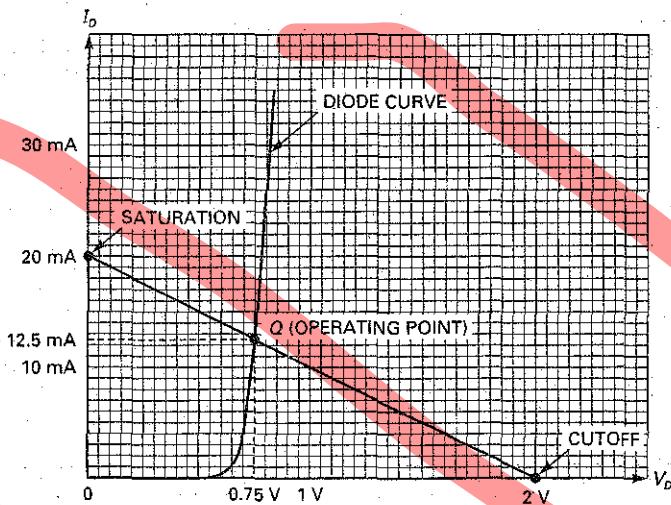


Figure 3-18 Q point is the intersection of the diode curve and the load line.



Incidentally, the Q point has no relationship to the figure of merit of a coil. In the present discussion, Q is an abbreviation for *quiescent*, which means "at rest." The quiescent or Q point of semiconductor circuits is discussed in later chapters.

3-11 Surface-Mount Diodes

Surface-mount (SM) diodes can be found anywhere there is a need for diode applications. SM diodes are small, efficient, and relatively easy to test, remove, and replace on the circuit board. Although there are a number of SM package styles, two basic styles dominate the industry: SM (surface mount) and SOT (small outline transistor).

The SM package has two L-bend leads and a colored band on one end of the body to indicate the cathode lead. Figure 3-19 shows a typical set of dimensions. The length and width of the SM package are related to the current rating of

Figure 3-19 The two-terminal SM-style package, used for SM diodes.

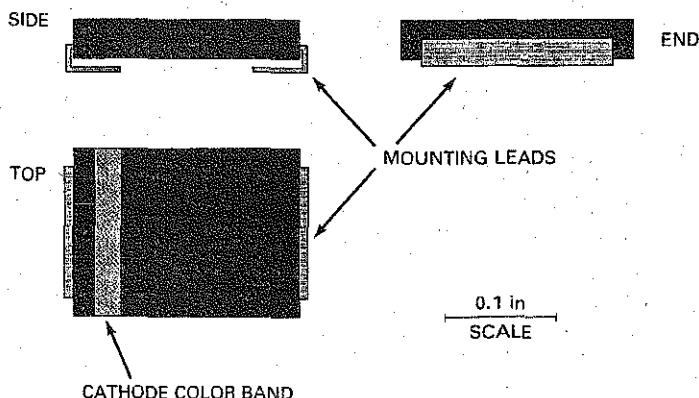
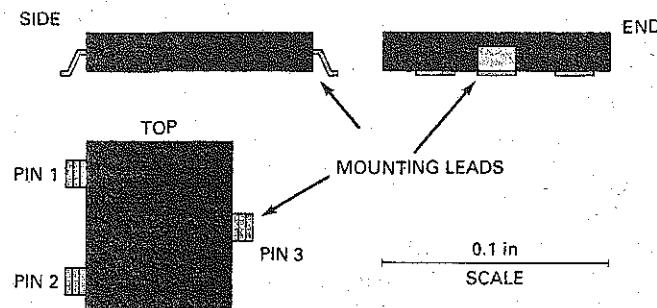


Figure 3-20 The SOT-23 is a three-terminal transistor package commonly used for SM diodes.



the device. The larger the surface area, the higher the current rating. So an SM diode rated at 1 A might have a surface area given by 0.181 by 0.115 in. The 3 A version, on the other hand, might measure 0.260 by 0.236 in. The thickness tends to remain at about 0.103 in for all current ratings.

Increasing the surface area of an SM-style diode increases its ability to dissipate heat. Also, the corresponding increase in the width of the mounting terminals increases the thermal conductance to a virtual heat sink made up of the solder joints, mounting lands, and the circuit board itself.

SOT-23 packages have three gull-wing terminals (see Fig. 3-20). The terminals are numbered counterclockwise from the top, pin 3 being alone on one side. However, there are no standard markings indicating which two terminals are used for the cathode and the anode. To determine the internal connections of the diode, you can look for clues printed on the circuit board, check the schematic diagram, or consult the diode manufacturer's data book. Some SOT-style packages include two diodes, which have a common-anode or common-cathode connection at one of the terminals.

Diodes in SOT-23 packages are small, no dimension being greater than 0.1 in. Their small size makes it difficult to dissipate larger amounts of heat, so the diodes are generally rated at less than 1 A. The small size also makes it impractical to label them with identification codes. As with many of the tiny SM devices, you have to determine the PIN from other clues on the circuit board and schematic diagram.

Summary

SEC. 3-1 BASIC IDEAS

A diode is a nonlinear device. The knee voltage, approximately 0.7 V for a silicon diode, is where the forward curve turns upward. The bulk resistance is the ohmic resistance of the *p* and *n* regions. Diodes have a maximum forward current and a power rating.

SEC. 3-2 THE IDEAL DIODE

This is the first approximation of a diode. The equivalent circuit is a switch that closes when forward biased and opens when reverse biased.

SEC. 3-3 THE SECOND APPROXIMATION

In this approximation, we visualize a silicon diode as a switch in series with a knee voltage of 0.7 V. If the Thevenin voltage facing the diode is greater than 0.7 V, the switch closes.