

## VR –XX Voltage Regulator Module Kit

Version 1.02

May 2005

- **VR-5**     **5V Voltage Regulator**
- **VR-8**     **8V Voltage Regulator**
- **VR-12**    **12V Voltage Regulator**
- **VR-15**    **15V Voltage Regulator**

### Specifications

- Output voltage regulation: 2%
- Input voltage range: output voltage + 2 Volts (minimum) to 30 Volts maximum
- Output current: 1A (see notes on heat)

### Assembly Instructions

1. Insert and solder the .1uF capacitor at location labeled C3. This capacitor will be labeled 104.
2. Insert and solder the .33uF capacitor at location labeled C1. This capacitor will be labeled 334.
3. Using the supplied hardware, install the heat sink on U1. The metal back of U1 goes against the inside back of the heat sink. Line up the heat sink hole near the middle of the heat sink with the hole in the tab of U1. The other hole goes towards the pins of U1. The screw goes through the heat sink then through the tab of U1. Secure with the lock washer and hex nut.
4. Insert and solder the voltage regulator at location U1. The type of regulator supplied will depend on the voltage. A 7805 is a 5 volt regulator, a 7812 is a 12 volt regulator, etc. The flat backside of the U1/heat sink assembly must be away from the capacitors C1 and C3. The bottom of the heat sink should rest lightly on the circuit board as you solder the pins.
5. Insert and solder a 100uF capacitor at locations labeled C2 and C4. Be sure to observe to proper polarity.
6. Examine your soldering to be sure there are no shorts or solder bridges.

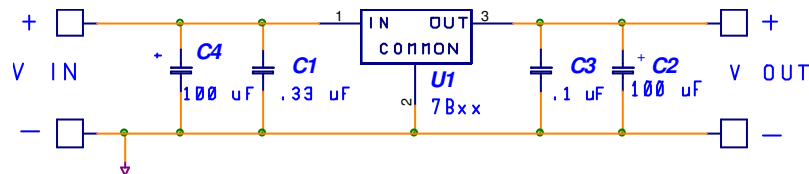


Figure 1. VR-XX Schematic

## **Input Voltage**

You will connect your supply voltage at the V IN connections. Be sure to observe proper polarity. The input voltage must be at least 2 volts higher than the rated output voltage. If the input voltage falls below this rating the regulator will not be able to do its job.

**Note that as the load current increases, the input voltage may drop below the minimum if it is not well regulated. Inexpensive wall-wart type power supplies often have poor regulation. Be sure that your voltage source can provide the required voltage at load.**

If your voltage source is a battery or a regulated voltage power supply, you will not need additional input filtering. If your voltage source is a transformer with a diode rectifier, you will need an additional capacitor between the output of the rectifier and ground, in parallel with C4. Typical values will be 220uF to 4500uf, depending on the output voltage of your transformer, the current drawn by the circuit the regulator is powering, and the type of rectifier used. Be sure the capacitor voltage rating is high enough and the capacitor is installed with the proper polarity.

Note that with only a transformer and rectifier, the peak voltage will be more than 1.4 times higher than the RMS voltage. Thus if you have a 12V transformer, the voltage at the regulator input will be  $12 \times 1.4 = 16.9\text{V}$ . For this application you would want to use a 25V capacitor.

## **Heat Considerations**

A linear voltage regulator acts as an automatic variable resistor. At low load currents its effective resistance will be high. As the load current increases, the effective resistance will reduce, keeping the load voltage constant. The voltage difference between Vin and Vout multiplied by the current is the power that the regulator must dissipate as heat.

Example: 12 V input, 5 V output, load current = 200ma (.2A)

$$\text{Power (watts)} = V_{\text{diff}} * I_{\text{load}} = (12\text{V}-5\text{V}) * .2 = 1.4 \text{ Watts}$$

The temperature of U1 will increase approximately 17° C/watt (30.6° F/watt) in calm air. It is not recommended to run your regulator at more than 4 watts dissipation.

**CAUTION! IC U1 AND THE HEAT SINK CAN GET VERY HOT!**

Depending on the difference between input and output voltages, and the load current, it may be necessary to use a larger heat sink and/or use a fan to blow air across the heat sink.

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