DEPARTMENT OF ELECTRONICS AGH UST

LABORATORY
OF
ELECTRONIC ELEMENTS

DIODES

REV. 1.0

1. THE GOAL OF THE EXERCISE

- measurements DC characteristics of rectifier, LED and stabilizer diodes
- to get familiar and acquainted with practical aspects of diodes,
- determination and estimation of basic parameters of semiconductor junctions.

2. THE UTILIZED MODELS AND ELEMENTS

During the exercise following components will be used:

- NI ELVIS Prototyping Board (ELVIS) connected with PC,
- Virtual measurement devices: `Virtual Instruments (VI):`
- `Digital Multimeter (DMM),`
- `Variable Power Supply (VPS),`
- `Two-Wire Voltage Analyzer (2-Wire)`
- Set of electronics elements listed in Table 1.

Table 1. Values of electronics elements required to perform the exercise

Resistors	2x100Ω, 2x220Ω, 2x330Ω, 2x470Ω, 2x1kΩ
Diodes	Rectifier diodes: 2x1N4001, 2x1N4448, 2x1N914, 2xBAV21 Zener diodes: 2x3.3V, 2x5.1V, 2x9.1V LED: 2xRed, 2xGreen, 2xWhite, 2xBlue, 2xYellow

3. PREPARING THE DRAFT

3.1. Draw an ideal and real DC current-voltage characteristic of a rectifier diode. Show the real DC current-voltage characteristic in linear as well as in lin-log scale.

3.2. In case of DC current-voltage characteristic in lin-log scale mark series resistance and the parameters, which are characteristic for the junction. Describe these parameters.

3.3. Basing on the datasheets, draw the DC current-voltage characteristics of the Zener diodes (V_z = 3.3V, V_z = 5.1V, V_z = 9.1V), which work in the inverse bias mode.

3.4. Determine the voltage drop for the specified colors of LEDs working in forward bias mode, and match the appropriate wave length.

3.5. Define a small signal resistance of the diode and describe the method of its determination.

4. THE COURSE OF THE EXERCISE

4.1. For the chosen by the teacher rectifier diode, investigate point by point a DC current-voltage characteristic with the use of VPS and DMM (see Fig. 4.1).

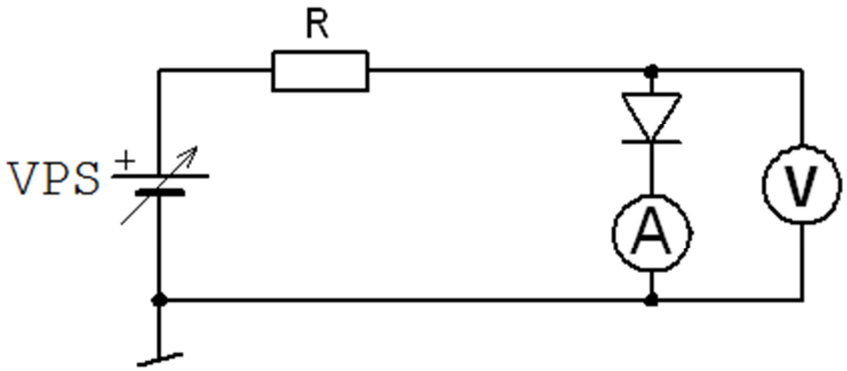

Fig. 4.1. Measurement of DC current-voltage characteristics of a diode.

4.2. Using DUT+, DUT- and Two-Wire Voltage Analyzer (2-Wire) determine and write the DC current-voltage characteristics of all rectifier diodes chosen by the teacher.

4.3. Using DUT+, DUT- and Two-Wire Voltage Analyzer (2-Wire) determine and write the DC current-voltage characteristics of all Zener diodes chosen by the teacher.

4.4. Basing on Fig. 4.1, with the use of VPS and DMM, measure the voltage drop on the LEDs chosen by the teacher. Determine, which currents flow by the diode during weak shining, strong shining and very strong shining. ATTENTION: adjust current restriction to 25mA!

4.5. Basing on the obtained measurement data for the rectifier diode, place in the report the DC current-voltage characteristic in the linear scale in one single graph. Moreover, for one chosen diode place on the graph the current-voltage characteristic in linear and lin-log scale. Identify and mark characteristic working areas of the diode. Additionally, determine the following parameters of the diode: saturation current value, generic recombination current value, series resistance, nonideality factor of the junction. Values of this parameters need to be compared with those presented in datasheets.

4.6. Basing on the obtained measurement data for the Zener diodes, place in the report the DC current-voltage characteristic in the linear scale in one graph. Mark the Zener voltage and determine small signal resistance for three chosen current values (for example 1mA, 10mA, 20mA). Compare the obtained results with those given in datasheets. Explain the difference in shaped of the characteristics for the specified diodes. Which effects are responsible for these differences? Which diode has the best stabilizing properties and why?

5. LITERATURE

[1] Lecture (P. Dziurdzia)

[2] Behzad Razavi „Fundamentals of Microelectronics”

[3] Marciniak W. „Przyrządy półprzewodnikowe i układy scalone ”, Warszawa, WNT, 1987