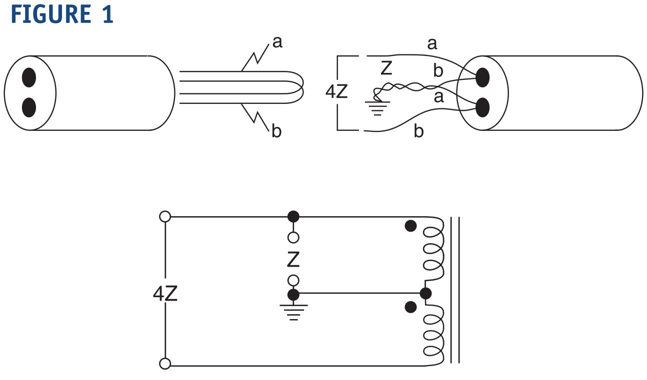
Design Considerations

APPLICATION NOTES:
Multi-hole cores provide specialized shapes that are sometimes more useful than single hole devices. One example is wide band transformers where good coupling between short windings is needed over a wide frequency range. Since most of these cores are used in applications of this kind, our standard tests are performed at critical frequencies within their practical operating range. This assures that the cores will operate properly in your application.

In this section you will find curves of X_p, R_p and Z versus frequency for many of these cores. This data was taken with a single winding passing through both holes, the number of turns being chosen for convenience in testing. Except for the highest frequencies, where results are controlled by stray reactances rather than the core, characteristics for other numbers of turns may be determined by multiplying by the square of the turns ratio-$(N_{new}/N_{curve})^2$. The effect is to shift the curves up or down by this ratio.

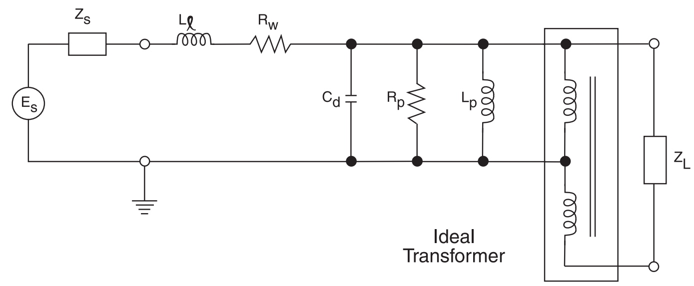
BALUNS:
These are transformers used for impedance matching, usually with one side balanced to ground and the other unbalanced (hence the name). They may be wound on any core shape, but often a two-hole core is used. Both cylindrical types and “binocular” or “shotgun” types (commonly called “balun cores”) are available. Many possible winding arrangements are used, but one simple type is shown in figure 1. Two U-shaped wires (a, b) are inserted and connected as shown. Then one winding, consisting of a single (two hole) turn, forms the low impedance connection, while two turns in series form the high impedance winding. Since impedance transformation is proportional to the turns squared ratio, it is 4:1. The center-tap may be grounded or left floating. As with other wide band transformers (see TOROID section) the lower frequency limit is determined by the shunting effect of the reactance produced by the winding inductance, as shown in figure 2.

FIGURE 1



Balun Transformer

FIGURE 2

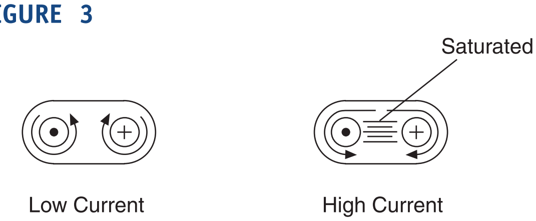


The upper frequency limit is determined by the leakage inductance (L_ℓ) and distributed self capacitance (C_d). Insertion loss is determined by core losses (R_p), winding losses (R_w) and L_p.

TWO-TRANSFORMER DEVICES:
There are a number of devices requiring two transformers in conjunction, such as wide band cable (CATV, MATV) directional taps, splitters and other hybrids. Although two toroids or beads are sometimes used, a two hole core is often more convenient. Each device is wound through one hole and around the outside. The leads are then in convenient and consistent locations for interconnection. There will be a small amount of coupling between the core halves which should be experimentally examined in your application for its influence on performance.

COMMON MODE CHOKES:
Simple noise suppression devices for power lines can be made by passing each side of a wire pair through one hole of a two hole core. At low current levels each half of the core acts as a choke on its own conductor. But at higher currents, when individual beads would saturate, only the web between the holes saturates (figure 3).

FIGURE 3



The power frequency currents in the outer portion cancel so that the outer ring may function as a choke to common mode noise signals. For further information, see the **BEAD** section.