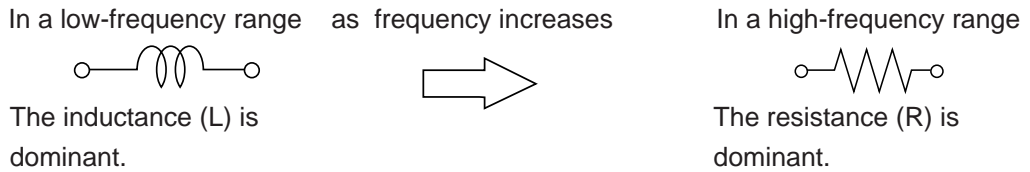
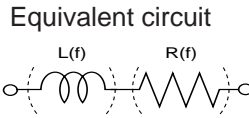


3. Noise Suppression by Low-pass Filters
 3.11. Understanding Ferrite Bead Inductors

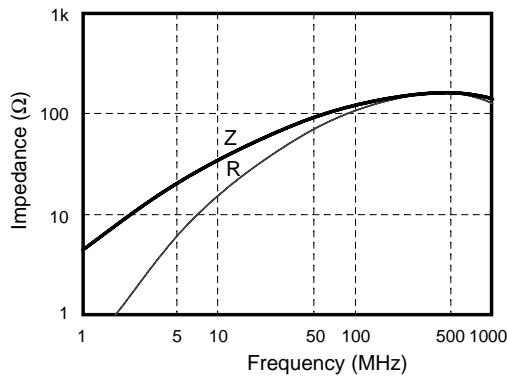
Understanding Ferrite Bead Inductors

At high frequencies, ferrite bead inductors work like resistors instead of inductors.



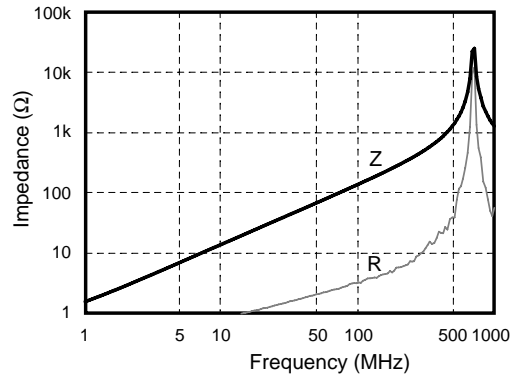
Examples of impedance characteristic

Ferrite bead inductor



Resistance is dominant.
 (The loss is high.)

Reference: Coil for high-frequency filter circuits
 (Air-core coil)



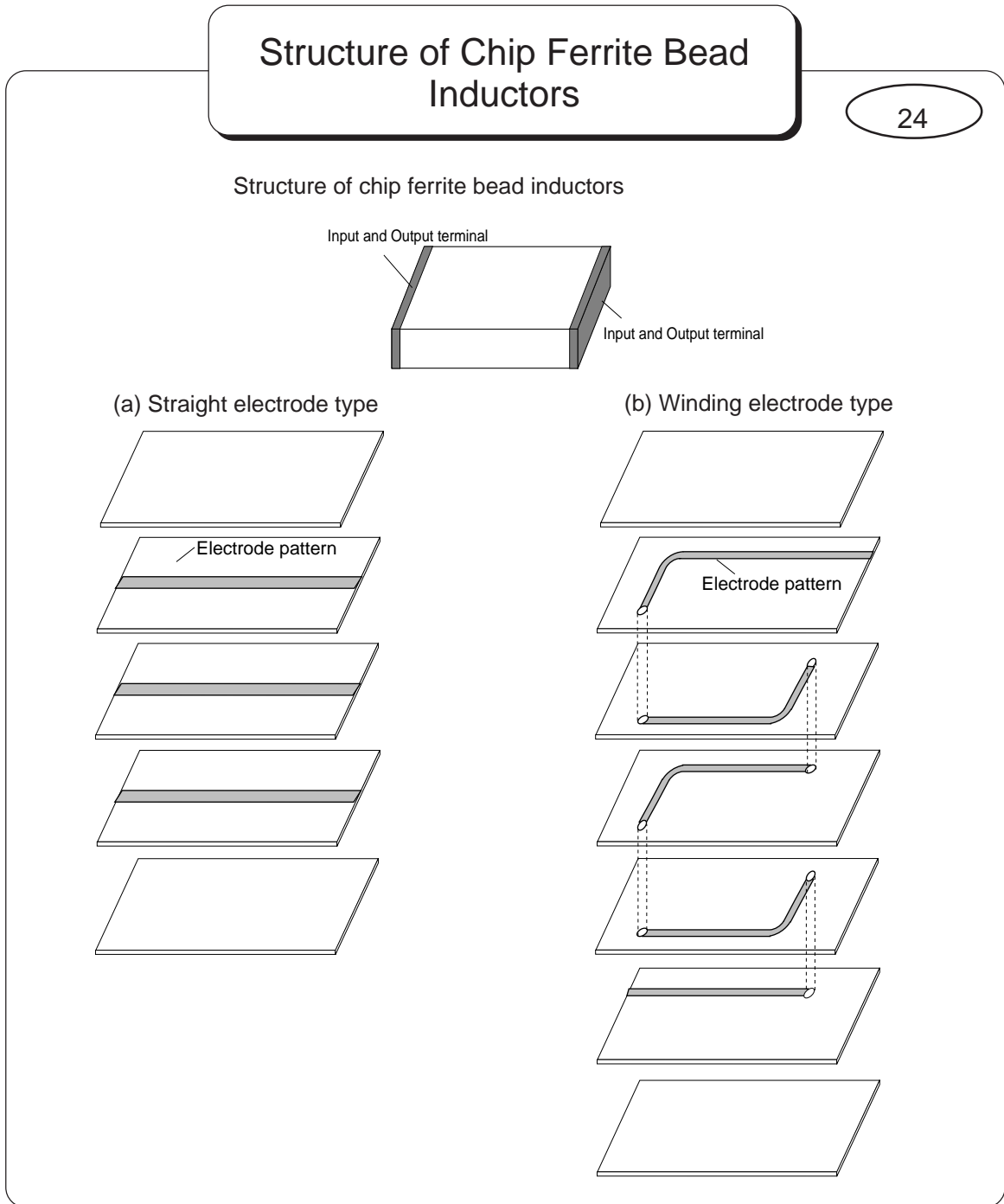
Resistance is small.
 (The loss is low, i.e. "Q" is high.)

In addition to small stray capacitance, ferrite bead inductors have another excellent feature. At high frequencies, this type of inductor works not as an inductor but as a resistor, and dissipates noise in the form of heat.

The above graphs show examples of the impedance curves exhibited by a ferrite bead inductor and coil for high-frequency filter circuits. "Z" shows the impedance and "R" shows the resistance. The "R" is high in the ferrite bead inductor.

[Notes]

3. Noise Suppression by Low-pass Filters
3.12. Structure of Chip Ferrite Bead Inductors



The above drawings show the structure of chip ferrite bead inductors. An electrode pattern, which forms a feedthrough electrode, is printed on ferrite sheets. These sheets are stacked to form a chip inductor. When larger impedance is required, the electrode pattern on each sheet is connected through the via-holes to form a winding electrode type chip inductor.

Unlike general inductors, both chip types are designed so that stray capacitance is small.

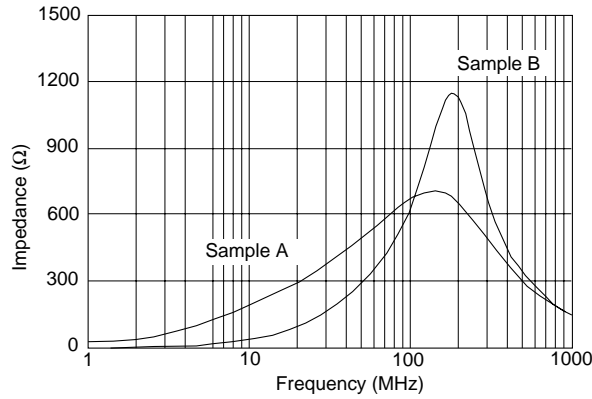
[Notes]

3. Noise Suppression by Low-pass Filters

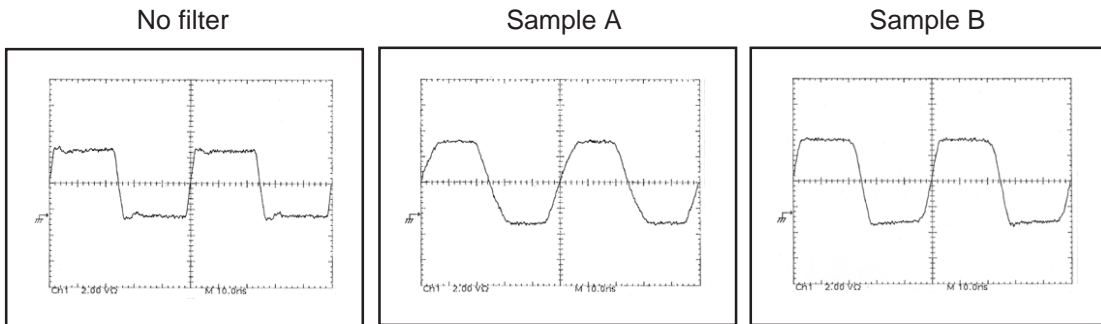
3.13. Impedance Characteristic

Impedance Characteristic

Example of different impedance characteristic



Examples of measured signal waveforms (10 MHz)



With ferrite bead inductors, the impedance characteristic varies depending on the material and structure. The signal waveform and noise suppression effect vary depending on the impedance.

With ferrite bead inductors the impedance varies depending upon the material and internal structure. The above graphs show examples of signal waveforms varying with impedance. The signal frequency is 10 MHz. When selecting a ferrite bead inductor, it is necessary to consider the impedance in the noise band and also the impedance gradient.

[Notes]