

The references for the two common-base regulator transistors (Q_1 and Q_2), which provide stable supply voltages for the op amps, are actually two pairs of standard NPN bipolar transistors (2N3904s) used as Zener diodes ($Q_{1,4}$ through $Q_{1,7}$). They are connected in series (with their collector leads clipped off) to obtain a net breakdown voltage of around 15 V for the pair. There really is a good reason for using such an arrangement since it would obviously be easier to use a 15 V "Zener" diode, as opposed to this seemingly more complicated approach. In reality, the connection of two bipolar transistors in this manner exhibits significantly less low frequency noise than the 15 V "avalanche" diodes, as they are more appropriately called, and is actually more cost effective. The composite Zeners are bypassed with 10 μ F 25 V tantalum capacitors, used mainly for reasons of economy and size, which filter out residual noise from the diodes as well as the power supply rails. Two resistors marked R_{BIAS} on the circuit diagram (R_1 and R_2), which are connected to each supply, serve to bias Zener connected transistors $Q_{1,4}$ through $Q_{1,7}$ and should be chosen such that with nominal power supply operating voltages (anywhere from 50 to 70 volts) about 1 mA of current will flow through them.