design ideas

Edited by Bill Travis and Anne Watson Swager

Keep the heat down in power op amps

Vijay Damle, Digitronics, Pune, India

WHEN YOU INCLUDE a power op amp, such as PA05 from Apex Microtechnology, in your design, it is desirable to minimize the supply-to-output differential to a minimum to reduce power dissipation and to fully exploit the amplifier's output range. Our goal was to design a power amplifier to yield 70V p-p output at 10A with a fixed gain of 10 and a frequency of 30 Hz to 100 kHz. To obtain ±35V swing entailed dc supplies of approximately ±38V and two ±5V supplementary supplies. To derive the full 10A at lower voltage, you must reduce the supply voltage in proportion to the output voltage to decrease dissipation. In this case, the gain is fixed at 10. So, you can control the dc voltage proportional to the input voltage (**Figure 1**). SMPS1 and SMPS2 are identical voltage-programmed supplies (except for the ±5V supplementary supplies). The precision rectifier generates dc output proportional to the ac-input amplitude. To obtain approximately ±6V when no input signal is present, the circuit adds offset voltage to the signal.

As the input increases, the SMPS output increases from 6 to 38V for a 7V p-p ac input. To control the negative-side SMPS, you must transfer information from SMPS1 to SMPS2. The circuit in **Figure 2**, which generates current proportional to the input voltage, effects the transfer. Thus, SMPS2 generates an equal-value but opposite-polarity voltage to that of SMPS1. If you need higher output current, you may need to increase the voltage headroom, depending on the power amplifier you choose. Otherwise, you may experience output clipping. Note that for fast-changing input signals, the output may clip for a short time until the power-supply voltage rises. This phenomenon depends on the precision rectifier and the power supplies' response time.
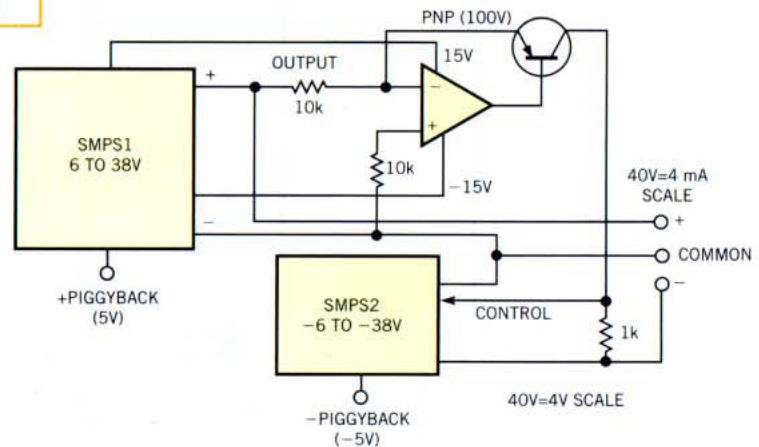
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Figure 1
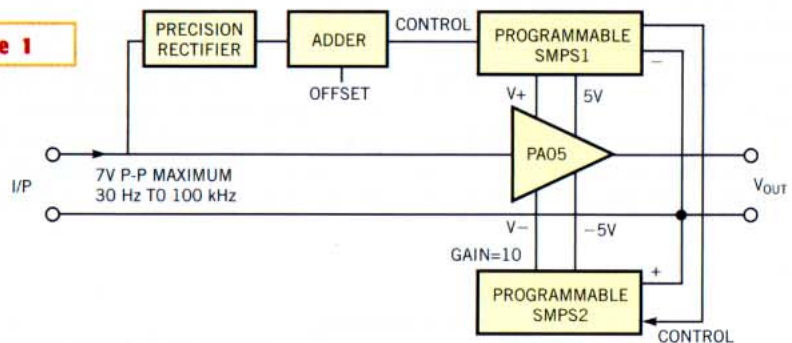
Power supplies track the input signal in bootstrap fashion, thus reducing power dissipation.

Figure 2

The switch-mode power supplies track each other with opposite-polarity outputs.