Recording the current-voltage characteristics of diodes

Objects of the experiment

■ Studying the current *I* as a function of the voltage *U* for different types of diodes.

Principles

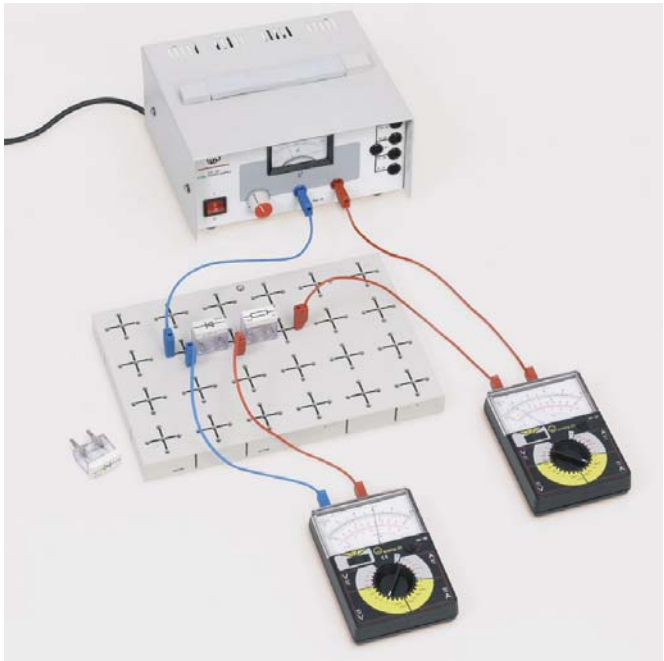
Virtually all aspects of electronic circuit technology rely on semiconductor components. The semiconductor diodes are among the simplest of these. They consist of a semiconductor crystal in which an n-conducting zone is adjacent to a p-conducting zone. Capture of the charge carriers, i.e. the electrons in the n-conducting and the “holes” in the p-conducting zones, forms a zone of low-conductivity at the junction called the depletion layer. The size of this zone is increased when electrons or holes are pulled out of the depletion layer by an external electric field with a certain orientation. The direction of this electric field is called the “reverse direction”. Reversing the electric field into what is called “forward direction” drives the respective charge carriers into the depletion layer, allowing current to flow through the diode.

In the experiment, the current-voltage characteristics of a Si-diode (silicon diode) and a Ge-diode (germanium diode) are measured and graphed manually point by point. The aim is to compare the current in the reverse direction and the threshold voltage as the most important specifications of the two diodes.

Apparatus

1 Rastered socket panel DIN A 4	576 74
1 STE Resistor 100 Ω, 2 W	577 32
1 STE Ge-Diode AA 118	578 50
1 STE Si-Diode 1 N 4007	578 51
1 AC/DC Power supply 0...12 V / 3 A	521 485
2 Multimeters LDanalog 20	531 120
1 Connecting Lead 100 cm Red	500 441
2 Pair cables 50 cm, red/blue	501 45

Setup



Carrying out the experiment

- Set up the experiment as shown in the figure. Plug in the Si-Diode 1N4007, so that the tip of the triangle points from plus to minus (in the direction of the current, “forward direction”). Pay attention to the measuring range and polarity of the multimeters.
- Record the characteristic: Carefully increase voltage *U* – starting with 0 V – and observe current *I*. The current *I* should not exceed 30 mA.
- For different pairs of voltage *U* and current *I* fill in the first two columns of table 1.
- Reverse the diode, i.e. plugged in reverse direction. Carefully increase voltage *U* – starting with 0 V – up to 5 V and observe current *I*.
- For different pairs of voltage *U* and current *I* fill in the first two columns of table 2.
- Repeat the experiment with the Ge-Diode AA118 and fill in the remaining two columns of table 1 and table 2.

KEM 0806

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- Measuring example

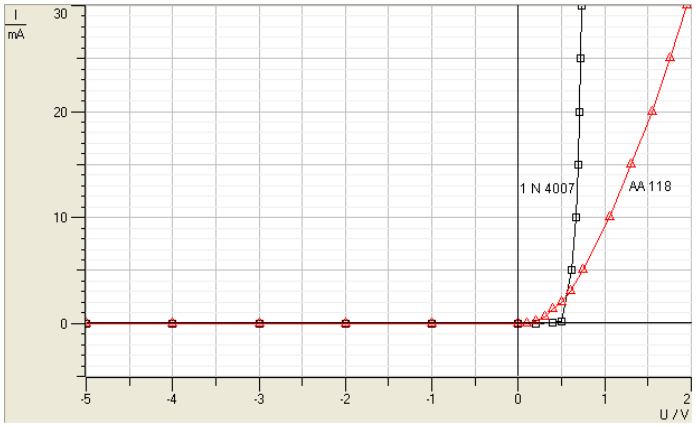
Table 1 : Diodes in conducting-state (forward) direction

Si-Diode 1 N 4007		Ge-Diode AA 118	
$\frac{U}{\mathrm{V}}$	$\frac{I}{\mathrm{mA}}$	$\frac{U}{\mathrm{V}}$	$\frac{I}{\mathrm{mA}}$
0	0	0	0
0.2	0	0.2	0
0.4	0.1	0.3	0.6
0.5	0.2	0.4	1.3
0.62	5	0.5	2.0
0.67	10	0.6	3.0
0.69	15	0.75	5
0.71	20	1.05	10
0.72	25	1.30	15
0.73	30	1.55	20
		1.75	25
		1.95	30

Table 2 : Diodes in reverse direction

	Si-Diode 1 N 4007	Ge-Diode AA 118
$\frac{U}{\mathrm{V}}$	$\frac{I}{\mathrm{mA}}$	$\frac{I}{\mathrm{mA}}$
0	0	0
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0

Evaluation and results



The current *I* of a diode in conducting state direction below the threshold voltage U_S is close to zero increasing very fast above U_S.

For the Si-diode the threshold voltage is about 0.7 V for the Ge diode threshold voltage is about 0.3 V.

The current *I* for Diodes connected in reverse direction is close to zero.

This way diodes are acting like a valve.

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