

DESIGN SHOWCASE

Low-power circuit reduces V_{CC} audio ripple by 40dB

The **Figure 1** circuit reduces noise and ripple voltage by 40dB over the 100Hz to 20kHz audio range. It provides a clean source of 5V power for driving audio circuits in portable applications such as cellular phones and multimedia notebook computers. Most linear regulators reject noise only up to 1000Hz or so, and the bulk of a low-frequency passive filter is unwelcome in portable applications.

The circuit shown accepts noisy V_{CC} in the range 4.5V to 6V, and produces quiet V_{CC} at a dc level 7% lower. For example, it produces 4.65V at 1A from a nominal 5V source, with only 200 μ A of quiescent current. The physical layout is very small: one SOT23 transistor, one μ MAX (shrink SO-8) op amp, and a few passive components. The largest capacitor is 10 μ F, and the resistors can be 0.1W or surface-mount 0805 size.

When operating, the circuit acts as a wide-bandwidth buffered voltage follower (not a regulator) whose dc

output level is 7% below that of V_{IN} . R1 and R3 form a voltage divider that provides the 7% attenuation, and C4 helps to form a 93% filtered replica of V_{IN} at the op amp's inverting input. The op amp's small input bias current (25nA typical) allows large resistor values for R1 and R3, yet limits the maximum dc error to only 20mV. The result is a lowpass filter with 2Hz corner frequency that provides 20dB of attenuation at 20Hz.

Because the op amp's common-mode input range extends from rail to rail, its noninverting input can sample the output voltage directly. The op amp's supply voltage is filtered by R2 and C5, providing lower output impedance and better power-supply rejection for the op amp at high frequencies. This filter's 300Hz rolloff augments the op amp's PSRR (already impressive at 110dB).

A related idea appeared in the 1/18/96 issue of EDN.

(Circle 3)

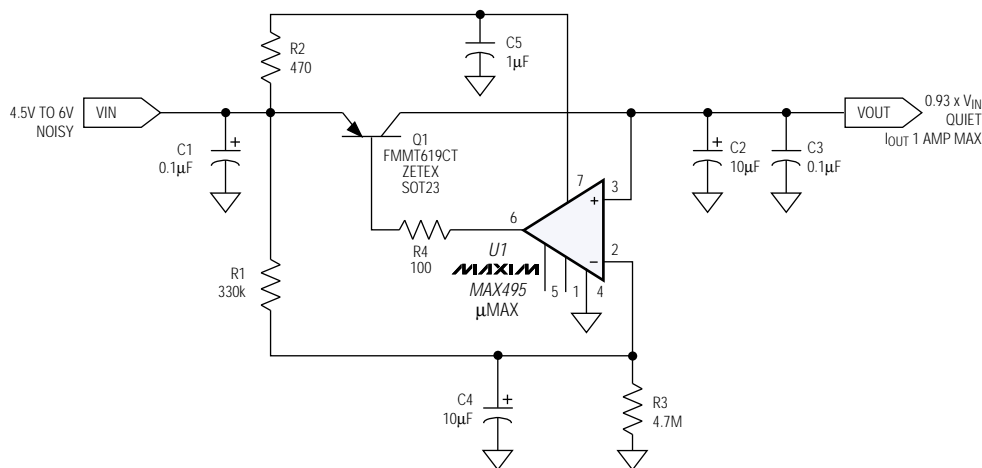


Figure 1. This compact circuit actively compensates for power-supply ripple and noise, providing 40dB of attenuation in the 100Hz to 20kHz audio band.