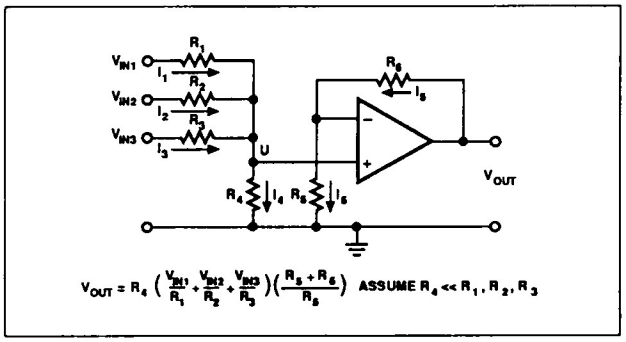


**FIGURE 5:** *Noninverting Adder*

## CURRENT FEEDBACK AUDIO POWER AMPLIFIER

The SSM-2131 can be used as the input buffer in a current feedback audio power amplifier as shown in Figure 6. This design is capable of very good performance as shown in Figures 7, 8 and 9. At 1kHz and 50 watts output into an 8Ω load, the amplifier generates just 0.002% THD, and is flat to 1MHz. The slew rate for the overall amplifier is more than adequate at 300V/µs and is responsible for the very low dynamic intermodulation distortion (DIM-100) that was measured at just 0.0017% at 50 watts output into 8 ohms. The total amplifier idling current for all tests was approximately 300mA; the V+/V++ and V−/V— power supplies were both ±40V; and the gain was set to 24.0.

In a current feedback amplifier, a unity or low gain input buffer drives a low impedance network. Any differential current that flows in the collectors of the buffer (SSM-2131) output transistors is fed, via the two complementary Wilson current mirrors A and B, to a high impedance gain node where the high output voltage is generated.

This voltage is then buffered by a double emitter follower driver stage and fed to the complementary power MOSFET output stage. No RC compensation network to ground or output inductor is required at the output of this amplifier to make it stable. As the 100kHz square wave response shows, there's no evidence of any instability in the circuit. Capacitive load compensation can be provided by the components marked TBD on the amplifier schematic. These were not used in the test, however.

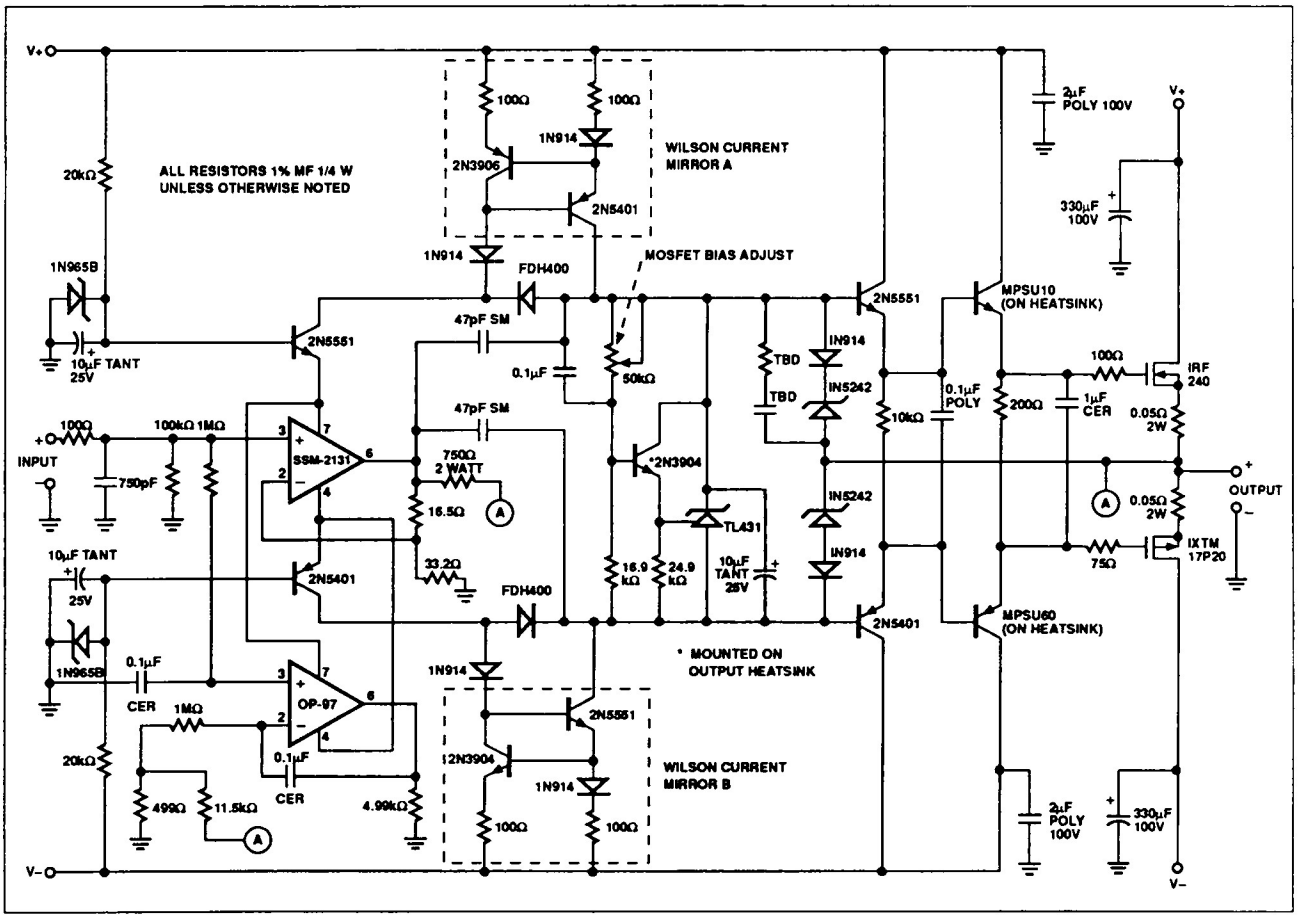


**FIGURE 6:** *Audio Power Amplifier Schematic*

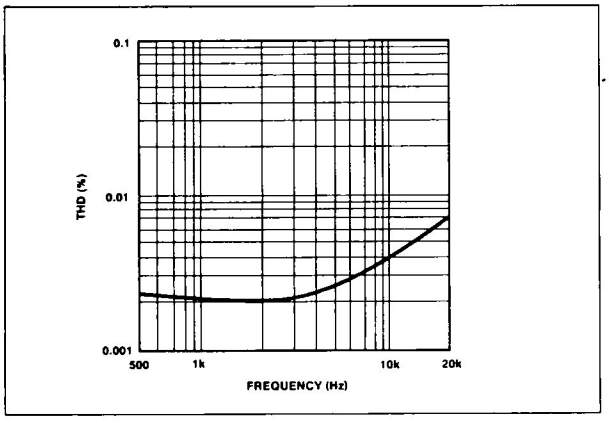


**FIGURE 7:** *THD vs. Frequency (at 50W into 8Ω)*

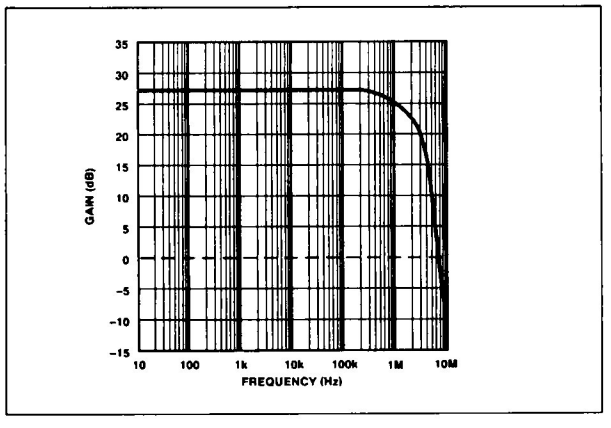


**FIGURE 8:** *Frequency Response*

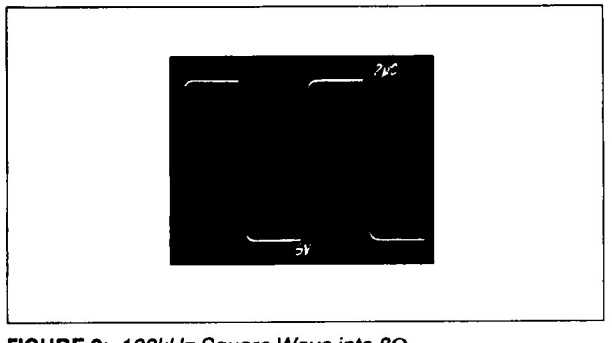

**FIGURE 9:** *100kHz Square Wave into 8Ω*

One problem that is commonly encountered with current feedback amplifiers is that the mismatch between the two current mirrors A and B forces a small bias current to appear at the input buffer's output terminal. This bias current (usually in the range of 1-100μA) is multiplied by the feedback resistor of 750Ω and generates an output offset that could be tens of millivolts in magnitude. Matched transistors could be used in the current mirrors, but these do not completely eliminate the output offset problem.

An inexpensive solution is to use a low power precision DC op amp, such as the OP-97, to control the amplifier's DC characteristics, thus overriding the DC offset due to mismatch in the current feedback loop. The OP-97 acts as a current output DC-servo amplifier that injects a compensating current into the emitters of the low voltage regulator transistors (that power the SSM-2131) to correct for current mirror mismatch. Since the OP-97 is set for an overall input-to-output gain of 24.0 as well, the DC output offset is equal to the OP-97's $V_{OS}$ x 24.0, which is roughly 1 millivolt. Thus, any offset trimming can be completely eliminated. Together, the SSM-2131 and OP-97 provide a level of performance that exceeds most of the requirements for audio power amplifers. The driver circuit can handle several pairs of power MOSFETs in the output stage if required. This topology can be used in circuits that must deliver several hundreds of watts to a load by using higher voltage transistors in the driver stage. Operation with rail voltages in excess of ±100V is possible. If more gain is desired, the SSM-2131 input buffer can have its gain increased from the nominal value of 1.5 used in this example to as much as 10 before its bandwidth drops below that of the current feedback section.

### DRIVING A HIGH-SPEED ADC

The SSM-2131's open-loop output resistance is approximately 50Ω. When feedback is applied around the amplifier, output resistance decreases in proportion to closed-loop gain divided by open-loop gain ($A_{VCL}/A_{VOL}$). Output impedance increases as open-loop gain rolls-off with frequency. High-speed analog-to-digital converters require low source impedances at high frequency. Output impedance at 1MHz is typically 5Ω for an SSM-2131 operating at unity-gain. If lower output impedances are required, an output buffer may be placed at the output of the SSM-2131.