

Rarely Asked Questions

Strange stories from the call logs of Analog Devices

A Capacitectomy? Sounds Awfully Painful!

Q. One of your high-speed triple amplifiers is oscillating. What's wrong with it?

A. Well there are a variety of things that could be wrong with the "circuits," but most likely there nothing intrinsically wrong with the amplifier. With many high-performance amplifiers, however, you do need to pay close attention to layout and bypassing. If ignored, you and your circuit could feel a little ill.

With wideband devices, you need to be careful and pay attention to the small details. In this case, it turned out that the oscillation experienced by the customer wasn't caused by the amplifier itself, but by poor layout.

To be specific, the problem was parasitic capacitance at the inverting input of the amplifier to ground. Capacitance at the inverting input introduces a pole in the amplifier's loop response, lowering the amplifier's phase margin and causing instability, peaking, and ringing. It doesn't take much capacitance¹ to cause an oscillation, and you can easily accumulate 2 to 3 pF of capacitance at the summing node (inverting input) if you're not paying attention to layout. I always advise customers to breadboard the circuit if possible, and to test the heck out it in the lab. A high-performance simulated design can be rendered useless if proper layout guidelines are not followed.

The solution is a capacitectomy (not really a word) — although it's quite difficult to remove parasitic capacitance after it has infiltrated your board. Therefore, in these cases, prevention is the best medicine. The capacitance is formed by the small mounting pads of the amplifier, gain setting and feedback resistor pads, board dielectric and the ground plane. We always recommend removing the ground plane from beneath the amplifier mounting pads and around



the summing node where the feedback and gain set resistor pads are located. Doing so effectively removes the bottom plate of the parasitic capacitor and therefore eliminates the capacitance. This applies equally to the output, as parasitic capacitance at the output can also cause similar problems.

As with humans, a little preventative medicine goes a long way. Paying attention to board layout issues at the onset of your design, will keep you and your circuit in tip-top shape!

Keep an eye out for our New and Improved webinar this October, "A Practical Guide to High-Speed Printed-Circuit-Board Layout."

¹ Some customers ask how much capacitance is enough to cause a circuit to oscillate. I sometimes tell them a 1000pF is enough. Confused looks abound and I explain to them that if 1pF = a puff, then a 1000pF = 1 nF, then it stands to reason 1 nF = a nuff and a nuff is enough!

**To Learn More About
Board Layout**
Go to: <http://rbi.ims.ca/5713-100>



Contributing Writer
John Ardizzoni is an Application Engineer at Analog Devices in the High Speed Linear group. John has been with Analog Devices since 2002, he received his BSEE from Merrimack College in N. Andover, MA and has over 28 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

