

Laboratory Goals

- ❑ Introduce power supply design and operation
- ❑ Create PSpice simulations of the power supply designs
- ❑ Construct half-wave and full-wave power supply circuits
- ❑ Compare the PSpice simulations to measured and calculated values

Pre-lab reading

- ❑ *Student Reference Manual for Electronic Instrumentation Laboratories* by Stanley Wolf and Richard Smith, Copyright 1990.

Equipment needed

- ❑ Lab notebook, pen
- ❑ 24VAC center-tapped transformer
- ❑ 2 test leads, red, banana/EZ Hook
- ❑ 1 test lead, black, banana/EZ Hook
- ❑ Agilent 54622 Digital Oscilloscope
- ❑ 2 oscilloscope probes and ground clips

Parts needed

- ❑ Circuit breadboard
- ❑ Lab parts kit
- ❑ Diodes (2), 1N4002
- ❑ Resistor, 1K Ω , ¼ Watt
- ❑ Capacitors (2), Electrolytic, (values to be determined), 25VDC minimum
- ❑ Jumper wires

Lab safety concerns

- ❑ Do not touch the transformer output terminals while the transformer is on
- ❑ Be sure to connect the (-) terminal of the electrolytic capacitor to circuit ground
- ❑ Be sure to connect the diode(s) with the correct polarity

1. Pre-Lab Calculations and Simulations

- ❑ Calculate the DC level for a half-wave power supply, with an AC input of 14Vrms, and an output ripple voltage of 10%
- ❑ Calculate the DC level for a full-wave power supply, with an AC input of 28Vrms, and an output ripple voltage of 10%
- ❑ Create the PSPICE circuit, shown in Figure 1 below. Include your calculated values for **C**, and the 1K Ω resistor **RLoad**
- ❑ Modify the transformer parameters as follows:
 - Change L1 (the primary winding) to 10mH
 - Change L2 (the secondary winding) to 10mH
- ❑ Add a series resistance (**Rs**) of .2 Ω to the primary winding of the transformer (this transformer will not run without extra resistance)
- ❑ Run a **Transient** simulation with the following values:
 - **Print Step:** 1000ns
 - **Final Time:** 100ms
- ❑ Bring a diskette copy of the results to your lab section

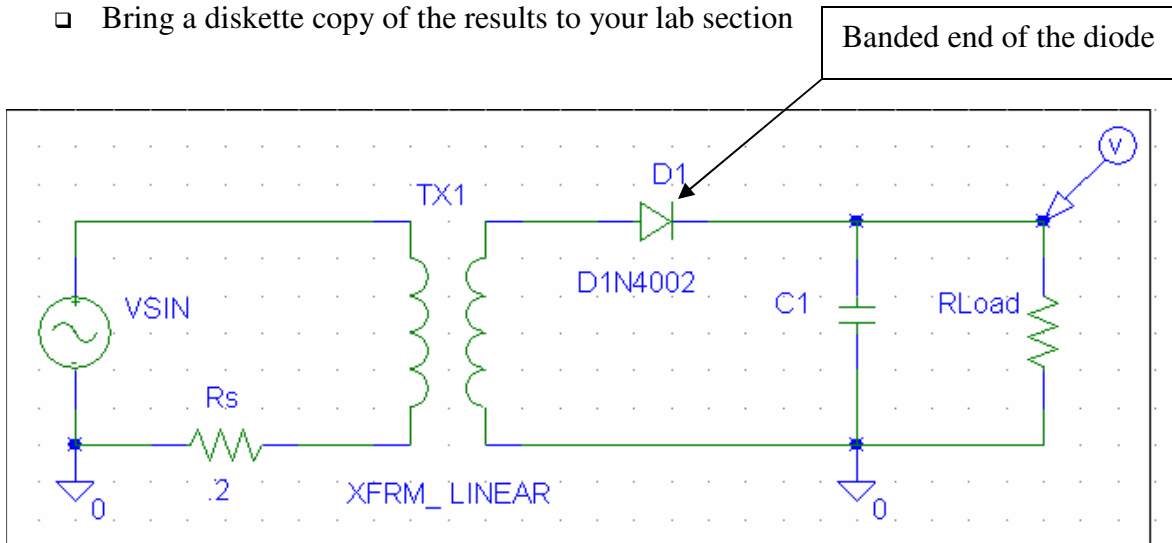


Figure 1 – PSPICE Schematic for the Half-Wave Power Supply

- ❑ Create the PSPICE circuit, shown in Figure 2 below. Include your calculated values for **C**, and the **1K Ω** resistor **RLoad**
- ❑ Modify the transformer parameters as follows:
 - Change **Lp** (the primary winding) to 10mH
- ❑ Run the same **Transient** simulation as you did for the half-wave circuit above
- ❑ Bring a diskette copy of the results to your lab section

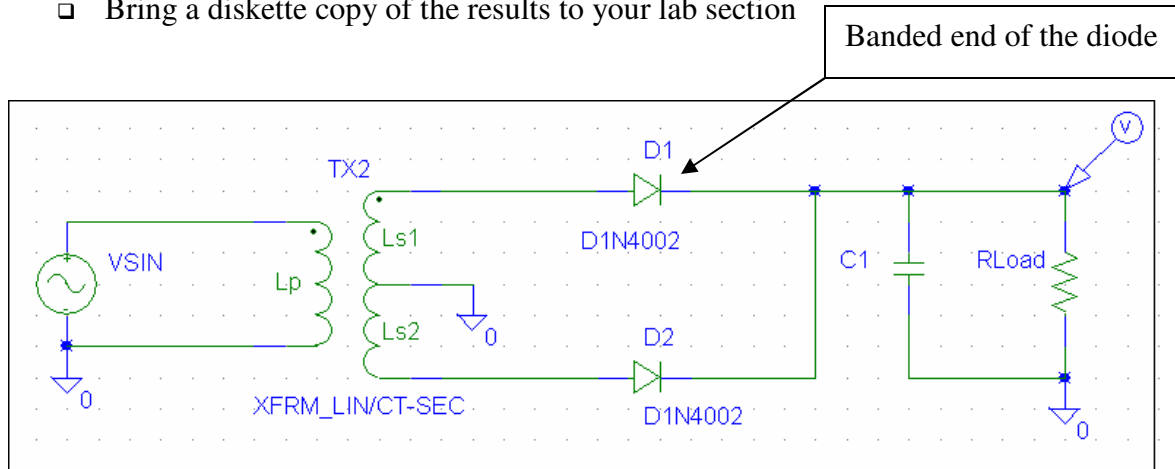


Figure 2 – PSPICE Schematic of the Full-Wave Power Supply

2. Half-Wave Power Supply: Construction and Test Measurement

- ❑ Build the half-wave power supply circuit, shown in Figure 1 above, using your calculated value for **C1** (**Note: you do not include R_s in the actual circuit!**)
- ❑ Connect a red banana/EZ Hook test lead between a red terminal of the 24VAC transformer and the anode (i.e. the end with no colored band) of diode **D1**
- ❑ Connect the black banana/EZ Hook test lead between the 24VAC transformer's black terminal (center-tap) and the circuit ground
- ❑ **RECHECK THE DIODE AND CAPACITOR POLARITIES AGAIN! The Negative band of the electrolytic capacitor must go to circuit ground. The colored bands on the diodes must be connected as shown in Figure 1.**
- ❑ Turn the transformer on

- ❑ Connect the **CH1** oscilloscope probe and ground clip to the input signal and circuit ground respectively
- ❑ Connect the **CH2** oscilloscope probe and ground clip to **Rload** and circuit ground respectively
- ❑ Measure and record the oscilloscope input and output waveforms in your lab notebook (include the DC level and ripple voltage)

- ❑ Copy the input and output waveforms to a diskette using the **Quick Print** option on the oscilloscope

- ❑ Turn the transformer off and disconnect the test leads from the circuit

3. Full-Wave Power Supply: Construction and Test Measurement

- ❑ Build the full-wave power supply circuit, shown in Figure 2 above, using your calculated value for **C1**

- ❑ Connect a red banana/EZ Hook test lead between a red terminal of the 24VAC transformer and the anode of **D1**
- ❑ Connect the black banana/EZ Hook test lead between the 24VAC transformer's black terminal (center-tap) and the circuit ground
- ❑ Connect the second red banana/EZ Hook test lead between the remaining red terminal of the 24VAC transformer and the anode of **D2**

- ❑ **RECHECK THE DIODE AND CAPACITOR POLARITIES AGAIN!**

- ❑ Turn the transformer on

- ❑ Connect the **CH1** oscilloscope probe and ground clip to the input signal and circuit ground respectively
- ❑ Connect the **CH2** oscilloscope probe and ground clip to **Rload** and circuit ground respectively
- ❑ Measure and record the oscilloscope input and output waveforms in your lab notebook (include the DC level and ripple voltage)

- ❑ Copy the input and output waveforms to a diskette using the **Quick Print** option on the oscilloscope

- ❑ Turn the transformer off and disconnect the test leads from the circuit

Before leaving the lab, take a few minutes to make sure all equipment and test leads are returned to your cabinet, and that you have cleaned up your work space.

4. Analysis

Write a summary report for this lab. Be sure to also include the following topics:

Compare calculated, PSPICE, and measured values. Are there differences? If so, Why?

Explain any difficulties you had with this lab. (Please include any suggestions to improve the lab, if you have them)