Rarely Asked Questions

Strange stories from the call logs of Analog Devices

Which carries more weight, a datasheet or SPICE macromodel?

(or Variety *isn't* always the SPICE of life!)

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Q. When running a SPICE (Simulation Program with Integrated Circuit Emphasis) simulation with one of your amplifier models, I get different results than those shown in the datasheet. Which should I believe?

A. This is one case where we'd rather not have any variety in our lives. In fact, what we're really after is monotony and consistency when it comes to SPICE models and datasheets. Before I answer this question, let me make a few general comments about SPICE, which uses macromodels to simulate real devices. A macromodel is a simplified circuit model that typically includes just a handful of "real" elements, but mainly consists of dependant and independent voltage and current sources. Macromodels are not full transistor level models. For many applications, SPICE simulations using macromodels will provide a good first-order approximation to real circuit performance; notice I said good, not exact. This is especially true when dealing with high-speed applications.

Most op amp macromodels only model about 50–75% of all available op amp parameters. This is due to a variety of reasons, including simulation speed, development time, and model complexity, to name a few. It's not surprising then to learn that some models fall short of the datasheet performance and may not exactly match the real world under every possible condition. Such is the limitation of macromodels.

Ok, let me step off my soap box and get back to the original question. Which information should you trust, the datasheet or the SPICE model? At Analog Devices we base our models on the measured data that is contained in the datasheet. Therefore, when questions arise regarding model performance vs. datasheet, we always advise customers to trust the information in the datasheet; it is measured, proven, and trustworthy.

The majority of our customers use some form of simulation when designing circuits; some customers will not even consider an amplifier unless it has a SPICE model. Few designers today have the time or resources to build breadboards or prototypes, but this can save time in the long run. I cannot emphasize enough how important breadboarding is, especially in high-speed applications, where the circuit board plays a major role in determining the circuit performance. If you can't breadboard, however, simulation is the next best thing. Just remember: always trust the datasheet first.

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