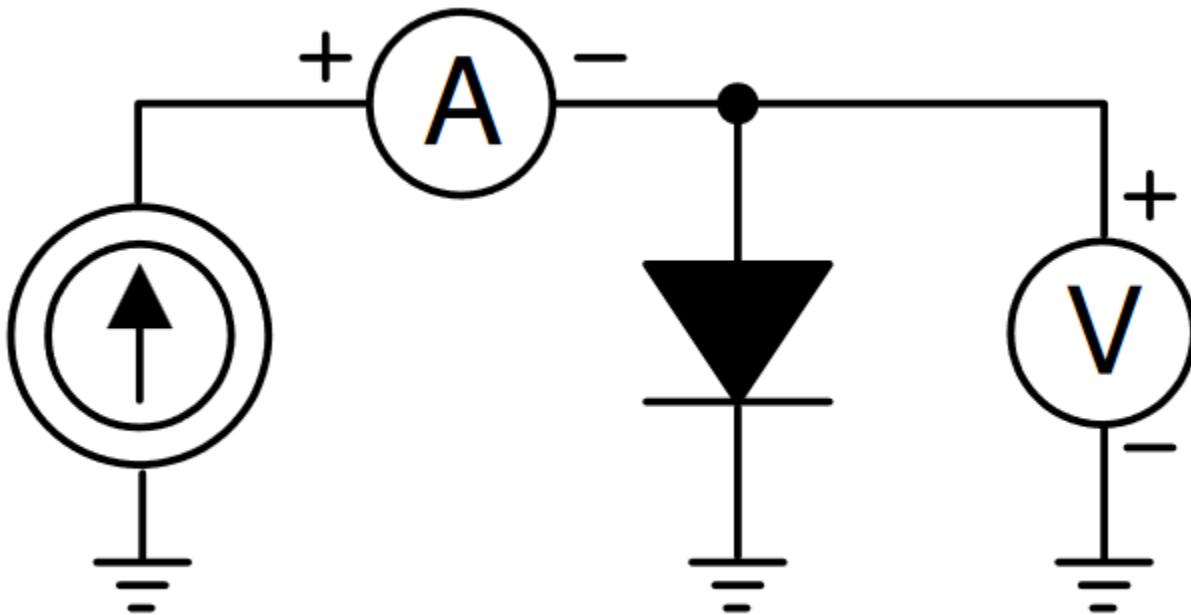


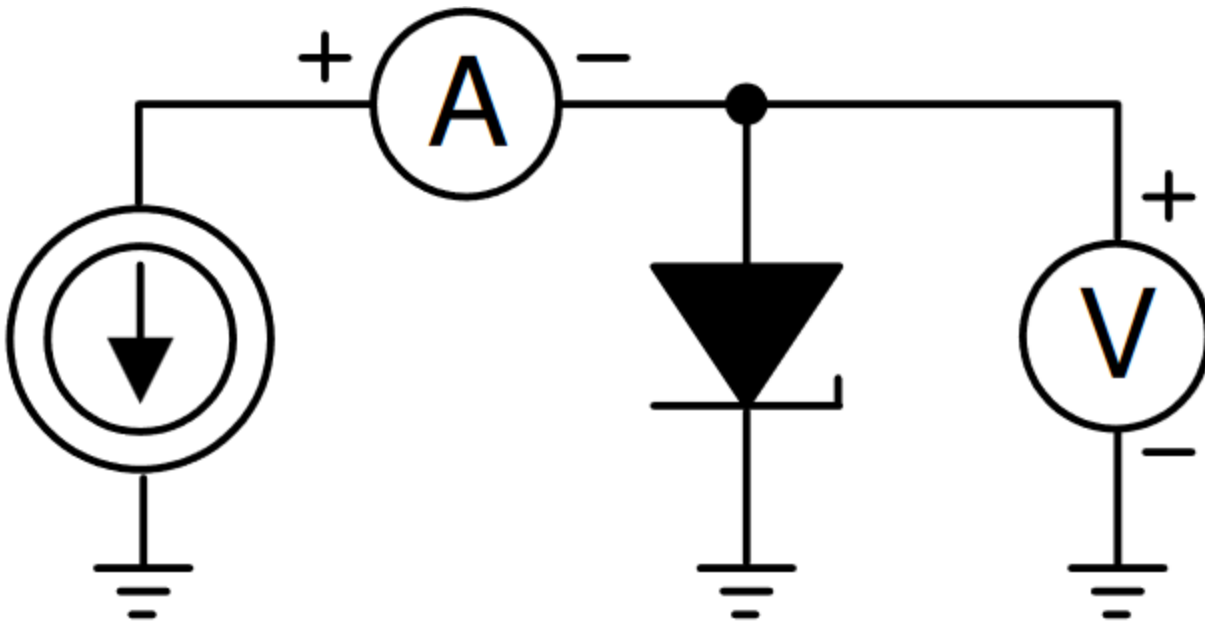
1) Goal

The goal of this experiment was to deepen our understanding on current-voltage characteristics of various semiconductor diodes, through measuring voltage across them, while changing output of the current source.

2) Measurement scheme

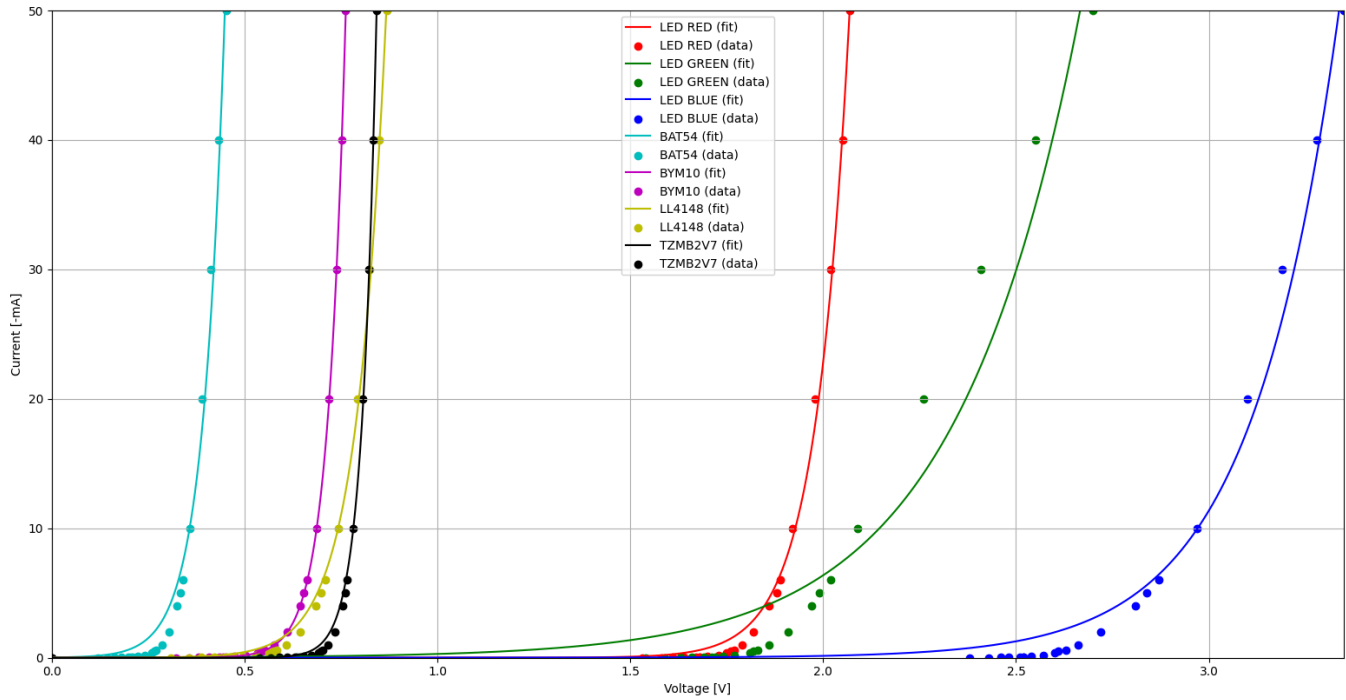


The measurement scheme used to measure red, green, blue LEDs and BAT54, BYM10, LL4148, TZMB8V2 diodes. The purpose of the setup is to measure the current-voltage characteristics of these diodes by adjusting the current and measuring the corresponding voltage drop.

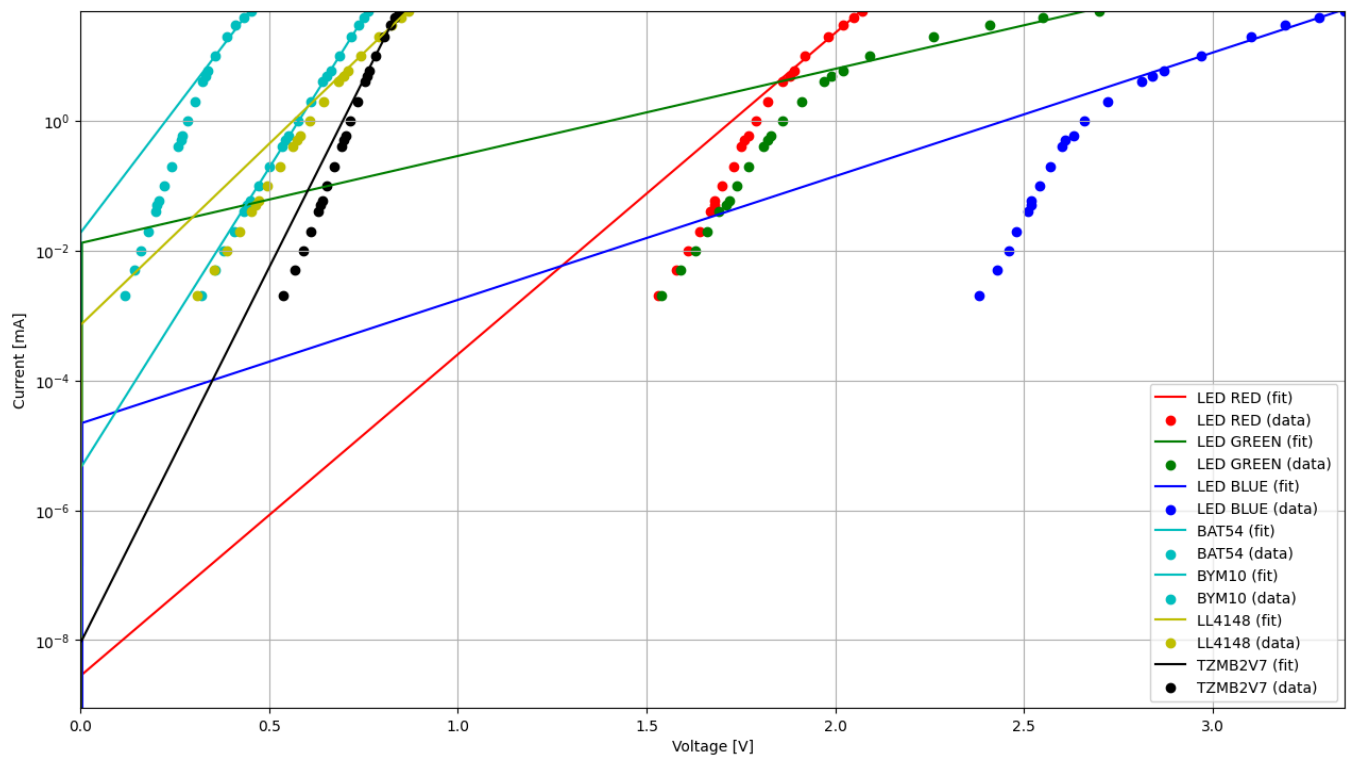


The measurement scheme used to measure TZMB2V7, TZMB8V2 diodes. The purpose of the setup is to measure the current-voltage characteristics of these diodes by adjusting the negative current and checking the output of voltmeter.

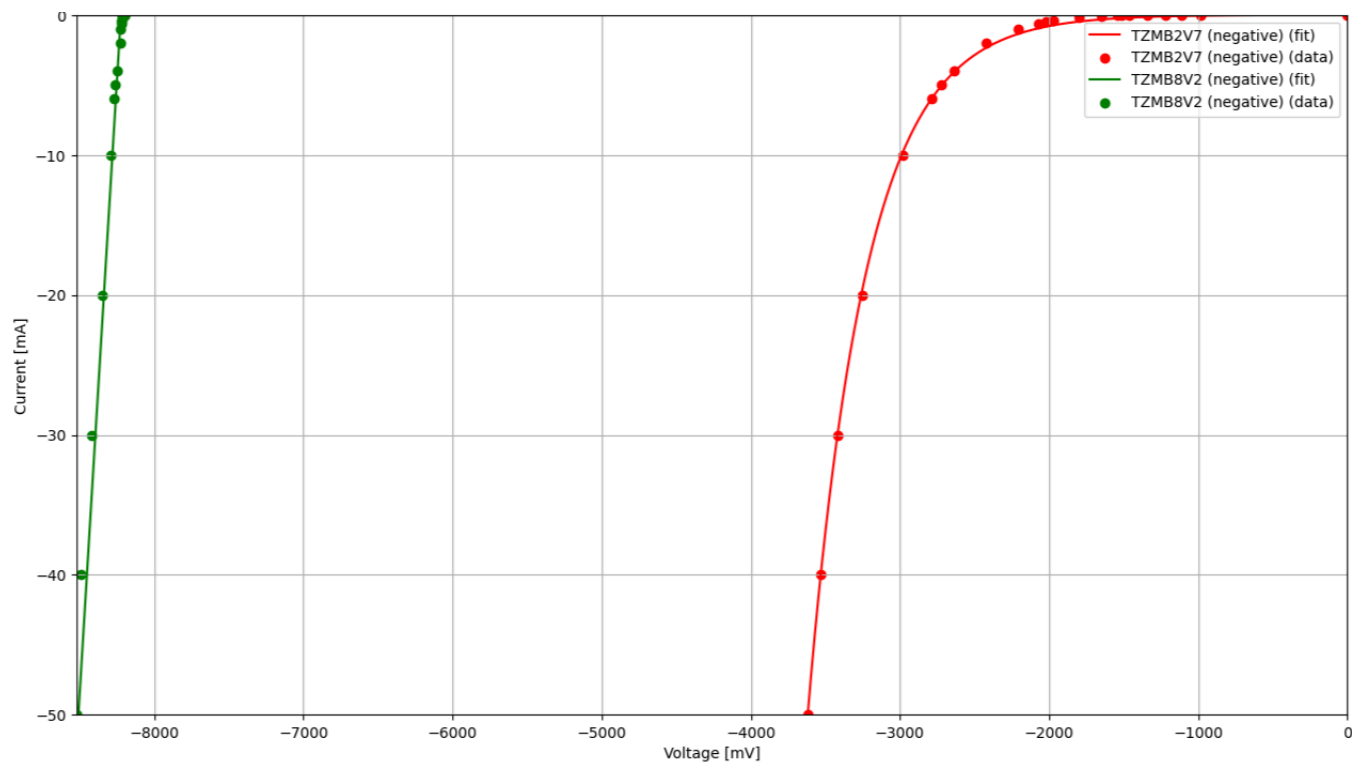
3) Results



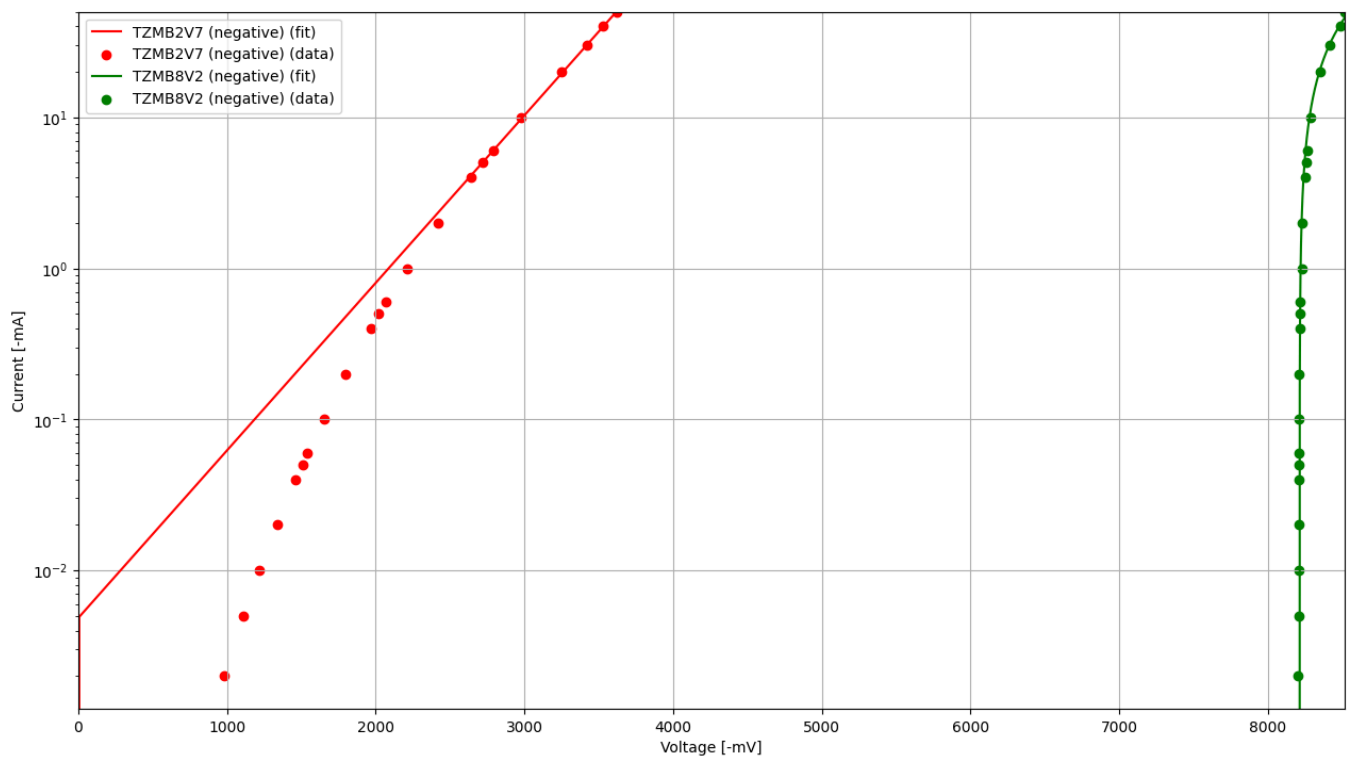
Linear plot for all diodes



Logarithmic plot for diodes D4 and D5



Linear plot for diodes D4 and D5



Logarithmic plot for diodes D4 and D5

To determine the dynamic resistance we use formula:

$$r_d = \frac{\Delta V}{\Delta I}$$

Calculations:

RED LED:

- **50 μ A:** $r_d = \frac{1.68\text{ V} - 1.67\text{ V}}{0.02\text{ mA}} = 500\ \Omega$
- **500 μ A:** $r_d = \frac{1.77\text{ V} - 1.75\text{ V}}{0.2\text{ mA}} = 100\ \Omega$
- **5 mA:** $r_d = \frac{1.89\text{ V} - 1.86\text{ V}}{2\text{ mA}} = 15\ \Omega$
- **40 mA:** $r_d = \frac{2.05\text{ V} - 2.02\text{ V}}{10\text{ mA}} = 3\ \Omega$

GREEN LED:

- **50 μ A:** $r_d = \frac{1.72\text{ V} - 1.69\text{ V}}{0.02\text{ mA}} = 1500\ \Omega$
- **500 μ A:** $r_d = \frac{1.83\text{ V} - 1.81\text{ V}}{0.2\text{ mA}} = 100\ \Omega$
- **5 mA:** $r_d = \frac{2.02\text{ V} - 1.97\text{ V}}{2\text{ mA}} = 25\ \Omega$
- **40 mA:** $r_d = \frac{2.55\text{ V} - 2.41\text{ V}}{10\text{ mA}} = 14\ \Omega$

BLUE LED:

- **50 μ A:** $r_d = \frac{2.52\text{ V} - 2.51\text{ V}}{0.02\text{ mA}} = 500\ \Omega$
- **500 μ A:** $r_d = \frac{2.63\text{ V} - 2.6\text{ V}}{0.2\text{ mA}} = 150\ \Omega$
- **5 mA:** $r_d = \frac{2.87\text{ V} - 2.81\text{ V}}{2\text{ mA}} = 30\ \Omega$
- **40 mA:** $r_d = \frac{3.28\text{ V} - 3.19\text{ V}}{10\text{ mA}} = 9\ \Omega$

D1:

- **50 μ A:** $r_d = \frac{0.209\text{ V} - 0.1986\text{ V}}{0.02\text{ mA}} = 520\ \Omega$
- **500 μ A:** $r_d = \frac{0.271\text{ V} - 0.260\text{ V}}{0.2\text{ mA}} = 55\ \Omega$
- **5 mA:** $r_d = \frac{0.339\text{ V} - 0.325\text{ V}}{2\text{ mA}} = 7\ \Omega$
- **40 mA:** $r_d = \frac{0.433\text{ V} - 0.412\text{ V}}{10\text{ mA}} = 2.1\ \Omega$

D2:

- **50 μ A:** $r_d = \frac{0.450\text{ V} - 0.434\text{ V}}{0.02\text{ mA}} = 800\ \Omega$
- **500 μ A:** $r_d = \frac{0.544\text{ V} - 0.534\text{ V}}{0.2\text{ mA}} = 50\ \Omega$
- **5 mA:** $r_d = \frac{0.663\text{ V} - 0.643\text{ V}}{2\text{ mA}} = 10\ \Omega$
- **40 mA:** $r_d = \frac{0.752\text{ V} - 0.738\text{ V}}{10\text{ mA}} = 1.4\ \Omega$

D3:

- **50 μ A:** $r_d = \frac{0.472\text{ V} - 0.453\text{ V}}{0.02\text{ mA}} = 950\ \Omega$
- **500 μ A:** $r_d = \frac{0.573\text{ V} - 0.562\text{ V}}{0.2\text{ mA}} = 54\ \Omega$
- **5 mA:** $r_d = \frac{0.709\text{ V} - 0.684\text{ V}}{2\text{ mA}} = 10\ \Omega$
- **40 mA:** $r_d = \frac{0.849\text{ V} - 0.824\text{ V}}{10\text{ mA}} = 1.5\ \Omega$

D4:

- **50 μ A:** $r_d = \frac{0.641\text{ V} - 0.630\text{ V}}{0.02\text{ mA}} = 950\ \Omega$
- **500 μ A:** $r_d = \frac{0.698\text{ V} - 0.692\text{ V}}{0.2\text{ mA}} = 52\ \Omega$
- **5 mA:** $r_d = \frac{0.766\text{ V} - 0.754\text{ V}}{2\text{ mA}} = 10\ \Omega$
- **40 mA:** $r_d = \frac{0.843\text{ V} - 0.833\text{ V}}{10\text{ mA}} = 1.3\ \Omega$

4) Conclusions

In conclusion, the current-voltage characteristic of diodes is non-linear, with voltage rising more slowly as current increases. This leads to a decrease in dynamic resistance at higher currents. The threshold voltage, or forward voltage, varies between different types of diodes, as seen with the red, green, and blue LEDs and D1 - D4 diodes. Once a diode reaches its threshold, even small voltage increases cause significant current changes.