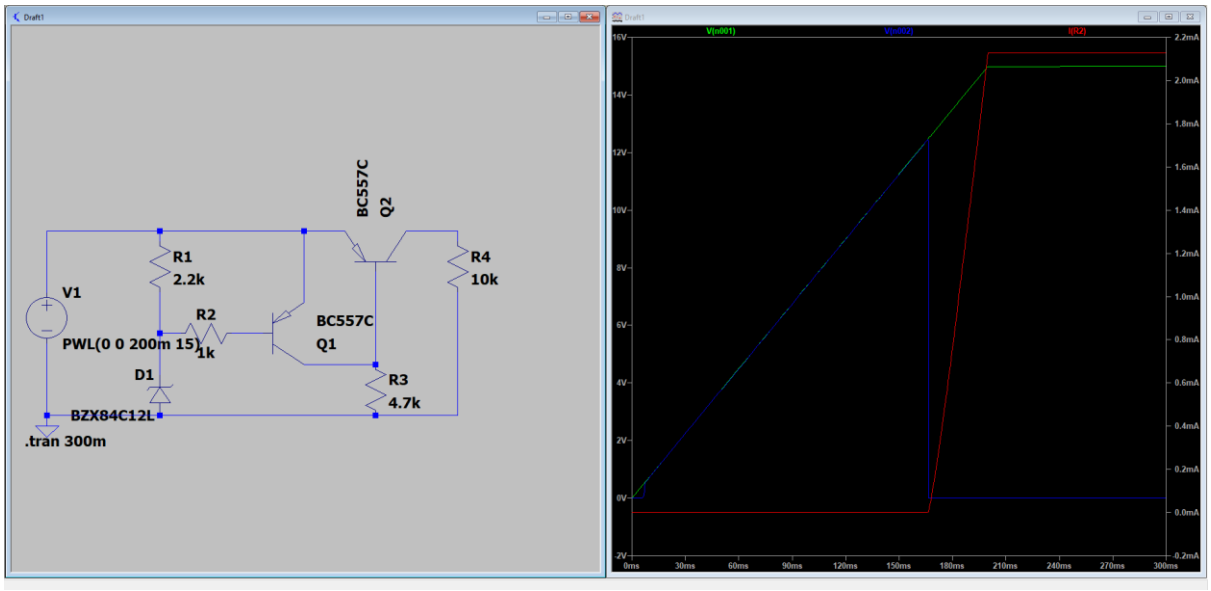
OVERVOLTAGE PROTECTION CIRCUITS

PNP BJTs:



Voltage set to steadily increase from 0v to 15v in a 200ms interval

Consider R4 to be a load that has a voltage rating of 12v. Up to 12v, the Zener diode D1 prevents current from flowing through acting as an open circuit making sure the transistor Q1 is turned off. Consequently, current flows only through Q2 and the load.

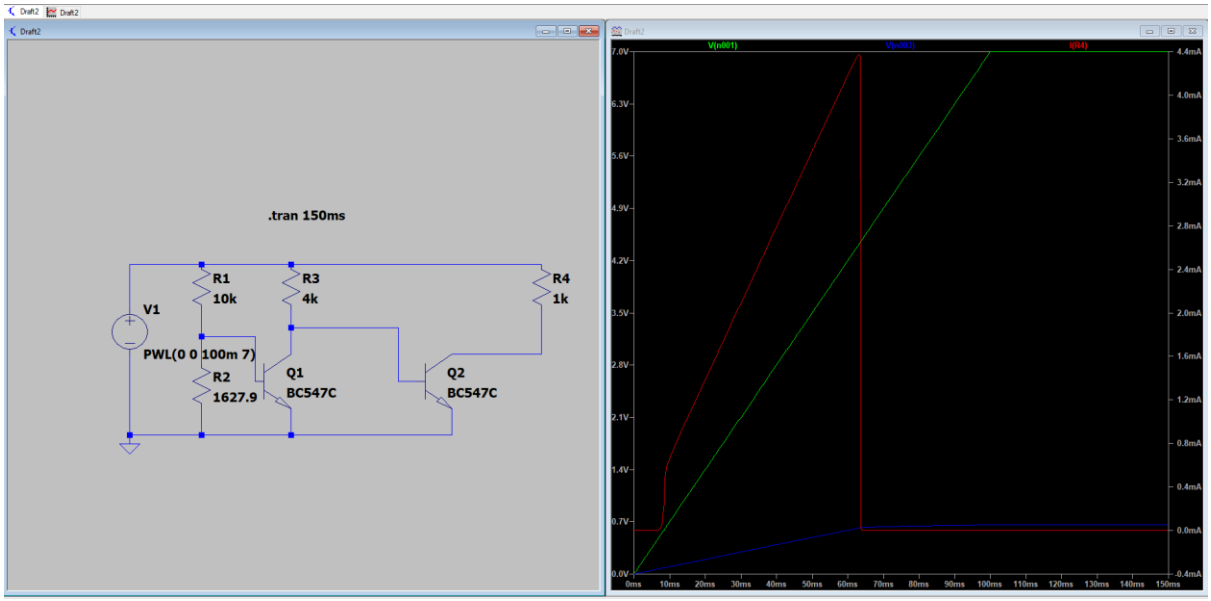
Once the supply outputs a voltage higher than the Zener breakdown voltage (12v) , the Zener diode short circuits allowing current to flow through the Q1 transistor and cutting off current to the Q2 transistor and therefore the load.

Green line: supply voltage

red line: current flowing through R2

Blue line: current flowing through R4 (load)

NPN BJTs:



Voltage set to steadily increase from 0v to 7v in a 100ms interval

Consider R4 to be a load having a voltage rating of 5v. Up to 5v, the voltage divider circuit consisting of R1 and R2 doesn't provide the necessary voltage of 0.7v at the base junction to allow the transistor Q1 to be turned on making it act as an open switch and therefore allowing current to only flow through the R3 resistor and into the base junction of the transistor Q2. Creating a larger current at the collector junction that flows through the load

However, once V1 reaches 5v, the voltage divider circuit allows provides enough voltage at the base junction to turn on the transistor Q1 redirecting the current flowing through the R3 resistor away from the Q2 transistor to satisfy the equation $I_E = I_B + I_C$. With no current flowing through the base junction of Q2 there will be no collector current flowing through the load.

Green line: supply voltage

red line: current flowing through R4 (load)

Blue line: voltage across the Q1 transistor

Google drive link to videos:
https://drive.google.com/drive/u/0/folders/1_VUXGjPv11SyZZWZK8QpbG83fBnt-jQ9