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EE4035 Electronics Laboratory

Laboratory 6 Shunt Voltage Regulator

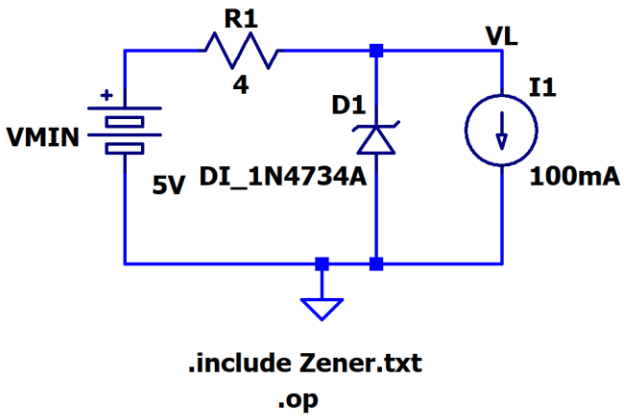
1N4734 Datasheet Link

PART-I

Pre-Lab Question

1. Design a circuit to provide a constant voltage of 3.6V when the input voltage varies from 4V to 5V.

Given a Zener diode of 3.6V, 1 mA and 1 W

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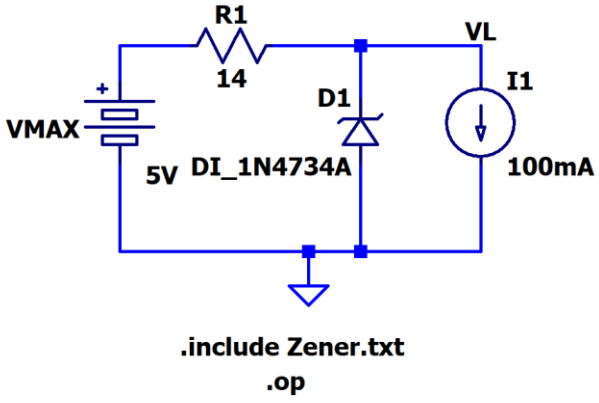
--- Operating Point ---

V(n001):        4               voltage
V(vl):          3.6             voltage
I(I1):          0.1             device_current
I(R1):          -0.1            device_current
I(Vmin):        -0.1            device_current
Ix(d1:1):       -7.63053e-011   subckt_current
Ix(d1:2):       7.63052e-011    subckt_current
```

Fig 1. Circuit Diagram and Operating Points V_{MIN} 4V




```
--- Operating Point ---

V(n001):        4               voltage
V(vl):          3.6             voltage
I(I1):          0.1             device_current
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Ix(d1:1):       -7.63053e-011   subckt_current
Ix(d1:2):       7.63052e-011    subckt_current
```

Fig 2. Circuit Diagram and Operating Points V_{MAX} 5V

$$R_S = \frac{V_S - V_Z}{I_L + I_Z}$$

2. What can be the maximum value of the series resistance? The minimum value?

$$R_S = \frac{V_S - V_Z}{I_L + I_Z}$$

$$R_{MAX} = \frac{5 - 3.6}{101\ mA} = 14\ Ohms$$

$$R_{MIN} = \frac{4 - 3.6}{101\ mA} = 4\ Ohms$$

3. What is the knee current (I_K) of the 1N4734 Zener diode?

45 mA

4. What is the maximum power dissipation of the 1N4734?

1 Watt

PART-II

Experimental Procedure for Measurements

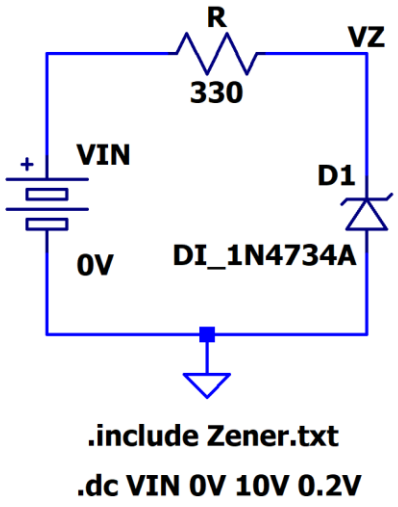

Fig 2. Circuit Diagram

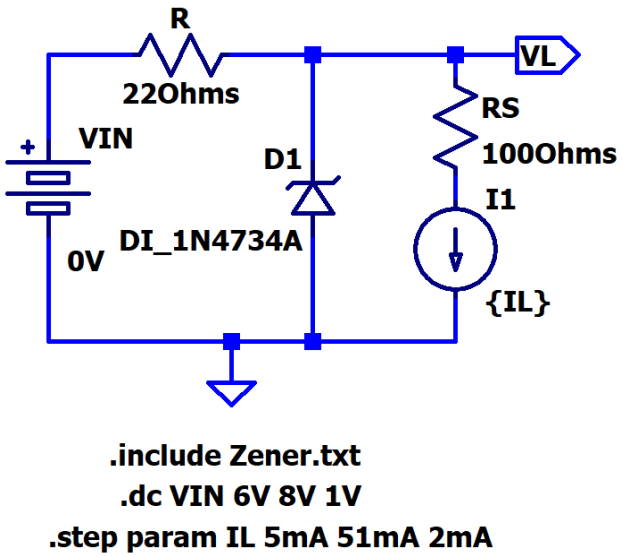

Fig 3. Circuit Diagram

(Refer Excel Sheet for Plots)

PART-III

Post-Lab Exploration

1. What is the knee current of the Zener diode as determined by your experiment?

Approx. Around 50-55 mA

2. What is the Zener resistance (R_Z)?

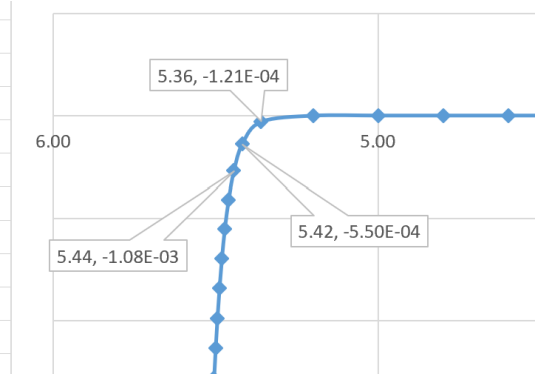

Fig 4. Excel Plot

$$-R_Z = \frac{55\text{mA} - 1.08\text{mA}}{5.42 - 5.44} = -2.696\ \text{Ohms}$$

$$R_Z = 2.696 \text{ Ohms}$$

3. With V_{IN} 7V and R 22 Ohms, what is the minimum value of load resistance R_L, below which the circuit will lose regulation? Why will the circuit no longer work as a voltage regulator?
