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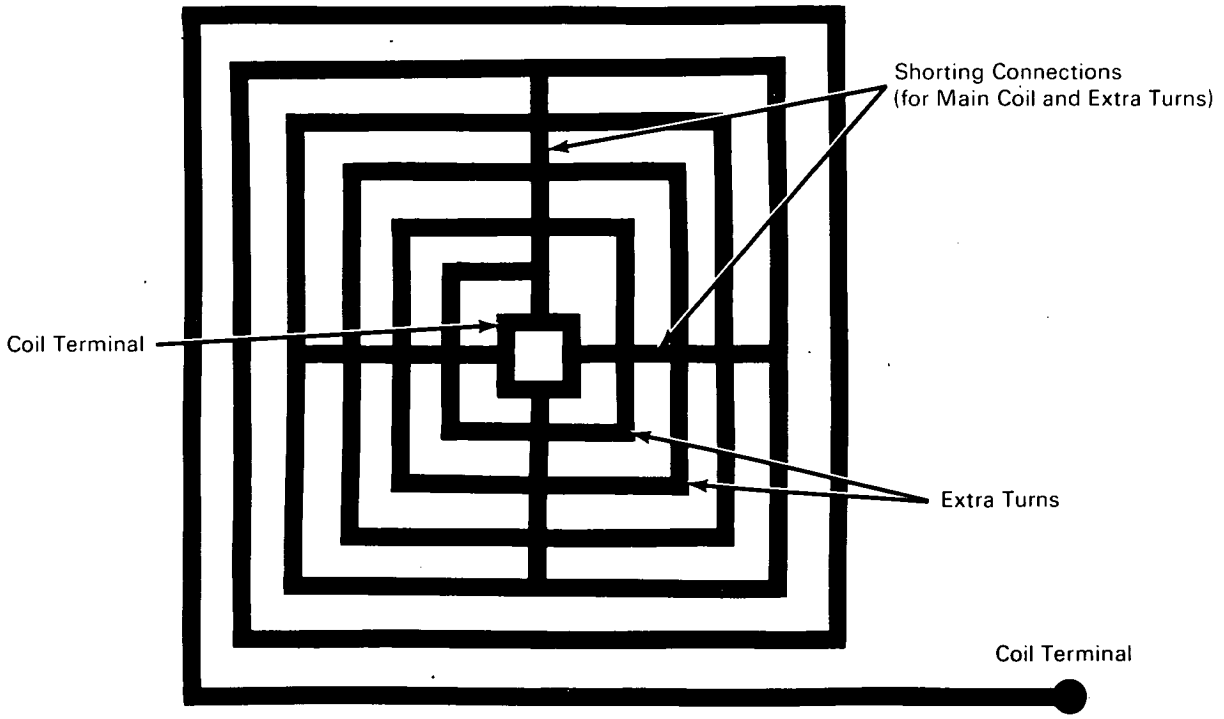
NASA TECH BRIEF

Design of Printed Circuit Coils



The problem:

The fabrication process of printed circuit components results in essentially fixed device parameters. Considerable variation in the inductance value of coils occurs as a result of spacing, plating thickness, and the physical relationship of the component placement and the location of the circuit ground plane. The fixed printed coil must be trimmed in order to obtain the desired inductance value.

The solution:

A spiral-like coil, shown in the figure, is printed with several extra turns which increase the realizable coil inductance; shorting connections are also included to reduce the inductance. The shorting connections not only short the extra turns, but also short out several turns of the main body. Coil tuning is accomplished with relative ease by removing the shorts until the desired inductance is obtained.

How it's done:

Approximate printed coil lengths and fabrication parameters are obtained by calculation from circuit models or experimentally determined design curves. After the approximate coil dimensions are obtained, the printed coil layout is constructed with the several

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extra turns and shorting bars. Shorting connections are then removed from the coil until the exact value of inductance is obtained. This procedure calibrates the layout and subsequent photoetching process.

Once the exact coil geometry is obtained, the designer has several options. If there are a limited number of active devices in the circuit, the existing printed circuit art work may be modified by removing the appropriate shorting connections. On the other hand, if the circuit contains a large number of active devices, individual coils may be trimmed to account for differences in active device parameters. The former approach was used in a phased-array receiver. Nineteen coils of values from 50 nanohenrys to 100 nanohenrys were used in a variety of circuits such as delay lines, hybrids, and amplifiers. For the larger coils a tolerance of ± 2% was obtained, and a tolerance of ± 1% was obtained for the smaller coils. The cost per coil was very competitive with commercially available fixed or tuned devices. In addition, the other advantages of the printed wiring approach are obtained at marginal cost.

Note:

No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Headquarters
National Aeronautics
and Space Administration
Washington, D.C. 20546
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Patent status:

No patent action is contemplated by NASA.

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