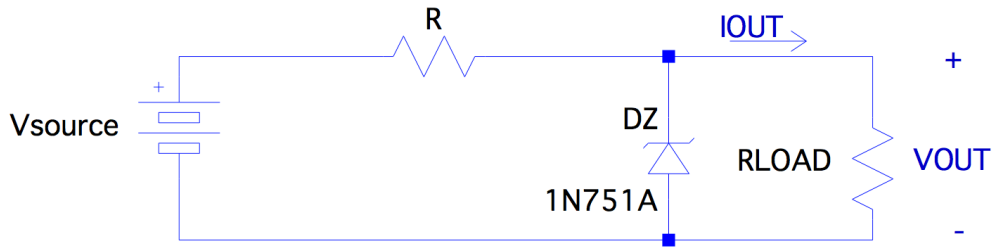
Objectives

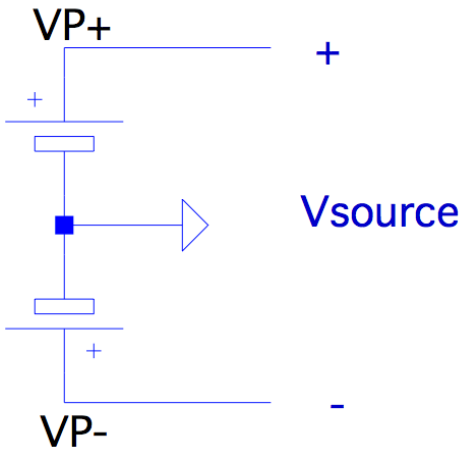
To design, construct, and test a Zener diode voltage regulator.

Instructions

Your regulator requires a 1N751A and thus has a nominal zener voltage of 5.1V. Your design should resemble the following Figure.



NOTE: Use the programmable voltage supplies VP+ and VP- to generate the required Vsource



DESIGN TIPS:

Make sure the diode will remain in the breakdown region over the specified range of operation (10V ≤ Vsource ≤ 15V). In addition, make sure the regulator will not get damaged under any possible loading condition (loads can range from R_{LOAD}=0 Ω to R_{LOAD} = ∞ Ω).
The nominal load is R_{LOAD} = 250 Ω.

Pre-Lab:

1. Calculate the expected range of output voltages and currents (extremes) using a piecewise linear circuit model for the diode. Assume the load is nominal. Show your work.

_____≤ Iout ≤ _____

_____≤ Vout ≤ _____

2. Show the piecewise model you used for your zener diode (plot I_D vs. V_D)

Lab:

3. With a load of 250 ohm, vary the DC source voltage from 10V to 15 V and measure the output voltage at several points. Plot the output voltage as a function of the source voltage.

$R_{LOAD} = 250\ \Omega$

V_{source} [V]	V_{OUT} [V]
10	
11	
12	
13	
14	
15	

V_{OUT} vs. V_{source} Plot:

Repeat for $R_{LOAD} = \infty\ \Omega$

V_{source} [V]	V_{OUT} [V]
10	
11	
12	
13	
14	
15	

V_{OUT} vs. V_{source} Plot:

Determine the line regulation: (Line regulation ≡ ΔVout/ΔVsource ×100)

4. With a source voltage of 15 V, vary the load current from 0 to 20 mA by changing the load resistor RLOAD from _____ to _____ (Fill the blanks)

   For Vsource = 15V

R_{LOAD} [Ω]	I_{OUT} [mA]	V_{OUT} [V]
	0	
	20	

Plot the output current vs. the output voltage.

Repeat for Vsource = 10 V

R_{LOAD} [Ω]	I_{OUT} [mA]	V_{OUT} [V]
	0	
	20	

Plot the output current vs. the output voltage.

Determine the load regulation:
Load regulation ≡ $100\times (V_{out,noload} - V_{out,\ fullload})/(I_{L,noload} - I_{L,\ fullload}) = 100 \times \Delta Vout / \Delta IL$

5. Did the Zener diode stay in breakdown the whole time? _____

6. If not indicate on your plots where the diode was not in breakdown and explain why the diode was not in breakdown.