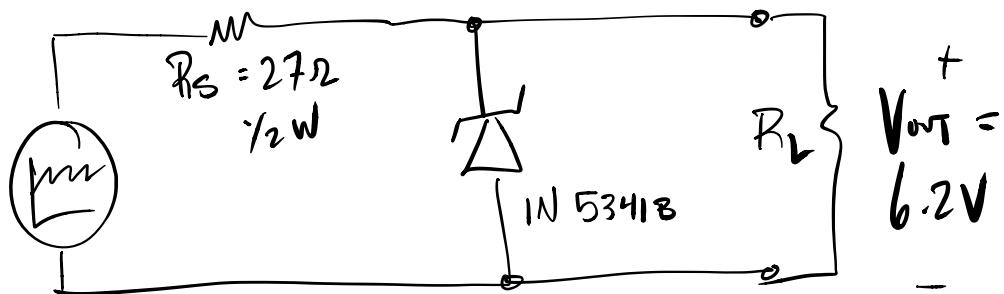


Voltage Regulation

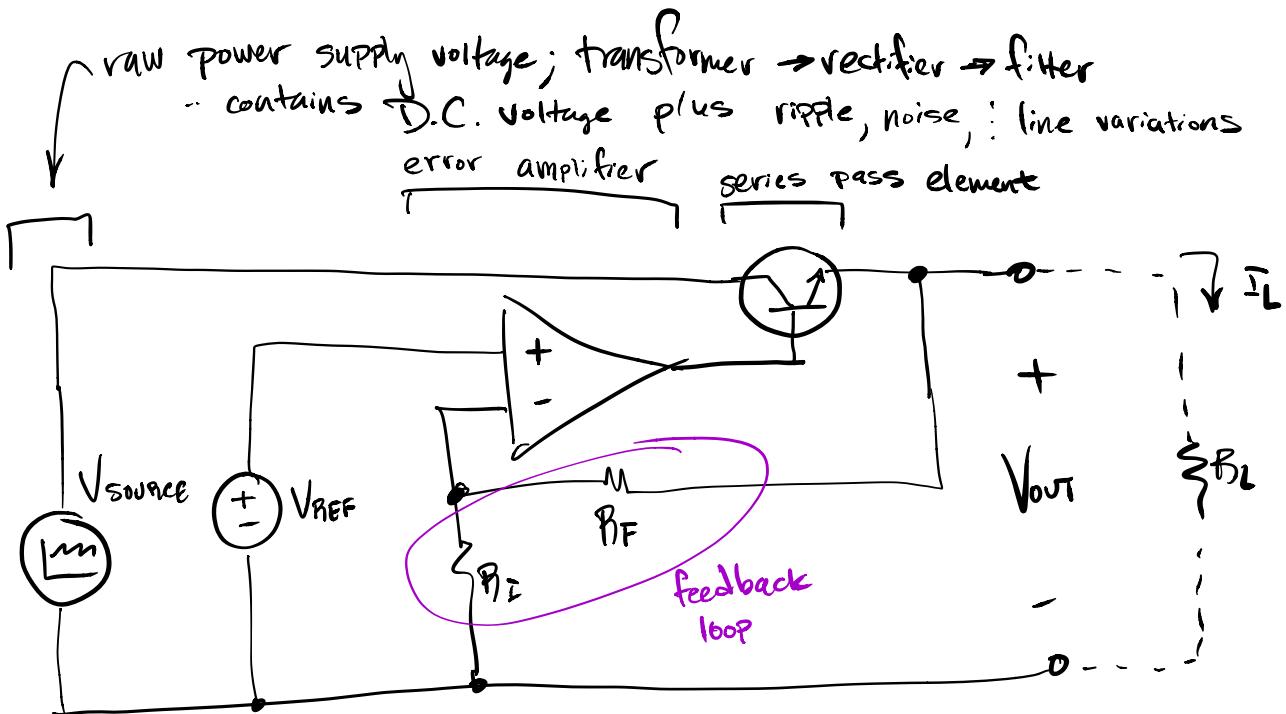
- in Bioelectronics I, we designed a simple zener diode regulator



- this is called a shunt regulator because the voltage reference (zener diode) is in parallel with the load.

- More efficient method : Series feedback regulator

basic concept: precision D.C. voltage reference is applied to a non-inverting amplifier to provide tightly-controlled output voltage
↓
negative feedback!



- V_{REF} is often a precision zener diode or avalanche diode (driven from current source)
 - gives very accurate voltage
- if V_{REF} is 5VDC and we need a precise 12V regulated power supply, then

$$A_v = 1 + \frac{R_f}{R_i} = \frac{12}{5}$$

$$R_f = 10k \quad \rightarrow R_i = 7.143k \quad (\text{eg6 value, whatever})$$

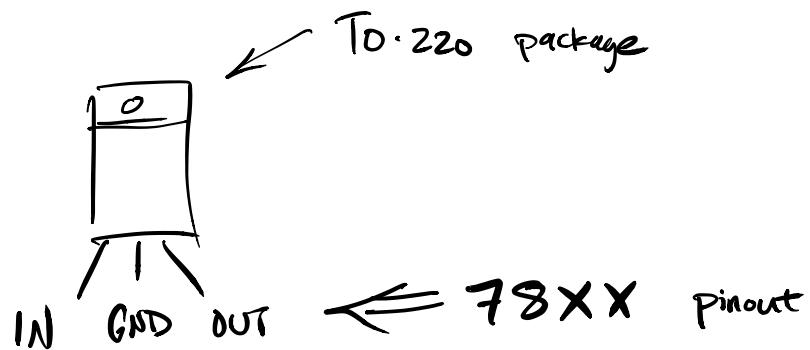
.. the pass element dissipates the heat caused by the drop across the regulator \times load current:

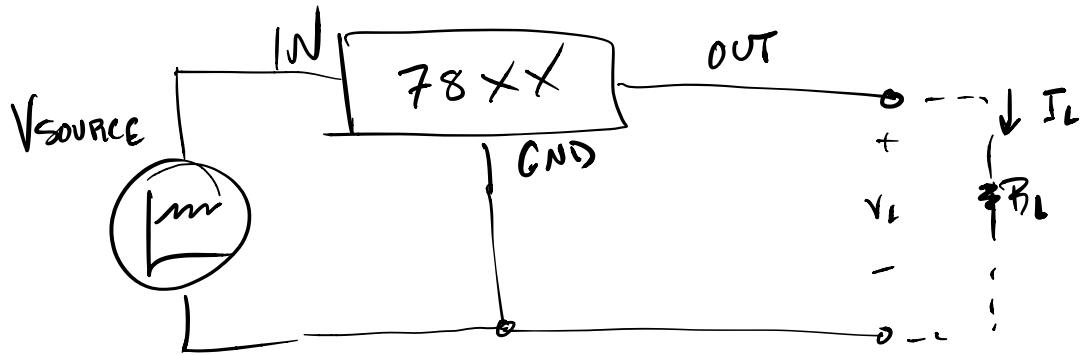
$$P_{\text{diss}} = (V_{\text{SOURCE}} - V_{\text{OUT}}) \times I_L$$

... so the error amplifier is simply tested with removing ripple, noise, line variations etc.

78XX and 79XX I.C. Regulators

a/k/a "three-terminal" regulators





7805 -- 5V output

7806 6V

7808

7809

7810

7812

7815

7818

7824

1.) most of these are rated for
1.5 A max. load current

2.) 35V max. (input -output)
Voltage range

(so if you use a 7805 5V regulator, don't exceed 40V at the input)

3.) Power dissipation limited by temperature

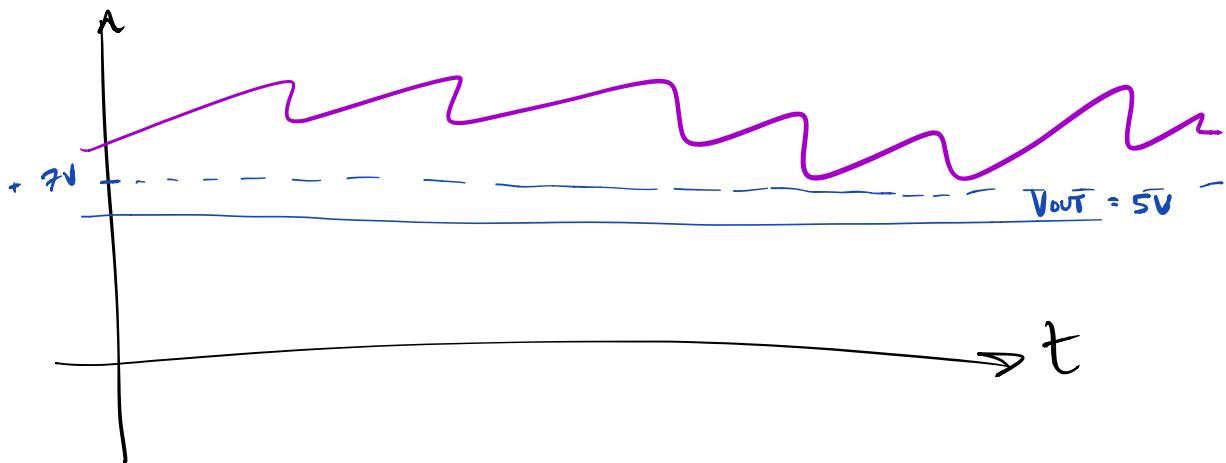
→ require heat sinking

TO-220 w/ no heat sink → couple watts, tops [w/ heat sink: 50W or more]

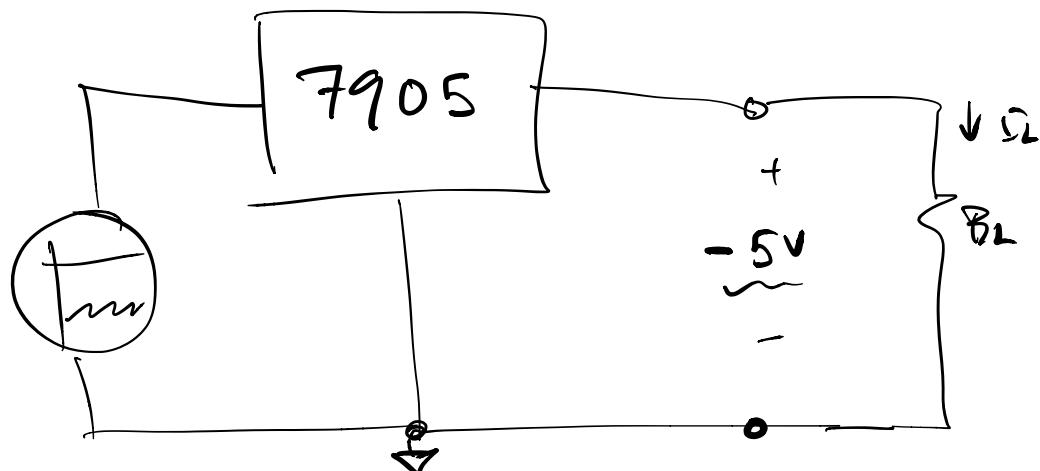
Note : metal fab is connected to ground

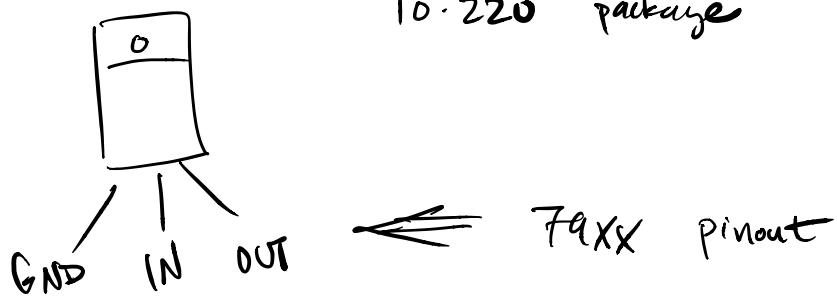
ii) dropout voltage $\approx 2V$

so make sure, for the 5V example, that
source never goes below $7V$ \rightarrow includes ripple!



79XX : negative Voltage regulator
is the complement to the 78XX series





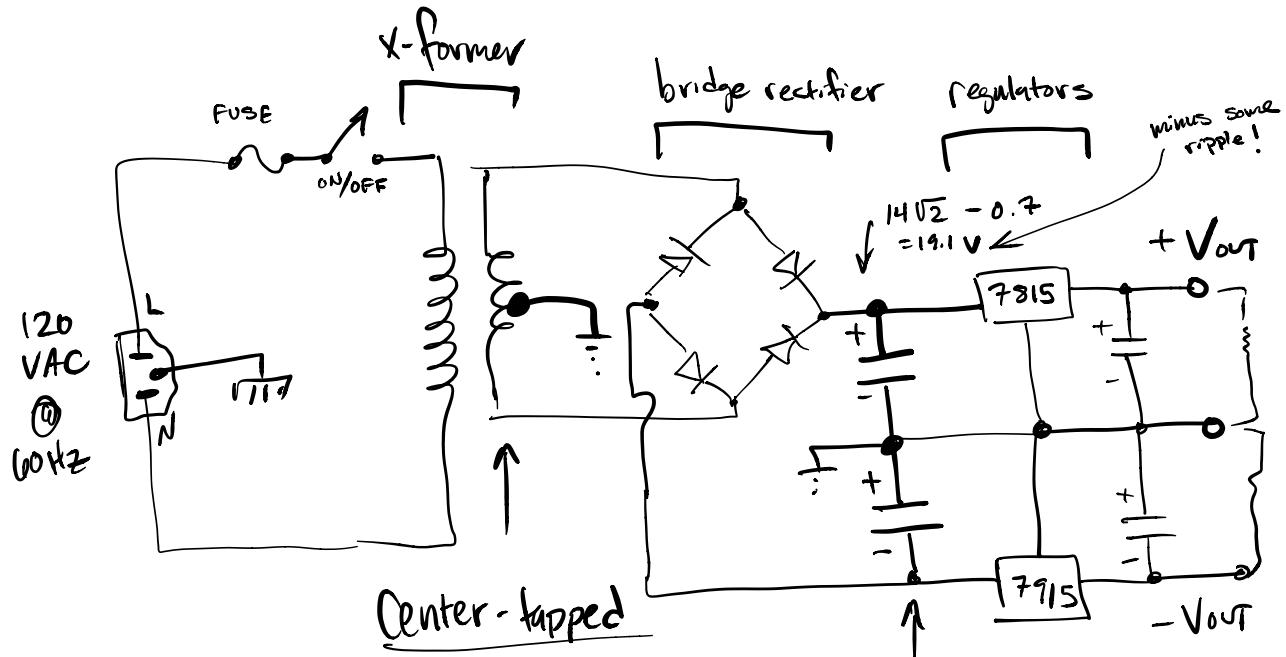
- the metal tab is the input on the 79XX series -- be careful !!!

LM 317 : adjustable regulator , if you need an exact voltage not available

- add two resistors!

LM 339 : negative adjustable regulator

- can be configured for constant-current regulation
- Complete bipolar power supply suitable for powering op amp circuits, etc .. :



Center-tapped

Secondary

(14 - 0 - 14)

or 28 V CT

Compute value
that gives sufficiently
low ripple for
expected I_L!

(1000 - 10,000 μF
range)