Ferrite beads: Useful components.

By Signal Processing Group Inc., Techteam. November 2011

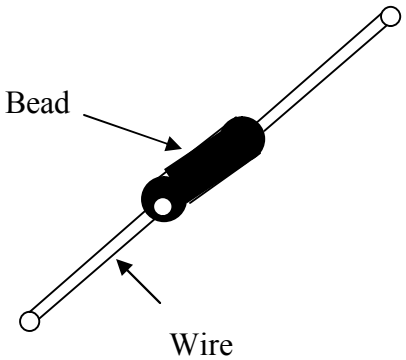


Fig. A

Fig B

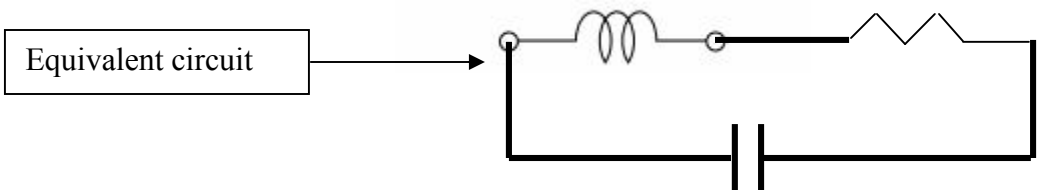


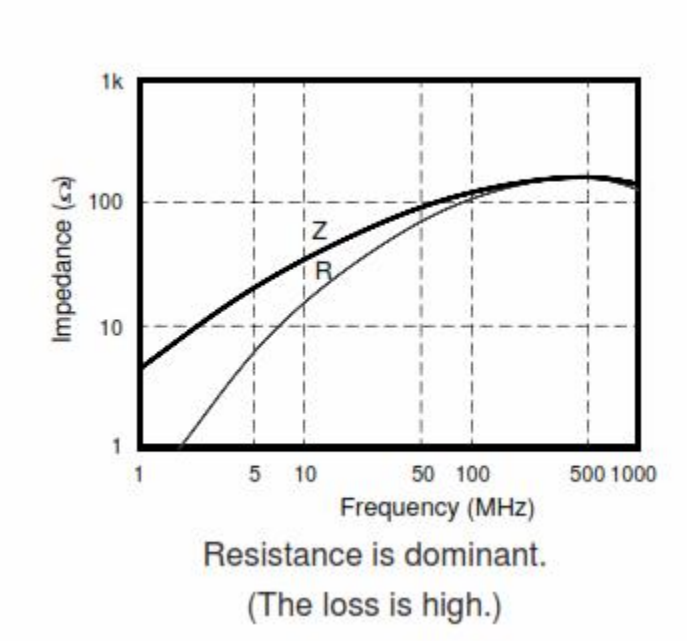
Fig C

Figure A, shows a cylindrical bead installed over a connecting wire. Figure B is a surface mount bead. Figure C is the equivalent circuit of the bead.

The component values of the equivalent circuit are all highly frequency dependent and not easy to describe mathematically. Modeling is quite complicated so one port or two port measurements are the most accurate representation.

The series resistor value is dependent on the frequency and current and the type of ferrite material. At DC the series resistor value equals that of the wire of the cylindrical bead implementation. The inductance is significant because of the high permeability of the bead. In addition the series resistance increases with frequency, and peaks at some specific frequency. The inductive reactance peaks much sooner than the resistor. As frequencies increase the inductive reactance changes to capacitive reactance. At the resistor peaking frequency the bead looks almost purely resistive.

The figure below shows a ferrite bead characteristic as an example.



Z is of course, the reactance.

Ferrite beads are used in multiple applications. EMI is a favorite one. The bulbous shapes at the ends of computer cables are ferrite beads. A ferrite bead inserted into the power supply line of an IC will prevent EMI and high frequency noise from reaching the power supply. They are basically low pass filters with zero DC loss.

A very useful component in a very small space and size!