff}-R_w}{\omega L}=\tan\delta_h+\tan\delta_e+\tan\delta_r$$

R_m:仅磁心损耗的等效电阻

ω:角频率

L:线圈的自感

R_{eff}:包含磁芯在内线圈损耗的等效电阻

R_w:仅线圈损耗的等效电阻

绕组绝缘介电损耗R_D

$$R_D=P_F\omega^3L^2C_D$$

P_F:分布电容的功率因数　　ω :2πf(Hz)

L:电感量(H)　　C_D:分布电容(法拉)

电感Q值(品质因数)

Q值是衡量电感器件的主要参数之一，是电感器损耗系数的倒数。是指电感器在某一频率的交流电压下工作时，所呈现的感抗与其等效损耗电阻之比。Q 值越高，意味着相对于储存的能量而言，所需付出的能量耗散越少，亦即谐振电路储能的效率越高。Q值的大小主要由磁芯的损耗和电感线圈的分布电容所决定。

忽略分布电容引起的自谐振效果，则Q值计算公式：

$$Q=\frac{\omega L}{R_{eff}}=\frac{\omega L}{R_{dc}+R_{ac}+R_D}$$

Q:品质因数　　L:电感量(H)

ω:2πf(Hz)　　R_{dc}:绕组直流电阻(Ω)

R_{eff}:包含磁芯在内的线圈等效损耗电阻(Ω)

R_{ac}:由于磁粉芯损耗而产生的等效电阻(Ω)

R_D:由于绕组绝缘介电损耗而产生的等效电阻(Ω)

表观Q值Q_{app}

是指如下式所示包含磁芯在内的线圈的Q(Q_e) 和不包含磁芯在内的线圈的Q(Q_0)的比。

$$Q_{app}=\frac{Q_e}{Q_0}$$

磁导率的温度系数α_μ

是用因温度变化而引起的磁导率变化率除以温度变化量所得的值，用下式表示：

$$\alpha_\mu=\frac{\mu 2-\mu_1}{\mu_1}\times\frac{1}{T_2-T_1}$$

μ_1:基准温度T_1下的磁导率

μ_2:温度T_2下的磁导率

磁性材料的居里温度T_c

居里点(Curie point)又称作居里温度(Curie temperature,T_c)或磁性转变点。是指磁性材料中自发磁化强度降到零时的温度，是铁磁性或亚铁磁性物质转变成顺磁性物质的临界点。低于居里点温度时该物质成为铁磁体，此时和材料有关的磁场很难改变。当温度高于居里点时，该物质成为顺磁体，磁体的磁场很容易随周围磁场的改变而改变。这时的磁敏感度约为10的负6次方。居里点由物质的化学成分和晶体结构决定。

电感器电感

$$e_L=-\frac{d_\gamma}{d_t}\qquad L=-e_L\Big/\left(\frac{d_I}{d_t}\right)\qquad L=-\frac{d_\gamma}{d_t}\Big/\left(\frac{d_I}{d_t}\right)=\frac{d_\gamma}{d_I}$$

多电感器串联计算公式：$L=L_1+L_2+L_3+\cdots+L_n$

多电感器并联计算公式：$1/L=1/L_1+1/L_2+\ldots+1/L_n$

电感最好串联使用，并联时必须考虑电感之间的平衡，以避免因为电感大小不平衡而形成环流。

电容器电容

$$C=\frac{\varepsilon_r S}{4\pi kd}$$

C：电容容量(F)

S：电容极板的正对面积(m^2)

ε_r：电容极板间介质的介电常数

d：电容极板的距离

k：静电力常量，$k = 8.987551\times 10^9 N\cdot m^2/C^2$

TERMS DEFINITIONS AND EXPLANATIONS
术语及解释

电感器设计注意事项

影响电感器的特性主要有以下几个方面：

A、频率特性，磁芯材料损耗随工作频率的影响是主要的。

B、温度特性，不同磁芯磁路结构散热不同，磁损和铜损的比例优化很重要。

C、轻重负载电感量的协调性，磁导率和磁芯材质以及磁路的设计至关重要。

D、绕组杂散分布电容的影响，可以通过绕线方式优化，通过自振频率检测。

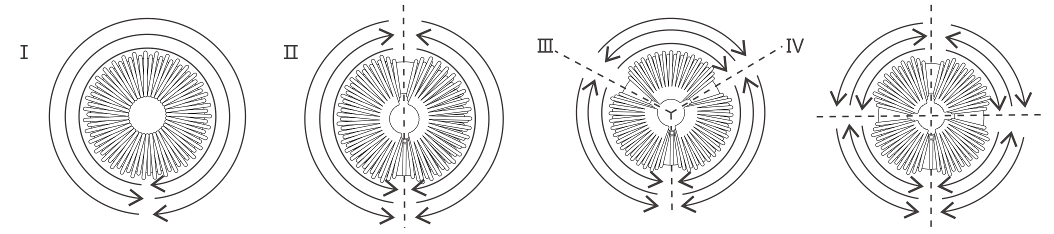
电感的工作频率是磁芯材质选取的重要因素，频率越高，越需要磁芯损耗密度低的材料，在对应的交变磁通密度下，Class B的磁芯损耗控制在300~350mW/cm^3，Class F的磁芯损耗控制在350~400mW/cm^3。

电感器的温升因散热方式，磁路结构，工作频率，交流工作磁通密度不同而有不同的温升，Class B电感的估算工作温度控制在110~115℃, Class F电感的估算工作温度控制在130~135℃。

新能源电感器件要求综合效率，轻重负载电感量的需求不一样，APFC有源功率因数矫正电感要求轻重载时都有高的功率因数PF，因而要对不同负载下的电感都做出分析，优化磁芯常数，磁导率，以满足不同工作状况下的应用需求，因为实际电感量越大，基于相同条件的电感损耗越大。

绕组杂散分布电容越大，电感自振频率越小，磁性器件的自振频率SRF可以通过LCR扫频测试。SRF是由分布电容和电感所决定，而分布电容是由绕组圈数，结构，截面积以及绕线方法共同决定的。避免减少分布电容过大是绕组设计中非常重要的因素。分布电容与电感是并联关系。分布电容是绕组匝与匝之间，层与层之间，绕组与磁粉芯之间的电容之和。SRF一般设计要大于等于电感工作频率的至少3倍。

光伏产品灌胶处理后，特别是匝数相对比较多的环型电感，分布电容会较大幅度增大，SRF大幅度下降。这时理论上可以通过对电感绕组进行分段或者叫分区间绕制，分象限绕制来适当减小一定量的分布电容，提高些许SRF。值得提醒的是并不是分段越多越好，分段增加后，继续增加分段可能分布电容不再减小，而且分段越多，绕制难度越大，磁芯窗口空间利用率越小，绕组DCR越大，最好通过实验测试确定最佳分段数。常见四重环形绕组分段情况如下图：



环形磁芯最常见误区就是选择一个磁环，选择一个线径，绕满内孔为止。这样设计，磁导率并没有得导优化，绕组分布电容偏大，平均匝长也偏大，而且也可能电感过剩，造成电感损耗也偏大。

当频率高于100KHz时，铁氧体磁芯来设计的电感，即使采用了分段气隙，评估计算损耗必须考虑气隙所产生的边缘磁通对绕组损耗的显著影响，很多时候气隙边缘磁通损耗会超过磁芯损耗，而且电感各部分温差很大，需要评估最热点。磁粉芯的气隙是均匀分布的，边缘磁通效应几乎为零，可以作为对比设计方案考虑。

电感的温升测试建议放在设计最大环境允许温度条件下运行4-8小时，以运行到电感器达到热平衡为标准。评估最热点，具体可以在磁芯里打个小洞，埋入温升线，但要注意温升线与磁芯以及线圈之间的绝缘。这样才能获得真正的电感和磁粉芯的最高温度。不同磁粉芯有不同的导热系数，会形成不同的温度分布级别情况。

多电感器串联计算公式：$L=L_1+L_2+L_3+\ldots+L_n$

多电感器并联计算公式：$1/L=1/L_1+1/L_2+\ldots+1/L_n$

电感最好串联使用，不得已并联使用时必须考虑电感之间的平衡，以避免因为电感大小不平衡而形成环流。

磁粉芯有很微小的有磁滞伸缩或者叫磁力格化现象。磁粉被磁化时，它们磁粉颗粒尺寸会发生极其微小的变化，但在可听频率>20KHz以上交变频率应用中近乎于零，只在某些50/60Hz的用途中，磁芯在特殊环境偶尔会有蜂鸣噪音出现，这种情况E型磁芯比环型磁芯更明显，也会随着交流磁通密度的增大而增大。

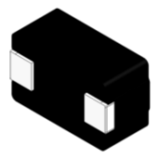
三钛科技磁芯材质参考对照选取表

Material	Samtec Mark	Permeability	Core Loss (mW/cm^3) @50kHz 100mT	DC Bias (%μ) @100Oe	Bs(T)	Frequency Range	POCO	KDM	CSC	Magnetics
Sendust Gen I	SAA	26-125	250	47%	1.05	1MHz	NPS	KS	CS	77 Kool Mu
Sendust Gen II	SAB	26-90	300	60%	1.2	1MHz	NPH	KS-HF	CK	79 Kool Mu Max
Sendust Gen III	SAC	26-75	150	66%	1.2	1MHz	NPC	KPH-HP	HS	79 Kool Mu Max/76 Kool Mu Hf
Sendust Gen IV	SAD	19-60	70	55%	1.0	2MHz	NPX	KAM-HP	HP	Kool Mu Ultra
Sendust Gen V	SAE	60	110	70%	1.2	1MHz	GPC	KPH-HT		
FeSi Gen I	SFA	19-125	550	76%	1.6	1MHz	NPF	KSF	CK	78 XFLux
FeSi Gen II	SFB	26-75	360	74%	1.6	1MHz	NPV	KSF-HP	CK-GT	74 XFuux Ultra
FeSi Gen III	SFC	60	345	81%	1.6	1MHz	GPV	KSF-HT		
FeSi Gen IV	SFD	60	300	73%	1.6	1MHz	GPC			
High Flux Gen I	SHA	26-125	200	80%	1.5	1MHz	NPN	KH	CH	58 High Flux
High Flux Gen II	SHB	26-60	145	85%	1.5	1MHz	NPN-LH	KH-H	CH-GT	59 Edge
High Flux Gen III	SHC	60	100	88%	1.5	1MHz	GPN	KH-HT	CH-GTS	

新材料在研发中
New Materials under Development

OTHER PRODUCTS
其它产品

模压电感· Molded Inductor



ST Ⅰ系列 单相 电感
ST Series Ⅰ Single Phase Inductor

SD Ⅰ系列双相电感
SD Series Ⅰ Two Phase Inductor

SD Ⅱ系列双相电感
SD Series Ⅱ Two Phase Inductor

SD Ⅲ系列双相电感
SD Series Ⅲ Two Phase Inductor

应用

- 服务器、移动工作站、移动电子设备电源系统
- 台式电脑和笔记本电脑CPU电压管理系统
- 人工智能 NPU 电压管理系统
- 显卡GPU电压管理系统
- 精密DCR传感电路
- 负载点电源模块
- 各种电压调节模块(VRM)

Applications

- Server, Workstation, Mobile Devices Power System
- Desktop Computer & Laptop CPU Voltage Management System
- AI NPU Voltage Management System
- GPU Voltage Management System on Graphics Cards
- Precision DCR Sensing Circuits
- Point-of-Load Power Modules
- Various Voltage Regulators (VRM)

产品特点

- 对低压大电流具有很高电压调节能力
- 小而准的直流电阻
- 低铜损和磁损
- 高饱和电流
- 工作温度：-40~125°C

Product Features

- High Regulation Capability for Low Voltage & High Current
- Precise & Low R_{DC}
- Low Copper and Core Losses
- High Satuartion Current
- Operating Temperature: -40~125℃

环境合规性和一般规范

- 存储温度：-40~85°C
- 存储相对湿度：20%~75%
- 除非另有说明，所有测试在25°C室温条件下进行
- 使用 TH2515 进行 DCR 测试
- 电感测试条件：100KHz 1.0V TH2829C或WK3255B
- I_{RMS}线圈温升40°C 时对应电流
- I_{SAT} 电感下降到初始值30%时的典型电流值

Environmental Compliance and General Speci cations

- Storage Tempearture: -40~85℃
- Storage Relative Humidty: 20%~75%
- All Test done @25℃ Room Tempearture Unless Speci ed
- DCR Tested With TH2515
- Inductance Tested @100KHz 1.0V By TH2829C or WK3255B
- I_{RMS} Current for 40℃ Coil Temperature Rise
- I_{SAT} Current for Inductance Drop down 30% Typical of Initial