HIGH SLEW RATE TECHNIQUES

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Want to achieve the best possible slew rates in high speed amplifier circuits? Here are a few ideas on how it might be done.

The highest square wave frequency that can be reproduced faithfully, utilizing a simple unity gain noninverting circuit like the PA19 in Fig. 1., is between 1 and 2MHz with a slew rate of about 50V/μsec. This is well below the PA19's capabilities.

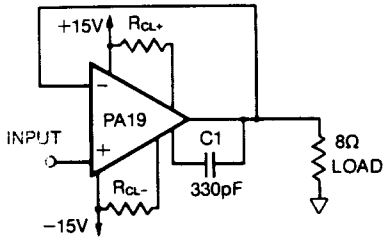


Figure 1. Simple Unity Gain Buffer.

One limitation is the frequency compensation capacitor C1 in Fig. 1. A look at the PA19 data sheet shows a 330pF capacitor for unity gain while smaller values can be used at higher gains. Increasing gain or reducing feedback would allow this capacitor to be reduced. The R-C network between the inputs and an added feedback impedance as shown in Fig. 2 would reduce feedback and comp cap requirements. The slew rate is now about 200V/μsec with a square wave capability nearly 3MHz.

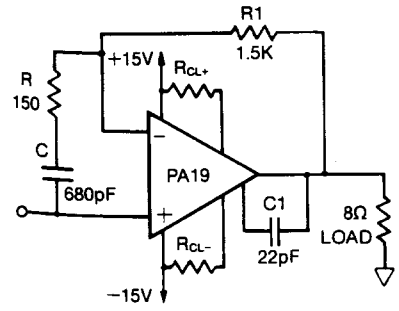


Figure 2. Fast Unity Gain Buffer.

As an alternative, look to higher gain. An input attenuator with a speedup capacitor can be used to enhance slew rates. Fig. 3 shows this in a gain of 30 circuit with a 30:1 input divider. C2 is the speedup capacitor. Less phase compensation (comp for a gain of 10 is shown) and higher supply voltages could be used for further improvement over the 4MHz square wave performance with 500V/μsec slew rate achieved.

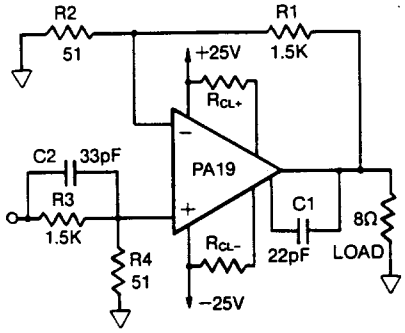
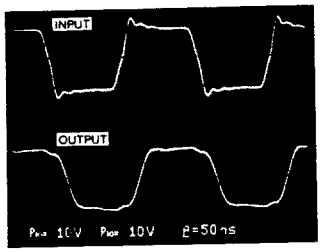


Figure 3. High Slew Rate Buffer.

PERFORMANCE . . .



This article has shown some of the general concepts required to achieve high slew rates. Keep in mind that manufacturers specify slew rates under input overdrive conditions. Not taken into account here are other measures of high speed performance such as settling time. These other parameters are not optimized in the circuits shown, and proper design is often a tradeoff between slew rate, settling, and stability.

To sum up techniques for high speed circuitry in general:

1. Maximize supply voltages.
2. Minimize impedances.

And for slew capability:

3. Minimize compensation (less feedback or more gain).
4. Input attenuator with speedup circuit.