



Description

A 12 Volt high current 20 Amp power supply. The output voltage is variable from 12.2 Volt to 14.4V so can be set for any device requiring voltage and current in that range. This PSU uses an LM723 as the regulator, 4 parallel connected outboard pass transistors and has current limiting above 25 amps.



<u>Notes</u>

The input transformer T1 has a primary rating of 240V for the Uk domestic supply. For North America the primary needs to be rated at 120V. The secondary must be cable of supplying 20V AC RMS at 25 Amp. F1 is the input fuse and must be a slow blow type rated at 4 amp. The supply is rectified by BR1, a 35 Amp bridge rectifier type MB356. C1 and C2 are the smoothing capacitors and the unregulated DC voltage will now be about 26V with no load.¹

The bulk of the work is performed by an LM723 regulator. The preset RV1 sets the output voltage, R1 and R3 setting upper and lower voltage limits. The error signal at pin 10 feeds a darlington combination made with Q1 to Q5. The BD131 boosts current from the regulator at pin 10 and

sources base current to the parallel connected 2N3055 power transistors, Q2 to Q5. Each transistor supplies up to 5 Amps of current into the load. As device parameters vary, in particular, forward current gain h_{FE} of a power transistor, R3 to R6 aid current sharing.

With RV1 at about 10% output voltage is about 12.3 Volts. The regulation is excellent, the graph below simulates a varying load resistance of 0.5Ω to 1Ω measured across the output (Vs) in the circuit diagram. The output voltage is solid at 12.3 Volt, even at 20 Amp. Only when the load increases to 21 Amp does the output start to drop by 50mV.



Current regulation is also built into the circuit. R7 to R10 are a parallel combination of 0.1 ohm 5 watt power resistors. The effective resistor value is 0.025 ohm and is connected back to current sense pins 2 and 3 of the LM723. Once the voltage across pins 2 and 3 reaches 0.6 Volt the IC will go into current limit, limiting output current. This starts to happen at 23 Amp, increase in load current now further the current limiting of the LM723. Load regulation at 14.4 V is shown below.



With progressively higher currents the output will be reduced further, but this design is for 20 Amps not higher. C5 and C4 are for high frequency decoupling, D7 is to prevent high voltage back EMF from damaging the IC and semiconductors. LED1 shows the supply is healthy, LED2 shows that the

regulated output is working.

Simulation Model

I have made a simulation model in LTspice². The simulation circuit does not include the transformer or bridge rectifier and the circuit is shown below.



The file <u>12v20a.zip</u> contains the circuit, symbols for LM723 and potentiometer, subcircuits for the LM723 and potentiometer model and spice data for the semiconductors. Once downloaded to your desktop or home folder and unzipped, it should work without problems. You can also measure individual device currents and voltages or modify the circuit.

¹Power Supply Design

²LTspice simulator section



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