

Build A 10 Amp 13.8 Volt Power Supply

By N1HFX

Sometimes amateurs like to home-brew their power supplies instead of purchasing one off the shelf at any of the major ham radio retail dealers. The advantage to rolling your own power supply is that it teaches us how they work and makes it easier to troubleshoot and repair other power supply units in the shack. It should be noted that there is no real cost advantage to building your own power supply unless you can get a large power transformer and heat sink for a super low price. Of course rolling our own gives us the ability to customize the circuit and make it even more reliable than commercial units. The circuit in Figure 1 will give us 10 amps (12 amps surge) with performance that equals or exceeds any commercial unit. The circuit even has a current limiting feature which is a more reliable system than most commercial units have.

Just like other commercial units, this circuit uses the LM723 IC which gives us excellent voltage regulation. The circuit uses 3 pass transistors which must be heat sinked. Resistor R9 allows the fine tuning of the voltage to exactly 13.8 volts and the resistor network formed by resistors R4 through R7 controls the current limiting. The LM723 limits the current when the voltage drop across R5 approaches .7 volts. To reduce costs, most commercial units rely on the HFE of the pass transistors to determine the current limiting. The fault in that system is that the HFE of the pass transistors actually increases when the transistors heat up and risks a thermal runaway condition causing a possible failure of the pass transistors. Because this circuit samples the collector current of the pass transistors, thermal runaway is not a problem in this circuit making it a much more reliable power supply.

The only adjustment required is setting R9 to the desired output voltage of anywhere between 10 and 14 volts. You may use a front panel mounted 1K potentiometer for this purpose if desired. Resistor R1 only enhances temperature stability and can be eliminated if desired by connecting pins 5 and 6 of IC-1 together. Although it really isn't needed due to the type of current limiting circuit used, over voltage protection can be added to the circuit by connecting the circuit of Figure 2 to Vout. The only way over voltage could occur is if transistors Q2 or Q3 were to fail with a collector to emitter short. Although collector to emitter shorts do happen, it is more much more likely that the transistors will open up when they fail. I actually tested this and purposely destroyed several 2N3055's by shorting the emitters to ground. In all cases the transistors opened up and no collector to emitter short occurred in any transistor. In any event, the optional circuit in Figure 2 will give you that extra peace of mind when a very expensive radio is used with the power supply.

The circuit in Figure 2 senses when the voltage exceeds 15 volts and causes the zener diode to conduct. When the zener diode conducts, the gate of the SCR is turned on and causes the SCR to short which blows the 15 amp fuse and shuts off the output voltage. A 2N6399 (Tech America) was used for the SCR in the prototype but any suitable SCR can be used. While over voltage protection is a good idea, it should not be considered a substitute for large heat sinks. I personally feel the best protection from over voltage is the use of large heat sinks and a reliable current limiting circuit. Be sure to use large heat sinks along with heat sink grease for the 2N3055 transistors.

I have used this power supply in my shack for several months on all kinds of transceivers from HF, VHF to UHF with excellent results and absolutely no hum. This power supply will be a welcome addition to your shack and will greatly enhance your knowledge of power supplies.

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Parts List

R1	1.5K ¼ Watt Resistor (optional, tie pins 6 & 5 of IC1 together if not used.)
R2,R3	0.1 Ohm 10 Watt Resistor (Tech America 900-1002)
R4	270 Ohm ¼ Watt Resistor
R5	680 Ohm ¼ Watt Resistor
R6,R7	0.15 Ohm 10 Watt Resistor (Tech America 900-1006)
R8	2.7K ¼ Watt Resistor
R9	1K Trimmer Potentiometer (RS271-280)
R10	3.3K ¼ Watt Resistor
C1,C2,C3,C4	4700 Microfarad Electrolytic Capacitor 35 Volt (observe polarity)
C5	100 Picofarad Ceramic Disk Capacitor
C6	1000 Microfarad Electrolytic Capacitor 25 Volt (observe polarity)
IC1	LM723 (RS276-1740) Voltage Regulator IC. Socket is recommended.
Q1	TIP3055T (RS276-2020) NPN Transistor (TO-220 Heat Sink Required)
Q2,Q3	2N3055 (RS276-2041) NPN Transistor (Large TO-3 Heat Sink Required)
S1	Any SPST Toggle Switch

F1	3 Amp Fast Blow Fuse
D1-D4	Full Wave Bridge Rectifier (RS276-1185)
T1	18 Volt, 10 Amp Transformer Hammond #165S18 (Tech America 900-5825)

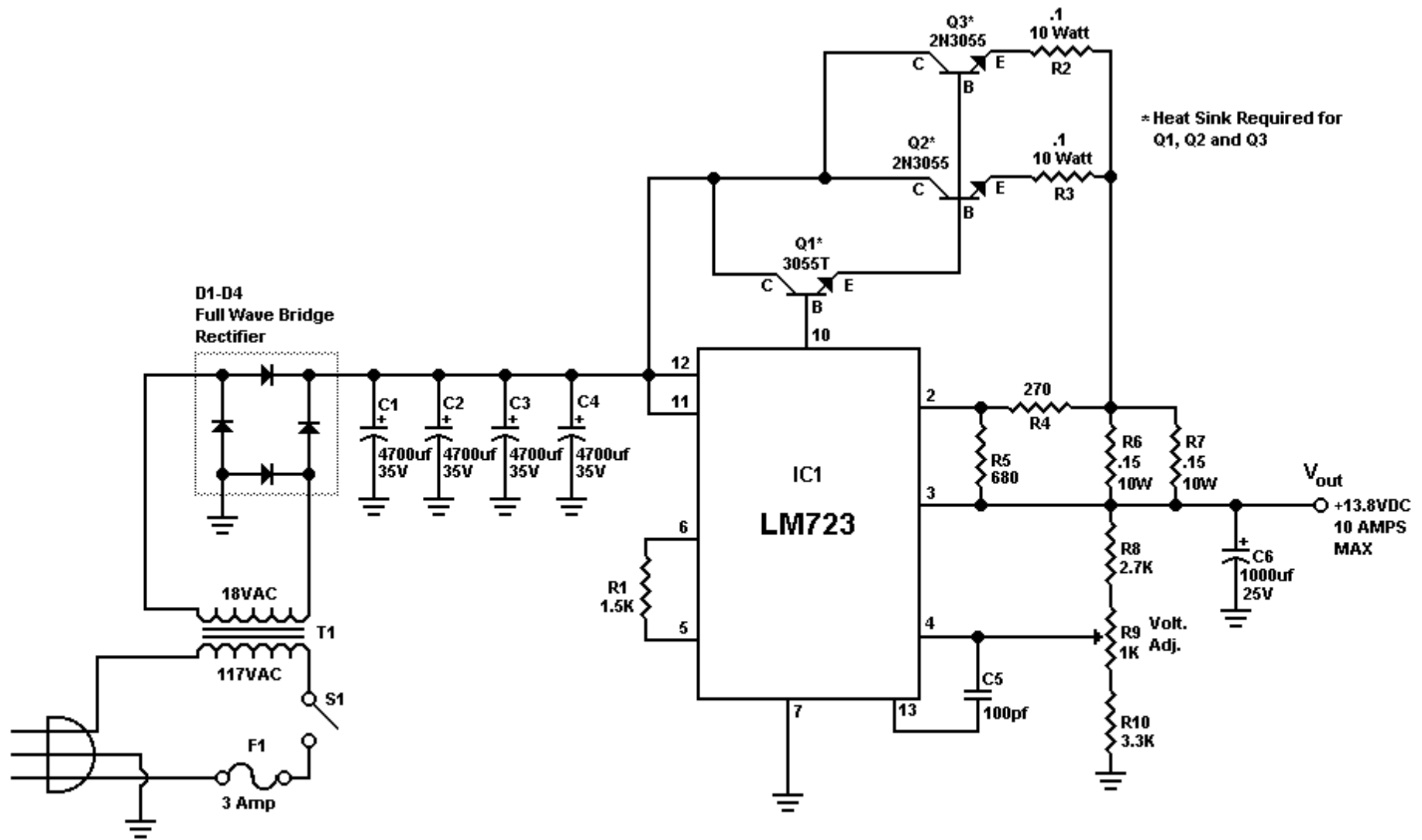


Figure 1

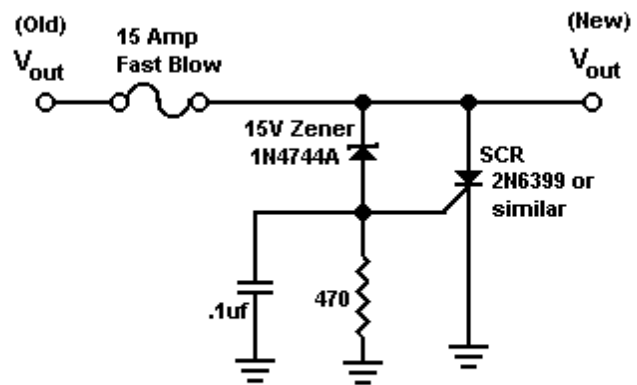


Figure 2