WIDE-BANDWIDTH FAST-SETTLING OPERATIONAL AMPLIFIER

AD9610 Slews at 3.5 V/ns, Settles to 0.1% in 18 ns, Has < 50 dB Distortion @20 MHz

Transimpedance Amplifier Bandwidth Has Little Sensitivity to Closed-Loop Gain

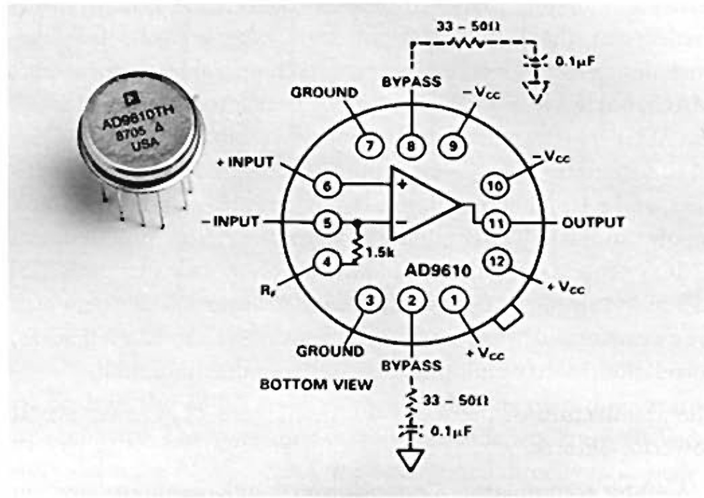
The AD9610* is a wideband dc-coupled operational amplifier housed in a 12-pin TO-8-style hermetic can. It combines exceptional dynamic performance with superior dc specifications at reasonable cost, employing thin-film hybrid technology and innovative design techniques. (Prices start at $49.88 in 100s.)

With its ±50-mA continuous output rating and ability to swing ±9 V with a 200-ohm load (±15-volt supplies), 0.1%-settling time of 29 ns max (−55°C to +125°C, gain of 10, 5-volt output step), slewing rate of 2.4 V/ns min over temperature, and maximum total harmonic distortion below −50 dB at 20 MHz, it is useful for such buffer tasks as driving high-speed a/d converters and unloading high-speed DACs, as well as for pulse-generator outputs and imaging and display drivers. In addition, its ability to maintain bandwidth independently of gain makes it useful in providing wideband gains for photodiode preamps—and radar and intermediate-frequency processors.

Another valuable feature is the character of its recovery from overdrive upsets; this is of special importance in non-ideal circuit environments. After the overdriven condition is relieved, the AD9610 comes out of its saturated shutdown mode without damage or performance degradation.

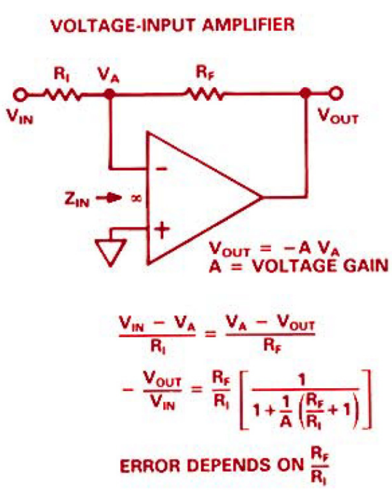
TRANSIMPEDANCE OP AMP

An unusual aspect of the AD9610 is its use of transimpedance (i.e., current-input-to-voltage-output), instead of voltage-to-voltage gain, in the feedback path. Figure 1 illustrates the basic difference between the two approaches and the results—with "ideal" amplifiers—in the inverting case. The voltage amplifier ideally has high input impedance and gain, A; the error arising from its limited open-loop gain is a direct function of R_F/R_I, which also determines its closed-loop gain (the principle is little different for noninver-



ters, just ground V_{IN} and picture a voltage source in series with the + input; closed-loop gain is $1 + R_F/R_I$). The dc value of A is usually so large that it is not often critical in dc amplification, but the usual 6dB/octave reduction of gain with increased bandwidth results in a tendency towards constant gain-bandwidth; e.g., the −3-dB frequency for gain of +50 is about 1/50 of that for unity gain.

In the second case, Z_{IN} is of the order of ohms (ideally zero), and the output is the product of input current, I, and transimpedance, r_T (of the order of 1 megohm). The ideal closed-loop inverting transfer function is the same (R_F/R_I), but now the gain error depends only on R_F (i.e., if R_F is held fixed and gain is varied by changing R_I only, there is no change in gain error for changes in the ratio, R_F/R_I, even at frequencies for which r_T has decreased). Consequently, the −3-dB frequency for gain of 50 V/V in the actual AD9610, 60 MHz, is better than one-half of the 100 MHz bandwidth for a gain of 1. ◻



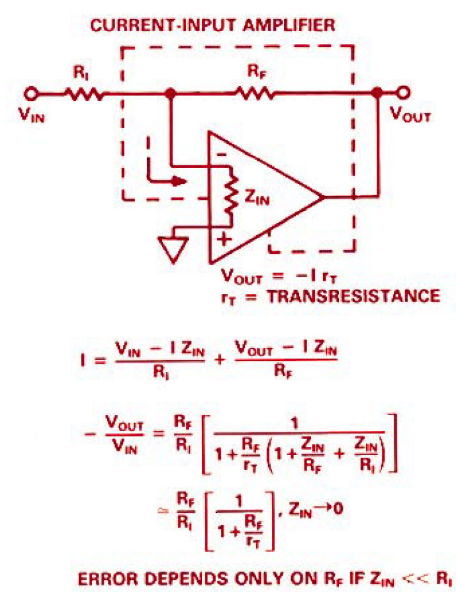


Figure 1. Why current-input amplifier closed-loop gain error tends to be insensitive to the gain ratio (and has less variation of bandwidth with closed-loop gain).

*For complete information on the AD9610—8-page data sheet and 14-page application note—use the reply card.