Low Dropout Regulator (PNP Regulator)

The power transistor (Qp) is a single PNP transistor.

The dropout voltage can be as low as the PNP saturation voltage. A single PNP has lower beta compared to an NPN darlington.

Ground pin current == load current / PNP_beta

Good PNP beta for this would be >100.

Gain is about 90 up to 10Hz, -40db/Dec to the load pole, -40db/Dec up to the ESR zero, then -20db/Dec to unity gain.

Unity gain crossover is about 30Hz.

PNP drive the output off the collector (common-emitter configuration).

This has a high output impedance and the loop gain has a load pole in it.

freq_loadpole = 1 / (2 * PI * R_load * Cout)

Use Ohm's Law to determine R_load.

Rz1 balances voltage for Cr1+Cr2+Cr3+Cr4 and cannot be removed.

R1+R2 need to be >=1w rated. R1+R2 can be up to 100ohm if full current output isn't used.

R1 balances voltage for C1+Q2+Cr3+Cr4 and cannot be removed.

Q1 is used to fine tune the voltage setting.

Expected Vout full load variation is 0.1v. +/-20% Vin to Vout variation is expected 0.2v.

Each phantom power channel (differential inputs) is fed through a pair of 6810 ohm resistors.

Parallel multiple metal film (or better) resistors for higher wattage and less noise.

Get the ohm meter and try to match the pair as close as possible. A 10uF capacitor or higher goes before the resistors to stabilize the power. Each signal input channel gets a 22uF DC block capacitor, 100hm resistor, and a pair of back to back 10vW zeners to protect it.

Higher value film type capacitors are preferred since the average mic has a 1x ohm resistance and will form an RC filter. Paralleling and adding a ceramic would also be good.

Other Modifications [Variable Voltage] The zener could be replaced by a regular diode (1n4001, or maybe 2x in series for more voltage drop?) and turned around. C2 should be increased to 100uF or more. R1 should have 1k protection on each side of it. [Current Overload Protection] Adding another signal level transistor (Qlim) and small resistor (Rlim) can limit current to about 1.5A regardless of voltage. Insert the Rlim resistor of 0.47ohm/2watt immediately after Q1’s emitter in series with Vout (a small resistor won't really effect Vout much). Qlim’s base connects between Q1’s emitter and Rlim. Qlim’s emitter connects after Rlim. Qlim’s collector connects to Q2’s base. (Capacitor Filtering Upgrades) If space isn’t an issue, split the capacitors, parallel them, and add a 100uF ceramics to improve high frequency response and lower ESR (but only parallel C1). Cr+ and Cout can safely have their capacitance increased if needed. Between the AC Voltage Doubler and the Voltage Regulator, more capacitors could be added straight from hot to hot ground. If a lot more capacitance is added, increase the VA rating on the transformer and current rating on the diodes so they can keep up (and maybe heat sinks and transistor current). Dr1+Dr2 could have 220uF capacitors added to each in parallel to reduce diode switching noise.