2.1 DIODE APPLICATIONS

2.1.1 SERIES DIODE CONFIGURATION WITH DC INPUTS

❖ The approximate models for the diode will be employed as shown in Fig(2-1)

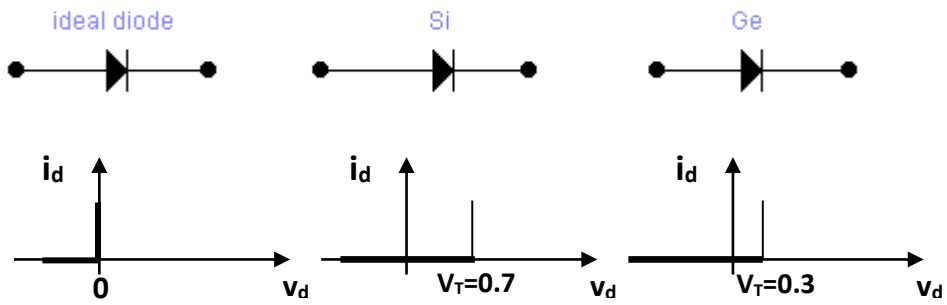
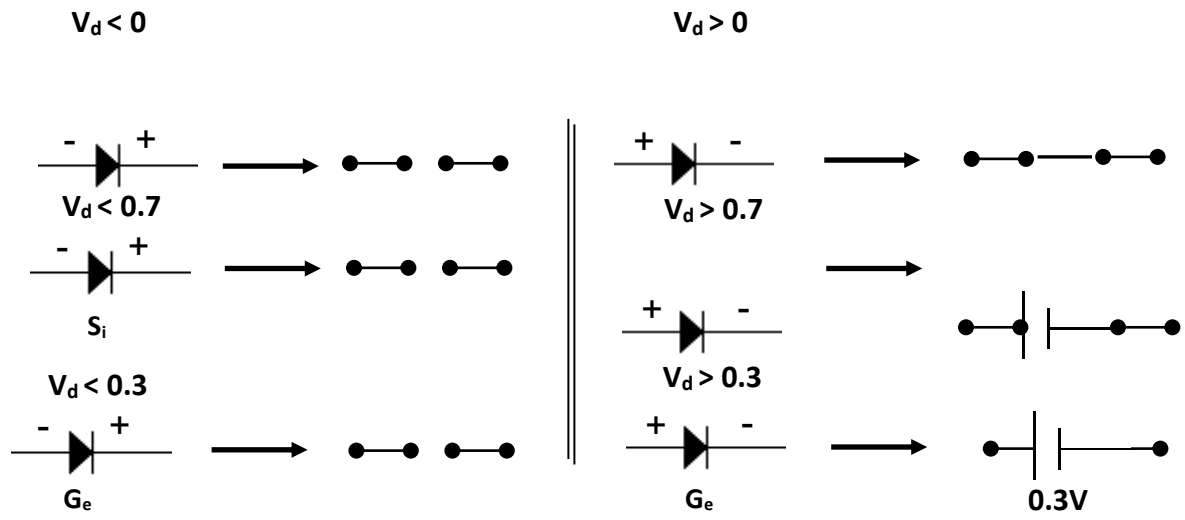


Fig (2-1) Ideal and Approximate for the diode

❖ For the approximate models voltages less than 0.7V for Si and 0.3V for Ge will also result in an open cct. and for voltage greater than the above values will result in an the equivalent cct. short cct. as shown in Fig(2-2).



OFF state for ideal , S_i ,G_e ON seat for ideal , S_i ,G_e

Fig(2-2) OFF state ON seat for ideal , S_i ,G_e

- Let us begin by determining the various voltages and the current level for the series DC configuration of Fig (2-3). The first question is the state of the diode (short cct.) or (open cct.) for most situations, removing the diode from the picture and determining the direction of the resulting current will provide the diode states short cct. or open cct. as shown in Fig(2-4).

Fig (2-4) Determining the state of diode

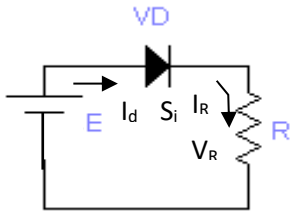
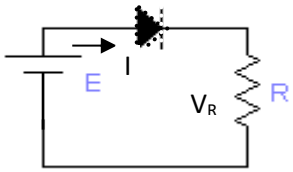


Fig (2-3) Series diode configure



- Assuming $E>V_T$, the diode is in the ON state and the equivalent cct is shown in Fig (2-5)

$V_D = V_T$

$V_R = E - V_T$

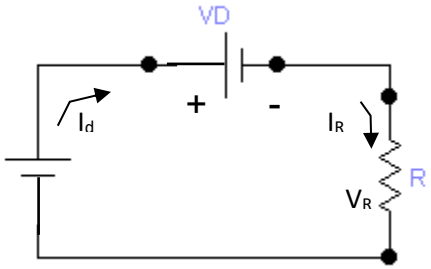


Fig (2-5)

EXAMPLE 2.1

For the series diode configuration of Fig (6-6) determine V_D, V_R, I_D

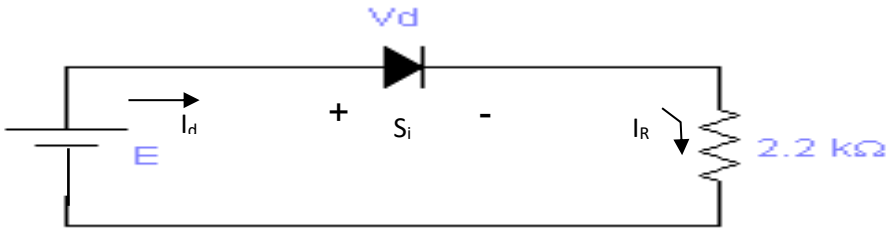


Fig (2-6)

SOLUTION

The diode is in the ON state because the applied voltage establishes a current in the clockwise direction to match the arrow of the symbol.

$V_T = V_D = 0.7V$

$V_R = E - V_T = E - V_D = 8 - 0.7 = 7.3V$

$$\therefore I_D = I_R = \frac{V_R}{R} = \frac{7.8}{2.2 \times 10^3} = 3.32mA$$

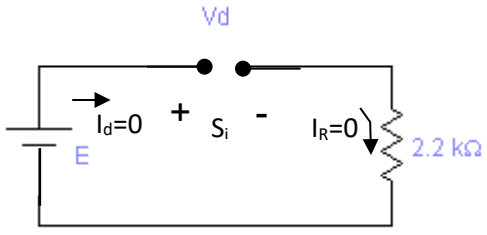
If the example above is repeated with the diode reversed , then removing the diode , we find that the direction of I in fig (2.6) as shown above is opposite to the arrow in the diode :-

The diode is in the open circuit (off state)

$\therefore I_D = 0$ A

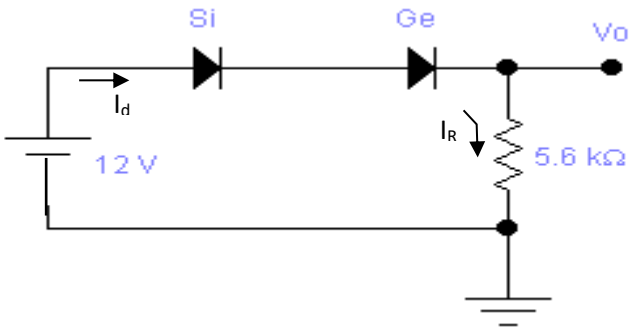
$V_R = I_R R = 0 (R) = 0$ V

$V_D = E - V_R = E - 0 = E = 8V$



EXAMPLE 6.2

Determine Vo and I_D for the series cct. in Fig(2-7)



Fig(2-7)

SOLUTION

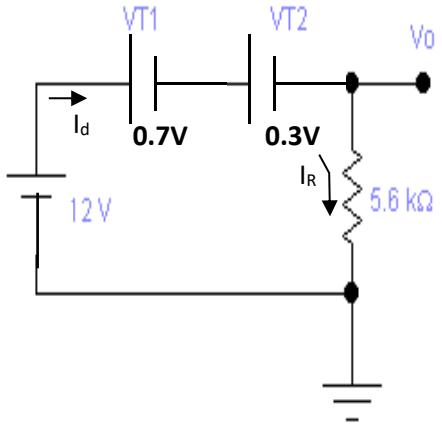
The resulting current, established by voltage source, has the same direction as the arrowhead of the symbols of both diodes

E> (0.7+0.3)V

$\therefore V_0 = E - V_{T1} - V_{T2}$

$= 12 - 0.7 - 0.3 = 11V$

$I_D = I_R = \frac{V_R}{R} = \frac{V_o}{R} = \frac{11}{5.6k\Omega} = 1.96$ mA



2.1.2 PARALLAL CONFIGURATION WITH DC INPUTS

The methods applied in series configuration can be extended to the analysis of parallel configuration.

EXAMPLE 2.3

Determine the current I for network of Fig (2-8)

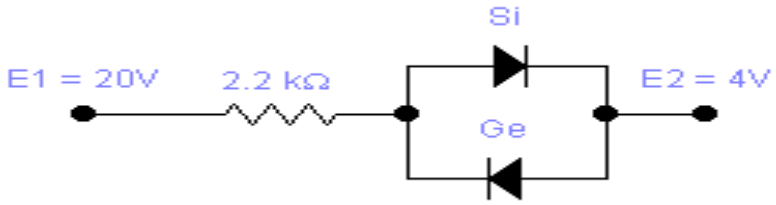
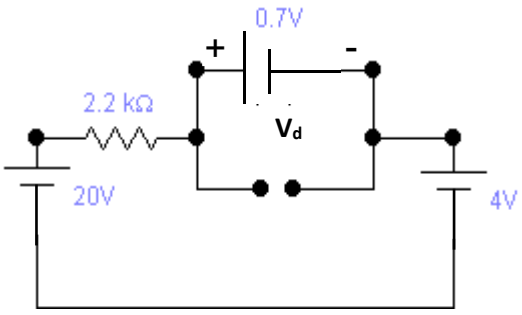


Fig (2-8)

SOLUTION

The resulting current direction is such as to turn ON the silicon diode and turn OFF the Germanium diode

$$I = \frac{E_1 - E_2 - V_D}{R} = \frac{20 - 4 - 0.7}{2.2 \times 10^3} = 6.95mA$$



2.1.3 SERIES–PARALLAL CONFIGURATION WITH DC INPUTS

The methods applied in series configuration and parallel configuration can be extended to the analysis of series –parallel configuration.

EXAMPLE 6.4

Determine V_o and I for the networks of Fig. (2-9)

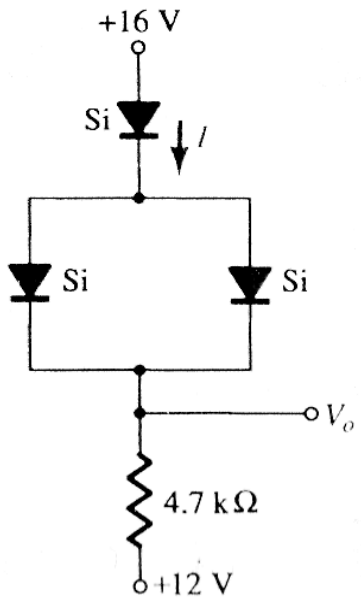


Fig. (2.9)

SOLUTION

H. W.