Training objectives and introduction

In this section we will learn how a semiconductor diode operates. You will record the current flowing through the diode for various amperages and voltage directions with the aid of an oscilloscope and then interpret the results.

Training content

- Recording a voltage and current characteristic
- Reading the breakdown voltage
- Reversing and conducting state response of the diode

Introduction

Modern diodes are semiconductor components, which have attained supreme importance in electrical engineering and electronics thanks to their compact design and robust nature. In the past, vacuum diodes were used with a heated cathode and anode. Today, silicon is the most important basic material.

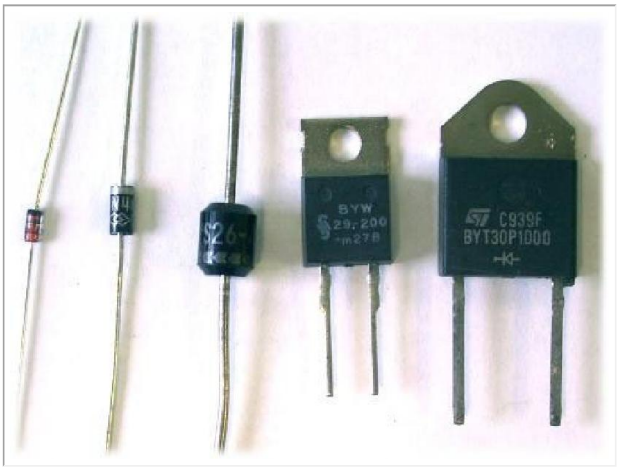

Figure 1:
Various models of semiconductor diodes, which differ in terms of their voltage-proof capacity, current carrying capacity and switching frequency. Precise specifications pertaining to this are provided by the manufacturer on a so-called data sheet.

Diodes are usually equipped with two terminals.

Anode Cathode

Figure 2:
Even today's semiconductor diodes are still shown as an anode and cathode.

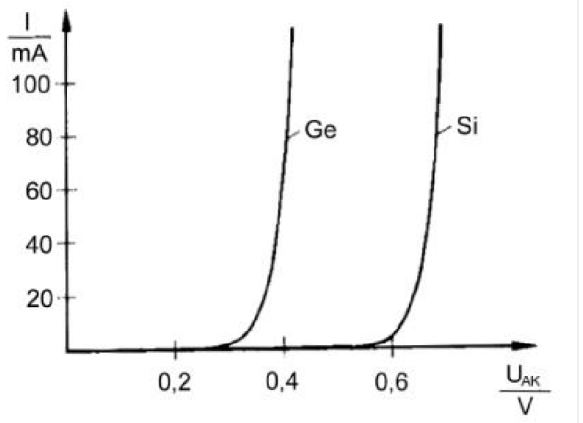

Figure 3:
Forward (conducting state) characteristics of silicon and germanium diodes

Functional description:
The ideal diode acts like a valve for electrical current. It allows current to flow through from the anode to the cathode in the forward (conducting) direction, while blocking current flowing from the cathode to the anode in the reverse (blocking) direction. The forward or conducting direction of the current can be recognised by the arrow in the circuit symbol (Figure 2).

Real diodes:
A component type designation (Fig. 1) is printed on the real component. The cathode is designated either with a ring or in the case of larger models by a circuit symbol or letter. Occasionally, there are also types that omit the designation altogether. Then, you have to refer to the corresponding data sheet of the manufacturer or perform a measurement using the diode tester.
The real diode deviates only slightly in its properties from the ideal diode. But it features neither ideal forward nor ideal blocking attributes. This is particularly recognisable in the diode characteristic (Fig. 3). At high frequencies additional adverse effects can be noticed which, however, we will ignored here.

- Forward or conducting direction:
  Diodes have a very low forward voltage of approx. 0.7 V for silicon and 0.3 V for germanium diodes. Furthermore, they have a forward DC resistance which can be seen in the slope of the diode characteristic.
  Diodes are subject to limits which may not be exceeded. In the forward range it is the maximum permissible current in particular that may not be exceeded.
- Reverse or blocking properties:
  Diodes have only a finite voltage-proof capability, which however can vary from type to type. In the reversing or blocking range it is the maximum permissible blocking voltage that must be taken into consideration.