The characteristic curve of a Z-diode (Item No.: P1400900)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 16-19
Topic: Electricity
Subtopic: Electronics
Experiment: The characteristic curve of a Z-diode

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

Additional Requirements:

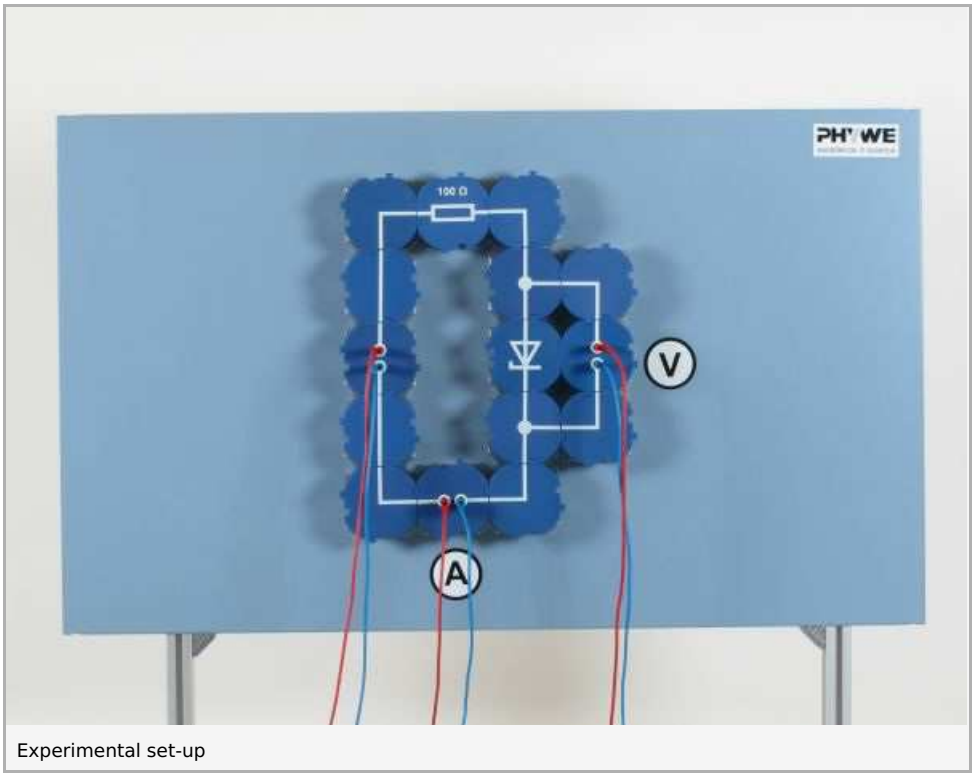
Experiment Variations:

Keywords:

Principle and equipment

Principle

The characteristic curve of a Z-diode is to be plotted.



Experimental set-up

Equipment

Position No.	Material	Order No.	Quantity
1	Multimeter ADM2, demo., analogue	13820-01	2
2	PHYWE power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A	13500-93	1
3	Demo Physics board with stand	02150-00	1
4	Connector interrupted, module DB	09401-04	3
5	Resistor 100 Ohm,module DB	09413-10	1
6	Z-diode ZF 4.7,module DB	09452-00	1
7	Electr.symbols f.demo-board,12pcs	02154-03	1
8	Connector, straight, module DB	09401-01	2
9	Connector, angled, module DB	09401-02	6
10	Connector, T-shaped, module DB	09401-03	2
11	Connecting cord, 32 A, 1000 mm, red	07363-01	2
12	Connecting cord, 32 A, 1000 mm, blue	07363-04	2
13	Connecting cord, 32 A, 750 mm, red	07362-01	1
14	Connecting cord, 32 A, 750 mm, blue	07362-04	1

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Set-up and procedure

- Set up the experiment as shown in Fig. 1; first switch the Z-diode in the forward direction; select the 1 00 mA-measurement range for current and 1 V- for voltage measurement
- Increase the direct voltage in small steps (see Table 1); read the value of the voltage U_{F} at the diode and of the conductivity state current I_{F} and enter them in Table 1
- Set the voltage back to 0 V; rotate the Z-diode building block through 180° and replace it
- Change the measurement range from 1 V- to 10 V-
- Increase the voltage in suitable steps, starting from 0 V; read off the values for U_{Z} and I_{Z} and enter them in Table 1.

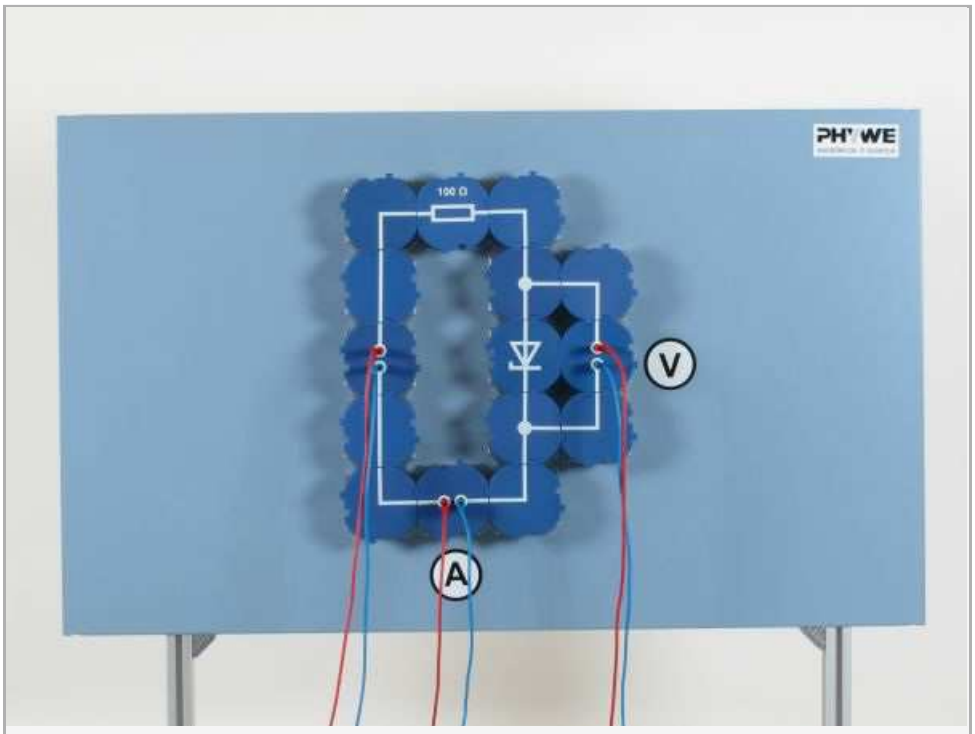

Fig. 1

Observation and evaluation

Observation

Table 1

Z-diode polarity for forward direction		Z -diode polarity for inverse direction	
$\frac{U_F}{V}$	$\frac{I_F}{mA}$	$\frac{U_Z}{V}$	$\frac{I_Z}{mA}$
0.20	0	-1.0	0
0.40	0	-2.0	0
0.60	0	-3.0	0
0.75	3	-4.0	0
0.80	17	-4.5	-9
0.83	55	-5.0	-53
0.85	100	-5.1	-95

Evaluation

The graphical representation of the measured values in Fig. 2 shows the characteristic curve of a Z-diode. When the polarity of the Z-diode is that for the forward direction, then it behaves as a customary silicon rectifying diode. A noticeable conductivity state current flows when the voltage exceeds the value of approx. 0. 7 V, and increases steeply with increasing voltage.

With polarity reversed, the Z-diode blocks the current up to a characteristic voltage, the breakdown voltage. When this voltage U_Z is exceeded, the Z-diode loses its blocking effect and a current of strength I_Z flows, that increases strongly with increasing voltage. The Z-diode that was examined, ZF 4.7, has a breakdown voltage of -4.7 V. A change in the voltage from -4.5 V to -5.1 V causes a change in the current of from -9 mA to -95 mA. The voltage on the diode remains relatively constant, even when the current strength changes.

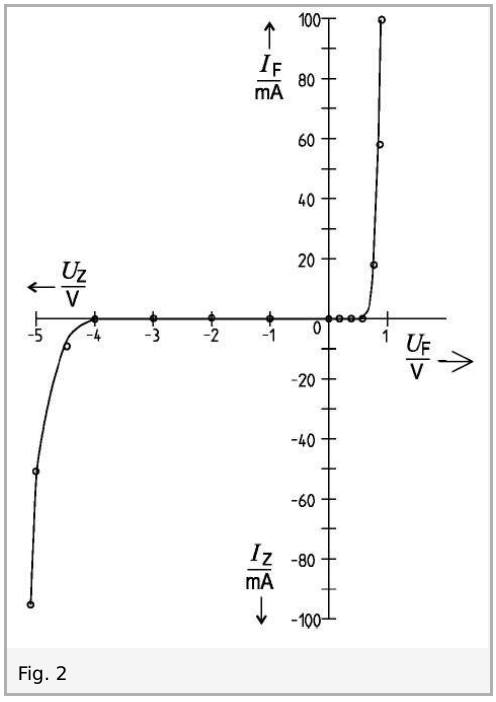

Fig. 2

Remarks

The behaviour of the Z-diode in the breakdown area is caused by the high electric field strength in the boundary layer. This so strongly accelerates freely mobile electrons that they liberate further charge carriers that are at first bonded. This causes the current strength to grow like an avalanch, and it must be restricted to a permissible maximum value by a series resistance.