

7.1 Inductors

An inductor is an electrical/electronic component that stores energy in the form of a **magnetic field** (produced by the current through wire). It is a passive component designed to resist changes in current.

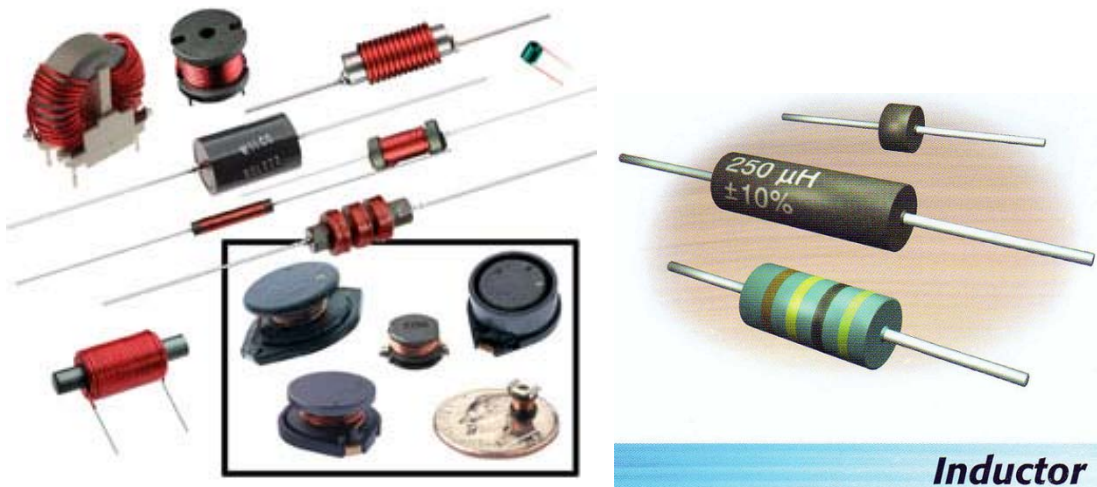
An inductor is typically made of a wire or other conductor wound into a coil, to increase the magnetic field.

Inductors are often referred to as “AC resistors”. It has the ability to resist changes in current and store energy in its magnetic field account for the bulk of the useful properties of inductors.

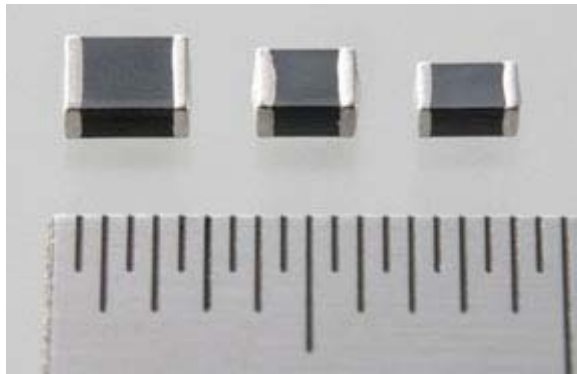
Current passing through an inductor will produce a magnetic field. A changing magnetic field induces a voltage which opposes the field-producing current. This property of impeding changes of current is known as inductance.

In its simplest form, an inductor consists of a wire loop or coil. An inductor will allow DC current to pass through and block AC.

It is difficult to fabricate inductors onto integrated circuit (IC) chips.



If you were to place any inductor value across an (multimeter) ohm range (DC circuit), you would quickly find out that the resistance of the meter will be in the range of 1 or 2 ohms.



Different Types Of Inductor

Inductors are used with capacitors in various wireless communications applications.

7.2 Measuring Unit for Inductance

The standard unit of inductance is Henry, abbreviated H.

This is a large unit.

More common units are the microHenry, abbreviated μH ($1 \mu\text{H} = 10^{-6}\text{H}$) and the milliHenry, abbreviated mH ($1 \text{ mH} = 10^{-3} \text{ H}$).

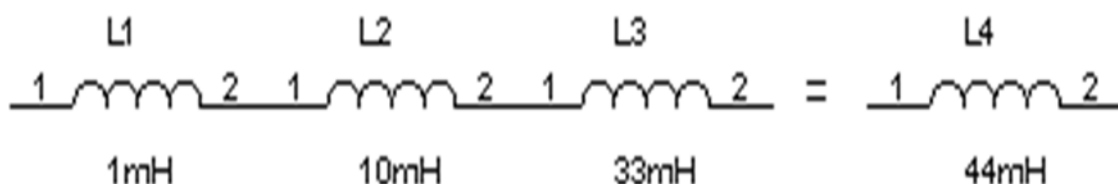
Occasionally, the nanoHenry (nH) is used ($1 \text{ nH} = 10^{-9} \text{ H}$).

7.3 Inductors in series

Inductor values add normally when connected in series, but add in reciprocal when connected in parallel, just like resistors.

For example, if three inductors of values 1mH, 10mH, and 33mH are connected in series, the total inductance would be:

$$L_4 = L_1 + L_2 + L_3 = 1\text{mH} + 10\text{mH} + 33\text{mH} = 44\text{mH}$$



Note that the total series inductance is always greater than the largest inductance.

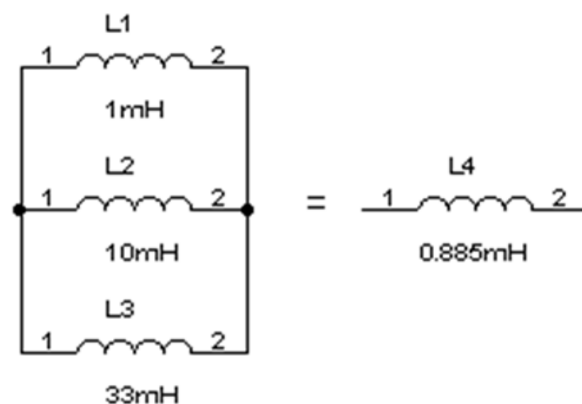
7.4 Inductors in Parallel

If the three inductors are connected in parallel, however, they add in reciprocal, as follows:

$$\begin{aligned} 1/L_4 &= 1/L_1 + 1/L_2 + 1/L_3 \\ &= 1/1 \text{ mH} + 1/10 \text{ mH} + 1/33 \text{ mH} = 330/330 + 33/330 + 10/330 \\ &= 373/330 \end{aligned}$$

$$L_4 = 330/373 = 0.885$$

Therefore, $L_4 = 0.885 \text{ mH}$ or $885 \mu\text{H}$



Note that the total parallel inductance is always less than the smallest inductance.

There is a special parallel case where all the inductors are the **same** value.

In this case, the total inductance is the common inductance value divided by the number of inductors being connected in parallel.

Example 1

If four 1mH inductors are connected in parallel,

the total inductance is equal to $1\text{mH}/4$, or $250\mu\text{H}$.

Another method of determining the value of two inductors in parallel is by using the following equation:

$$L = (L_1 \times L_2) / (L_1 + L_2)$$

Example 2

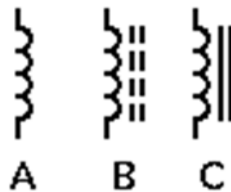
If a 22mH inductor is connected in parallel with a 33mH inductor,
the total inductance is equal to $(22\text{mH} \times 33\text{mH}) / (22\text{mH} + 33\text{mH}) = 13.2\text{mH}$.

7.5 Symbols for inductors

Symbol A is used for a basic inductor with only air anywhere in the magnetic field.

Symbol B shows an inductor with a core made of powdered iron (known as *ferrite*). This core helps to concentrate the magnetic field generated, and as such, increases the effective inductance of the coil.

Symbol C shows a laminated iron core. This kind of core concentrates the magnetic field greatly, and therefore increases the effective inductance even more than a ferrite core.



7.6 Standard Colour Chart For Inductors

**Inductor Colour Code
EIA Standard**

1st BAND		2nd BAND		MULTIPLIER		TOLERANCE
				Silver 0.01		± 5%
				Gold 0.1		± 10%
Black 0		0		1 uH		± 20%
Brown 1		1		10 uH		
Red 2		2		100 uH		
Orange 3		3		1,000 uH		
Yellow 4		4		10,000 uH		
Green 5		5				
Blue 6		6				
Purple 7		7				
Gray 8		8				
White 9		9				

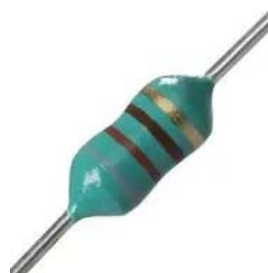
The fixed inductors are commonly identified using a colour code similar to that of resistors.

For example, a brown-black-red inductor has a value of 1000 uH.

At times, a silver or gold band is used as a decimal point.
So, the value of a red-gold-violet inductor would be 2.7 uH.



22µH Ferrite Leded Inductor



Choke 100µH