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RESISTANCE LEVELS

As the operating point of a diode moves from one region to another the resistance of the diode will also change due to the nonlinear shape of the characteristic curve.

DC or Static Resistance

The application of a dc voltage to a circuit containing a semiconductor diode will result in an operating point on the characteristic curve that will not change with time. The resistance of the diode at the operating point can be found simply by finding the corresponding levels of *V D* and *I D* as shown in Fig. 1.23 and applying the following equation:

$$R_D = \frac{V_D}{I_D} \qquad (1.4)$$

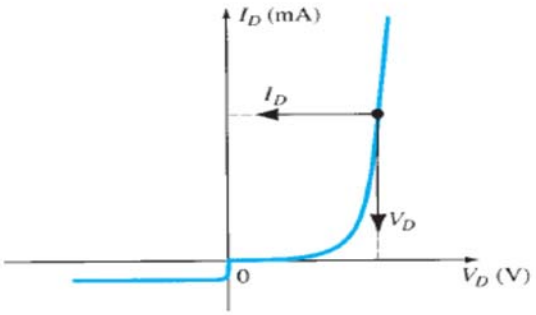

FIG. 1.23
Determining the dc resistance of a diode at a particular operating point.

In general, therefore, the higher the current through a diode, the lower is the dc resistance level.

Typically, the dc resistance of a diode in the active (most utilized) will range from about 10 Ω to 80 Ω.

AC or Dynamic Resistance

If a sinusoidal rather than a dc input is applied, the situation will change completely. The varying input will move the instantaneous operating point up and down a region of the characteristics and thus defines a specific change in current and voltage as shown in Fig. 1.25. With no applied varying signal, the point of operation would be the *Q*-point appearing on Fig. 1.25, determined by the applied dc levels. The designation *Q-point* is derived from the word *quiescent*, which means "still or unvarying."

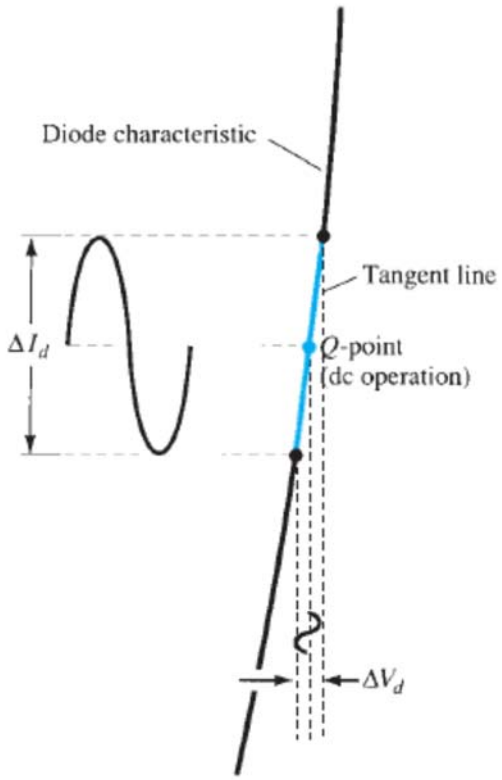

FIG. 1.25
Defining the dynamic or ac resistance.

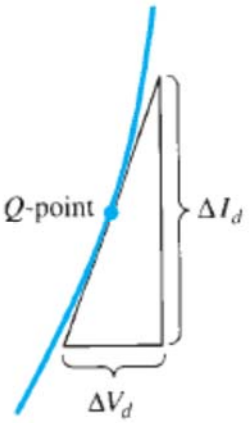

FIG. 1.26
Determining the ac resistance at a Q-point.

$$r_d = \frac{\Delta V_d}{\Delta I_d} \qquad (1.5)$$

where Δ signifies a finite change in the quantity.

The steeper the slope, the lower is the value of ΔV_d for the same change in ΔI_d and the lower is the resistance. The ac resistance in the vertical-rise region of the characteristic is therefore quite small, whereas the ac resistance is much higher at low current levels.

In general, therefore, the lower the Q-point of operation (smaller current or lower voltage), the higher is the ac resistance.