Section 10.5: Piecewise-Linear Diode Models

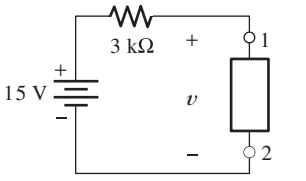
P10.42. If a nonlinear two-terminal device is modeled by the piecewise-linear approach, what is the equivalent circuit of the device for each linear segment?

P10.43. A resistor R_a is in series with a voltage source V_a. Draw the circuit. Label the voltage across the combination as v and the current as i. Draw and label the volt–ampere characteristic (i versus v).

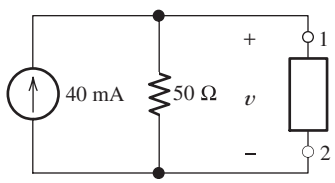
P10.44. The volt–ampere characteristic of a certain two-terminal device is a straight line that passes through the points (2 V, 5 mA) and (3 V, 15 mA). The current reference points into the positive reference for the voltage. Determine the equivalent circuit for this device.

P10.45. Consider the volt–ampere characteristic of an ideal 10-V Zener diode shown in Figure 10.14 on page 486. Determine the piecewise-linear equivalent circuit for each segment of the characteristic.

***P10.46.** Assume that we have approximated a nonlinear volt–ampere characteristic by the straight-line segments shown in Figure P10.46(c). Find the equivalent circuit for each segment. Use these equivalent circuits to find v in the circuits shown in Figure P10.46(a) and (b).

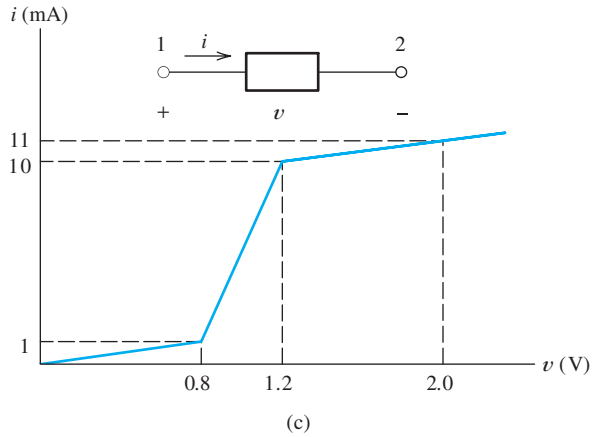


(a)



(b)

Figure P10.46



(c)

Figure P10.46 (*Cont.*)

***P10.47.** The Zener diode shown in Figure P10.47 has a piecewise-linear model shown in Figure 10.19 on page 489. Plot load voltage v_L versus load current i_L for i_L ranging from 0 to 100 mA.

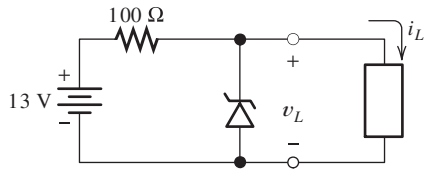


Figure P10.47

P10.48. The diode shown in Figure P10.48 can be represented by the model of Figure 10.23 on page 491, with $V_f = 0.7$ V. **a.** Assume that the diode operates as an open circuit and solve for the node voltages v_1 and v_2. Are

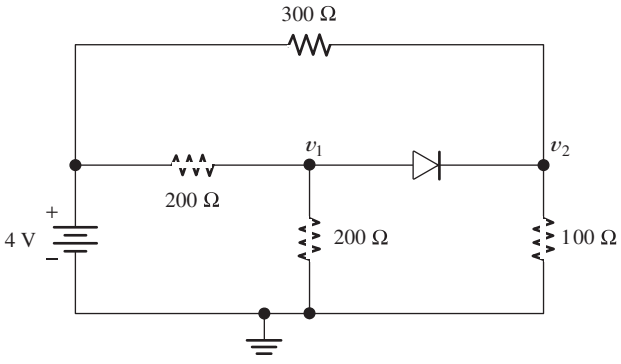


Figure P10.48