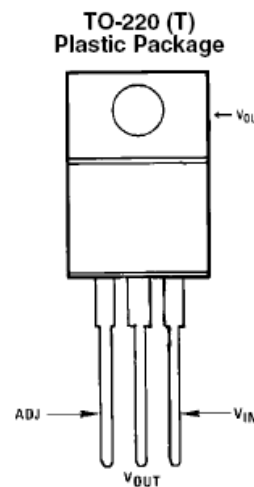
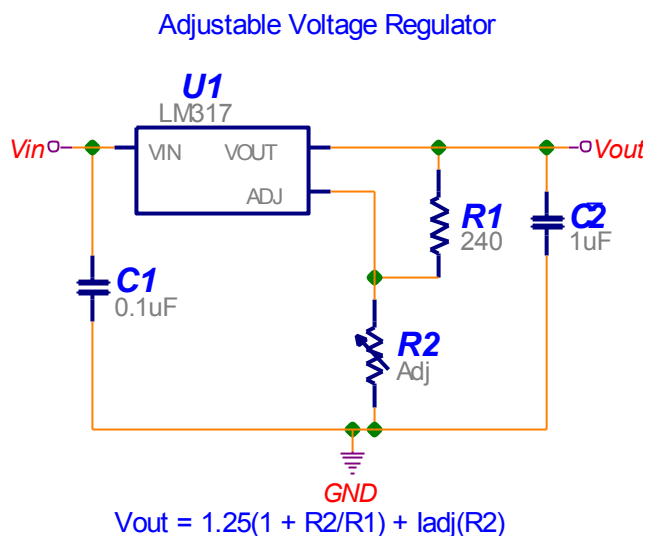


## Adjustable Linear Voltage Regulators

The LM317 is an adjustable voltage regulator. It is similar to the fixed voltage regulators used in class except by adding a few resistors the output voltage can be changed. The LM317 has an internal 1.25V reference that appears across the Vout and Adj pins. A resistor (**R1**) is placed between these two pins (usually 240Ω). This sets the current flowing through **R2**.  $V_{out} = 1.25(1 + R2/R1) + I_{adj}(R2)$ .  $I_{adj}$  (the current flowing out of the ADJ pin) is usually small (~100uA) and can be ignored most of the time. Note: You still need a few volts of headroom for the regulator to work (i.e.  $V_{in} \geq (V_{out} + 2V)$ ).  
 LM317 datasheet: <http://www.ti.com/lit/ds/symlink/lm117.pdf>

The pin configuration is also different from the fixed voltage regulators (Adj, OUT, IN instead of IN, GND, OUT). Also, the metal tab on the adjustable regulator is tied to Vout instead of GND. Unless you use an insulator between the heatsink and the metal tab the heatsink will be at the same voltage as Vout. At low voltages this usually isn't a problem unless you have multiple regulators sharing a common heatsink. The size of the input and output capacitors aren't critical unless you're trying to smooth the ripple from a rectifier. Keep the decoupling capacitors as close to the regulator as possible.



The LM317 can be configured to limit the current (shown below). The voltage drop from Vin to Vout will adjust to try and keep the internal reference voltage (1.25V) across R1. Ex: If  $R1 = 125\Omega$  than the max current will be  $1.25V/125\Omega = 10mA$ . If the load only draws 5mA the regulator will minimize the voltage drop from Vin to Vout (usually 1.5-2V) trying to increase the voltage across the load. If the load tries to draw more than 10mA the regulator will drop more voltage ( $V_{in} - V_{out}$ ) until the output voltage drops low enough so the load only draws 10mA. You could put the current limit circuit below in front of the voltage regulator circuit above to make a current limited power supply similar to what is used in class.

Adjustable Current Limit

