

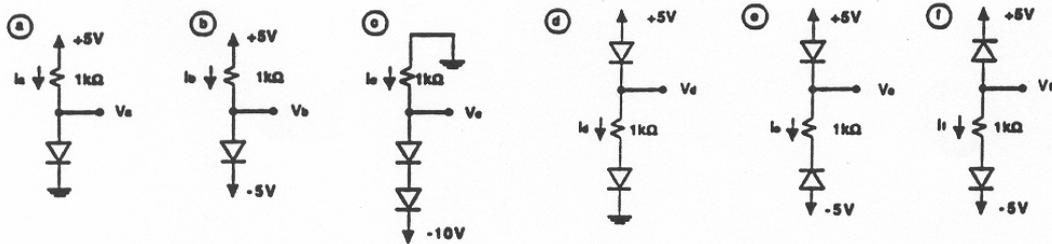
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Folha Prática 3

Díodo – 1

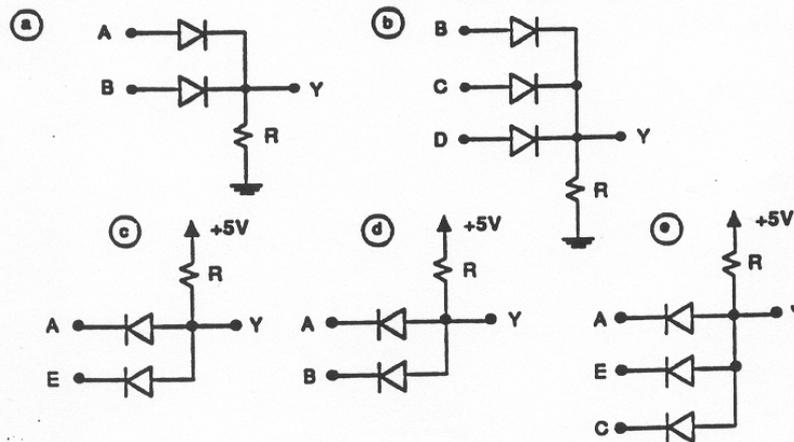
SECTION 3.1: The Ideal Diode

3.1 For the following circuits employing ideal diodes, find the labelled currents, I , and voltages, V , measured with respect to ground.

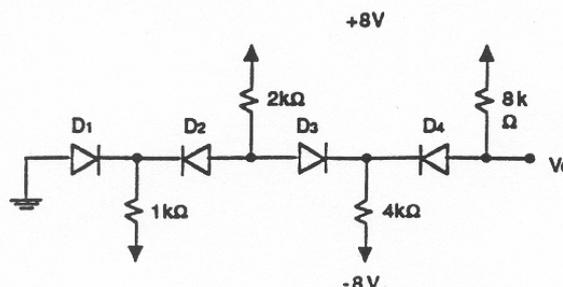


3.2 For the following logic gates using ideal diodes:

- If $V_A = V_E = 5\text{ V}$, and $V_B = V_C = V_D = 0\text{ V}$, what is the value of V_Y produced?
- If logic '1' = 5 V and logic '0' = 0 V , identify the logic function performed.
- If logic '1' = 0 V and logic '0' = 5 V , identify the logic function performed.



3.5 Find the currents I_1, I_2, I_3, I_4 in each of the diodes D_1, D_2, D_3, D_4 of the circuit shown. What V_O results? The diodes are assumed to be ideal.



- 3.6 A small discrete silicon diode (a "100 μA diode") is found to conduct 100 μA at 0.700 V and 1 mA at 0.815 V. Find the values of n and I_S which correspond.
- 3.7 A diode for which $n=1$ conducts 0.1 mA at 0.7 V. Find its voltage drop at 1 mA. For what current is its voltage drop equal to 0.815 V?
- 3.8 A 10-A silicon diode for which $n=2$ is known to have a forward voltage drop of 0.700 V at 10 A. What is the junction voltage at which it conducts 10 mA? 10 μA ?
- 3.9 A particular "1 mA diode", which at 25° C conducts 1 mA at 0.7 V, is operated at 95° C in a circuit which provides it a constant 100 μA . What does its junction voltage become if $n = 2$?
- 3.10 For the situation described in P3.9 above, the leakage current at 25° C is 1 nA. What does it become at 95° C? at 100° C?
- 3.16 A series string of 5 diodes is connected through a resistor R to a 10 V supply. For diodes having 0.7 V drop at 1 mA and a 0.1 V/decade characteristic, find R required to establish a total diode-string voltage of 4.0 V.
- 3.17 In problem P3.16 above if R is reduced to 500 Ω , what does the voltage across the string of 5 diodes become?
- 3.18 A 1-mA diode having a 0.1 V/decade characteristic operates from a constant-current supply with $V_D = 0.8$ V. If it is shunted by two more identical diodes, what does the voltage drop become?
- 3.28 A half-wave rectifier using diodes for which $V_D = 0.7$ V, is supplied by an 8 V rms sine wave at 60 Hz. What is the peak value of the output voltage for very light loads? For what fraction of a cycle does the diode conduct (first approximately, and then more exactly). What is the average value of the output voltage? What is the peak-inverse voltage across the diode? Now, if the diode resistance is 10 Ω , the source resistance is 50 Ω , and the load resistance is 1 k Ω , what do the peak and average output voltages become?
- 3.29 In a half-wave rectifier employing an 8 V rms sine-wave supply and driving a 1 k Ω load, a 6.8 V Zener connected with Zener cathode at the output is accidentally substituted for the rectifier diode. Using 6.8 V and 0.7 V drops for diode conduction in the two directions, sketch the output voltage. What is the average value of the output voltage?
- 3.31 A transformer secondary winding whose output is a 12 V rms sinusoid at 60 Hz is used to drive a bridge rectifier whose diodes' conduction can be modelled by 0.7 V drops. The load is a 1 k Ω resistor. Sketch the load waveform. What is its peak value? Over what time interval is it zero? What is its average value? What is the *PIV* for each diode?
- 3.32 A half-wave rectifier employing a 12-V-rms 60-Hz sine-wave source and no *dc* load is filtered using an electrolytic capacitor having a small leakage current. For diodes assumed to have a 0.7 V drop independent of current, characterize the resulting output. What is the *PIV* required of the diode?
- 3.33 To the circuit in P3.32 above, a load which can be modelled as a 1 mA constant current is connected. If an output ripple of 0.4 V pp results, what is the value of the filter capacitor used? For half this ripple, and double the load, what capacitor is necessary? In each case, what average current flows during the diode's conduction interval?
- 3.34 For both situations described in P3.33 above, but with full-wave rectification, what capacitor values are necessary? What average diode currents flow? What diode *PIV* is required?
- 3.35 A design is required of a full-wave rectifier with capacitor filter to supply 12 volts to a 100 Ω load. A ripple voltage of less than or equal 0.4 V pp is necessary. Diodes are assumed to conduct with 0.7 V drop. Characterize the required 60 Hz transformer secondary, the capacitor and the diodes. For the diodes, provide the required *PIV* and peak-current rating.