Signal generator output booster using an LM1877

Like the Precision Audio Signal Amplifier project (October 2019; siliconchip.com.au/Article/12025), this circuit is designed to boost the output from an audio signal generator. This booster has two channels and can supply significantly more current. However, it doesn't have as much precision or bandwidth, nor can it deliver the same amplitude.

As it is a two-channel unit, it's suitable for connecting to the headphone output of a computer, tablet or smartphone to turn it into a more capable signal generator (with appropriate software).

It's based on a single LM1877 chip, which is a 2W/channel audio amplifier in a 14-pin DIL package. It can drive loads from 8Ω and up, running from a 9-26V supply. When powered with a 24V DC regulated supply, it has an output signal swing of 18V peak-to-peak, which equates to 6.36V RMS.

The amplifier channels are configured with a gain of 10, which results in a full-scale input sensitivity of 636mV RMS (just under the 775mV RMS which is typical for a 'line level' signal), and a bandwidth of around 65kHz.

The two signals are applied to CON1 and CON2. Potentiometers VR1 and VR2 provide independent gain controls for each channel, and set the device's input impedance to 1kΩ. The signals then go to SPDT switches S1 & S2, which allow the unit to be configured in a few different ways.

With S1 in the up position and S2 in the down position, the signals are fed to amplifiers IC2a & IC2b, which each provide 10 times voltage gain. Their output signals are AC-coupled to output connectors CON3 and CON4 via 1000µF electrolytic capacitors, to remove the DC bias inherent in a single-supply amplifier.

Alternatively, if both switches are in the lower position, the signal from input 2 is fed to output 2, while output 1 receives an inverted version of that same signal. Inversion is accomplished by op amp IC1.

The two 300kΩ resistors connected to its inverting input set the gain to -1 while the non-inverting input is connected to a half-supply rail that's internally generated by IC2 and stabilised by a 100µF capacitor.

The 150kΩ series resistor is used so that the impedances seen by both inputs of IC1 are equal. The half supply rail from pin 1 of IC2 is also used to DC bias the signals fed into IC2a and IC2b.

The third configuration is with both S1 and S2 up, in which case the signal from input 1 is fed to both outputs.

The gain for both IC2a and IC2b is set to 10 by the ratio of the 18kΩ and 2kΩ feedback resistors. This is the minimum gain required for stability.

Each amplifier also needs a Zobel network for stability, consisting of a series resistor and capacitor from each output to ground. The 100µF capacitors at the bottom of the feedback dividers are necessary due to the half-supply DC bias at the inputs.

Diodes D1-D4 protect IC2a and IC2b from back-EMF spikes from inductive loads and also from accidental output shorts or externally applied voltages. Diode D5 provides reverse supply polarity protection, as it will conduct and blow fuse F1 if a negative supply voltage is applied. LED1 provides power-on indication.

If designing a PCB for this project, it's a good idea to connect large copper pours to the pins of IC2 (especially the six ground pins) for heatsinking. You can also glue or clamp a small finned heatsink on top of the IC package.

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