كلية الرشيد الجامعة

هندسة تقنيات الاجهزة الطبية

ELECTRONIC CIRCUITS AND DEVICES

DIODE CHARACTERISTICS

(2)

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مرحلة ثانية

Diode Switching Circuits

Basic Concepts:

Diode switching circuits typically contain two or more diodes, each of which is connected to an independent voltage source. Understanding the operation of a diode switching circuit depends on determining which diodes, if any, are forward biased and which, if any, are reverse biased. The key to this determination is remembering that ***a diode is forward biased only if its anode is positive with respect to its cathode*** (see Fig. 2-1). One of the very import applications of diode switching circuits is logic gates.

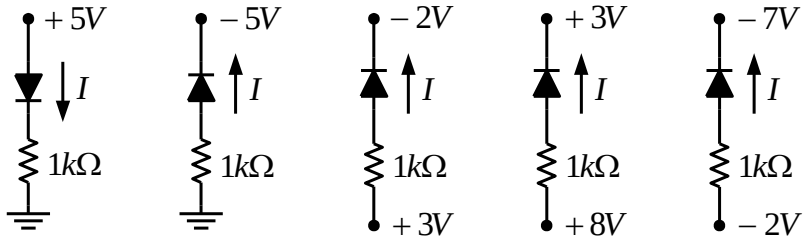


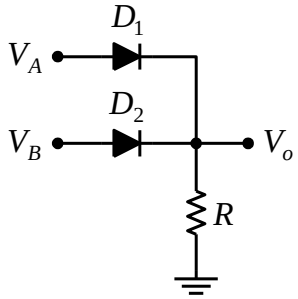
Fig. 2-1

Logic Gates:

Diodes can be used to form logic gates, which perform some of the logic operations required in digital computers.

➢ OR Gate:

It has output when there a signal in any input channels (see Fig. 2-2).

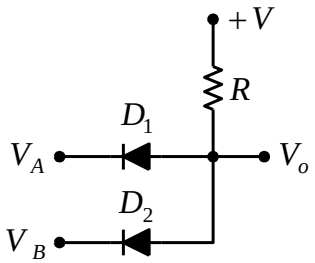


Input voltages		State of diodes		Output voltage
V_A	V_B	D_1	D_2	V_o
0	0	off	off	0
0	1	off	on	1
1	0	on	off	1
1	1	on	on	1

Fig. 2-2

➢ AND Gate:

It has output only when all inputs are present (see Fig. 2-3).



Input voltages		State of diodes		Output voltage
V_A	V_B	D_1	D_2	V_o
0	0	on	on	0
0	1	on	off	0
1	0	off	on	0
1	1	off	off	1

Fig. 2-3

Example 2-1:

Determine which diodes are forward biased and which are reverse biased in the circuits shown in Fig. 2-4. Assuming a 0.7-V drop across each forward-biased diode, determine the output voltage V_o.

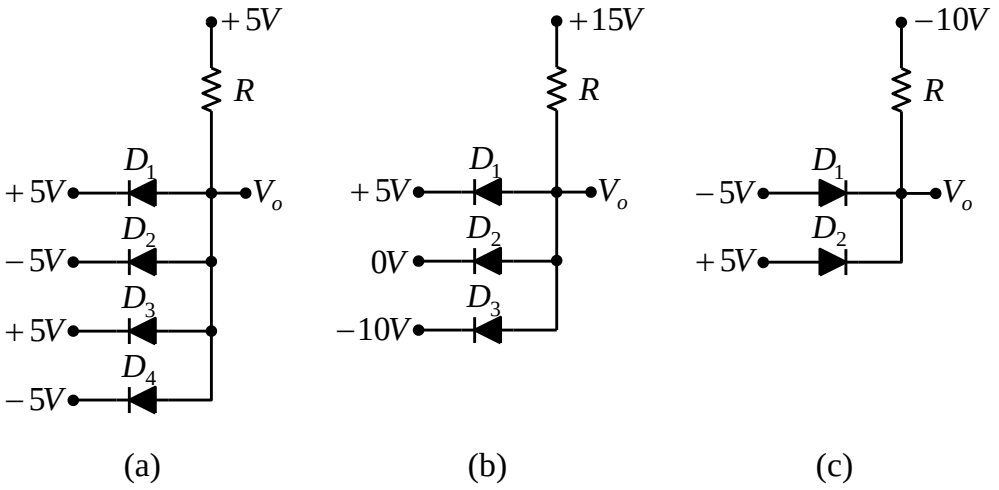


Fig. 2-4

***Solution*:**

Appling a golden rule, a diode is forward biased when

$\boxed{V^{Anode} - V^{Catode} = V^{+ve} > V_T}$, yields:

In (a) the net forward-biasing voltage between supply and input for each diode is

D_1 & D_3: +5 - (+5) = 0*V*,

D_2 & D_4: +5 - (-5) = 10*V*.

Therefore, D_2 and D_4 are forward biased and D_1 and D_3 are reverse biased.

V_o = -5 + 0.7 = -4.3*V*.

While in (b) the net forward-biasing voltage between supply and input for each diode is

D_1: +15 - (+5) = +10*V*,

D_2: +15 - 0 = +15*V*,

D_3: +15 - (-10) = +25*V*.

Therefore, D_3 is forward biased and D_1 and D_2 are reverse biased.

V_o = -10 + 0.7 = -9.3*V*.

Finally, in (c) the net forward-biasing voltage between supply and input for each diode is

D_1: -5 - (-10) = +5*V*,

D_2: +5 - (-10) = +15*V*.

Therefore, D_2 is forward biased and D_1 is reverse biased.

V_o = +5 - 0.7 = +4.3*V*.

Exercise:

Determine V_o and I for each circuit in Fig. 2-5. Assume that each of the diodes in these circuits has a forward voltage drop of 0.7 V.

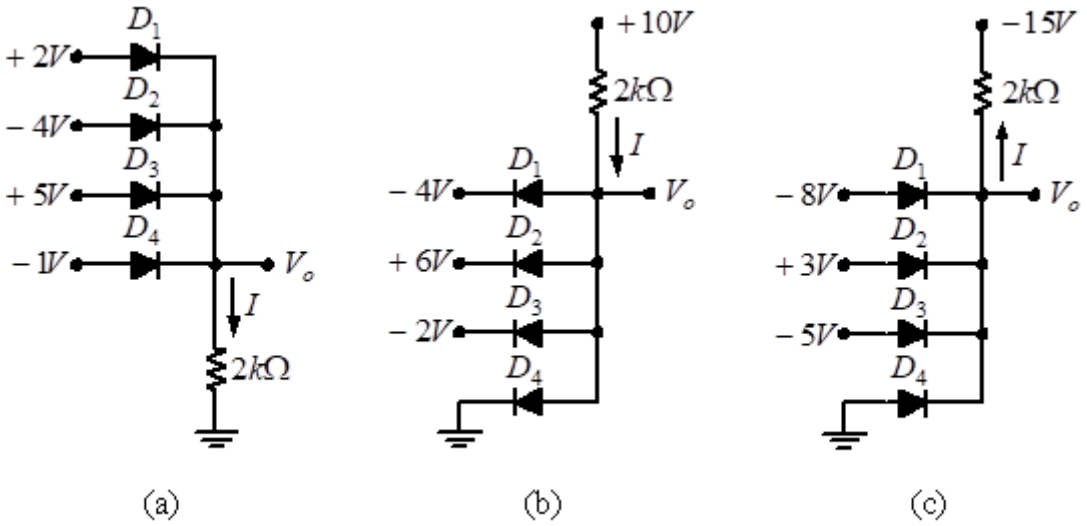


Fig. 2-5