

R A Q ' s

Rarely Asked Questions

Strange but true stories from the call logs of Analog Devices

Should you butcher your circuit or your test gear? Capable engineers should be prepared to question, and modify, anything, not just their own designs.

Q. While probing a new high-speed amplifier board, I noticed the output had huge overshoot and was ringing like a bell. I had paid close attention to the layout, optimizing supply bypassing, grounding, parasitic reactances, and trace terminations. Where did I go wrong?

A. You've identified the common causes of ringing and overshoot (decoupling, grounding, parasitics, and terminations). Assuming careful design, there may be nothing wrong with your circuit (really!). The problem may be with testing it, and the culprit may be your oscilloscope probe.

Many high-speed amplifiers have difficulty when driving capacitive loads (which introduce a pole in the feedback response, lowering phase margin and causing instability—but that's a RAQ for another day). Probes can add about 10 pF (for a typical 10× passive probe) to the measurement node. This additional capacitance may well cause ringing and overshoot. See if a lower capacitance probe helps. Active probes typically have less capacitance than passive probes, so try using one. Or you could try a passive probe with a higher attenuation factor (100×); these also have lower capacitance.

It's more likely that the inductance of the wire to the ground clip of the probe is responsible, though. The parasitic inductance of the wire and the capacitance of the probe form a resonant (tank) circuit. Tank circuits are commonly found in... that's right... oscillators. Fast edges may have enough energy to excite the tank circuit and make it ring.

So, be brutal and amputate the wire. To do so you will need to dismantle the probe. Remove (unscrew) the plastic sleeve that surrounds the probe tip, exposing the outer metal jacket of the probe—which is its ground connection—and then remove



the ground clip lead. This leaves a stripped down probe with an exposed ground shield. Such a probe is very suitable for high-speed measurements.

To use it, simply place the tip on your test point while touching the outer metal to ground. If you can't conveniently make a direct ground connection, wrap a short length of bare wire around the probe's outer metal jacket a few times. The free end of the wire, which should be as short as possible, is touched to the closest ground point.

You will be impressed with the improvement in the measurements you can make with this modified probe. It may not be pretty, but it works like a charm.

**To learn more about
high-speed amplifiers,
Go to: <http://rbi.ims.ca/5696-122>**



Contributing Writer

John Ardizzoni is an Application Engineer at Analog Devices in the High Speed Amplifier Group. John has been with Analog Devices for 4 years, he received his BSEE from Merrimack College in 1988 and has over 27 years experience in the electronics industry.

Have a question involving a perplexing or unusual analog problem? Submit your question to:

raq@reedbusiness.com

For Analog Devices' Technical Support, call 800-AnalogD

SPONSORED BY

