

BTS Electrotechnique ANGLAIS Session 1999

WHAT IS A SCHOTTKY DIODE?

The Schottky diode is an important device which is widely used in radio-frequency (RF) applications. It possesses many similarities to the point-contact diode. In fact many of the early devices were made in the same way as a point-contact diode, although today's devices are made with totally different manufacturing techniques.

Unlike conventional semiconductor diodes, which consist of a PN junction, the Schottky diode is made from a metal semiconductor junction. This offers a number of advantages in some circumstances as the diode has a very low forward-voltage drop, and secondly it has a very fast switching speed. Both of these properties make it ideal for many RF applications as well as giving it uses in many other areas, as we shall see.

Characteristics.

The Schottky diode is what is called a majority carrier device. This gives it tremendous advantages in terms of speed. By making the devices small, the normal RC (resistance-capacitance) type time constants can be reduced, making the Schottky diode an order of magnitude faster than the conventional PN diodes. This factor is the prime reason why they are so popular in RF applications.

The Schottky diode also has a much higher current density than an ordinary PN junction. This means that forward-voltage drops are lower, making these diodes ideal for use in power-rectification applications. The main drawback of the diode is found in the level of its reverse current, which is relatively high. For many uses this may not be a problem, but it is a factor which is worth watching when using Schottky diodes in more exacting applications.

Variety of Applications.

The Schottky diode is used in a wide variety of applications. It can naturally be used as a general-purpose rectifier. However, in terms of RF applications, it is particularly useful because of its high switching speed and high-frequency capability. Schottky diodes are similarly very good as RF detectors as their low capacitance and forward-voltage drop enable them to detect signals which an ordinary PN junction would not see.

It has already been mentioned that the Schottky diode has a high-current density and low forward-voltage drop. As a result, Schottky diodes are widely used in power supplies. By using these diodes, less power is wasted, making the supply more efficient. Also this increase in efficiency means that less heat has to be dissipated, and smaller heatsinks may be able to be incorporated in the design.

The Schottky diode is used in logic circuits. Although not as common these days, the 74LS (low-power Schottky) and 74S (Schottky) families of logic circuits use Schottky diodes as a core component. The Schottky is inserted between the collector and base of the driver transistor to act as a clamp (see Fig. 2). To produce a low or logic '0' output the transistor is driven hard on, and in this situation the base-collector junction of the diode is forward biased. When the Schottky diode is present, this takes most of the current and allows the turn-off time of the transistor to be greatly reduced, thereby improving the speed of the circuit.

The Schottky diode is also used as a fundamental building block in a number of other devices

from photodiodes to metal-semiconductor field-effect transistors (MESFETs). Not only does this diode find widespread use in many applications in its own right, but it is an essential part of many other components as well.

Adapted from Popular Electronics, July 1998

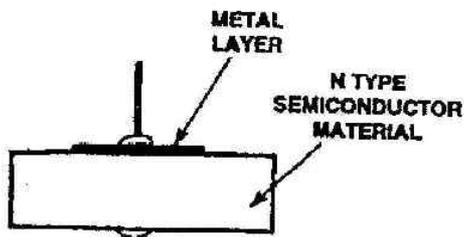


Fig. 1. Basic construction of a Schottky diode.

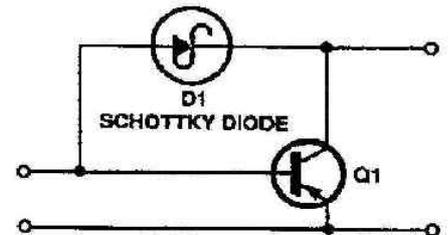


Fig. 2 Schottky clamp diode used for improved switching speed.

durée 2 heures

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Travail à faire

1 - Rédiger en français (200 à 250 mots) un compte-rendu clair, pertinent et utilisable du document proposé. 12PO:

Le candidat veillera plus particulièrement à bien dégager les éléments essentiels et à s'exprimer dans une langue de qualité.

2 - Traduire les deux premiers paragraphes du texte, depuis : "The Schottky diode is " jusqu'à " as we shall see".

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