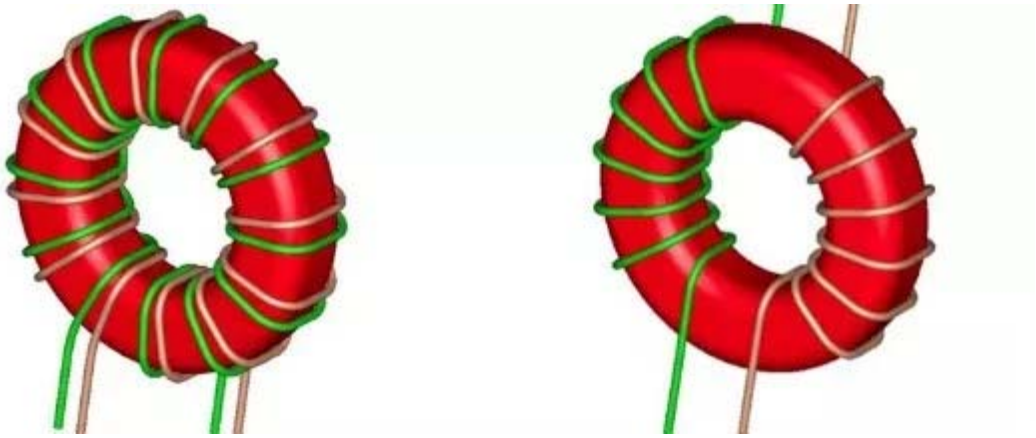
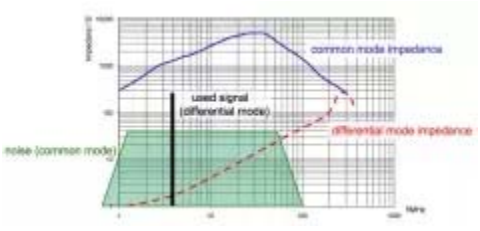


How Common Mode Chokes Work

Let us examine the function and operation of a common mode choke and the way it reduces unwanted interference.

Differential Interference

First, we examine differential interference. With differential interference, what occurs through the device is that for any signal transmission from the line side, there should be an equal return on the neutral side. Whatever is crossing from your line (or the topside) back through the neutral (bottom side), should be cross-canceling. What is happening is that you're not going to get any unwanted noise in a differential mode if there is equal signal cancellation. When these types of transmissions are not balanced and cancelling, there will be the occurrence of differential noise.



Common Mode Noise

In a common mode noise situation, there is noise coming in simultaneously from both input sides (line and neutral) and exiting simultaneously, but is also coupling back to earth ground. What you want to do is capture the unwanted noise and keep it from being transmitted and coupling back to earth ground. To do this, both the line and the neutral signal currents should be captured and burned off as heat through a common device such as a magnetic core. A common mode choke is where both line and neutral windings are wound on a single core.

When using a current compensated choke to decrease common mode noise, (the interference pattern or the unwanted noise) you want to have a high impedance at the unwanted frequencies to knock down that unwanted noise. On this particular slide, the blue line is a common mode suppression. The dashed red line on the bottom is differential mode suppression. Even though it's a common mode choke, it does have some differential mode suppression as well at various frequency levels. You see a black bar that's drawn there as well. That's a transmission frequency for example.

Consider the scenario where you are transmitting a wanted data carrier, also known as “a signal” at some frequency. Now, if there is also noise around this frequency, you want to eliminate the noise (unwanted frequencies), but not distort the signal. Usually, the noise would be common mode noise, so the solution to lower (if not eliminate) the unwanted noise frequencies is to use a common mode choke that will have a high impedance at the

unwanted frequencies only. With the proper common mode choke, this reduces the noise, but does not affect the required signal.

	current compensated or common mode choke	single choke
common mode impedance	high	low to medium
differential mode impedance	low	medium
dependency of impedance from load current	independent	depends on "core"
attenuation of used signal	low	high

Common Mode Choke vs. Single Choke

Sometimes you want common mode impedance, but very little differential mode impedance. Look at comparisons for various parts between common mode chokes. There is a considerable difference between a single choke used for differential mode suppression, and a current compensated (or common mode choke) used for common mode suppression. The main difference between the two parts is that in the common mode choke, there are two windings or multiple windings, meaning you can have a three line winding, or more. You can have four line carriers as well, but all the windings are on a common core.

On a common mode choke, the core material keeps the windings coupled together. By contrast, the single choke or single winding inductors have just the one winding on the one core. This is a chart showing the difference of common mode impedance. Obviously, a common mode choke would have common mode impedances to suppress unwanted common mode noise. For a communication or signal application, it would be beneficial to have very low differential noise suppression on the common mode choke Even though we're talking about common mode chokes, every common mode choke will also have some differential mode impedance as well. It is important that the differential suppression is not at the transmitted signal frequency, so as not to distort the signal.

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