カーボニルコアの広帯域仕様

Iron powder cores are very commonly used in RF tuned circuit applications where high Q (quality factor) is a primary objective. The "General Magnetic Properties" table on page 2 indicates the frequency ranges which will produce the highest Q for each core material.
The useful frequency range for broadband applications, since they do not require the highest Q, will be much higher.

The frequency range of a core material for broadband use is highly application dependent. The primary parameters that affect the performance of broadband transformers can be broken down into those affecting the low frequency performance limit and those affecting the high frequency performance limit.
The design of a broadband transformer is a matter of compromise between the parameters controlling the low and high frequency performance limits.

Broadband transformers produced with iron powder cores will not have the wide bandwidth attainable with high permeability ferrite cores.

Iron powder cores are well-suited for applications requiring a moderate bandwidth, low loss, and good stability. The main factors limiting low frequency performance of a transformer in order of importance are:

1. Primary inductance
2. Core material losses
3. Resistive winding losses

Primary inductance: The minimum required inductance for acceptable performance at low frequency will produce inductive reactance of bout four times the source impedance.　Inductance is a function of the turns squared, the effective permeability of the core material at the operating frequency and the ratio of the core's cross-sectional area to magnetic path length.

$$L\,(nH) = \left[\frac{4\pi\,\mu\,\mathrm{eff} A N^2}{\ell} \right]$$

The initial permeability of the iron powder materials commonly used for RF applications ranges from 4 to 35.　All of these materials maintain the listed initial permeability to frequencies above 500 MHz.

Core Material Losses: The tuned-circuit frequency ranges listed in the table on page l indicate the frequency at which each material will produce the lowest core material losses. However these losses are only of secondary importance.　In most low power broadband applications, the losses of any of the iron powder materials will be at an acceptable level.
In high power applications,　the core material losses are of greater importance and more consideration needs to be given to this characteristic. In general, the lower permeability materials will provide lower core loss under high power conditions. These lower permeability materials will require more turns to meet the minimum inductance resulting in a lower operating flux density and, thus, less core loss.

Resistive Winding Losses: This characteristic is normally of such little significance that it can be ignored in all but very low frequency applications.

The main factors limiting high frequency performance of a transformer in order of importance are:

1. Self Capacitance of the Winding
2. Leakage inductance

Self Capacitance of the Winding: Minimizing self capacitance of the winding will improve high frequency performance.　Self capacitance of a winding results from both wire-to-core capacitance and turn-to-turn capacitance.
The wire size, number of strands, proximity of adjacent wire, number turns, total length of wire, and operating frequency will all affect self capacitance of a winding・ Minimizing turns is the first step to minimizing self capacitance. Small core sizes will also tend to operate more successfully at high frequencies.

Leakage Inductance: Leakage inductance needs to be minimized for successful high frequency performance. This is particularly true when using iron powder cores. The relatively low permeability of iron powder puts a premium on winding technique to help minimize leakage inductance.

If, for example, a transformer was wound on a toroidal core with the primary winding on one side of the toroid and the secondary winding on the other side of the toroid, the coupling between the two windings is reliant on the ability of the core material to contain and transfer the magnetic field.
With such a winding configuration, the relatively low permeability of iron powder will cause a significant amount of magnetic field leakage (leakage inductance) resulting in poor coupling between the primary and secondary windings. This will cause a deterioration of the high frequency performance.

Whenever possible multifilar windings should be used. The close proximity of such windings will help to more

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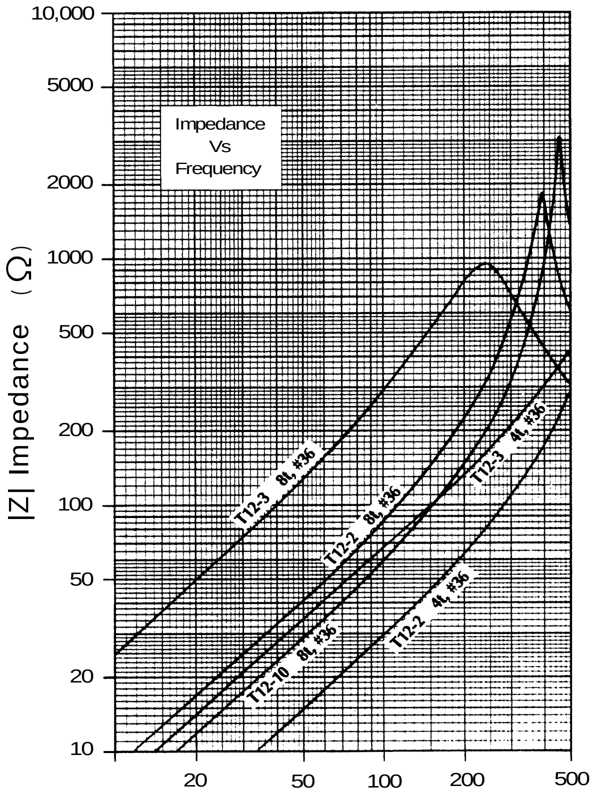
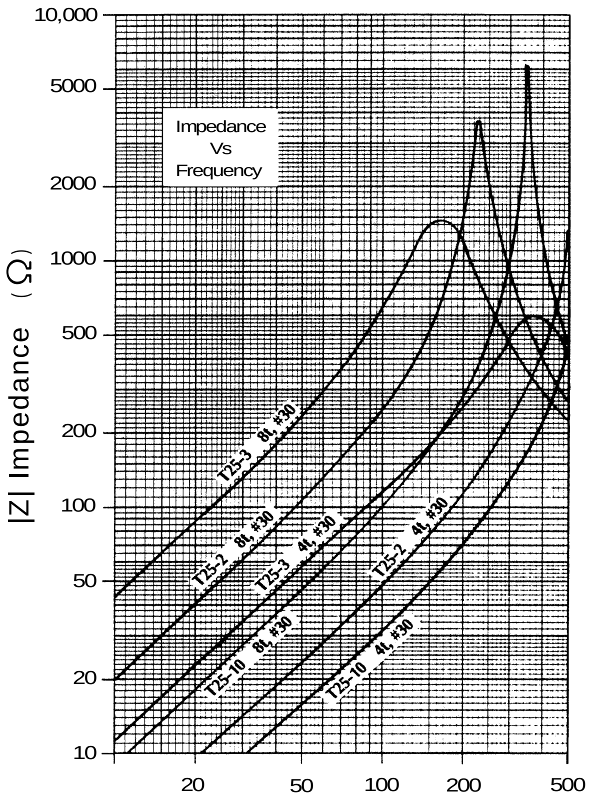
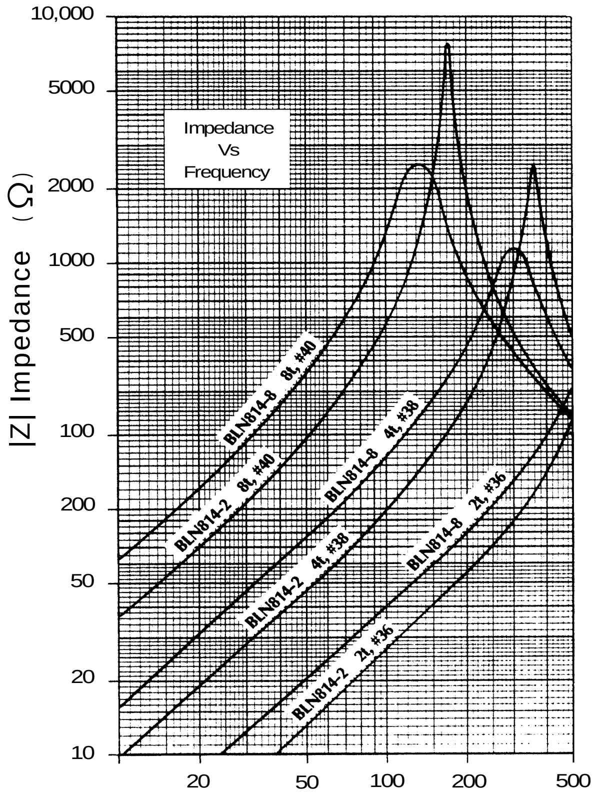
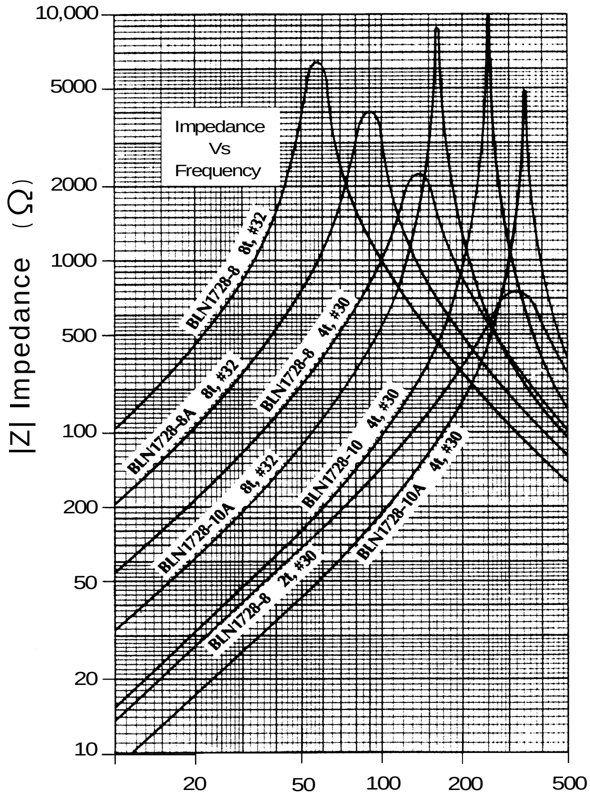
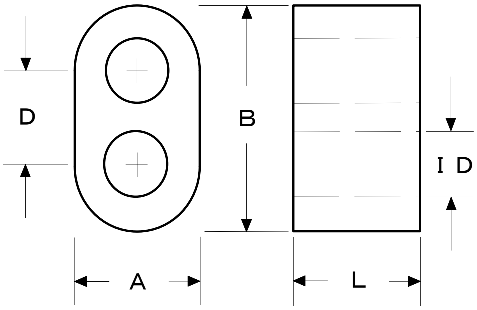

Impedance
Vs
Frequency
|Z| Impedance (Ω)
10,000
5000
2000
1000
500
200
100
50
20
10
20
50
100
200
500
T12-3 8t, #36
T12-2 8t, #36
T12-3 4t, #36
T12-10 8t, #36
T12-2 4t, #36


Impedance
Vs
Frequency
|Z| Impedance (Ω)
10,000
5000
2000
1000
500
200
100
50
20
10
20
50
100
200
500
T25-3 8t, #30
T25-2 8t, #30
T25-3 4t, #30
T25-2 4t, #30
T25-10 8t, #30
T25-10 4t, #30


Impedance
Vs
Frequency
|Z| Impedance (Ω)
10,000
5000
2000
1000
500
100
200
50
20
10
20
50
100
200
500
BLN814-8 8t, #40
BLN814-2 8t, #40
BLN814-8 4t, #38
BLN814-2 4t, #38
BLN814-8 2t, #36
BLN814-2 2t, #36


Impedance
Vs
Frequency
|Z| Impedance (Ω)
10,000
5000
2000
1000
500
100
200
50
20
10
20
50
100
200
500
BLN1728-8 8t, #32
BLN1728-8A 8t, #32
BLN1728-8 4t, #30
BLN1728-10A 8t, #32
BLN1728-10 4t, #30
BLN1728-8 2t, #30
BLN1728-10A 4t, #30

バルンコア



品番の説明

ＢＬＮ１７２８－１０ Ａ

材料番号

長さ（Ｌ）の違いを示す

品　番	ＡＬ値 nH/nN^2	外径 (A)	外径 (B)	内径 (ID)	ピッチ (D)	高さ (L)	磁路長 (ℓ)cm	体　積 (V)cm^3
BLN814-0	2.5	2.08	3.56	0.84	1.47	2.36	0.753	0.22
-2	8.1							
-6	7.3							
-8	14.4							
-10	5.6							
BLN1728-2	22.0	4.29	7.16	1.96	2.90	6.35	1.56	0.104
-6	18.0							
-8	55.0							
-10	15.8							
BLN1728-2A	11.0	4.29	7.16	1.96	2.90	3.17	1.56	0.052
-6A	9.0							
-8A	27.5							
-10A	7.9							

広帯域アプリケーション(12 頁より続く)

tightly couple the primary and secondary, thus, minimizing leakage inductance.

The most commonly used core configurations for broadband transformers are toroidal cores and balun cores.

Toroidal Cores: Toroidal cores are often selected for broadband transformer applications due to the relative ease of winding. Toroids which have a relatively large outside diameter to inside diameter ratio (more like a bead) will tend to produce broader band performance.

Balun Cores: The balun configuration has been available in ferrite core materials for many years. This geometry was developed specifically for broadband applications, Since it produces more impedance per unit length of wire than a typical toroidal core when produced in the same core material, this shape will tend to produce transformers which will operate over a broader frequency range than a comparable toroidal core. This is particularly true when the winding is applied from one hole to the other, rather than around the outside of the core. Balun cores are somewhat more difficult to wind than a typical toroid but allow for more variety in winding configuration.

The graphs on page 13 contain a number of impedance versus frequency curves for both toroidal cores and balun cores. The balun cores were wound through both holes. All measurements were made on a HP4191A using spring clip fixture 16092A.

This information is intended primarily to assist in core selection for broadband transformer applications.
It should be noted, however, that the impedance versus frequency characteristics of iron powder make it useful for EMI suppression applications above 200 MHz.