Get More Power Out of Dual or Quad Op-Amps

National Semiconductor
Linear Brief 44
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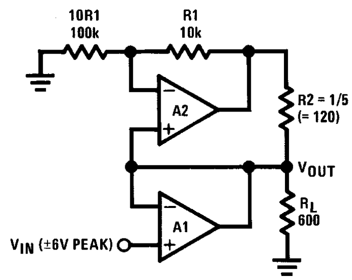
April 1979

Although simple brute-force paralleling of op-amps is a bad scheme for driving heavy loads, here is a good scheme for dual op-amps. It is fairly efficient, and will not overheat if the load is disconnected. It is *not* useful for driving active loads or nonlinear loads, however.

In *Figure 1*, an LF353N mini-DIP can drive a 600Ω load to ±9V typical (±6V min guaranteed) and will have only a 47°C temperature rise above free air. If the load R is removed, the chip temperature will rise to +50°C above free air. Note that A2's task is to drive half of the load. A1 could



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A1, A2 = 1/2 LM747 or 1/2 LF353 or any op-amp.

FIGURE 1. A1 and A2 Share the Load

be applied as a unity-gain follower *or* inverter, or as a high-gain or low-gain amplifier, integrator, etc.

While *Figure 1* is suitable for sharing a load between 2 amplifiers, it is not suitable for 4 or more amplifiers, because the circuit would tend to go out of control and overheat if the load is disconnected.

Instead, *Figure 2* is generally recommended, as it is capable of driving large output currents into resistive, reactive, nonlinear, passive, or active loads. It is easily expandable to use as many as 2 or 4 or 8 or 20 or more op-amps, for driving heavier loads.

It operates, of course, on the principle that every op-amp has to put out the same current as A1, whether that current is plus, minus, or zero. Thus if the load is removed, all amplifiers will be unloaded together. A quad op-amp can drive 600Ω to ±11 or 12 volts. Two quads can put out ±40 mA, but they get only a little warm. A series R-C damper of 15Ω in series with 0.047 μF is useful to prevent oscillations (although LM324's do not seem to need any R-C damper).

Of course, there is no requirement for the main amplifier to run only as a unity-gain amplifier. In the example shown in *Figure 3*, A1 amplifies a signal with a gain of +10. A2 helps it drive the load. Then A3 operates as a unity-gain inverter to provide V2 = −V1, and A4 helps it drive the load. This circuit can drive a floating 2000Ω load to ±20V, accurately, using a slow LM324 or a quick LF347.

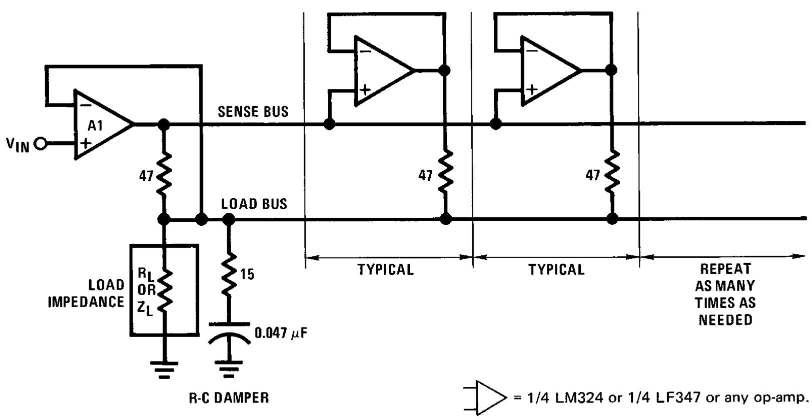

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FIGURE 2. Improved Load-Sharing Circuit

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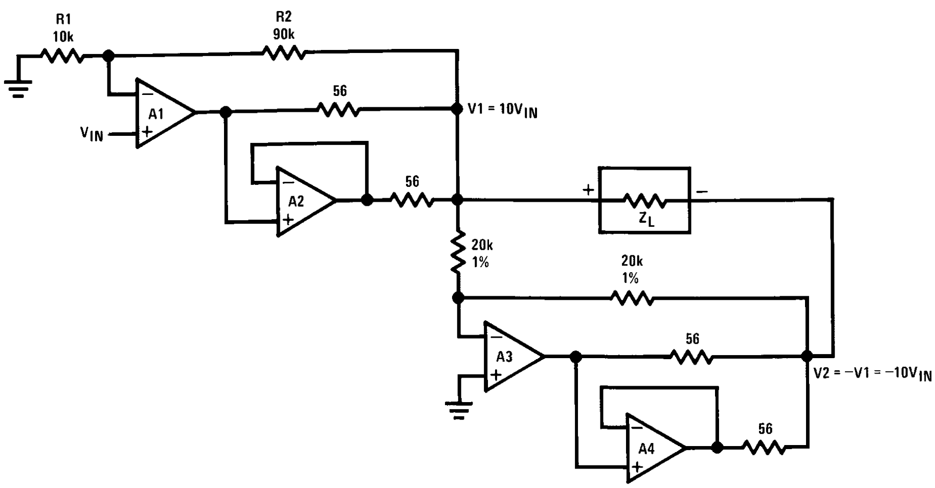

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FIGURE 3. Typical Application of Load-Sharing

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