BY BONNIE BAKER

# Voltage- and current-feedback amps are *almost* the same

Current-feedback amplifiers have a higher slew rate than do voltage-feedback amplifiers. As such, current-feedback amps can better solve high-speed problems than their voltage-feedback counterparts. The name "current-feedback amp" carries some mystique, but, generally, the application-circuit configurations for voltage- and current-feedback amps are the same, except for a few key points.

First, the feedback resistor of a current-feedback-amp circuit must stay within a small range of values. Lower value resistors reduce the current-feedback amp's stability. The feedback resistor's higher values reduce the current-feedback amp's bandwidth. You can find the prescribed feedback-resistor value in the current-feedback amp's product data sheet. The voltage-feedback-amp's feedback-resistance value is more forgiving. This amplifier's drive capability limits the resistor's minimum value, and the overall circuit noise limits the maximum value.

**Figure 1** shows a circuit that is appropriate for either a current- or a voltage-feedback amp. If the feedback resistance, $R_F$, equals $2R_{IN}$, where $R_{IN}$ is the input resistance, the closed-loop gain of each channel is −2V/V. At first glance, it is easy to assume that the closed-loop bandwidth equals the gain-bandwidth product divided by each channel's gain, or |−2V/V|. Don't make this assumption!

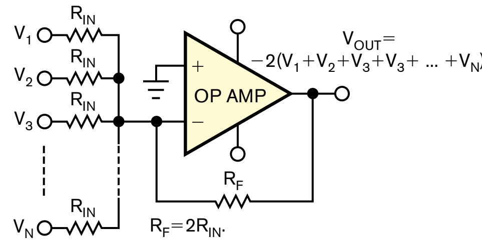
If you use a voltage- or current-feedback amp with the circuit in **Figure 1**, the noise gain is:

$$1+\frac{R_F}{R_{IN}/N}, \qquad (1)$$

**If you add channels to the circuit, a small variation in the signal bandwidth and gain peaking in the circuit may occur.**

where N is the number of input channels. This circuit's bandwidth, with a voltage-feedback amp, equals the gain-bandwidth product divided by the noise gain. For instance, if you have a voltage-feedback amp with a gain-bandwidth product of 180 MHz and there are three input channels (N=3) at a gain of −2V/V, the circuit's closed-loop bandwidth is 25.7 MHz. Additional channels reduce the closed-loop bandwidth, even though the input signals continue to see a gain of −2V/V.

If you use a current-feedback amp with the circuit in **Figure 1**, the amplifier's closed-loop bandwidth depends less on the closed-loop gain and the number of input channels. If you design this circuit with such an amp, you would first pick the optimum feedback resistor, per the manufacturer's specification and the circuit's noise gain. You would then select the appropriate value for $R_{IN}$. From this point, if you add channels to the circuit, a small variation in the signal bandwidth and gain peaking in circuit may occur. If that scenario is a concern, go back and refine your feedback-resistor selection. For both current- and voltage-feedback amps, the noise gain always equals the result of **Equation 1**, but you can reduce the feedback-resistor value with the current-feedback-amp circuit and get an *increase* in circuit bandwidth. EDN




NOTE: ASSUME A SOURCE RESISTANCE OF 0Ω.

Figure 1 If you vary the number of channels in this circuit, the current-feedback amp will help keep the closed-loop bandwidth constant.

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