TOROIDAL MAGNETIC POWDER CORES

Tolerance of A_L value

Core Size	Sendust	MPP	High Flux	Mega Flux®
OD035~OD046	±15%	±12%	±12%	NA
OD063~OD112	±12%	±8%	±8%	±8%
OD127~OD1625	±8%	±8%	±8%	±8%

Inductance Calculation by A_L vs NI Curves;

Inductor specification
- Core : CM270125
- Number of Winding : 22Turns
- Current : DC 10Amperes

Solution

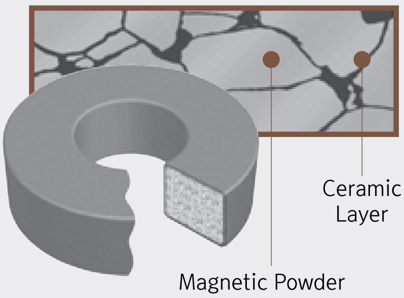
a) Calculate NI (Ampere · Turns) NI = 22Turns X 10Ampere = 220
b) Read the A_L value of CM270125 using the A_L vs NI curve on page 56.
A_L value of CM270125 yields 100.4 when NI is 220.
c) Calculate L at 10Ampere by using formula; $LN = A_L \times N^2 \times 10^{-3}$($\mu$H)
Therefore,
L(@10A) = $100.4 \times 22^2 \times 0.001$
= 48.6(μH)

CHANG SUNG CORPORATION'S ADVANCED TECHNOLOGY ENABLES US TO FULFILL THE DIVERSE NEEDS OF OUR CLIENTS FOR SOFT MAGNETIC POWDER CORES.

Powder cores are distributed air gap cores made from ferrous alloy powders for low losses at high frequencies. Small air gaps distributed evenly throughout the cores increase the amount of Direct Current (DC) that can be passed through the winding before core saturation occurs. Molybdenum Permalloy Powder (MPP) cores are ideal for low loss inductors such as switching regulators and noise filters.
High Flux, Sendust and Mega Flux® cores are the preferred choices for Power Factor Correction (PFC), switching regulator inductors, in-line noise filters, pulse and flyback transformers and many other applications requiring low losses at high frequencies.

▼ Products

Cross Sectional View



Core Materials

- MPP Cores : Ni-Fe-Mo alloy
- High Flux Cores : Fe-Ni alloy
- Sendust Cores : Fe-Si-Al alloy
- Mega Flux® Cores : Fe-Si alloy
- HS, KS, KH, Fine Flux Cores : Fe alloy

Core Shapes

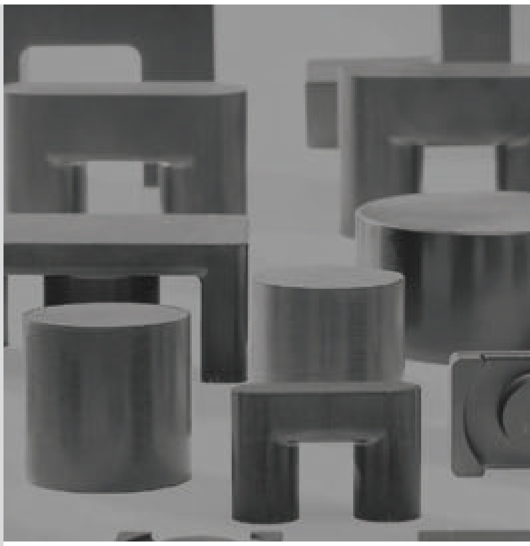
- Toroids : From 3.5mm to 165mm OD
- Special : Block, Round Block, Cylinder,
  Ellipse, E, ER, EER, EQ, ER+I, U,
  Big Block(~180mm),
  Other Customized shapes

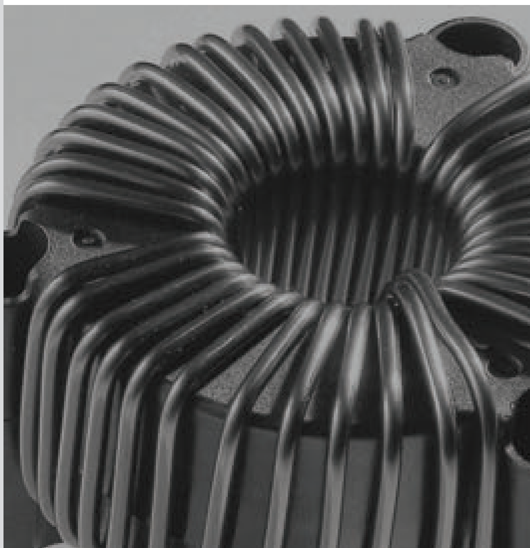
Permeability

- MPP : 26, 60, 125, 147, 160, 173, 200μ
- High Flux : 26, 60, 125, 147, 160μ
- Sendust : 26, 60, 75, 90, 125μ
- Mega Flux® : 26, 50, 60, 75, 90μ
- HS : 60, 75, 90μ
- KS : 26, 40, 60μ
- KH : 26, 40, 60, 90μ
- HP : 19, 26, 60u
- Fine Flux : 26μ, 40μ, 60μ

Core Finishes

- Finish : Epoxy
- Color - MPP : Gray
  - High Flux : Khaki
  - Sendust : Black
  - Mega Flux® : Dark Brown
  - HS, KS, KH, HP, Fine Flux : Dark Blue
- Break-Down Voltage : 500V min.
- Remark : Core finishes are going to be changed to Black powder coating with laser marking for all materials.





OUTSTANDING PRODUCTS BEGIN WITH A STANDARDIZED PRODUCTION LINE AND A STRICT QUALITY CONTROL PROCESS

Chang Sung Corporation manufactures four types of soft magnetic powder cores including the Molybdenum Permalloy(MPP), High Flux, Sendust and Mega Flux®, which are mainly used for inductors and transformers requiring low losses and inductance stability under high DC bias conditions. A fully standardized production management system under strict quality control of the raw materials (nickel, iron, molybdenum, aluminum and silicon) enables CSC to guarantee consistent quality and thus build greater confidence in our company' s product line.

MPP

Ni-Fe-Mo alloy powder cores are made from alloy powders of nickel, iron and molybdenum.

MPP cores exhibit a highly sustainable level of stability in temperature and inductance under high DC magnetization or high DC Bias conditions. They offer the highest permeability among our materials and the lowest core loss compared to any other core material. MPP cores are also considered to be a premium material for direct current output inductors for SMPS including high Q filters, loading coils and EMI/RFI filters. Finished toroid cores are coated with a gray epoxy to provide dielectric protection and added physical strength.

HIGH FLUX

Ni-Fe alloy powder cores are made from alloy powders of nickel and iron.

The 15,000 Gauss saturation level of High Flux cores has a higher energy storage capability and more effective permeability when compared to the performance of gapped ferrite or powdered iron cores of a similar size. The excellent DC bias characteristics and low core losses of High Flux cores offer a reduction in size and the number of winding turns as well as superior magnetic properties. CSC High Flux cores are an excellent choice for applications such as PFC reactors, switching regulator inductors, in-line noise filters, pulse transformers and flyback transformers. Finished High Flux cores are coated with a Khaki epoxy and come in a variety of shapes and sizes.

SENDUST

Fe-Si-Al alloy powder cores are made from alloy powders of iron, silicon and aluminum.

Near-zero magnetostriction makes Sendust cores ideal for eliminating audible noise in filter inductors. Core losses of Sendust cores are significantly lower than those of powdered iron cores. Especially Sendust E shapes provide a higher energy storage capability than gapped Ferrite E cores. Gap losses and eddy current losses are minimized with Sendust E cores compared to gapped ferrite E shapes. Sendust cores are a smart choice for PFC circuits. Other major applications include switching regulator inductors, In-line noise filters, pulse transformers and flyback transformers. Finished Sendust cores are coated in a black epoxy.

MEGA FLUX®

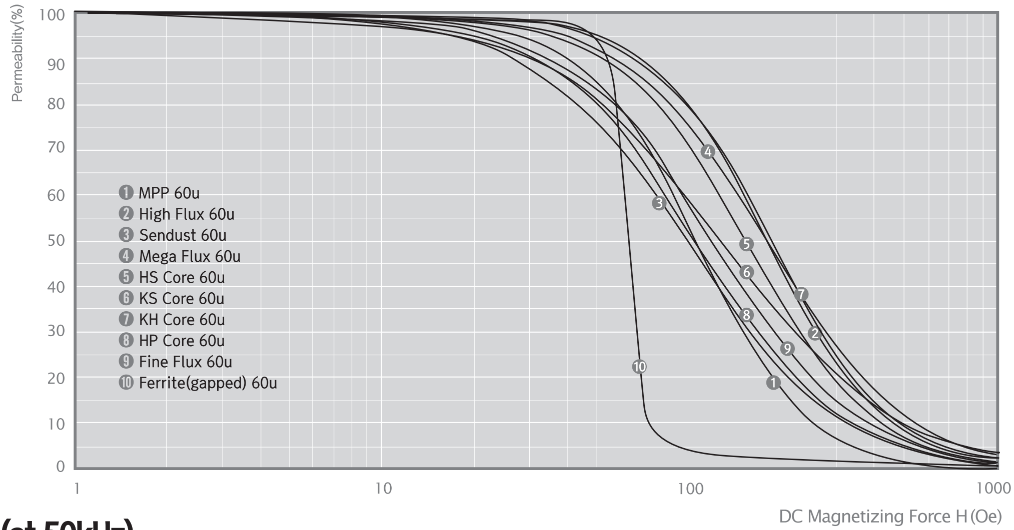
Fe-Si alloy powder cores are made from an alloy of iron and silicon.

CSC is the first company in the world to develop magnetic powder cores made from iron and silicon. The innovative design of these unique Mega Flux cores includes a smaller size, higher current and higher energy storage capability. Mega Flux cores have a higher flux density than any other magnetic material,16,000 gauss compared to 15,000 gauss for High Flux cores and 10,000 gauss for Sendust cores. The excellent DC bias characteristics provide the best solution for high end applications including buck/boost inductors for high power supply systems, smoothing chokes for inverters and reactors for electric vehicles. Mega Flux cores are pressed without organic binders and have significantly lower core losses than powdered iron cores and Fe-Si strip cores. They also present excellent thermal properties with no thermal aging effects. Finished Mega Flux cores are coated with a dark brown epoxy.

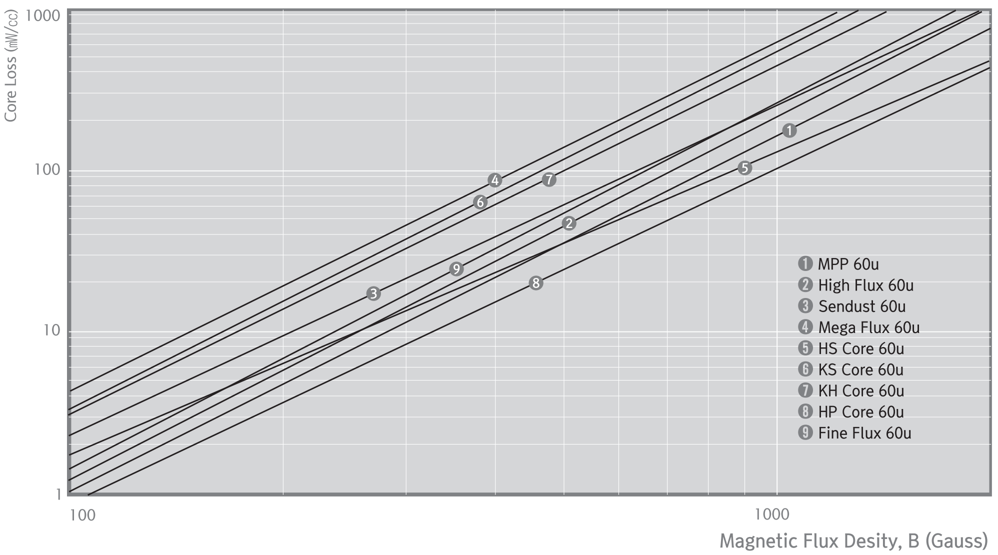
Comparison of Core Materials

Materials		Perm. (μi)	Bs(kg)	Core Loss	DC Bias	Relative Cost	Temp. Stability	Curie Temp(℃)
Powder	MPP	26~200	10	Lower	Good	High	Best	450
	High Flux	26~160	15	Low	Best	Medium	Better	500
	Sendust	26~125	10	Low	Good	Low	Good	500
	Mega Flux®	26~90	17	Medium	Best	Low	Better	700
	HS	60~90	13	Low	Better	Medium	Better	500
	KS	26~60	14	Medium	Better	Low	Good	500
	KH	26~90	16	Medium	Best	Medium	Good	600
	HP	19~60	8.5	Lowest	Better	Medium	Good	500
	Fine Flux	26~60	12	Low	Better	Low	Good	500
Strip	Fe-Si Strip (Gap)		20	High	Better	Lowest	Good	740
	Amorphous (Gap)		15	Low	Better	Medium	Good	399
	Ferrite (Gap)		3~5	Lowest	Poor	Lowest	Poor	100~300

Permeability vs DC Bias



Core Loss (at 50kHz)



CSC's Core Designation

Toroidal Core Designation

CM 270 125 E

E	Epoxy coated	**Core finish** E : Epoxy
125	Permeability : 125µ	**Available perm.** 26, 50, 60, 75, 90, 125, 147, 160, 173, 200µ
270	OD size : 27.0mm	**Available size** 3.5mm~165.0mm(OD)
CM	MPP core	**Core material** CM:MPP, CH:High Flux, CS:Sendust, CK : Mega Flux®

Nominal Inductance Table (AL Value)

(nH/N²)

Permeability Part No.	26µ 026	60µ 060	75µ 075	90µ 090	125µ 125	147µ 147	160µ 160	173µ 173	200µ 200
C□ 035 □□□	-	13	16	19	26	31	33	36	42
C□ 039 □□□	-	17	21	25	35	41	45	48	56
C□ 046 □□□	-	20	25	30	42	49	53	57	67
C□ 063 □□□	10	24	30	36	50	59	64	69	80
C□ 066 □□□	11	26	32	39	54	64	69	75	86
C□ 067 □□□	21	50	62	74	103	122	132	144	165
C□ 068 □□□	14	33	42	50	70	81	89	95	112
C□ 078 □□□	11	25	31	37	52	62	66	73	83
C□ 096 □□□	11	25	32	38	53	63	68	74	84
C□ 097 □□□	14	32	40	48	66	78	84	92	105
C□ 102 □□□	14	32	40	48	66	78	84	92	105
C□ 112 □□□	11	26	32	38	53	63	68	74	85
C□ 127 □□□	12	27	34	40	56	67	72	79	90
C□ 147 □□□	14	32	40	48	67	78	85	92	107
C□ 166 □□□	15	35	43	52	72	88	92	104	115
C□ 172 □□□	19	43	53	64	89	105	114	123	142
C□ 203 □□□	14	32	41	49	68	81	87	96	109
C□ 229 □□□	19	43	54	65	90	106	115	124	144
C□ 234 □□□	22	51	63	76	105	124	135	146	169
C□ 252 □□□	27	62	78	93	130	152	166	179	207
C□ 270 □□□	32	75	94	113	157	185	201	217	251
C□ 300 □□□	29	68	85	102	141	166	181	195	-
C□ 330 □□□	28	61	76	91	127	150	163	176	-
C□ 343 □□□	16	38	47	57	79	93	101	109	-
C□ 358 □□□	24	56	70	84	117	138	150	162	-
C□ 378 □□□	30	70	87	104	145	170	185	201	-
C□ 400 □□□	35	81	101	121	168	198	215	233	-
C□ 434 □□□	40	92	115	138	191	225	245	-	-
C□ 467 □□□	59	135	169	202	281	330	360	-	-
C□ 468 □□□	37	86	107	128	178	210	228	-	-
C□ 488 □□□	44	101	126	151	210	247	269	-	-
C□ 508 □□□	32	73	91	109	152	179	195	-	-
C□ 540 □□□	44	102	128	153	213	250	272	-	-
C□ 571 □□□	60	138	172	206	287	306	333	-	-
C□ 572 □□□	33	75	94	112	156	185	200	-	-
C□ 596 □□□	54	125	156	187	260	-	-	-	-
C□ 610 □□□	83	192	240	288	400	-	-	-	-
C□ 640 □□□	49	113	141	169	234	-	-	-	-
C□ 680 □□□	62	143	179	215	299	-	-	-	-
C□ 740 □□□	89	206	257	309	429	-	-	-	-
C□ 777 □□□	30	68	85	102	142	-	-	-	-
C□ 778 □□□	37	85	107	128	178	-	-	-	-
C□ 888 □□□	24	57	71	85	119	-	-	-	-
C□ 1016 □□□	48	112	137	164	228	-	-	-	-
C□ 1325 □□□	68	156	195	234	325	-	-	-	-
C□ 1650 □□□	80	184	230	276	384	-	-	-	-

※ example) AL value of CM270125 is 157(nH/N²)

■ Core Dimension Table (Millimeters)

Part Number	Magnetic Path Length ℓ(cm)	Cross Section A(cm²)	Window Area (cm²)	Surface Area(cm²)		Weight(g)				Dimensions (mm) OD(Max) X ID(Min) X HT(Max)		Package Unit
				After Finish	40% winding factor	CM	CH	CS	CK	Before Finish	After Finish	(pcs/box)
C□ 035 □□□	0.817	0.0137	0.018	0.5	0.61	0.09	0.09	0.07	0.08	3.56X1.78X1.52	3.94X1.52X1.96	30K
C□ 039 □□□	0.942	0.0211	0.0308	0.7	0.93	0.19	0.18	0.13	0.15	3.94X2.24X2.54	4.41X1.98X2.97	30K
C□ 046 □□□	1.060	0.0285	0.0290	0.9	1.13	0.26	0.25	0.20	0.23	4.65X2.36X2.54	5.21X1.93X3.30	30K
C□ 063 □□□	1.361	0.0470	0.0412	1.7	2.03	0.56	0.53	0.41	0.47	6.35X2.79X2.79	6.99X2.29X3.43	30K
C□ 066 □□□	1.363	0.0476	0.0412	1.7	2.06	0.60	0.57	0.44	0.50	6.60X2.67X2.54	7.24X2.29X3.18	30K
C□ 067 □□□	1.363	0.0920	0.0384	2.4	2.76	1.12	1.07	0.83	0.96	6.60X2.67X4.78	7.32X2.21X5.54	20K
C□ 068 □□□	1.650	0.0725	0.0934	2.7	3.31	1.03	0.98	0.76	0.88	6.86X3.96X5.08	7.62X3.45X5.72	20K
C□ 078 □□□	1.787	0.0615	0.0922	2.4	3.04	0.94	0.90	0.69	0.80	7.87X3.96X3.18	8.51X3.43X3.81	12K
C□ 096 □□□	2.18	0.0752	0.1429	3.1	4.14	1.41	1.34	1.04	1.21	9.65X4.78X3.18	10.29X4.27X3.81	9K
C□ 097 □□□	2.18	0.0945	0.1429	3.5	4.47	1.76	1.68	1.30	1.50	9.65X4.78X3.96	10.29X4.27X4.57	8K
C□ 102 □□□	2.38	0.1000	0.164	3.7	4.85	2.09	2.00	1.55	1.79	10.16X5.08X3.96	10.80X4.57X4.57	7K
C□ 112 □□□	2.69	0.0906	0.273	4.3	6.05	2.11	2.02	1.57	1.81	11.18X6.35X3.96	11.90X5.89X4.72	5K
C□ 127 □□□	3.12	0.114	0.383	5.6	8.00	3.13	2.99	2.32	2.69	12.70X7.62X4.75	13.46X6.99X5.51	4K
C□ 147 □□□	3.63	0.154	0.528	7.5	10.72	4.9	4.6	3.6	4.3	14.70X8.90X5.60	15.50X8.20X6.40	–
C□ 166 □□□	4.11	0.192	0.713	9.3	13.66	6.9	6.6	5.2	6.0	16.51X10.16X6.35	17.40X9.53X7.11	1.96K
C□ 172 □□□	4.14	0.232	0.638	9.9	13.91	8.2	8.0	6.1	7.1	17.27X9.65X6.35	18.03X9.02X7.11	1.96K
C□ 203 □□□	5.09	0.226	1.14	12.1	18.95	10.0	10.0	7.4	8.7	20.32X12.70X6.35	21.1X12.07X7.11	1.37K
C□ 229 □□□	5.67	0.331	1.41	15.7	24.13	15.9	15.1	11.7	13.6	22.86X13.97X7.62	23.62X13.39X8.38	580
C□ 234 □□□	5.88	0.388	1.49	17.9	26.78	19.6	19	14.5	16.8	23.57X14.40X8.89	24.30X13.77X9.70	750
C□ 252 □□□	6.10	0.504	1.52	21.1	30.39	26.6	25.4	19.6	23.2	25.20X14.60X10.00	26.00X13.90X10.80	–
C□ 270 □□□	6.35	0.654	1.56	24.7	34.42	35.6	34.0	26.4	30.6	26.92X14.73X11.18	27.70X14.10X11.99	360
C□ 300 □□□	7.27	0.652	2.19	28.1	41.47	41	39.1	30.2	35.7	30.00X17.40X10.90	30.80X16.70X11.80	–
C□ 330 □□□	8.15	0.672	2.93	31.5	49.01	47.0	44.8	34.8	40.4	33.02X19.94X10.67	33.83X19.30X11.61	240
C□ 343 □□□	8.95	0.454	4.01	29.3	52.34	35.3	33.7	26.2	30.3	34.29X23.37X8.89	35.20X22.60X9.83	280
C□ 358 □□□	8.98	0.678	3.64	34.5	56.09	52	50	39	45	35.81X22.35X10.46	36.70X21.50X11.28	240
C□ 378 □□□	9.40	0.867	3.91	41.4	64.65	71	68	52	62	37.80X23.20X12.50	38.70X22.30X13.40	–
C□ 400 □□□	9.84	1.072	4.27	48.4	73.77	91	87	67	78	39.88X24.13X14.48	40.70X23.30X15.37	120
C□ 434 □□□	10.74	1.308	5.11	58.1	88.40	124	118	91	108	43.40X26.40X16.20	44.30X25.50X17.10	–
C□ 467 □□□	10.74	1.990	4.27	69.2	96.50	182	174	134	157	46.74X24.13X18.03	47.60X23.30X18.92	72
C□ 468 □□□	11.63	1.340	6.11	61.6	97.79	130	124	96	112	46.74X28.70X15.24	47.60X27.90X16.13	72
C□ 488 □□□	11.74	1.569	5.73	67.6	102.63	163	156	120	142	48.80X27.90X15.80	49.70X27.00X16.70	–
C□ 500 □□□	12.73	1.250	7.50	64.2	108.52	132	126	98	114	50.80X31.75X13.46	51.70X30.90X14.35	96
C□ 540 □□□	12.63	1.710	6.20	74.8	114.18	193	184	142	168	54.00X29.00X14.40	54.90X28.10X15.30	–
C□ 571 □□□	12.50	2.29	5.14	84.8	120.40	248	237	184	213	57.15X26.39X15.24	58.00X25.60X16.10	77
C□ 572 □□□	14.30	1.444	9.48	77.2	133.19	181	173	133	155	57.15X35.56X13.97	58.00X34.70X14.86	88
C□ 596 □□□	14.33	2.371	8.55	100.9	153.11	301	287	222	262	59.60X34.00X19.50	60.60X33.00X20.50	–
C□ 610 □□□	14.37	3.675	7.73	125.1	173.99	444	423	329	381	62.0X32.6X25.0	63.1X31.37X26.27	24
C□ 640 □□□	16.04	2.394	11.95	115.0	185.01	338	322	249	294	64.00X40.00X21.00	65.10X39.00X22.10	–
C□ 680 □□□	15.81	3.008	9.62	124.8	233.34	430	410	317	374	68.00X36.00X20.00	69.10X35.00X21.10	–
C□ 740 □□□	18.38	5.040	15.27	194.2	283.09	764	729	566	656	74.1X45.3X35.0	75.2X44.07X36.27	18
C□ 777 □□□	20.00	1.770	17.99	117.3	224.42	301	287	223	258	77.8X49.23X12.7	78.9X48.0X13.97	40
C□ 778 □□□	20.00	2.270	17.99	130.2	236.84	377	359	279	323	77.8X49.23X15.9	78.9X48.0X17.2	35
C□ 888 □□□	24.10	1.83	32.72	134.5	262.03	369	351	273	316	88.8X66.0X15.9	90.13X64.54X17.4	15
C□ 1016 □□□	24.27	3.522	24.37	207.0	358.37	774	739	572	665	101.6X57.2X16.5	103.1X55.7X17.8	12
C□ 1325 □□□	32.42	6.710	46.57	367.6	648.48	1863	1779	1376	1620	132.5X78.6X25.4	134.2X77.0X26.8	4
C□ 1650 □□□	38.65	9.46	59.31	538.4	389.82	3267	3120	2413	2808	165.0X88.9X25.4	167.2X86.9X27.3	4

※ CM : MPP Core, CH : High Flux Core, CS : Sendust Core, CK : Mega Flux® Core
※ Window area : area of inner diameter
※ In addition to the cores listed above, customized specifications are also available.
※ Please refer to our web site(www.changsung.com) for the new toroidal cores.

Magnetic Design Formulas

Inductance ofa Wound Core

The inductance of a wound core at a given number of turns is calculated using the following formula.

$$L = \frac{0.4 \pi \mu N^2 A \times 10^{-2}}{\ell}$$

$$L_N = A_L \times N^2 \times 10^{-3}$$

- L = inductance(μH)
- μ = core permeability
- N = number of turns
- A = effective cross section area(cm^2)
- ℓ = mean magnetic path length(cm)
- L_N = Inductance at Nturns(μH)
- A_L = nominal Inductance(nH/N^2)

Permeability – Flux Density – Magnetizing Force

Ampere's Law and Faraday's Law show the relations of permeability, flux density and magnetizing force of a wound core.

$$H = \frac{0.4 \pi N I}{\ell} \quad \text{----- Ampere's Law}$$

$$B_{max} = \frac{E_{rms} \times 10^8}{4.44 f A N} \quad \text{----- Faraday's Law}$$

$$\mu = \frac{B}{H}$$

- H = magnetizing force(oersteds)
- N = number of turns
- I = peak magnetizing current(amperes)
- ℓ = mean magnetic path length(cm)
- B_{max} = maximum flux density(gausses)
- E_{rms} = voltage across coil(volts)
- f = frequency(hertz)

Inductance Calculation by Permeability vs DC Bias Curves

Inductor specification
- Core : CM270125
- Number of Windings : 22Turns
- Current : DC 10Amperes

solution

a) Formula to calculate L at 0Ampere

$L_N = A_L \times N^2 \times 10^{-3}$

The Nominal inductance table on page 22 shows the A_L value of CM270125 to be 157.

Therefore, L (@0A) = 157 × 22² × 0.001 = 76 (μH)

b) Determine DC magnetizing force (H) by using Ampere's law to achieve the roll off.

$H = 0.4 \pi N I / \ell$

$H = 0.4 \times 3.14 \times 22 \times 10 / 6.35 = 43.5$(Oe)

The magnetizing force(dc bias) is 43.5 oersteds, yielding 64% of initial permeability. See on page 28.

The inductance at 10Ampere will decrease the inductance by 64% compared with 0Ampere.

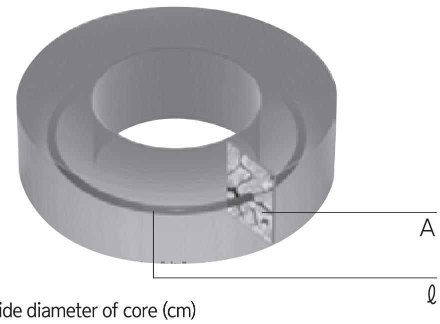
Therefore, L(@10A) = 76 × 0.64 @

= 48.6 (μH)

※ Inductance calculation by A_L vs NI Curve is also available on page 18.

Mean Magnetic Path Length

For toroidal powder cores, the effective area(A) is the same as the cross sectional area. By definition and Ampere's Law, the effective magnetic path length is the ratio of ampere-turns(NI) to the average magnetizing force. Using Ampere's Law and averaging the magnetizing force gives the formula for effective path length.



$$\ell = \frac{\pi(OD - ID)}{\ln\left(\frac{OD}{ID}\right)}$$

OD = outside diameter of core (cm)
ID = inside diameter of core (cm)
A = core cross section (effective area)
ℓ = mean magnetic path length (cm)

Q Factor

The Q factor is defined as the ratio of reactance to the effective resistance for an inductor and thus indicates its quality. The Q of wound core can be calculated using the following formula, when neglecting the effects of self-resonance caused by the distributed capacitance resulting from the differential voltage between adjacent turns.

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

Q = quality factor
ω = 2π frequency (hertz)
L = inductance (henries)
R_{dc} = DC winding resistance (ohms)
R_{ac} = resistance due to core loss (ohms)
R_d = resistance due to winding dielectric loss (ohms)

Core Loss

Powder cores have low hysteresis loss, minimizing signal distortion, and low residual loss. The total core loss at low flux Densities is the sum of three frequency dependent losses : hysteresis loss, residual loss, and eddy current loss. The core loss is calculated from the following Legg's equation.

$$\frac{R_{ac}}{\omega L} = aB_{max}f + cf + ef^2$$

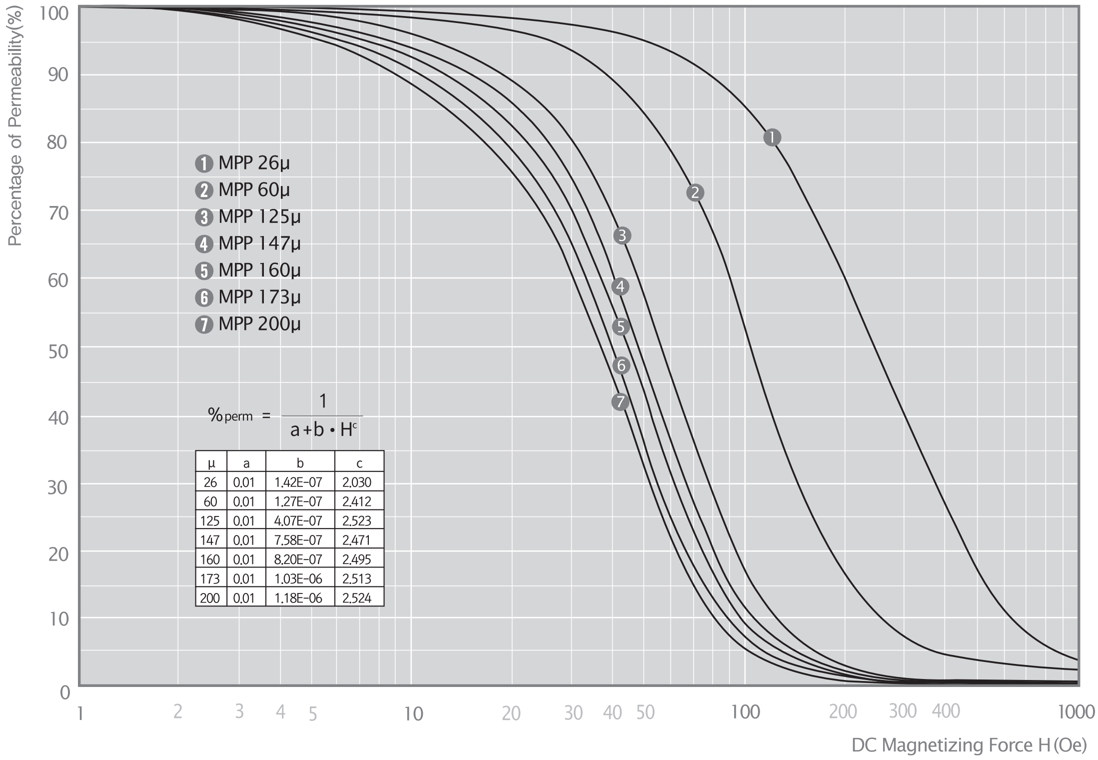
- $\frac{R_{ac}}{\omega L}$: Total loss factor
- $aB_{max}f$: Hysteresis loss
- cf: Residual loss
- ef^2: Eddy current loss

Where R_{ac} = core loss resistance (ohms)
a = hysteresis loss coefficient
c = residual loss coefficient
e = eddy current loss coefficient
ω, L, B_{max}, f = same as mentioned before

When a varying magnetic field passes through the core, eddy currents are induced in it. Joule heat loss by these currents is called eddy current loss. Hysteresis loss is due to the irreversible behavior in the hysteresis curve and equal to the enclosed area of the loop.
The other core loss is called residual loss.

Permeability vs DC Bias Curves

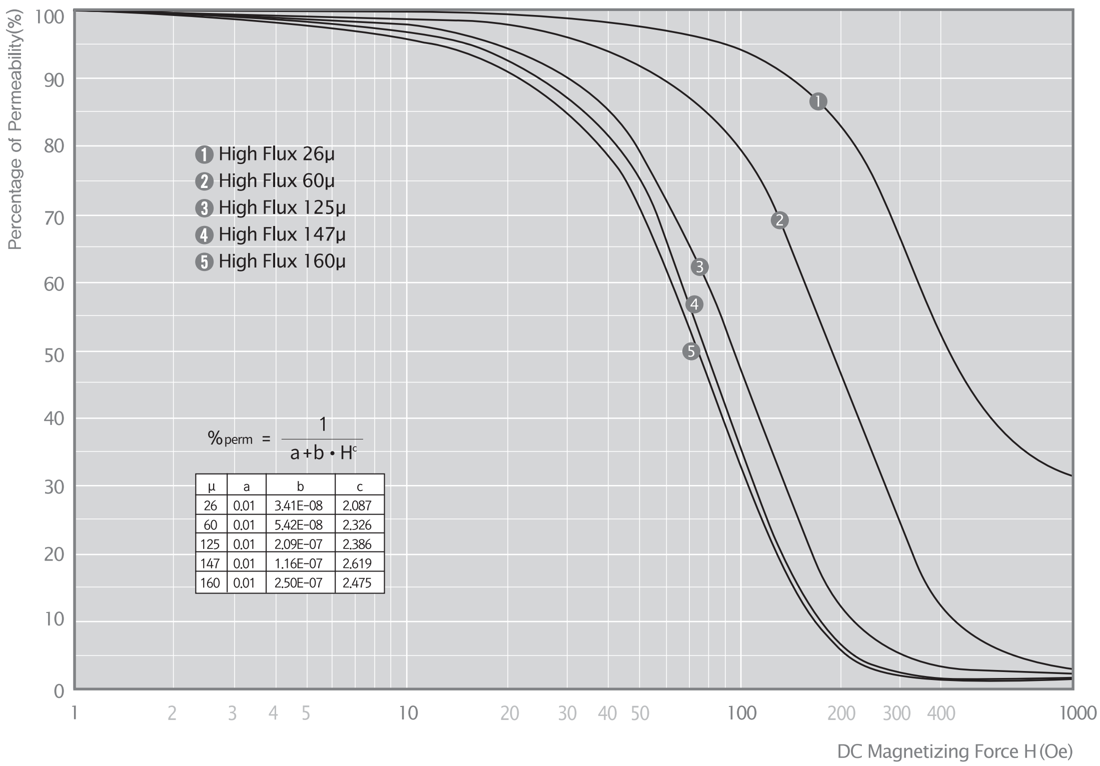
MPP



$$\%_{perm} = \frac{1}{a + b \cdot H^{c}}$$

μ	a	b	c
26	0.01	1.42E-07	2.030
60	0.01	1.27E-07	2.412
125	0.01	4.07E-07	2.523
147	0.01	7.58E-07	2.471
160	0.01	8.20E-07	2.495
173	0.01	1.03E-06	2.513
200	0.01	1.18E-06	2.524

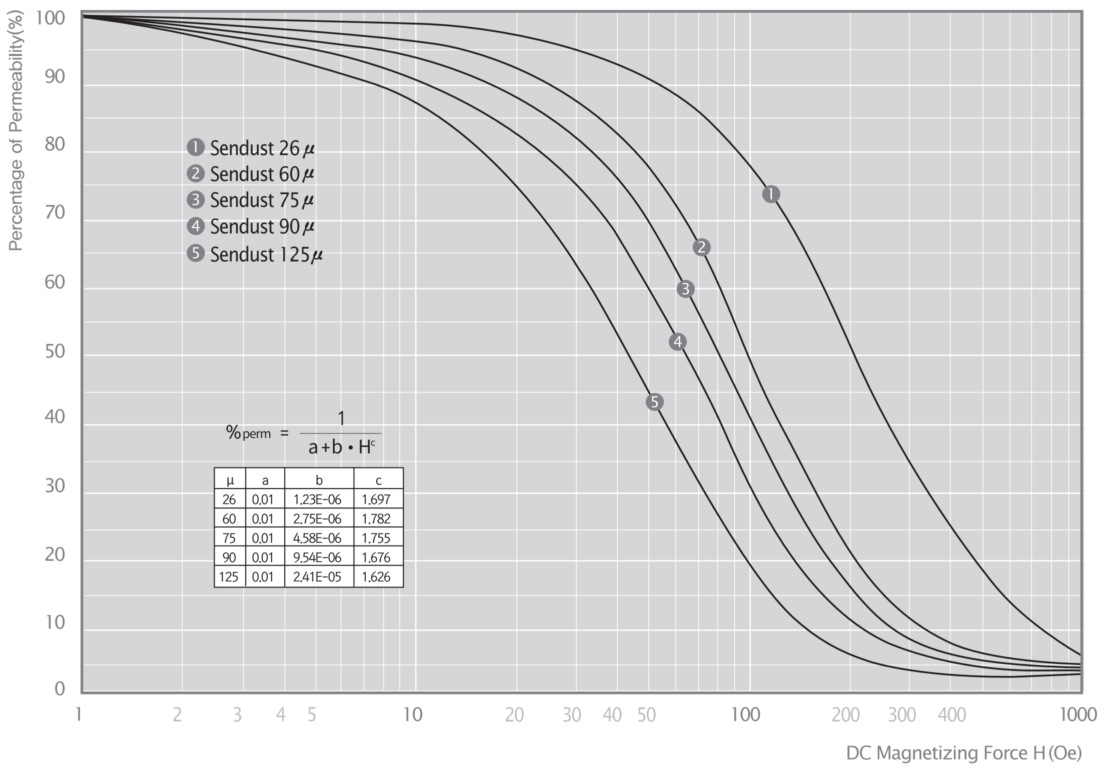
High Flux



$$\%_{perm} = \frac{1}{a + b \cdot H^{c}}$$

μ	a	b	c
26	0.01	3.41E-08	2.087
60	0.01	5.42E-08	2.326
125	0.01	2.09E-07	2.386
147	0.01	1.16E-07	2.619
160	0.01	2.50E-07	2.475

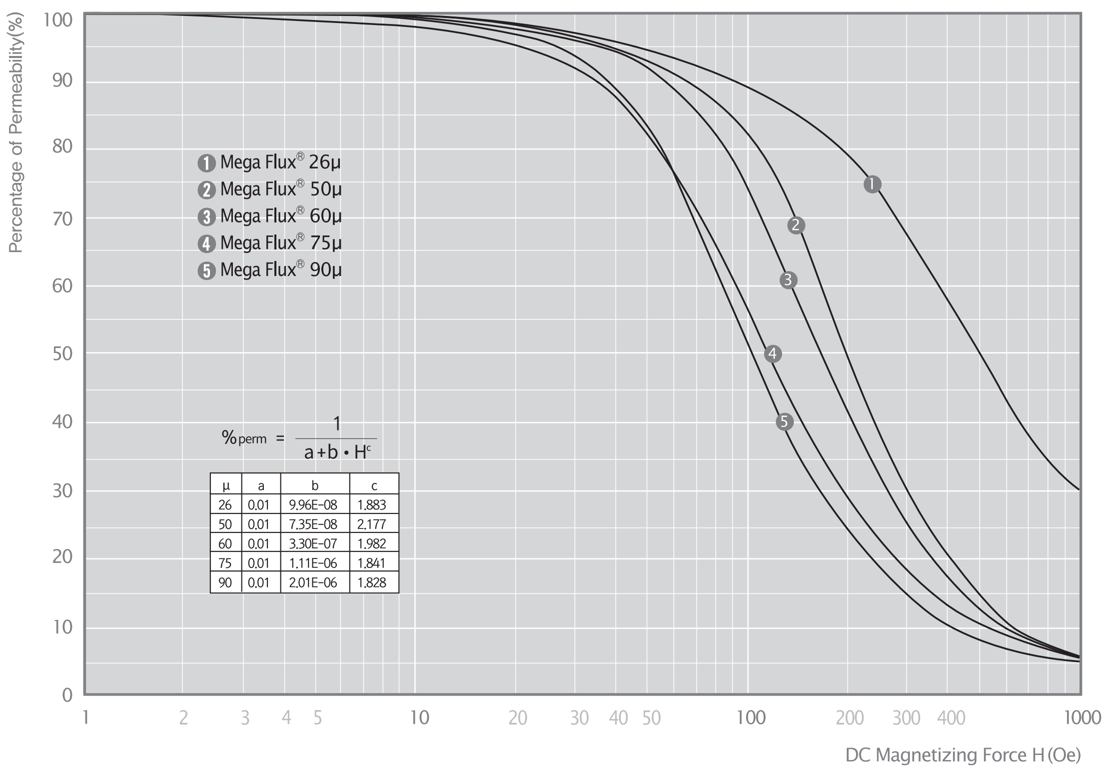
Sendust



$$\%_{perm} = \frac{1}{a+b \cdot H^c}$$

μ	a	b	c
26	0.01	1.23E-06	1.697
60	0.01	2.75E-06	1.782
75	0.01	4.58E-06	1.755
90	0.01	9.54E-06	1.676
125	0.01	2.41E-05	1.626

Mega Flux®

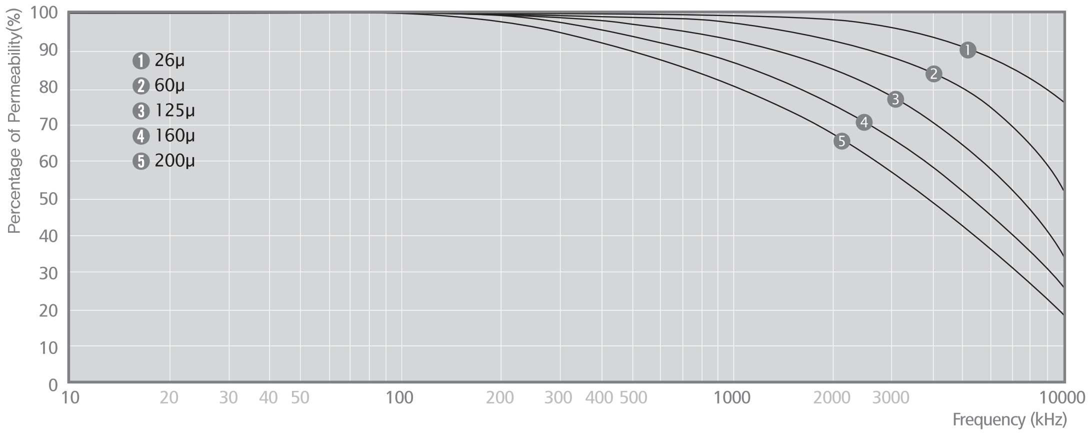


$$\%_{perm} = \frac{1}{a+b \cdot H^c}$$

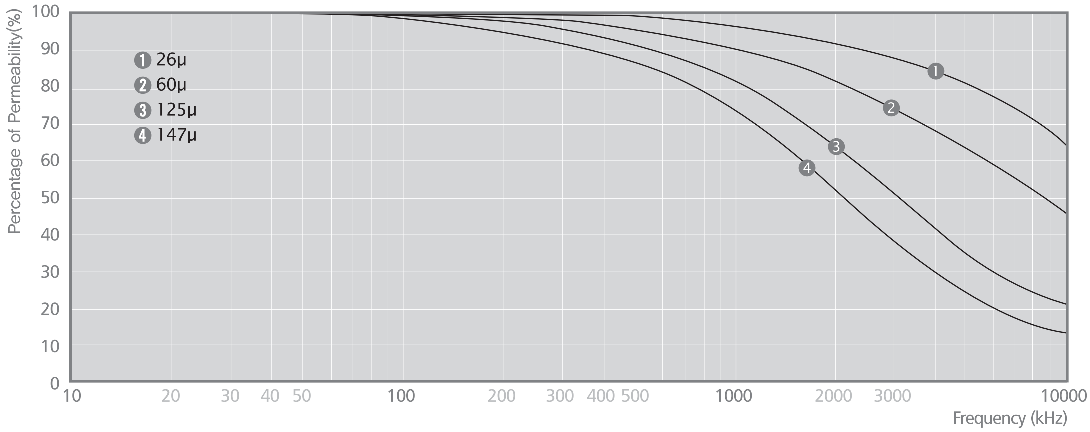
μ	a	b	c
26	0.01	9.96E-08	1.883
50	0.01	7.35E-08	2.177
60	0.01	3.30E-07	1.982
75	0.01	1.11E-06	1.841
90	0.01	2.01E-06	1.828

Permeability vs Frequency Curves

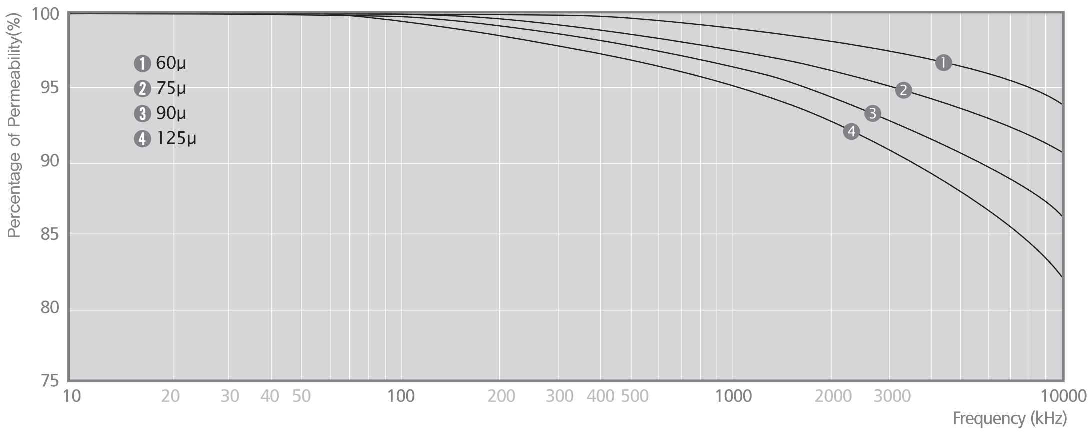
MPP



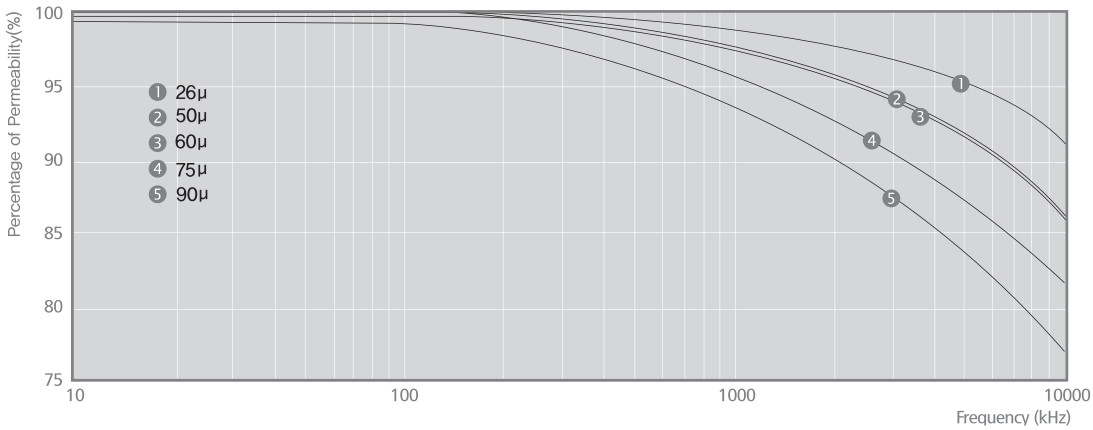
High Flux



Sendust

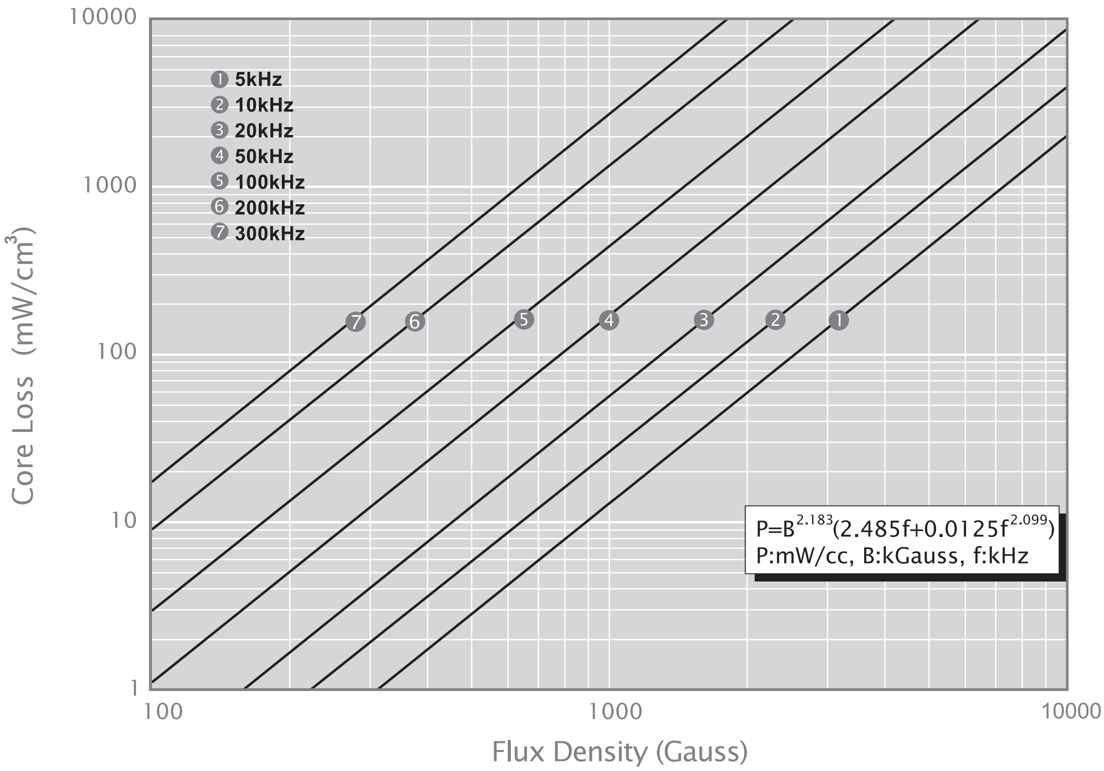


Mega Flux®

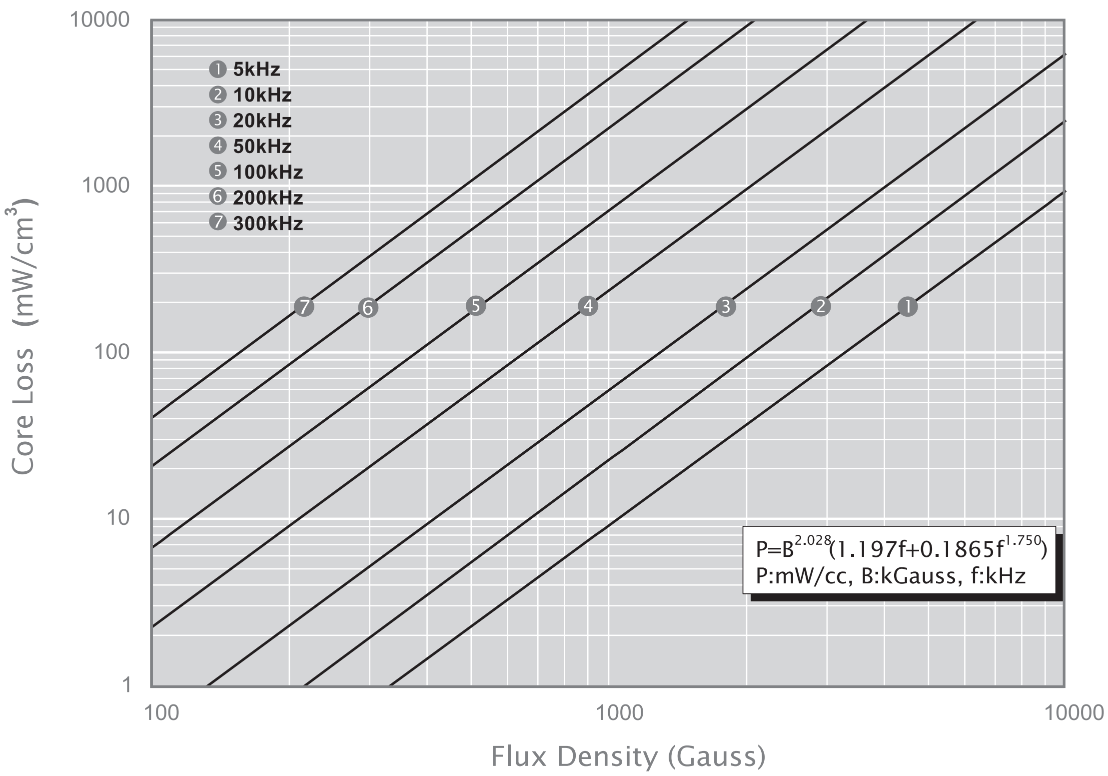


MPP Core Loss

MPP 26μ, 60μ



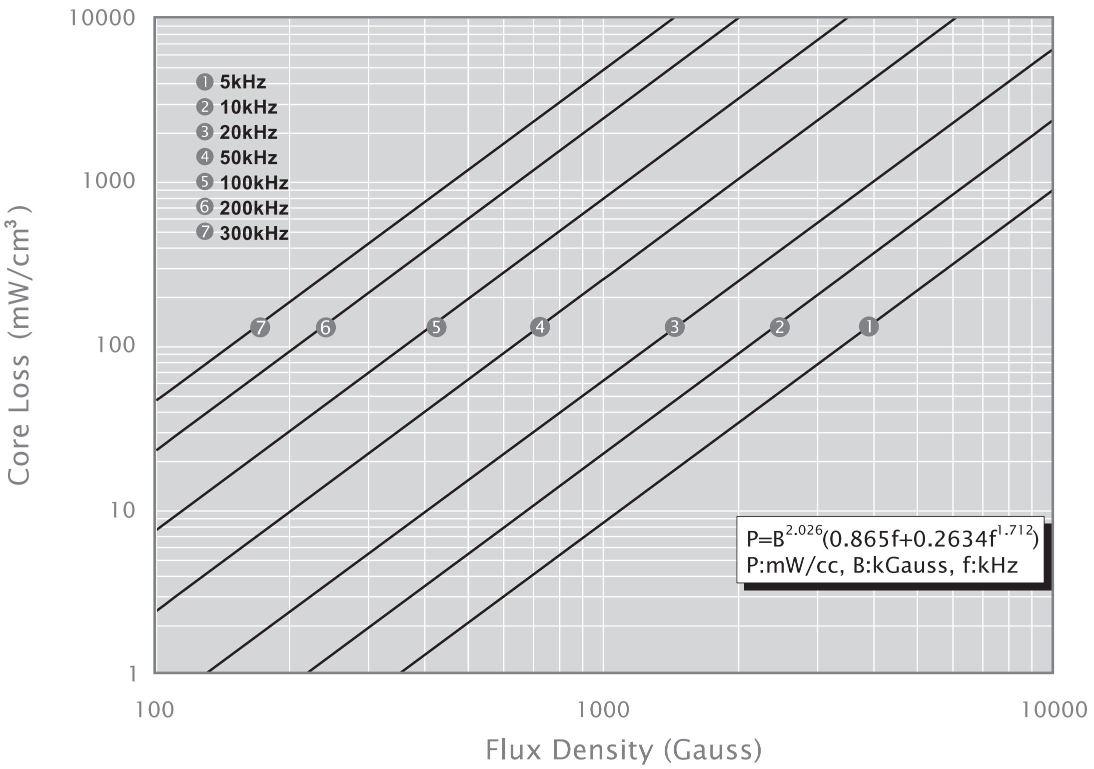
MPP 125μ



MPP Core Loss

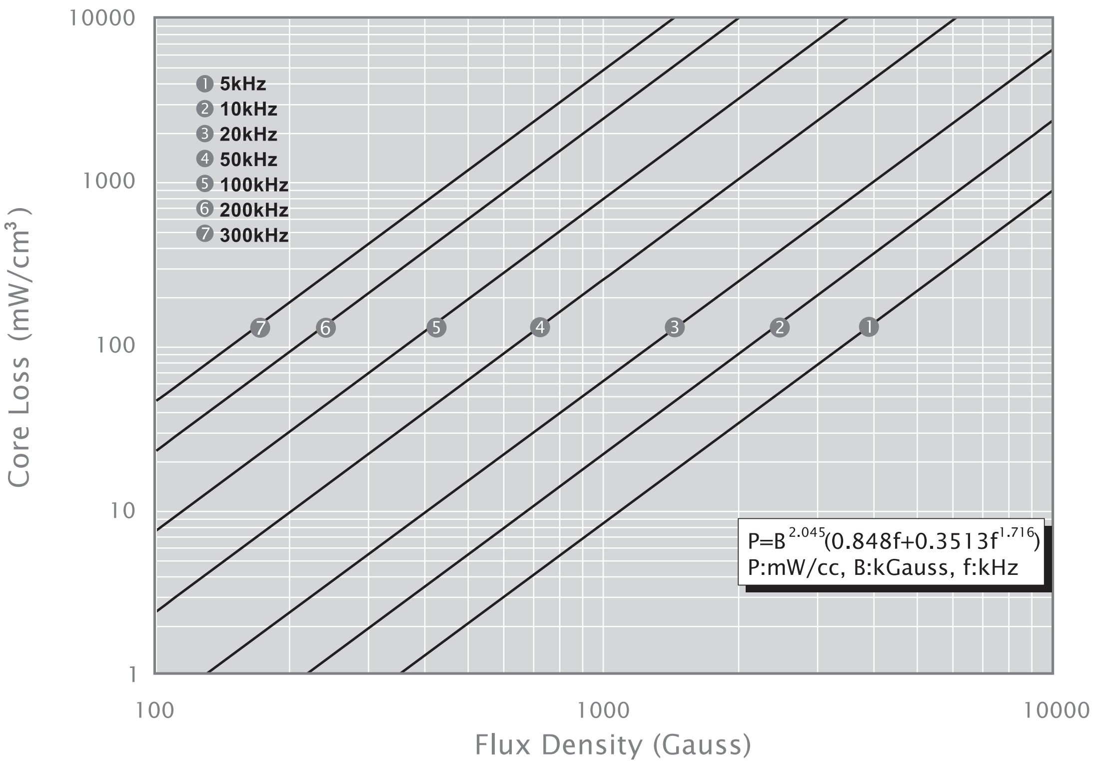
MPP 147μ, 160μ, 173μ

MPP 147μ, 160μ, 173μ



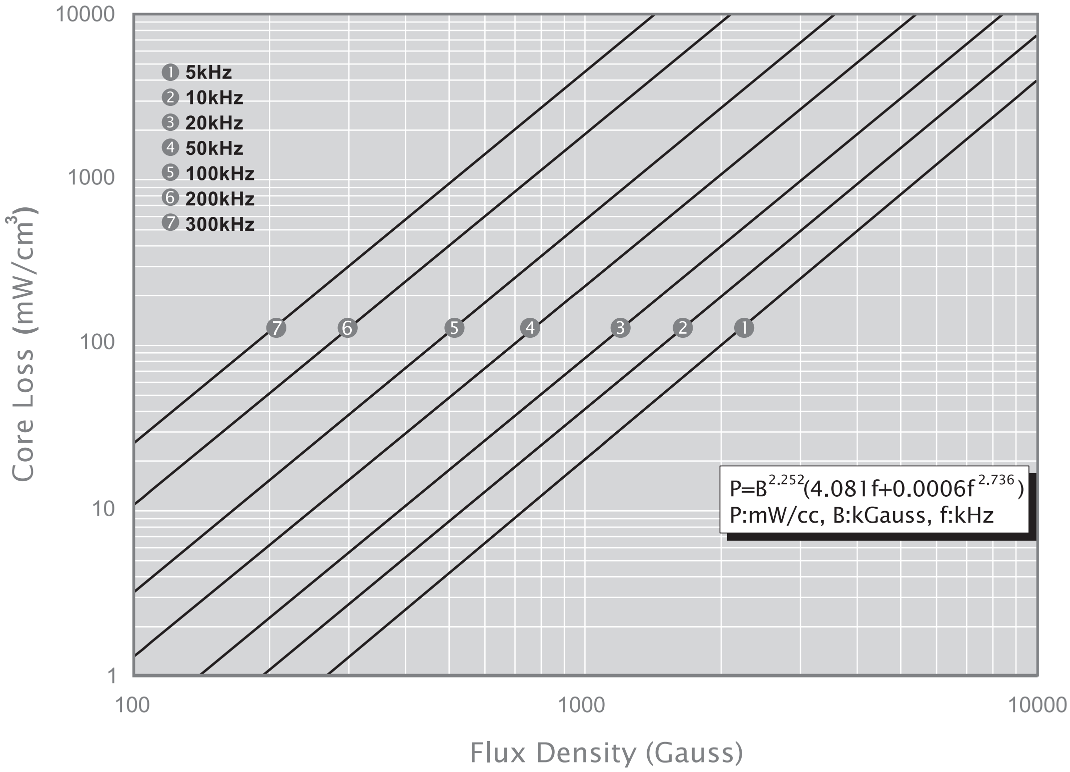
MPP 200μ

MPP 200μ



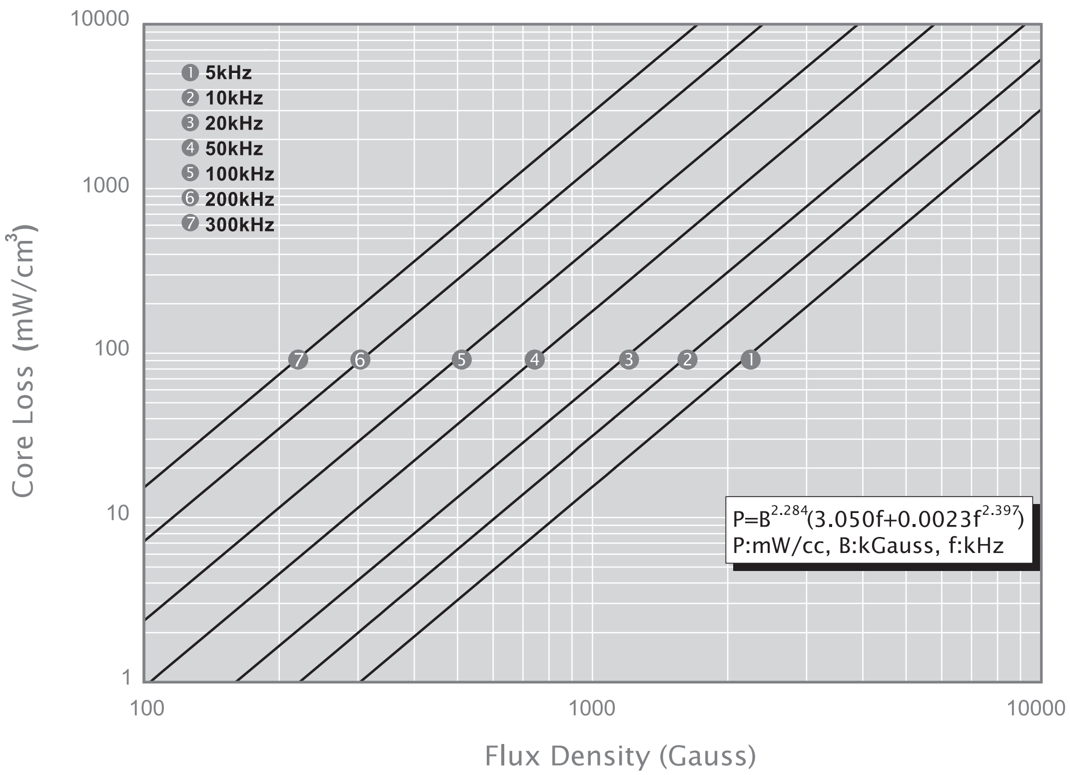
■ High Flux Core Loss

High Flux 26µ



High Flux 26 µ

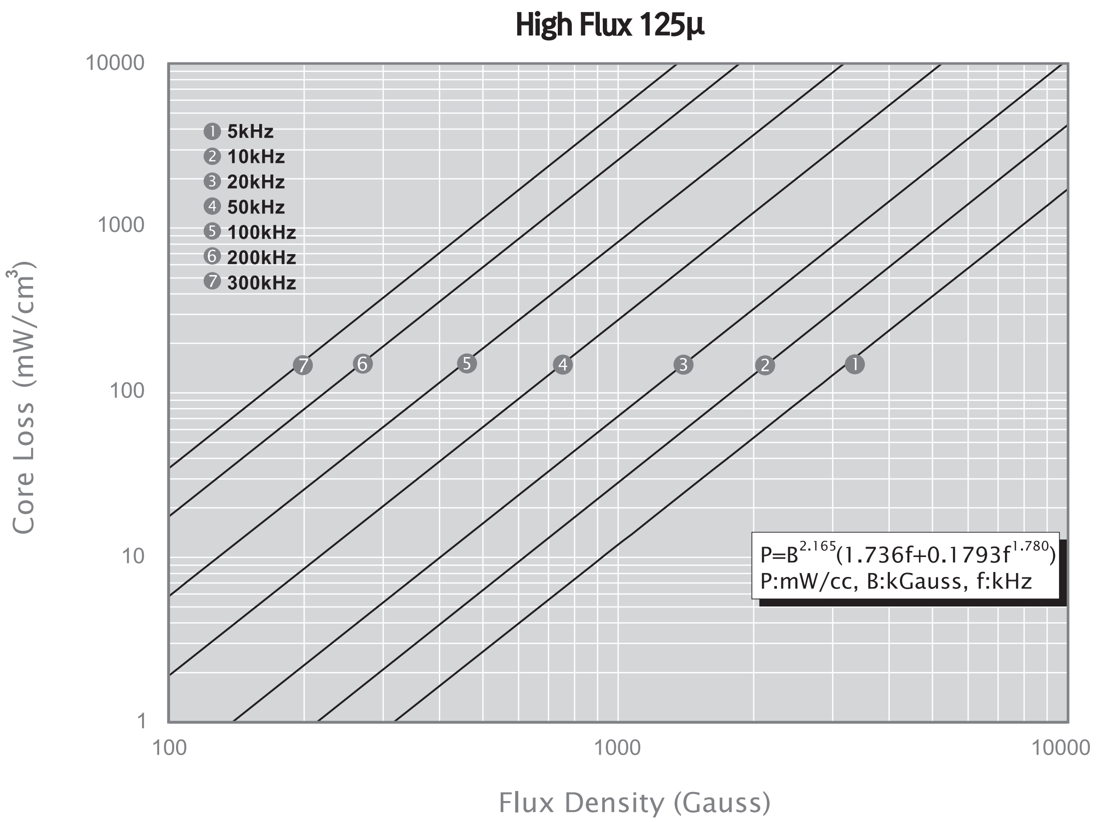
High Flux 60µ



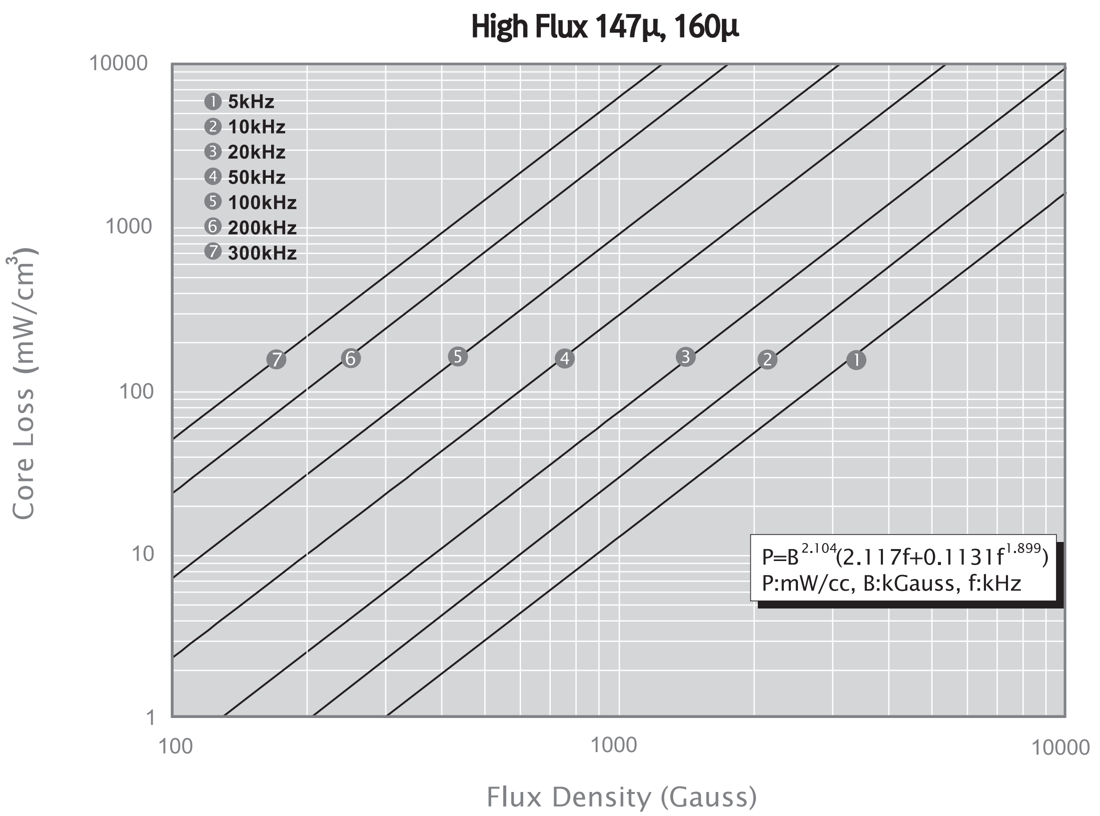
High Flux 60µ

High Flux Core Loss

High Flux 125 µ

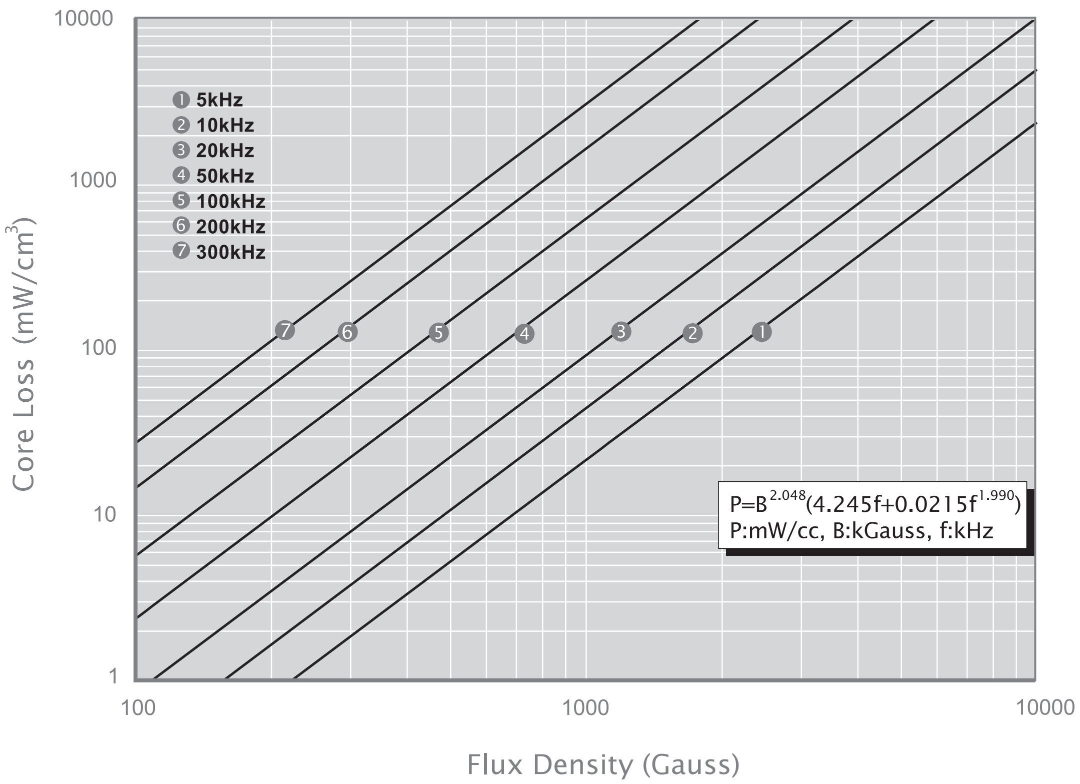


High Flux 147 µ, 160 µ



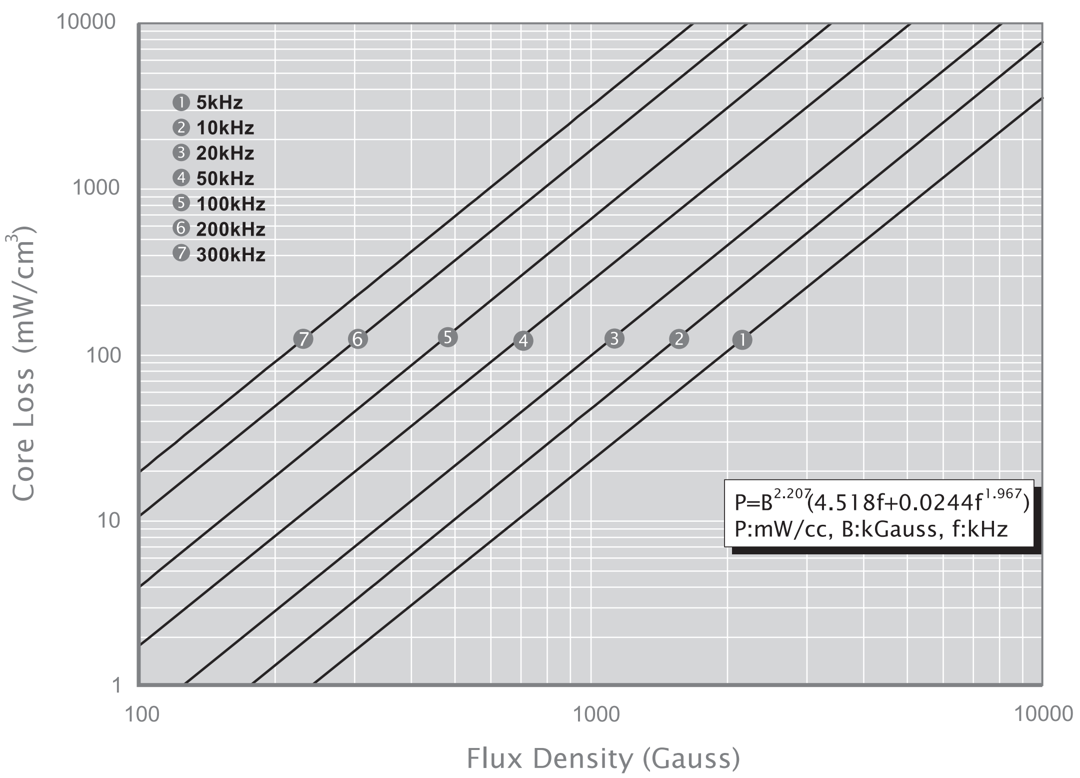
Sendust Core Loss

Sendust 26µ



Sendust 26µ

Sendust 60µ, 75µ, 90µ, 125µ

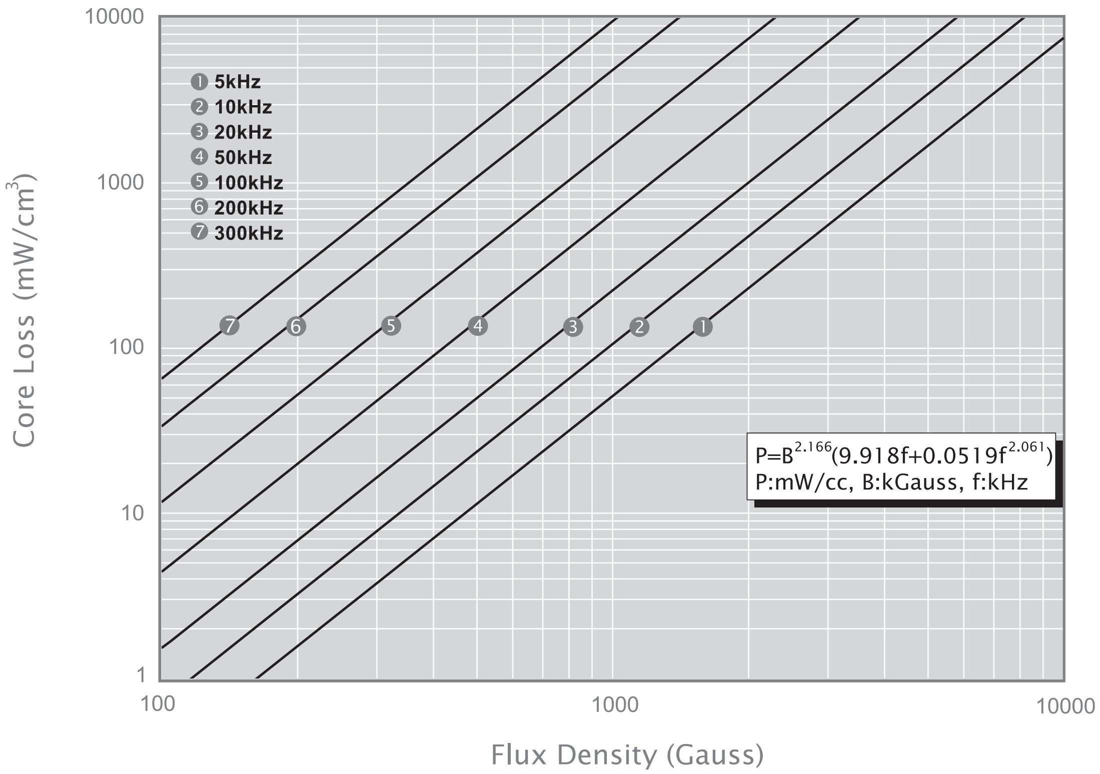


Sendust 60µ,75µ,90µ,125µ

■ Mega Flux® Core Loss

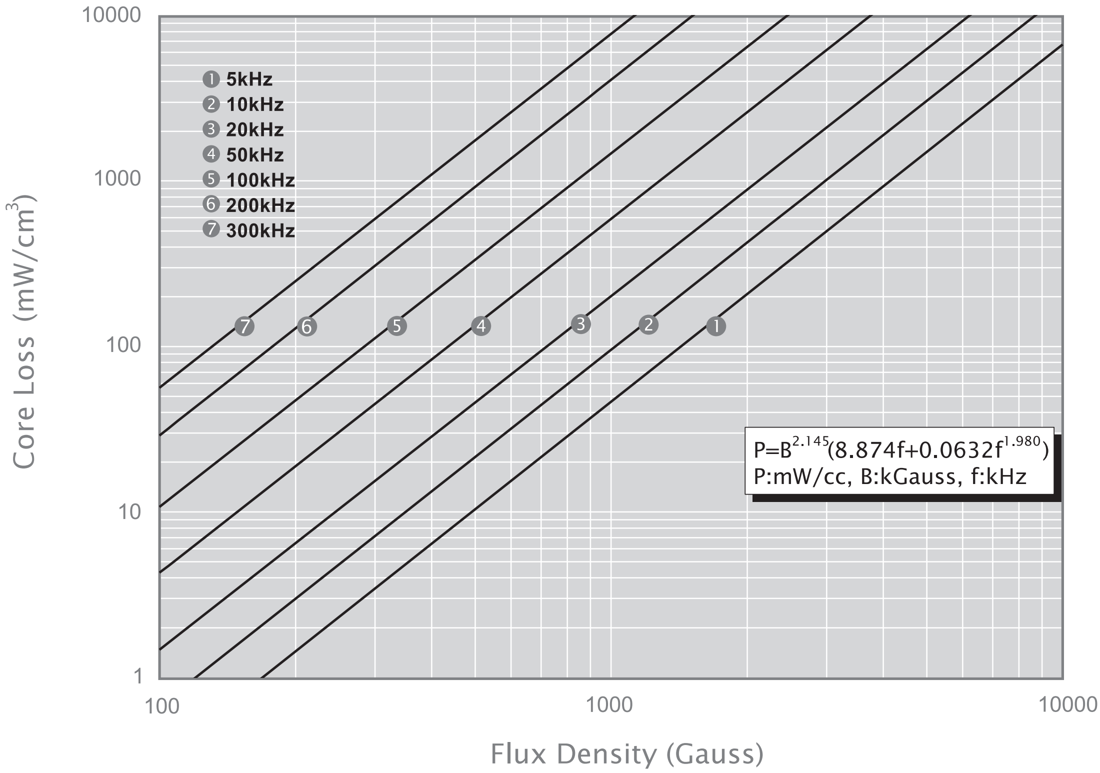
Mega Flux ® 26μ

Mega Flux® 26μ

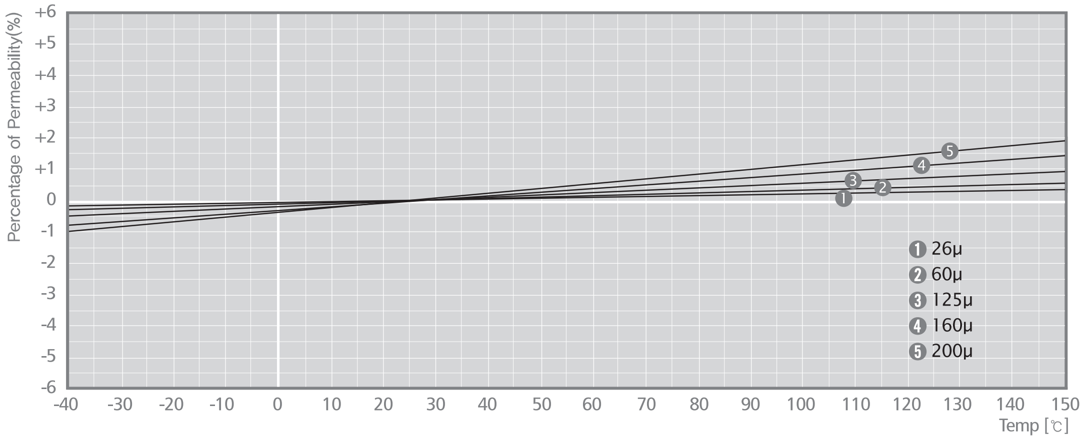


Mega Flux ® 50μ, 60μ, 75μ, 90μ

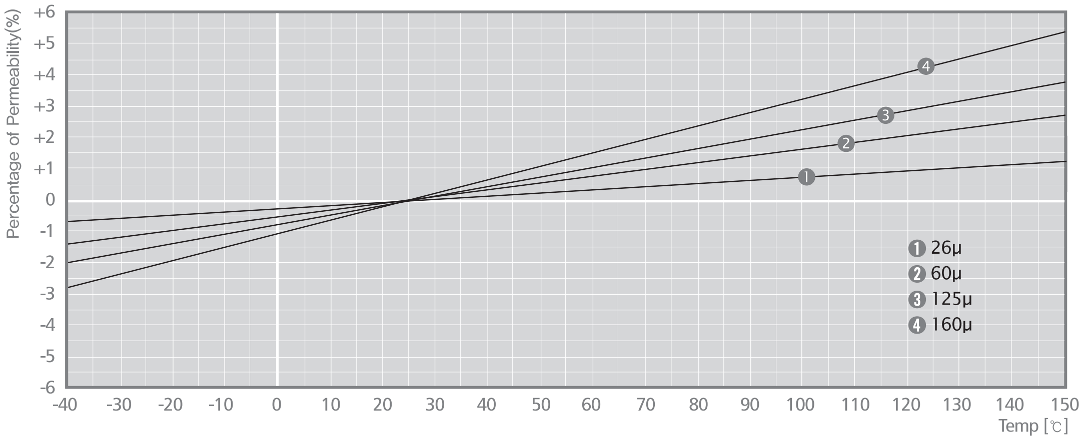
Mega Flux® 50μ, 60μ, 75μ, 90μ



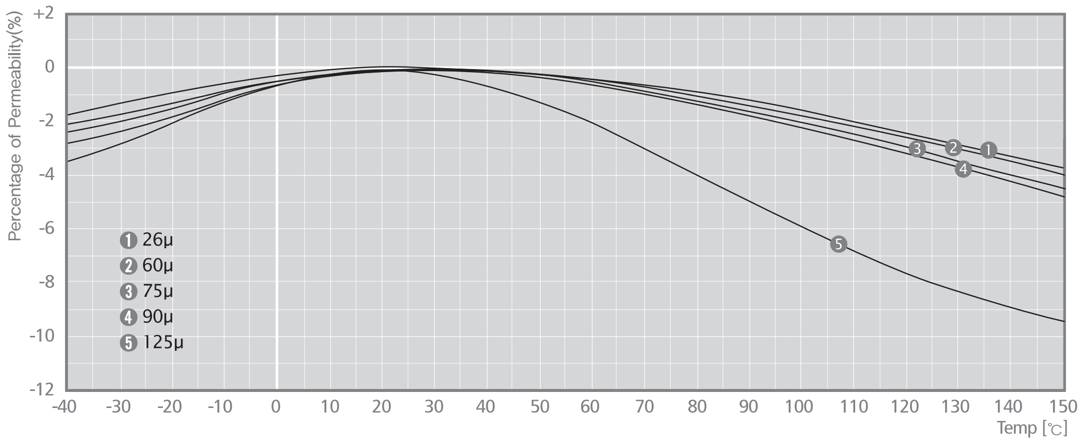
Temperature Stability



MPP



High Flux



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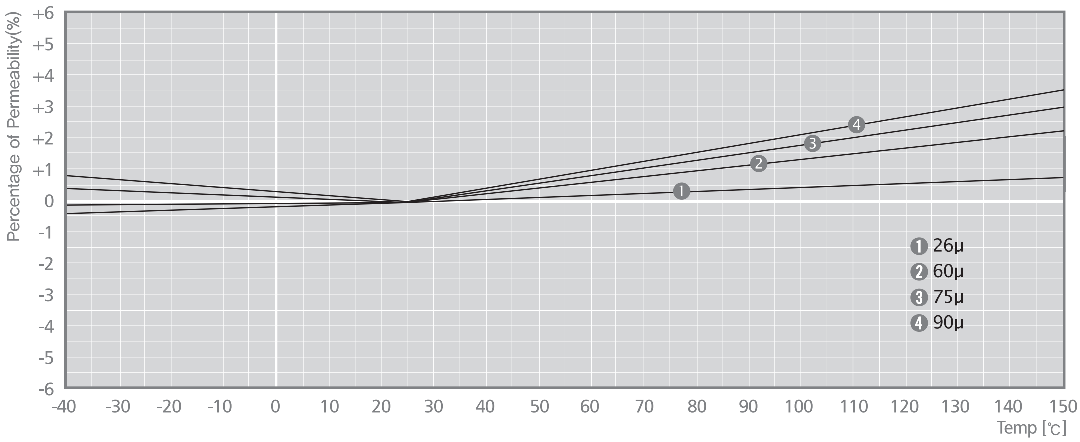

Mega Flux®

Wire Table

AWG Wire No.	Bare Area		Resistivity	Heavy Synthetics					Current Capacity Amps (listed by columns of amps/cm^2)			
				Area		Diameter		Weight				
	cm^2 ($\times10^{-3}$)	Cir-Mil	$10^{-6}\Omega$ cm at 20℃	cm^2($\times10^{-3}$)	Cir-Mil	cm	inch	gm/cm	200	400	600	800
10	53.61	10384	32.70	55.9	11046	0.267	0.1051	0.468	10.4	20.8	31.2	41.6
11	41.68	8226	41.37	44.5	8798	0.238	0.0938	0.3750	8.23	16.4	24.6	32.8
12	33.08	6529	52.09	35.64	7022	0.213	0.0838	0.2977	6.53	13.06	19.6	26.1
13	26.26	5184	65.64	28.36	5610	0.190	0.0749	0.2367	5.18	10.4	15.5	20.8
14	20.82	4109	82.80	22.95	4556	0.171	0.0675	0.1879	4.11	8.22	12.3	16.4
15	16.51	3260	104.3	18.37	3624	0.153	0.0602	0.1492	3.26	6.52	9.78	13.0
16	13.07	2581	131.8	14.73	2905	0.137	0.0539	0.1184	2.58	5.16	7.74	10.3
17	10.39	2052	165.8	11.68	2323	0.122	0.0482	0.0943	2.05	4.10	6.15	8.20
18	8.228	1624	209.5	9.326	1857	0.109	0.0431	0.07472	1.62	3.25	4.88	6.50
19	6.531	1289	263.9	7.539	1490	0.0980	0.0386	0.05940	1.29	2.58	3.87	5.16
20	5.188	1024	332.3	6.065	1197	0.0879	0.0346	0.04726	1.02	2.05	3.08	4.10
21	4.116	812.3	418.9	4.837	954.8	0.0785	0.0309	0.03757	0.812	1.63	2.44	3.25
22	3.243	640.1	531.4	3.857	761.7	0.0701	0.0276	0.02965	0.640	1.28	1.92	2.56
23	2.588	510.8	666.0	3.135	620.0	0.0632	0.0249	0.02372	0.511	1.02	1.53	2.04
24	2.047	404.0	842.1	2.514	497.3	0.0566	0.0223	0.01884	0.404	0.808	1.21	1.62
25	1.623	320.4	1062.0	2.002	396.0	0.0505	0.0199	0.01498	0.320	0.641	0.962	1.28
26	1.280	252.8	1345.0	1.603	316.8	0.0452	0.0178	0.01185	0.253	0.506	0.759	1.01
27	10.21	201.6	1687.6	1.313	259.2	0.0409	0.0161	0.00945	0.202	0.403	0.604	0.806
28	0.8046	158.8	2142.7	1.0515	207.3	0.0366	0.0144	0.00747	0.159	0.318	0.477	0.636
29	0.6470	127.7	2664.3	0.8548	169.0	0.0330	0.0130	0.00602	0.128	0.255	0.382	0.510
30	0.5067	100.0	3402.2	0.6785	134.5	0.0294	0.0116	0.00472	0.100	0.200	0.300	0.400
31	0.4013	79.21	4294.6	0.5595	110.2	0.0267	0.0105	0.00372	0.0792	0.158	0.237	0.316
32	0.3242	64.00	5314.9	0.4559	90.25	0.0241	0.0095	0.00305	0.0640	0.128	0.192	0.256
33	0.2554	50.41	6748.6	0.3662	72.25	0.0216	0.0085	0.00214	0.0504	0.101	0.152	0.202
34	0.2011	39.69	8572.8	0.2863	56.25	0.0191	0.0075	0.00189	0.0397	0.0794	0.119	0.159
35	0.1589	31.36	10849	0.2268	44.89	0.0170	0.0067	0.00150	0.0314	0.0627	0.0940	0.125
36	0.1266	25.00	13608	0.1813	36.00	0.0152	0.0060	0.00119	0.0250	0.0500	0.0750	0.100
37	0.1026	20.25	16801	0.1538	30.25	0.0140	0.0055	0.000977	0.0203	0.0405	0.0608	0.0810
38	0.08107	16.00	21266	0.1207	24.01	0.0124	0.0049	0.000773	0.0160	0.0320	0.0480	0.0640
39	0.06207	12.25	27775	0.0932	18.49	0.0109	0.0043	0.000593	0.0123	0.0245	0.0368	0.0490
40	0.04869	9.61	35400	0.0723	14.44	0.0096	0.0038	0.000464	0.00961	0.0192	0.0288	0.0384
41	0.03972	7.84	43405	0.0584	11.56	0.00863	0.0034	0.000379	0.00785	0.0157	0.0236	0.0314
42	0.03166	6.25	54429	0.04558	9.00	0.00762	0.0030	0.000299	0.00625	0.0125	0.0188	0.0250
43	0.02452	4.84	70308	0.03683	7.29	0.00685	0.0027	0.000233	0.00484	0.00968	0.0145	0.0194
44	0.0202	4.00	85072	0.03165	6.25	0.00635	0.0025	0.000195	0.00400	0.00800	0.0120	0.0160

Winding Data

Core Size	Window Area[a]		Wire Length / Turn				Wound Dimension[c] OD×HT(Max)	
			100% (unity)[b]		0%			
	Cir-Mils	cm^2	ft	cm	ft	cm	inch	mm
035	3,600	0.018	0.0229	0.698	0.0195	0.594	0.195 × 0.108	4.95 × 2.74
039	6,080	0.0308	0.0344	1.049	0.0293	0.894	0.227 × 0.187	5.77 × 4.75
046	5,780	0.029	0.0375	1.143	0.0324	0.988	0.262 × 0.195	6.65 × 4.94
063	8,100	0.0412	0.0442	1.348	0.0379	1.156	0.347 × 0.212	8.81 × 5.38
066	8,100	0.0412	0.0435	1.327	0.0371	1.132	0.359 × 0.202	9.12 × 5.13
067	7,570	0.0384	0.0575	1.754	0.0531	1.620	0.361 × 0.292	9.17 × 7.42
068	18,500	0.0934	0.0586	1.786	0.0512	1.561	0.378 × 0.394	9.60 × 10.01
078	18,200	0.0922	0.0524	1.598	0.0417	1.272	0.433 × 0.265	11.0 × 6.73
096	28,200	0.1429	0.0588	1.793	0.0448	1.366	0.526 × 0.293	13.4 × 7.44
097	28,200	0.1429	0.0632	1.928	0.0498	1.519	0.526 × 0.323	13.4 × 8.20
102	32,400	0.164	0.0651	1.986	0.0504	1.537	0.554 × 0.333	14.1 × 8.46
112	53,800	0.273	0.0720	2.195	0.0507	1.545	0.618 × 0.353	15.7 × 9.0
127	75,600	0.383	0.0815	2.49	0.0574	1.751	0.717 × 0.451	18.2 × 11.5
166	140,600	0.713	0.1057	3.22	0.0721	2.20	0.932 × 0.599	23.7 × 15.2
172	126,000	0.638	0.1204	3.67	0.0763	2.33	0.980 × 0.641	24.9 × 16.3
203	225,600	1.14	0.1204	3.67	0.0763	2.33	1.148 × 0.684	29.2 × 17.4
229	277,700	1.41	0.1405	4.29	0.0886	2.70	1.283 × 0.778	32.6 × 19.8
234	293,800	1.49	0.1473	4.49	0.0982	3.00	1.319 × 0.843	33.5 × 21.4
270	308,000	1.56	0.1714	5.23	0.1233	3.76	1.468 × 0.944	37.3 × 24.0
330	577,600	2.93	0.1943	5.93	0.1238	3.78	1.840 × 1.103	46.7 × 28.0
343	788,500	4.01	0.1923	5.87	0.1059	3.23	1.974 × 1.142	50.1 × 29.0
358	719,100	3.64	0.204	6.22	0.1238	3.78	2.01 × 1.165	51.1 × 29.6
400	842,700	4.27	0.242	7.38	0.1578	4.81	2.22 × 1.385	56.4 × 35.2
467	842,700	4.27	0.284	8.66	0.204	6.22	2.51 × 1.525	63.8 × 38.7
468	1,206,000	6.11	0.273	8.34	0.1706	5.20	2.61 × 1.568	66.3 × 39.8
508	1,484,000	7.50	0.279	8.51	0.1623	4.95	2.85 × 1.600	72.4 × 40.6
571	1,014,049	5.14	0.296	9.02	0.212	6.46	2.98 × 1.34	75.7 × 34.0
572	1,871,000	9.48	0.306	9.33	0.1739	5.30	3.20 × 1.748	81.3 × 44.4
777	3,550,000	17.99	0.340	10.40	0.193	5.90	4.40 × 2.14	112.0 × 54.3

※ a : Window Area (=π /4×ID^2: Core inside diameter), b : Winding Factor (k= Usable window area/Total window area), c : 100% Winding Assumed

Single Layer Winding Capacity

Core Size		046	063 066	068 078	096 097	102	112	127	166	172	203	229	234	270	330	343	358	400 467	468	508	571	572	610	777
ID(mm)		1.93	2.29	3.45	4.27	4.57	5.89	6.99	9.53	9.02	12.07	13.39	13.77	14.10	19.30	22.60	21.50	23.30	27.90	30.90	25.60	34.70	31.37	48.00
Wire No.	Wire Dia	Turns / Single Layer																						
10	2.67																		26	30	26	37	35	53
11	2.38																		30	33	30	42	39	60
12	2.13								10	9	13	15	15	16	23	27	25	22	34	38	34	48	44	67
13	1.90								11	10	15	17	17	18	26	30	29	25	38	43	39	54	50	76
14	1.71								13	12	17	19	20	20	29	34	32	28	43	48	43	60	56	84
15	1.53							10	15	14	19	22	22	23	32	38	37	31	48	54	49	68	63	95
16	1.37						9	11	17	16	22	25	25	26	37	43	41	35	54	60	55	76	71	106
17	1.22						11	13	19	18	25	28	29	29	41	49	46	40	61	68	62	85	80	119
18	1.09					9	12	15	21	20	28	31	32	33	46	55	52	45	68	76	70	96	90	134
19	0.98				9	10	14	17	24	23	32	35	36	37	52	61	58	50	77	85	78	108	101	150
20	0.88				11	12	16	19	27	26	35	40	41	42	58	69	65	57	86	95	88	120	113	168
22	0.70			11	14	15	21	25	35	33	45	50	52	53	74	87	82	71	108	120	111	152	143	211
24	0.56		8	14	18	20	26	31	44	41	56	63	65	66	92	108	103	90	134	149	138	189		
26	0.45	9	11	18	23	25	33	40	55	52	71	79	81	83	115	135	129	112	168	186	174	237		
28	0.36	12	14	23	29	32	42	50	69	65	89	99	101	104	143	168	160	140						
30	0.29	15	19	29	37	40	52	63																
32	0.24	19	23	36	46	49	64	77																
34	0.19	25	30	46	58	62																		
36	0.15	31	38	58	73																			