

## QUASAR PROJECT # 3083 - UNIVERSAL DUAL POLARITY 1 AMP POWER SUPPLY

Many times the hobbyist wants to have a simple, dual polarity DC power supply for a project. Existing power supplies may be too big either in power output or physical size. Just a simple power supply is required.

For most non-critical applications the best and simplest choice for a voltage regulator is the 3-terminal type. The 3 terminals are input, ground and output. The 78xx & 79xx series can provide up to 1A load current and it have on-chip circuitry to prevent damage in the event of over heating or excessive current. That is, the chip simply shuts down rather than blowing out. These regulators are inexpensive, easy to use, and they make it practical to design a system with many PCBs in which an unregulated supply is brought in and regulation is done locally on each circuit board.

This kit provides a dual DC power supply. With the appropriate choice of transformer and 3-terminal voltage regulator pairs you can easily build a small power supply delivering up to one amp at +/- 5V, +/- 9V, +/- 12V, +/- 15V or +/-18V. You have to provide the centre tapped transformer and the 3-terminal pair of regulators you want: 7805 & 7905, 7809 & 7909, 7812 & 7912, 7815 & 7915 or 7818 & 7918. We have provided the PCB and other components necessary. Note that the + and - regulators do not have to be matched: you can for example, use a +5v and -9V pair. However, the positive regulator must be a 78xx regulator, and the negative a 79xx one.

We have built in plenty of safety into this kit so it should give many years of continuous service. Voltage regulators have not been supplied. The user must choose the pair he needs for his particular application.

**Transformer.** Our design uses a full wave bridge rectifier coupled with a centre-tapped transformer. A transformer with a power output rated at at least 7VA should be used. The 7VA rating means that the maximum current which can be delivered without overheating will be around 390mA for the 9V+9V tap; 290mA for the 12V+12V and 230mA for the 15V+15V. If the transformer is rated by output RMS-current then the value should be divided by 1.2 to get the current which can be supplied. For example, in this case a 1A RMS can deliver  $1/(1.2)$  or 830mA.

**Rectifier.** We use an epoxy-packaged 4 amp bridge rectifier with at least a peak reverse voltage of 200V. (Note the part numbers of bridge rectifiers are not standardised so the number are different from different manufacturers.) For safety the diode voltage rating should be at least three to four times that of the transformers secondary voltage. The current rating of the diodes should be twice the maximum load current that will be drawn.

**Filter Capacitor.** The purpose of the filter capacitor is to smooth out the ripple in the rectified AC voltage. The residual amount of ripple is determined by the value of the filter capacitor: the larger the value the smaller the ripple. The 2,200uF is a suitable value for all the voltages

generated using this Kit. The other consideration in choosing the correct capacitor is its voltage rating. The working voltage of the capacitor has to be greater than the peak output voltage of the rectifier. For an 18V supply the peak output voltage is  $1.4 \times 18V$ , or 25V. So we have chosen a 35V rated capacitor.

**Regulators.** The unregulated input voltage must always be higher than the regulators output voltage by at least 3V in order for it to work. If the input/output voltage difference is greater than 3V then the excess potential must be dissipated as heat. This is why heat sinks are provided with the Kit. Without a heatsink 3 terminal regulators can dissipate about 2 watts. A simple calculation of the voltage differential times the current drawn will give the watts to be dissipated. Over 2 watts a heatsink must be provided. If not then the regulator will automatically turn off if the internal temperature reaches 150°C. For safety it is always best to use a small heatsink even if you do not think you will need one.

**Stability.** C4 & C5 improve the regulators ability to react to sudden changes in load current and to prevent uncontrolled oscillations.

**Decoupling.** The monoblok capacitor C2 & C6 across the output provides high frequency decoupling which keeps the impedance low at high frequencies.

**LED.** Two LED's are provided to show when the output regulated power is on-line. You do not have to use the LED's if you do not want to. However, the LED on the negative side of the circuit does provide a minimum load to the 79xx regulator which we found necessary during testing. The negative 3-pin regulators did not like a zero-load situation. We have provided a 470R/0.5W resistors as the current limiting resistors for the LED's.

**Diode Protection.** These protect mainly against any back emf which may come back into the power supply when it supplies power to inductive loads. They also provide additional short circuit protection in the case that the positive output is connected by accident to the negative output. If this happened the usual current limiting shut-down in each regulator may not work as intended. The diodes will short circuit in this case and protect the 2 regulators.

### Construction

First check the components supplied against the components listing. Note that we have not supplied any three pin voltage regulators. These are for the user to supply according to the split voltage levels they require. It is generally easiest to assemble the lowest height components first. Make sure to get the diodes & the LED's the correct way around. Solder the bridge rectifier a few mm above the PCB to aid in cooling. Attach the heat sink to each regulator. Also mount the heat sink before you put the regulator onto the board. The heat sink is connected to

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the centre pin of each regulator internally and these are not at the same potential.

**If It Does Not Work.** Do the LED's light up. Check the orientation of all the components. Are the 3 pin regulators in correctly? Use a voltmeter to check the voltages at various parts of the circuit.

See our website at <http://www.quasarelectronics.com>

COMPONENTS			
Electrolytic capacitors:			
C1 C3			2
C4 C5	2		2
monoblok	C2 C6		2
resistor	R1 R2	2	
3mm red LED	L1 L2		2
diode	D1 D2		2
bridge rectifier		1	
3 pole terminal block			2
Heat sink HS103			2
Nut & bolt			2 sets
Kit 3083 PCB			1

