

Rarely Asked Questions

Strange stories from the call logs of Analog Devices

Transformers: They're Not All Boat Anchors

Q. What is the most undervalued analog component?

A. Probably the transformer. From college, many engineers remember transformers as the large components in power supplies which contain a lot of iron and copper and which are heavy enough to do serious damage if dropped on one's foot.

This is certainly true of the large low-frequency (50- or 60-Hz) power transformers which are sometimes disparagingly called "boat anchors" (the transformers in power stations would do catastrophic damage if dropped on a battleship), but today a wide variety of inexpensive transformers may be as small as an aspirin tablet.

Even though their input supply may be the 50-/60-Hz mains, switching power supplies work at much higher frequencies. They can use much smaller, lighter, and cheaper transformers than traditional supplies of the same power rating, so even the transformers in power supplies are lighter today. Analog Devices manufactures controllers for such switching supplies, but they are not the subject of this RAQ.

For innumerable ac analog applications, a transformer is the most appropriate component. This was widely known sixty to eighty years ago when amplifiers often used transformers for interstage coupling, and as phase splitters between single-ended and push-pull circuits. About forty or fifty years ago, however, transistors—and shortly afterwards integrated circuits—started to use dc interstage coupling, so the use of signal transformers was largely forgotten.

In many applications these dc-coupled techniques are indeed the optimum solution,



but where ac signals must cross an isolation barrier (where there may be a large potential difference between the signal circuitry in different parts of the system, for example) or where there is severe ground noise, the use of a transformer may simultaneously simplify the design and improve performance. It is normal for transformers to have absolute maximum interwinding voltage values of hundreds or even thousands of volts. In addition, the primary-secondary capacitance is rarely more than a few pF and may be even less for a screened transformer.

Where an ac signal must be sent an appreciable distance in the presence of ground noise, a transformer may well have considerably better ac common-mode rejection (CMR) than a differential amplifier; and where a differential ac amplifier is being fed with a single-ended signal, a transformer will probably be the best possible phase splitter.

And then there are current transformers for ac current measurements....



Contributing Writer
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