

Examination of P-N junction diodes

Tasks:

I. Practical measurements:

1. Measure the V-A characteristic in forward and reverse direction of *Ge* P-N junction diode for two different temperatures – T_1 (25°C) and T_2 (50 °C).
2. Measure the V-A characteristic in forward and reverse direction of *Si* P-N junction diode for two different temperatures – T_1 (25°C) and T_2 (50 °C).

II. Graphics:

1. In common coordinate systems draw the V-A characteristics of *Si* diode and *Ge* diode for $T=25^\circ\text{C}$.
2. In common coordinate systems draw the V-A characteristics of *Ge* and *Si* for two temperatures.

III. Calculations:

1. Calculate the dynamic resistance r_d from the measurements for current with value $I_F=10\text{mA}$ for both diodes.

$$r_d = \frac{U_{F2} - U_{F1}}{I_{F2} - I_{F1}}, \text{ for } I_F = 10\text{mA} = \text{const}$$

2. Calculate the value of temperature coefficient TKU_F for current with value $I_F=20\text{mA}$ for both diodes.

$$TKU_F = \frac{U_{F2} - U_{F1}}{T_2 - T_1}, \text{ for } I_F = 20 \text{ mA} = \text{const}$$

Answer the questions

1. What are the values of turn-on forward voltage for *Si* and for *Ge* diodes?
2. What are the approximately values of reverse currents for *Si* and *Ge* diodes?
3. What is the approximately value of dynamic resistance for forward-biased diode?
4. What is the approximately value of dynamic resistance for reverse- biased diode?
5. How changes the reverse current with increasing the temperature?
6. What is the polarity of temperature coefficient TKU_F ?
7. Draw the circuit of forward-biased *Si* diode. Show the polarity of voltage source and the current direction. Calculate the current through the circuit, if the source voltage is $E=6\text{V}$ and resistance $R= 1 \text{ kohm}$.

Forward Characteristic:

Table 1

	I_F, mA	0	0.1	0.5	1	2	4	6	8	9	10	11	12	15	20
U_F, mV 25°C	Ge diod														
	Si diod														
U_F, mV 50°C	Ge diod														
	Si diod														

Reverse Characteristic:

Table 2

	U_R, V	0	1	2	4	6	8	10	12	15	20	40	60	80	100
$I_R, \mu\text{A}$ 25°C	Ge diod														
	Si diod														
$I_R, \mu\text{A}$ 50°C	Ge diod														
	Si diod														

Remark:

First measure all characteristics for $T = 25 \text{ }^\circ\text{C}$ and after switch on heating. Otherwise we need to wait for diodes cooling.