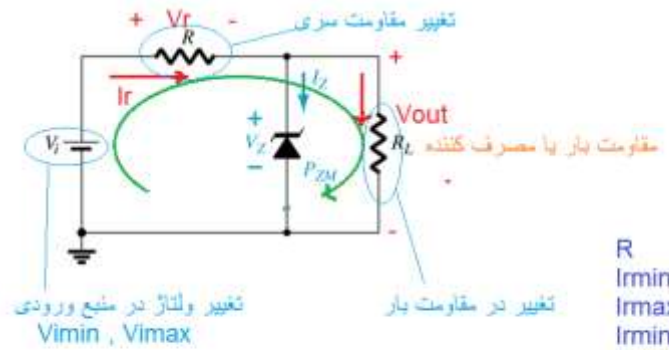

-Vi+Vr+Vout=0
Vout=Vz
Ir=Iz+Irl

Vout= Vi. Rl/(Rl+R)=Vz
Vz= Rl . Irl = Vout

Rl
Rlmin=Vz / Irlmax
Rlmax=Vz / Irlmin
Ir=(Vi-Vz) / R
Ir=Irlmin+Izm
Ir=Irlmax+Izk

R
Irmin=(Vi-Vz) / Rmax
Irmax=(Vi-Vz) / Rmin
Irmin=Izk+Irl
Irmax=Izm+Irl
Irl=Vz / Rl

Vi
Vimin
Vimax
Irmin=(Vimin-Vz) / R
Irmax=(Vimax-Vz) / R
Irmin=Izk+Irl
Irmax=Izm+Irl
Irl=Vz / Rl

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تمرین) مبحث دیود پیوندی نیمه هادی

4.2 For the circuits shown in Fig. P4.2 using ideal diodes, find the values of the voltages and currents indicated.

4.3 For the circuits shown in Fig. P4.3 using ideal diodes, find the values of the labeled voltages and currents.

4.4 In each of the ideal-diode circuits shown in Fig. P4.4, v_I is a 1-kHz, 5-V peak sine wave. Sketch the waveform resulting at v_O. What are its positive and negative peak values?

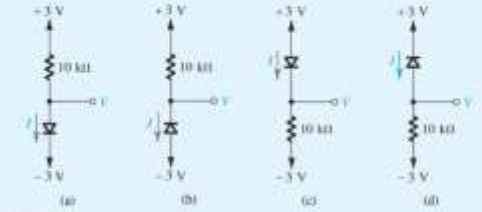


Figure P4.2

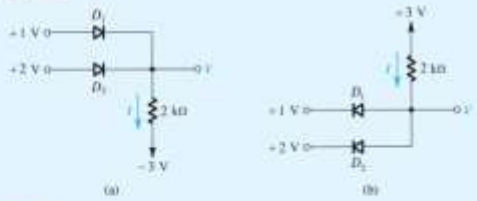


Figure P4.3

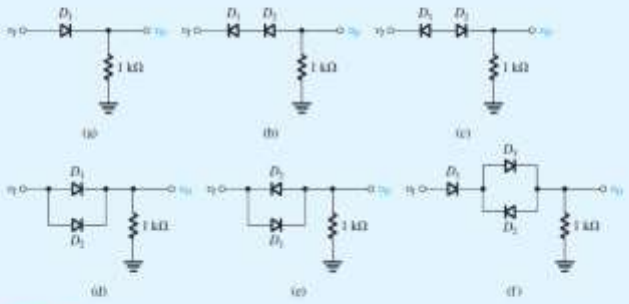


Figure P4.4

■ = MultisimPSpice; * = difficult problem; ** = more difficult; *** = very challenging; D = design problem

4.6 The circuits shown in Fig. P4.6 can function as logic gates for input voltages that are either high or low. Using "1" to denote the high value and "0" to denote the low value, prepare a table with four columns including all possible input combinations and the resulting values of X and Y. What logic function is X of A and B? What logic function is Y of A and B? For what values of A and B do X and Y have the same value? For what values of A and B do X and Y have opposite values?

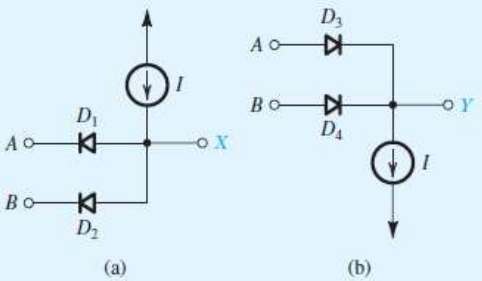


Figure P4.6

4.9 Assuming that the diodes in the circuits of Fig. P4.9 are ideal, find the values of the labeled voltages and currents.

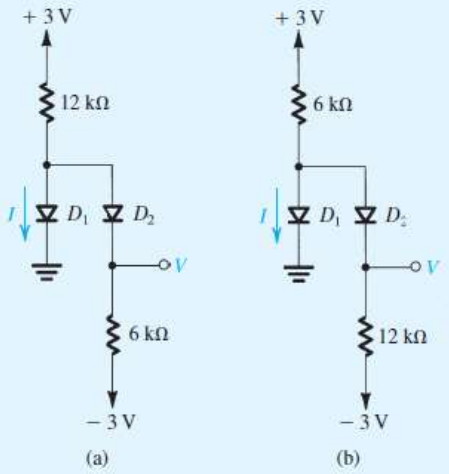


Figure P4.9

4.13 A symmetrical square wave of 5-V peak-to-peak amplitude and zero average is applied to a circuit resembling that in Fig. 4.3(a) and employing a 100-Ω resistor. What is the peak output voltage that results? What is the average output voltage that results? What is the peak diode current? What is the average diode current? What is the maximum reverse voltage across the diode?

*4.51 In the circuit shown in Fig. P4.51, diodes D_1 through D_4 are identical, and each exhibits a voltage drop of 0.7 V at a 1-mA current.

(a) For small input signals (e.g., 10-mV peak), find the small-signal equivalent circuit and use it to determine values of the small-signal transmission v_o/v_i for various values of I: 0 μA, 1 μA, 10 μA, 100 μA, 1 mA, and 10 mA.

(b) For a forward-conducting diode, what is the largest signal-voltage magnitude that it can support while the corresponding signal current is limited to 10% of the dc bias current? Now, for the circuit in Fig. P4.51, for 10-mV peak input, what is the smallest value of I for which the diode currents remain within ±10% of their dc values?

(c) For $I = 1$ mA, what is the largest possible output signal for which the diode currents deviate by at most 10% of their dc values? What is the corresponding peak input? What is the total current in each diode?

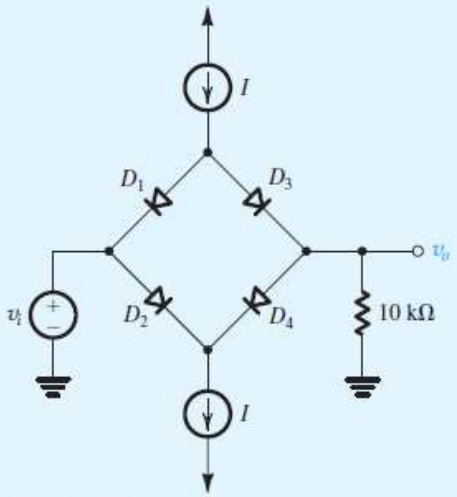


Figure P4.51

D 4.60 A designer requires a shunt regulator of approximately 20 V. Two kinds of zener diodes are available: 6.8-V devices with r_z of 10 Ω and 5.1-V devices with r_z of 25 Ω. For the two major choices possible, find the load regulation. In this calculation neglect the effect of the regulator resistance R.

4.62 A 9.1-V zener diode exhibits its nominal voltage at a test current of 20 mA. At this current the incremental resistance is specified as 10 Ω. Find V_{Z0} of the zener model. Find the zener voltage at a current of 10 mA and at 50 mA.

SIM 4.69 Consider a half-wave rectifier circuit with a triangular-wave input of 5-V peak-to-peak amplitude and zero average, and with $R = 1$ kΩ. Assume that the diode can be represented by the constant-voltage-drop model with $V_D = 0.7$ V. Find the average value of v_O.

*4.91 Plot the transfer characteristic of the circuit in Fig. P4.91 by evaluating v_I corresponding to $v_O = 0.5$ V, 0.6 V, 0.7 V, 0.8 V, 0 V, –0.5 V, –0.6 V, –0.7 V, and –0.8 V. Use the exponential model for the diodes, and assume that they have 0.7-V drops at 1-mA currents. Characterize the circuit as a hard or soft limiter. What is the value of K? Estimate L_+ and L_-.

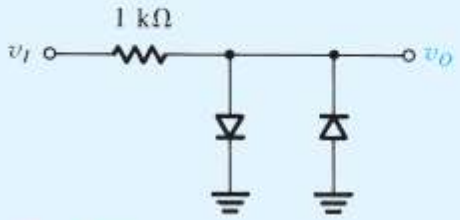
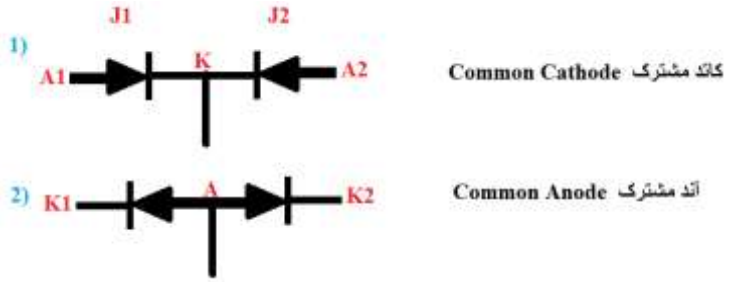


Figure P4.91

ترانزیستورهای پیوندی دوقطبی Bipolar Junction Transistor (BJT)

دو قطبی Bipolar --> دارای دو اتصال است --> اتصال pn --> قطب --> Pole



پیوند pn --> پیوند --> Junction

مقاومت انتقالی --> Transfer Resistor --> ترانزیستور --> Transistor

حالات کار ترانزیستور

1- اشباع