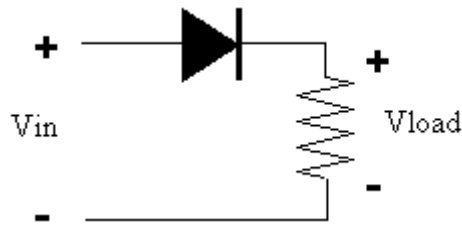


UNIVERSITY OF CALIFORNIA, BERKELEY
EE40: Introduction to Microelectronic Circuits
Diodes Lab Guide

Half-Wave Rectifier

1. Build the half-wave rectifier circuit drawn in the figure below. Use a potentiometer (as a rheostat) for the load and set it to about 1K ohm. Use a light emitting diode (LED). **NOTE: To avoid damage to the diode, set the current limit to 30mA.**

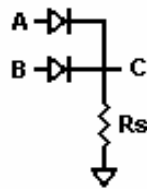


2. In the following set of questions, you will be measuring the threshold voltage of the diode of the circuit you built above. To do this, measure the voltage difference the input and output signal.
 - a. Measure V_T when the input is Frequency = 1KHz, $V_{pp} = 5V$, Offset = 0.
 - b. What happens when you lower V_{pp} ?
 - c. What happens if you use a negative offset?
 - d. What happens to the output if you make the input $V_{pp} = 0.5V$ and you increase the offset = 0.5V.
 - e. What happens if you lower the frequency of the function generator?
 - f. What happens as you vary the resistance on the rheostat?
 - g. Do different color LED's have different threshold voltages?
3. Replace the LED with a 1N914 diode and measure the new threshold voltage. Is it different?

Diode Logic

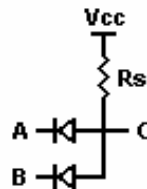
1. First, calculate the value of the series resistor R_S to control current through the LED diodes. R_S is chosen such that the voltage ($V_{CC}-V_{DIODE}$) across R_S results in a limited but sufficient current I_{DIODE} through itself and the diodes. The design formula is $R_S = (V_{CC}-V_{DIODE})/I_{DIODE}$. Use $I_{DIODE}=10\text{mA}$, $V_{CC}=5\text{V}$, and $V_{DIODE}=1.6\text{V}$ (for red LEDs).
2. Build the OR circuit shown below on the breadboard. Hint: leave wires for *inputs* A and B (not breadboard columns A and B) that you will apply by hand. Use long columns A and B (red and blue, not inputs A and B) on the breadboard to “bus” ground=0VDC and $V_{CC}=5\text{V}$ from the DC power supply.

Diode Logic OR



3. Using your hands to move input wires A and B to the “bussed” logic voltages, start with logic inputs $A=B=0$ and measure the resulting output voltage C using the DMM. Repeat for the other 3 possible input combinations to the circuit.
4. Build the AND circuit and measure the resulting output voltages for all input combinations.

Diode Logic AND



5. Chain the OR gate to the AND gate by connecting the output C of the OR gate to input A of the AND gate. There should be three input nodes which you can control (A and B of the OR gate and B from the AND gate). Apply all combinations of inputs to these nodes and measure the voltage of output C on the AND gate.
6. Does it still perform still perform the logic correctly? Why or why not?