RELIABILITY TEST CONDITIONS (Environmental Testing)

The reliability of products are tested under the following conditions. (Not including some cut cores)

TEST TITLE	COMPLIANT STANDARD	CONDITIONS
Vibration (Sinusoidal)	JISC 60068-2-6	Amplitude: 1.5mm Frequency Range: 10-55Hz (1 minute/sweep cycle) Test Duration: Total 6 hours (2 hours each per X・Y・Z axis)
Free Fall	JISC 60068-2-32	Three consecutive drops from 1m height onto veneer plywood (width 10mm)
Cold	JISC 60068-2-1	Temperature: -25℃ 500 hours
Dry Heat	JISC 60068-2-2	Temperature: 120℃ 500 hours
Damp Heat, Steady State	JISC 60068-2-3	Temperature: 55℃ Relative Humidity: 95% Test Duration: 500 hours
Change of Temperature	JISC 0025	Temperature / Conditioning Times: -25°C / 30 minutes Room Temperature / Less than 1 minute +120°C / 30 minutes Room Temperature / Less than 1 minute Number of cycles: 25

CUSTOM DESIGN CONDITIONS

Nippon Chemi-Con's amorphous choke coils are available in a wide variety of standard products, but we also offer custom-made products upon request. Here, we will introduce how our choke coils are designed, with reference to various data listed in the catalog.

① Required Specifications for Choke Coil

Rated Inductance	Ln	[μH]
Rated Current	In	[A]
Voltage across coil	Vo	[V]
Conversion Frequency	fsw	[kHz]

② Selection of Core

With reference to the graph of "Coil Volume and Energy Product"(Fig. 1), select a core with a similar energy product. The required energy product is calculated as below.

$$Ln \cdot In^2/1000$$

③ Determining the Number of Turns

The specifications of the selected cores are listed at the beginning of each series. Find the inductance coefficient (AL value) from the core specification table and determine the number of turns (N).

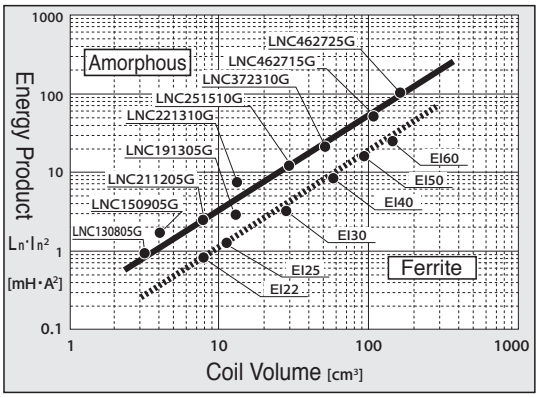
$$N = \sqrt{Ln / AL}$$

④ Determining Diameter of Winding

As a guide, the current density is around 6 [A / mm²] with respect to the effective value (Irms) of the current flowing through the choke coil.

Irms	Diameter
2 A	0.6mmφ
3 A	0.8mm
5 A	1.0mm
8 A	1.3mm
10 A	1.0mmx2P

◆ **Fig.1 Relationship between Coil Volume and Energy Product (Amount of energy that can be handled)**



⑤ Confirming the Winding

Check if the winding specifications set in ③ and ④ can be applied to the core. When winding is possible, the winding space factor is 30% or less. It is important to confirm the winding based on actual performance.

$$\text{Winding Space Factor} = \frac{(\text{Winding Diameter})^2}{(\text{Inner Diameter of Core Exterior})^2} \times \#\text{ of Turns} \times 100[\%]$$

If winding is not possible, reselect larger core size or choose from another series.

⑥ Calculation of Core Loss

Calculate the magnetic flux density (△Bp-p, [mT]) from the voltage across coil (Vo), the conversion frequency (fsw), and the maximum duty (D [%]). Please refer to the core reference table for the cross-sectional area of the core (Ae [cm²]).

$$\Delta Bp\text{-}p = Vo \cdot D / fsw / Ae / N \times 100$$

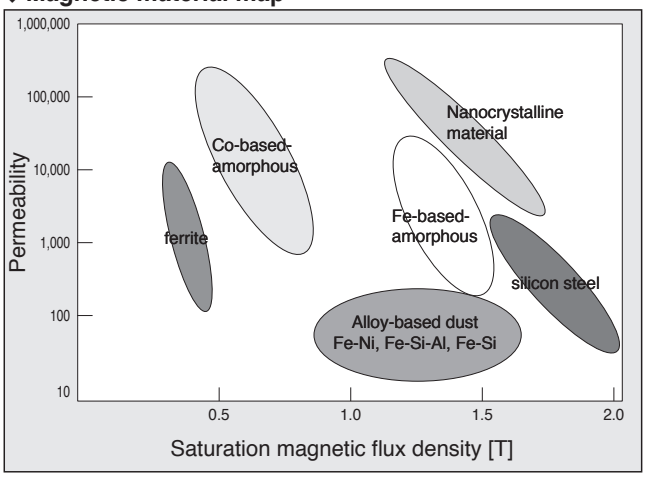
Based on the magnetic flux density, find the core loss per unit weight from the Core Loss Characteristics graph of each series. Multiply this by the core weight to calculate core loss.

CHOKE COIL CHARACTERISTICS

◆Characteristics comparison of magnetic materials

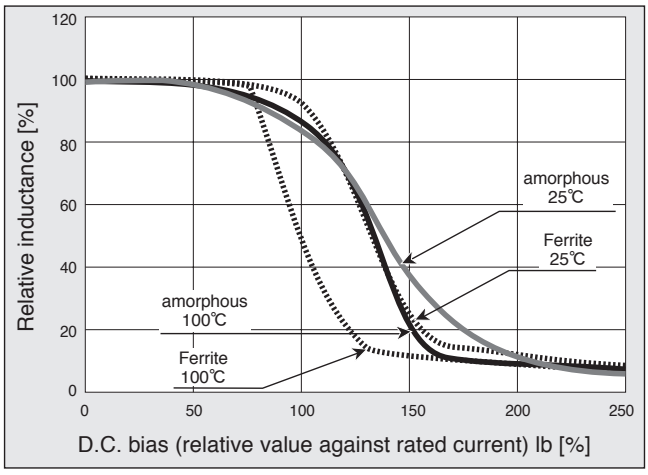
Application	Material shape	Product name	Composition	Saturation magnetic flux density Bs [mT]	Magnetic permeability μ(100[kHz])	Curie point Tc [°C]	Frequency Characteristics (Reference) [kHz]
Power system	Foil strip	Amorphous	Fe-Si-B	1.56	- 5,000	415	- 150
			Co-Fe-Ni-Si-B	0.6	- 18,000	180	-
		Silicon steel plate	Fe-Si	1.3	- 800	700	- 20
	Powder	Alloy dust	Fe-Ni (High Flux)	1.5	26 to 160	420	- 300
			Fe-Si-Al (Sendust)	1.1	26 to 125	570	- 150
			Fe-Si (Mega flax)	1.6	26 to 90	500	- 50
			Fe-Si-B (Amorphous dust)	1.56	60 to 200	415	- 300
		ferrite	Mn-Zn	0.4	- 2,400	250	- 500
			Ni-Zn	0.3	10 to 500	350	- 1,000
Normal	Powder	Fe dust	Fe	1.0	75	770	- 20
Common	Foil strip	Nanocrystalline	Fe-Si-Br-Nb-Cu	1.23	15,000 to 31,000	570	- 1,000
	Powder	ferrite	Mn-Zn	0.5	5,000 to 16,000	130	- 1,000

◆Magnetic material map

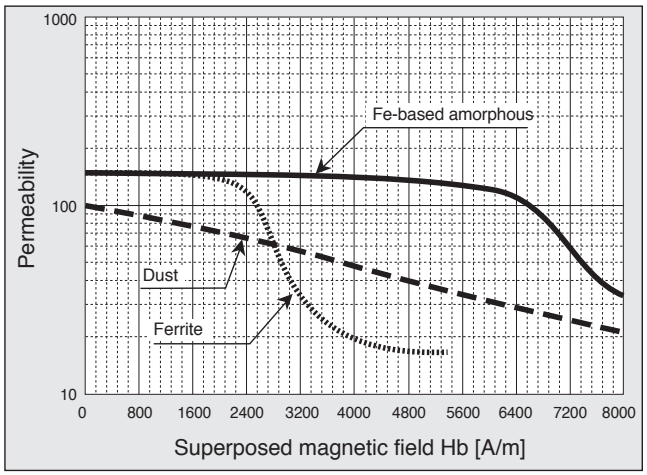


◆D.C. bias of amorphous choke coil

●Temperature dependence : Core temperature 25, 100℃



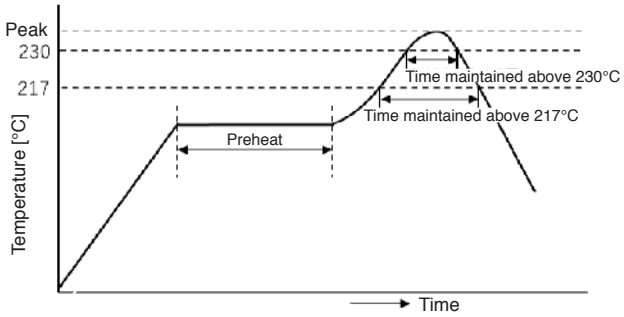
◆D.C. bias of normal mode choke coil



Recommended Soldering Conditions

◆SURFACE MOUNT TYPE

●Recommended soldering heat conditions



Preheat	Time maintained above 217°C	Time maintained above 230°C	Peak temp.	Reflow number
150 to 180°C 120 sec. max.	60 sec. max.	30 sec. max.	245°C max.	2 times or less

Reflow should be performed twice or less.
Please ensure that the coil became cold enough to the room temperature before the second reflow.

◆RADIAL LEAD TYPE

●Recommended soldering heat conditions

Preheat: 110 to 150°C 120 seconds max.
Flow soldering: 260+5°C 10+1 seconds max. (Or hand soldering: 380±10°C 10±1 seconds max.)