The characteristic curve of a silicon diode (Item No.: P1373900)

Curricular Relevance

Area of Expertise: Physik
Education Level: Klasse 10-13
Topic: Elektrizitätslehre
Subtopic: Elektronik
Experiment: Die Kennlinie einer Siliziumdiode

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	10 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional information

Characteristic curves provide professionals with information on the behaviour of electrical components. Each type of component has its own typical characteristic curve. The students are to learn this in connection with this experiment, in which they themselves record and evaluate the characteristic curve of a silicon diode.

Notes on setup and procedure

The 300 mA− measurement range is too large for the determinations of the forward currents at voltages of up to about 0.65 V. We therefore recommend the 30 mA− measurement range to be first selected, and to switch to the higher range during the series of measurements.
For the measurement of the reverse current, the turning of the diode through 180° is preferred here to the reversal of polarity of the operating voltage and the two measuring instruments. The students must recognise this, so that they understand why the voltages in the lower part of Table 1 are negative.

Remarks

The silicon diode is conductive from a voltage of approximately 0.7 V onwards. This voltage is called threshold voltage. It is required to compensate for the diffusion voltage. This is the voltage which is formed in the barrier layer between the p-conducting and n-conducting silicon as a result of the diffusion of electrons in the p-conducting area and electron holes in the n-conducting area.
The reverse current of the silicon diode used in the experiment is so low that it cannot be detected with common measuring instruments. This is why we do not recommend the use of the 50 mA− measurement range to determine if a reverse current flows. If this is done, however, with the appropriate type of connection for the forward direction (correct for voltage), then the ammeter would essentially show the current flowing through the voltmeter.

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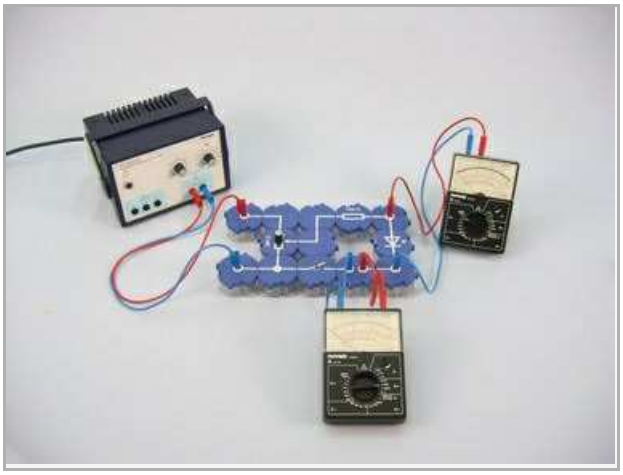
Task and equipment

Task

Which properties of a diode can be derived from its characteristic curve?

Determine the dependence of the intensity of the current that flows through a diode from the voltage drop across the diode.



Equipment

Position No.	Material	Order No.	Quantity
1	Angled connector module, SB	05601-02	3
2	T-shaped connector module, SB	05601-03	1
3	Interrupted connector module, SB	05601-04	1
4	Junction module, SB	05601-10	2
5	Angled connector module with socket, SB	05601-12	2
6	On-off switch module, SB	05602-01	1
7	Resistor module 100 Ohm, SB	05613-10	1
8	Potentiometer module 250 Ohm, SB	05623-25	1
9	Silicon-diode module 1N4007, SB	05651-00	1
10	Connecting cord, 32 A, 250 mm, red	07360-01	1
11	Connecting cord, 32 A, 250 mm, blue	07360-04	1
12	Connecting cord, 32 A, 500 mm, red	07361-01	2
13	Connecting cord, 32 A, 500 mm, blue	07361-04	2
14	Multi-range meter, analogue	07028-01	2
15	PHYWE power supply DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

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Set-up and procedure

Set-up

Set up the circuit as shown in Fig. 1 and Fig. 2, with the switch open; connect the diode in the forward direction; select the 1 V− and 30 mA− measurement ranges.

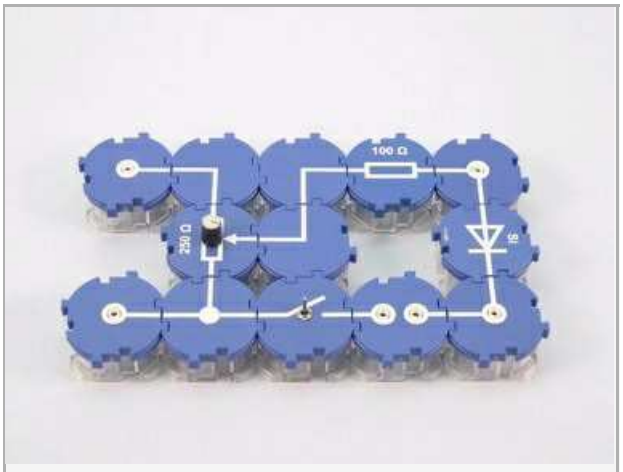

Fig. 1

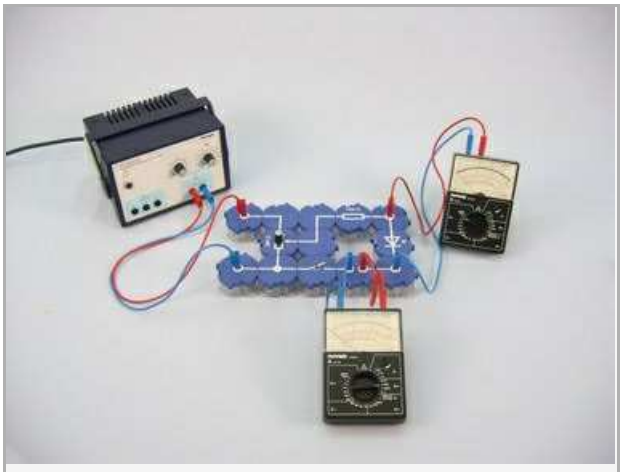

Fig. 2

Procedure

- Turn the rotary knob on the potentiometer to the left stop, switch on the power supply and set it to 12 V direct voltage.
- Close the switch.
- Increase the direct voltage in suitable steps up to 0.7 V, measure the current at each step (conductivity state current) and enter the measured values in Table 1 in the report.
- Select the 300 mA− measurement range and increase the voltage above 0.7 V; note the measured value.
- Finally turn the voltage back to 0 V, select the 3 V− measurement range and reverse the diode by 180°.
- Close the circuit, determine the current (reverse current) for 1 V and 2 V and enter the values in Table 1 (as negative voltage values).
- Switch off the power supply.

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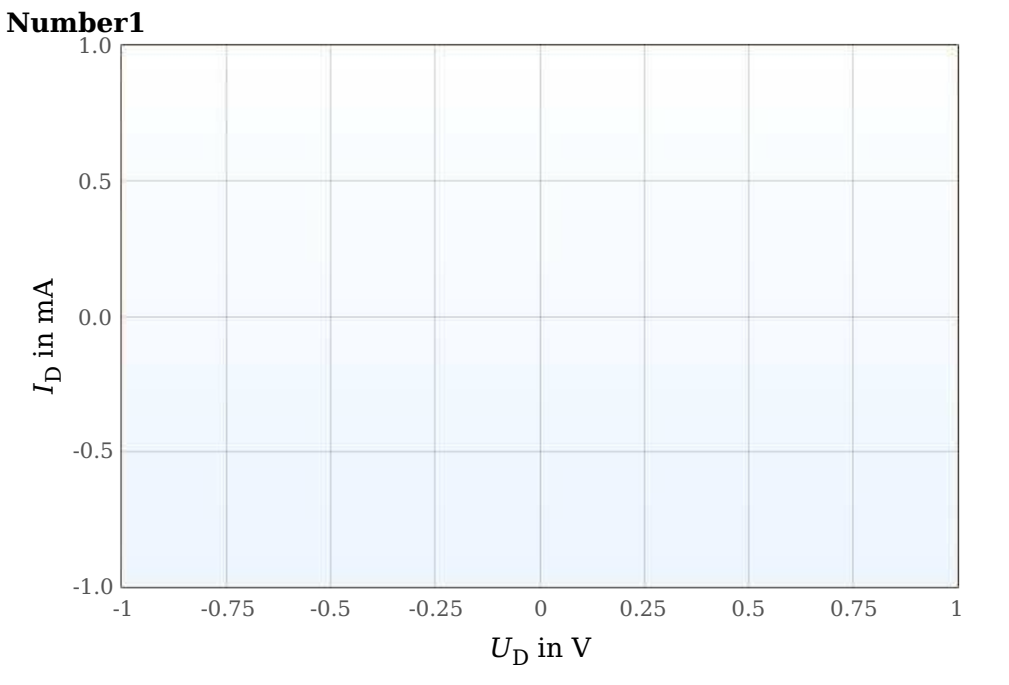
Report: The characteristic curve of a silicon diode

Result - Table 1

Record your measured values.

U_D in V	I_D in mA
	1 ±0
	1 ±0
	1 ±0
	1 ±0
	1 ±0
	1 ±0
	1 ±0
	1 ±0
	1 ±0
	1 ±0



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Evaluation - Question 1

Why is a graph such as that in the chart of Table 1 called the characteristic curve?

Note the information on the behaviour of the diode that you can derive from the characteristic curve.

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Evaluation - Question 2

What is the function of the 100 Ω resistor in the circuit?

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