

# Rarely Asked Questions

Strange stories from the call logs of Analog Devices

## Beware of big claims and large numbers... they don't always add up

**Q:** Are wide bandwidth and fast slew rate the best way to benchmark an amplifier?

**A:** Not necessarily; op amps typically specify 30 or more individual parameters. The task you're trying to accomplish will dictate which of these specifications are most important to you (and your circuit). When evaluating amplifiers, or any component, it is important to make sure you understand the specifications, the test conditions, how test data is collected, and how it is presented, as different manufacturers sometimes present the same parameters in different ways. Knowing both the test conditions and your circuit needs is imperative when comparing parts.

Since you brought up bandwidth and slew rate, let's have a look at those specifications.

Some people think, "the larger the bandwidth, the better," but the savvy analog engineer knows that having just enough bandwidth is better than having hugely excessive bandwidth. The best way to evaluate any parameter is to read the data sheet and look at the plots, as they tell the real story of how the amplifier will behave. Is there excess peaking in the bandwidth plot? Some manufacturers will spin this as a larger -3-dB bandwidth, but it may also indicate that the part has stability issues. Even though the -3-dB bandwidth may appear large, the amplifier's gain flatness may be decreased because of the peaking. Therefore, address bandwidth on just how much you need, noting that wider bandwidth amplifiers require more attention to stability and PCB layout.



Slew rate (SR) is the rate of change at an amplifier output due to a sudden change at the amplifier input. It is typically measured in volts per microsecond (V/ $\mu$ s). The maximum large-signal operating frequency can be determined by using the equation  $F = SR / (2\pi V_p)$ , where  $V_p$  is the peak voltage. Some amplifiers feature very large slew rates, but they are not always needed, because the maximum operating frequency will be limited by distortion. The easiest way to check this is to look at the distortion plots for your frequency of interest. Is the distortion level acceptable for your application? Again, knowing your system requirements is paramount. Then, plug this frequency into the slew rate equation and see exactly how much slew rate is needed.

In some cases, big numbers don't add up to better performance. Know your circuit and what you need to get the job done. Add a little more for margin and look at the plots... they tell the real story.

**To Learn More About Specifying Op Amps**

<http://dn.hotims.com/40992-1000>



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