**Seven tips to improve the Q value of the inductor**

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A group of copper coils

Description automatically generated

First, let's talk about the definition of the inductor quality factor Q.

The Q value is the main parameter for measuring the inductance device. It refers to the ratio of the inductive reactance and its equivalent loss resistance when the inductor operates under the AC voltage of a certain frequency. The higher the Q value of the inductor, the smaller the loss. The higher the efficiency.

The quality factor Q is an important parameter reflecting the quality of the coil. Increasing the Q value of the coil can be said to be one of the key points to be paid attention to when winding the coil.

To improve the Q value of the coiled coil, the following describes the specific methods below:

1. **According to the working frequency, select the wire of the coil.**

Inductors that operate in the low frequency range are usually wound with insulated wires such as enameled wires. The operating frequency is higher than tens of thousands of Hz, and in the circuit below 2MHz, the coil is wound by a plurality of insulated wires, so that the surface area of the conductor can be effectively increased, thereby overcoming the effect of the skin effect and making the Q ratio the same. A single wire wound with a cross-sectional area is 30%-50% higher. In circuits with a frequency higher than 2MHz, the inductor coil should be wound with a single thick wire, and the diameter of the wire is generally 0.3mm-1.5mm. An inter-winding inductive coil is used, which is usually wound with a silver-plated copper wire to increase the conductivity of the wire surface. At this time, it is not suitable to use multi-strand wire winding, because the multi-strand insulated wire will cause extra loss when the frequency is high, and the effect is not as good as that of a single wire.

**2. Select high-quality coil bobbin to reduce dielectric loss.**

In high frequency applications, such as short-wavelength bands, the dielectric loss is significantly increased due to the ordinary coil bobbin. Therefore, high-frequency dielectric materials such as high-frequency ceramics, polytetrafluoroethylene, polystyrene, etc. should be used as the skeleton. It is wound by a winding process.

**3. Choose a reasonable coil size.**

It can reduce the single-layer coil (φ20mm-30mm) with a certain loss outer diameter. When the ratio of the winding length L to the outer diameter D is L/D=0.7, the loss is the smallest; the multilayer coil with a certain outer diameter L/ D=0.2- 0.5, with t/D = 0.25-0.1, the loss is minimal. When the winding thickness t, the winding length L, and the outer diameter D satisfy 3t + 2L = D, the loss is also the smallest. The coil with the shield is optimal when L/D = 0.8-1.2.

**4. Select the diameter of a reasonable shield.**

The use of a shield will increase the loss of the coil and reduce the Q value, so the size of the shield should not be too small. However, the size of the shield is too large, which increases the volume, so the diameter of the proper shield is selected.

When the ratio of the shield diameter Ds to the coil diameter D satisfies the following value, that is, Ds/D = 1.6 - 2.5, the Q value is reduced by not more than 10%.

**5. The use of magnetic core can significantly reduce the number of coil turns.**

The magnetic core is used in the coil, which reduces the number of turns of the coil, not only reduces the resistance value of the coil, but also improves the Q value and reduces the volume of the coil.

**6. Coil diameter is appropriately selected to reduce the loss.**

Under the possible conditions, the coil diameter is selected to be larger, and the volume is increased, which is beneficial to reduce the loss of the coil. For general receivers, the diameter of a single layer coil is 12mm-30mm; the multilayer coil is 6mm-13mm, but it should not exceed the range of 20mm-25mm from the volume.

**7. Reduce the distributed capacitance of the coil.**

Try to use a non-skeleton winding method, or a coil wound on a rib type skeleton, to reduce the distributed capacitance by 15%-20%; the segment winding method can reduce the distributed capacitance of the multilayer coil by 1/3~ l/2. For a multilayer coil, the smaller the diameter D, the smaller the winding length L or the larger the winding thickness t, the smaller the distributed capacitance. It should be noted that after the diffused and sealed coils, the distributed capacitance will increase by 20%-30%.

In short, winding the coil always improves the Q value and reduces the loss as the focus of consideration.