

# Electronics Laboratory

Winter semester 2025

## Lab 1 – Diodes

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Score and comments (only for tutors, please leave blank)

*Please fill out this cover sheet and submit it with your lab report.*

## Lab 1 - Diodes

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### 1.2 A Variety of Diodes

#### 1.2.1 Simulation

The goal of the Simulation is to measure and plot the characteristics of different Types of Diodes, in this case one Si Diode (Model: 1N4148), one Schottky Diode (Model: BAT41) and one Zener Diode (Model: ZD3V9).

#### Circuit Diagrams:

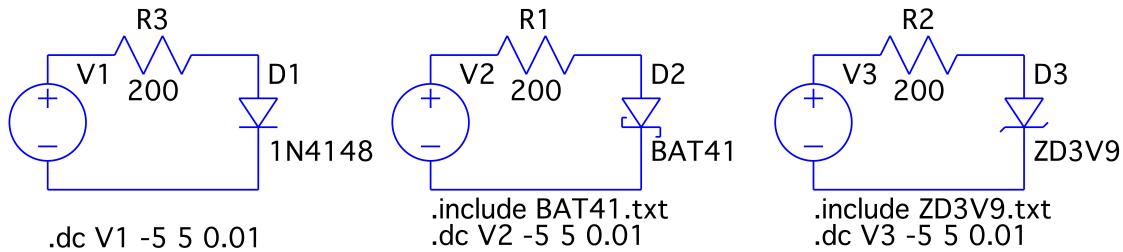


Figure 1: Circuit Diagrams from LTSpice

#### Plots:

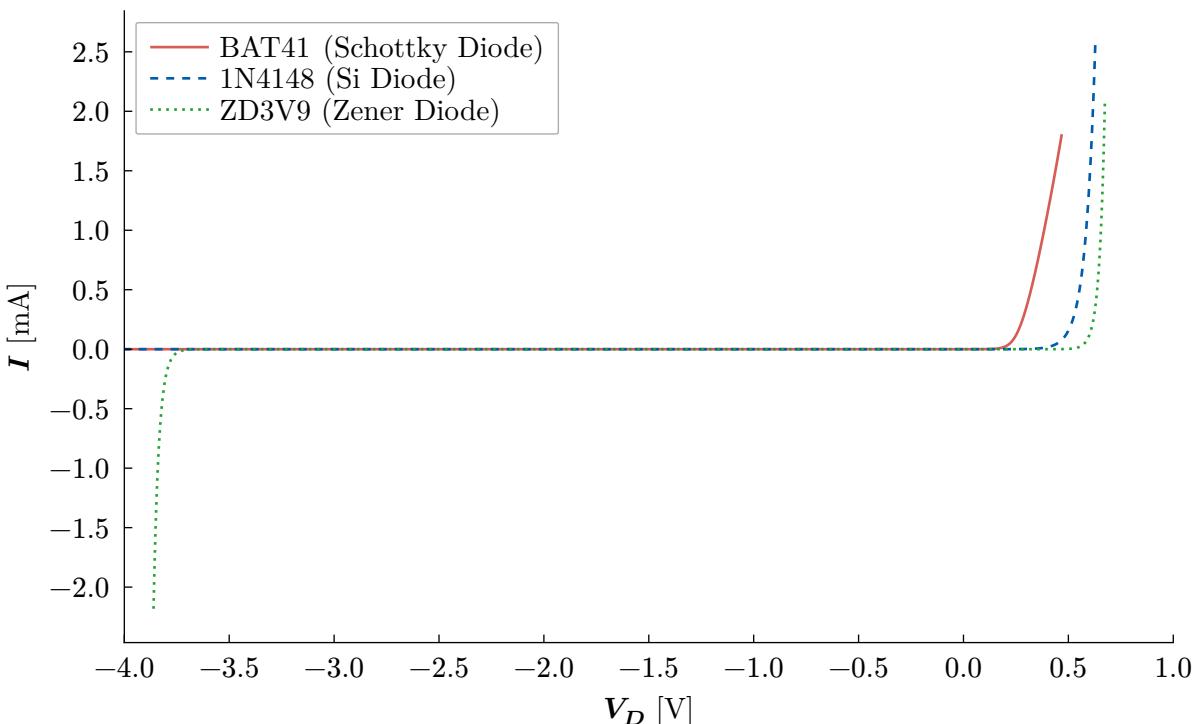


Figure 2: IV-Curves of all three Diodes

### **Text Questions:**

f)

Small-Signal Resistance  $r_D$  for  $|I_D| = 20$  mA for:

- 1N4148 Diode is  $r_D \approx 0.223 \Omega$
- BAT41 Diode is  $r_D \approx 0. \Omega$
- ZD3V9 Diode is  $r_D \approx 0.213 \Omega$  (reverse and forward)

g)

One essential difference between the characteristics is the breakdown voltage, which for the Schottky diode is  $\approx 0.3$  V, for the Si diode is  $\approx 0.6$  V and for the Zener diode is  $\approx 0.7$  V.

Also, the Zener Diode has the classical Zener-Curve in the negative voltages, having a reverse breakdown voltage of  $\approx 3.8$  V, whereas the other ones stay at 0.0 A.

### **Conclusion:**

We explored the IV-Curves and characteristics of the different types of diodes. The Plot had the interesting attribute that it only simulated to  $\approx 1V$  because of the exponential nature of the curve (as seen in Figure 2).

### 1.2.2. Measurement

The goal of the measurement is to verify the Simulation we created in the previous exercise.

#### Circuit Diagrams:

##### Text Questions:

(a)  $R_{14} = 199.1\Omega$

(b)

Diode	Forward Bias [V]	Reverse Bias <sup>1</sup> [V]
D1 (1N4148)	0.612	0
D2 (BAT41)	0.382	0
D3 (ZD3V9)	0.712	$\geq 2$

The results of D1 and D2 look fairly similar to the simulation, but all the diodes did read slightly higher voltages when measured in reality.

The Zener Diode (D3) was very different in real life, because the multimeter only operates to 1.99V in Diode Test mode, so we could not read the value for reverse bias, which was approximately 3.85V in the simulation.

### 1.3.3

(a)

LED	$V_f$ [V]
D11	$\geq 2$
D10	1.858
D9	1.828
D8	1.760

(f)

Kombination (L & R)	LED 1 (L)	LED 2 (R)
D8 & D9	Bright	Bright
D8 & D10	Bright	Not so bright
D8 & D11	Bright	Off
D9 & D11	A little less bright	Off
D10 & D11	Dim	Off

<sup>1</sup> $\geq 2$  means we could not measure it with our multimeter as the maximum ‘diode test’ can do is 2V