

It should be noted that a ferrite bead can be used instead of R1, however ferrite bead impedance is not well controlled and is generally no greater than 100 Ω at 10 MHz to 100 MHz. This requires a large value capacitor to attenuate lower frequencies.

In Amp Inputs

Precision in amps are particularly sensitive to dc offset errors due to the presence of CM EMI/RFI. This is very much like the problem in op amps. And, as is true with op amps, the sensitivity to EMI/RFI is more acute with the lower power in amp devices.

A general-purpose approach to proper filtering for device level application of in amps is shown in Figure 7-112. In this circuit the in amp could, in practice, be any one of a number of devices. The relatively complex balanced RC filter preceding the in amp performs all of the high frequency filtering. The in amp would be programmed for the gain required in the application, via its gain-set resistance (not shown).

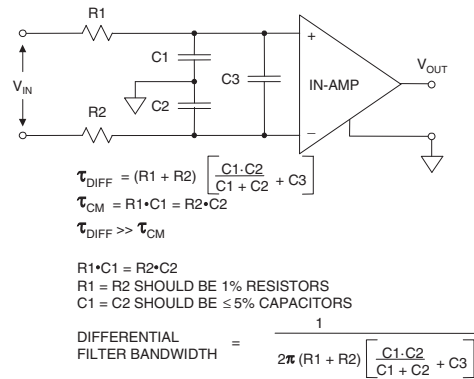


Figure 7-112: A general-purpose common-mode/differential-mode RC EMI/RFI filter for in amps

Within the filter, note that fully balanced filtering is provided for both CM (R1-C1 and R2-C2) as well as differential mode (DM) signals (R1+R2, and C3 || the series connection of C1-C2). If R1-R2 and C1-C2 aren't well matched, some of the input common-mode signal at V_{IN} will be converted to a differential mode signal at the in amp inputs. For this reason, C1 and C2 should be matched to within at least 5% of each other. Also, to aid this matching, R1 and R2 should be 1% metal film resistors. It is assumed that the source resistances seen at the V_{IN} terminals are low with respect to R1-R2, and matched. In this type of filter, C3 should be chosen much larger than C1 or C2 (C3 ≥ C1, C2), in order to suppress spurious differential signals due to CM⇒DM conversion resulting from mismatch of the R1-C1 and R2-C2 time constants.

The overall filter bandwidth should be at least 100 times the input signal bandwidth. Physically, the filter components should be symmetrically mounted on a PC board with a large area ground plane and placed close to the in amp inputs for optimum performance.

Figure 7-113 shows a family of these filters, as suited to a range of different in amps. The RC components should be tailored to the different in amp devices, as per the table. These filter components are selected for a reasonable balance of low EMI/RFI sensitivity and a low increase in noise (vis-à-vis that of the related in amp, without the filter).

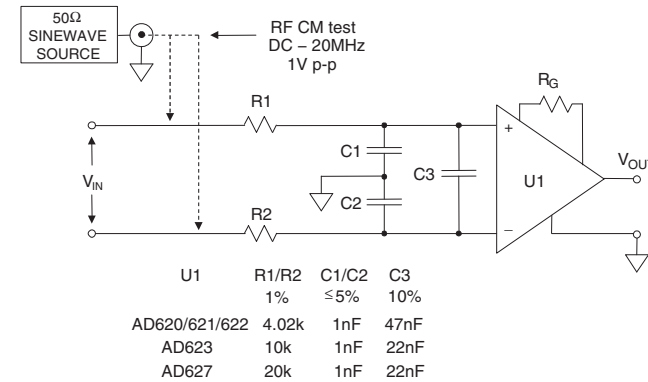


Figure 7-113: Flexible common-mode and differential-mode RC EMI/RFI filters are useful with the AD620 series, the AD623, AD627, and other in amps

To test the EMI/RFI sensitivity of the configuration, a 1 V p-p CM signal can be applied to the input resistors, as noted. With a typically used in amp such as the AD620 working at a gain of 1000, the maximum RTI input offset voltage shift observed was 1.5 μV over the 20 MHz range. In the AD620 filter example, the differential bandwidth is about 400 Hz.

Common-mode chokes offer a simple, one-component EMI/RFI protection alternative to the passive RC filters, as shown in Figure 7-114.

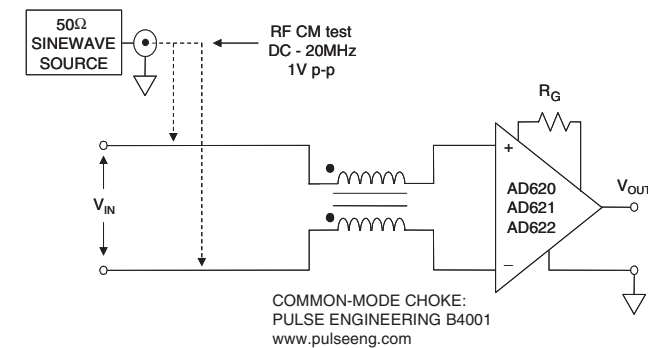


Figure 7-114: For simplicity as well as lowest noise EMI/RFI filter operation, a common-mode choke is useful with the AD620 series in amp devices