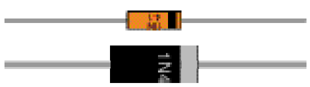
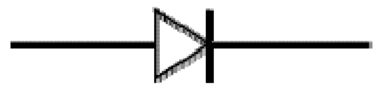
LAB#02

Objective

To study the characteristics of silicon and germanium diodes.

Theory

Diodes allow electricity to flow in only one direction. The arrow of the circuit symbol shows the direction in which the current can flow. Diodes are the electrical version of a valve and early diodes were actually called valves.

Example:  Circuit symbol: 

Forward Voltage Drop

Electricity uses up a little energy pushing its way through the diode, rather like a person pushing through a door with a spring. This means that there is a small voltage across a conducting diode, it is called the **forward voltage drop** and is about 0.7V for all normal diodes which are made from silicon. The forward voltage drop of a diode is almost constant whatever the current passing through the diode so they have a very steep characteristic (current-voltage graph).

Reverse Voltage

When a reverse voltage is applied a perfect diode does not conduct, but all real diodes leak a very tiny current of a few µA or less. This can be ignored in most circuits because it will be very much smaller than the current flowing in the forward direction. However, all diodes have a **maximum reverse voltage** (usually 50V or more) and if this is exceeded the diode will fail and pass a large current in the reverse direction, this is called **breakdown**.

Preparatory Exercise

Q1) Describe the most important characteristics of diode.

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Q2) Which end of a diode has the "band" marking (ie Cathode, or Anode)?

Q3) What is barrier potential?

Q4) What is cut in voltage?

Q5) What are the applications of diode?

Q6) Why is a diode conducting when it is forward biased but not when it is reverse biased?

Q7) Which are the two main mechanisms that cause breakdown in a diode? Describe them

Requirement

Instruments

1. DC power supply
2. Function Generator
3. Digital Multimeter (DMM)

Components

1. Diodes : Silicon (D1N4002), Germanium (D1N4148)
2. Resistors: 1kΩ, 1MΩ

Procedure

Part A: Forward-bias Diode Characteristics

1. Construct the circuit of *Fig. 2.1* with the supply (E) is set at 0 V. Record the measured value of the resistor.

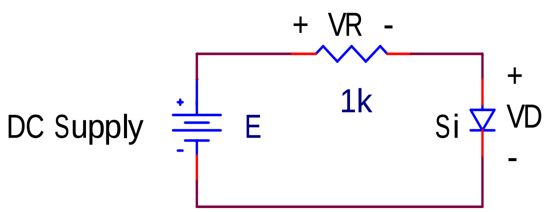

Fig. 2.1

2. Increase the supply voltage until V_D reads 0.1 V. Then measure current I_D and record the results in Table 2.1
3. Repeat step 2 for the remaining settings of V_D shown in the Table 2.1.
4. Replace the silicon diode by a germanium diode and complete Table 2.2.
5. Plot on a graph paper I_D versus V_D for the silicon and germanium diodes. Complete the curves by extending the lower region of each curve to the intersection of the axis at $I_D = 0$ mA and $V_D = 0$ V.

Part B: Reverse-bias Diode Characteristics

1. Construct the circuit of *Fig. 2.2* with E is set at 20V. Record the measured value of the resistor.

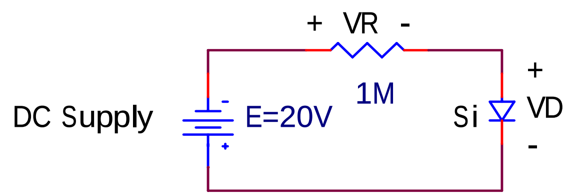

Fig. 2.2

2. Measure the voltage V_D. Measure the reverse saturation current, I_s.
3. Repeat the above step for germanium diode.
4. How do the results of Step 2 compare to Step 3? What are the similarities?

Observation

Results and Calculations

Part A (Forward Bias)

1. R (measured) = ________________
2. I_D (measured). Fill in Table 2.1 and Table 2.2

Table 2.1(Silicon Diode)

V_D (V)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.75
I_D (mA)								

Table 2.2 (Germanium Diode)

V_D (V)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.75
I_D (mA)								

Part B (Reverse Bias)

1. R (measured) = ___________
2. Silicon Diode

   V_D (measured) = ___________

   I_S (measured) = ___________

3. Germanium Diode

   V_D (measured) = ___________

   I_S (measured) = ____________