

# Electronics Laboratory

Winter semester 2025

## Lab 2 – Bipolars

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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

12. November 2025

### 2.2 Bipolar Characteristics

#### 2.2.1 Simulation

##### Introduction

The goal was to simulate the behaviour of a BC547B bipolar.

##### Circuit Diagrams:

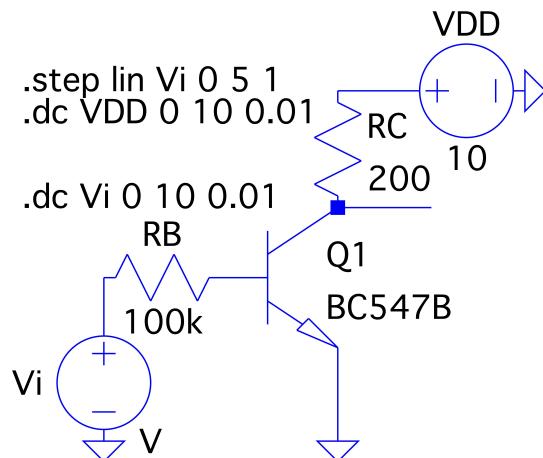


Figure 1: LTSpice circuit diagram with instructions for both the first (bottom) and second (top) task

##### Plots:

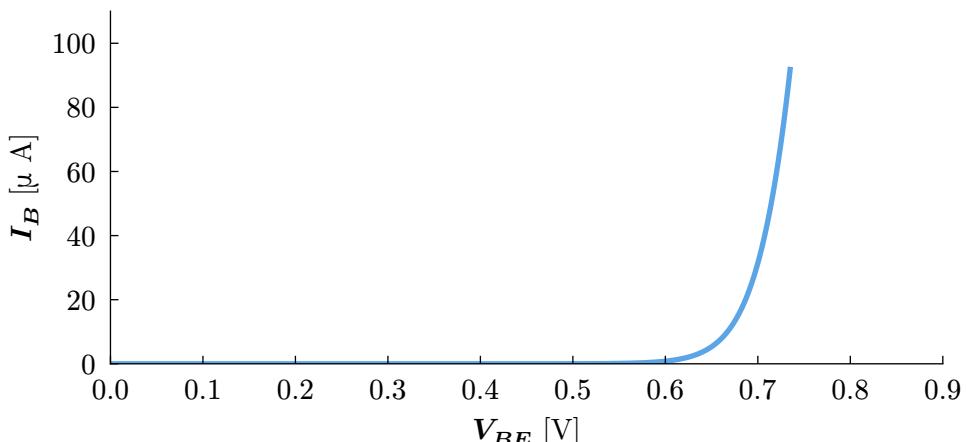


Figure 2: Simulated input characteristics

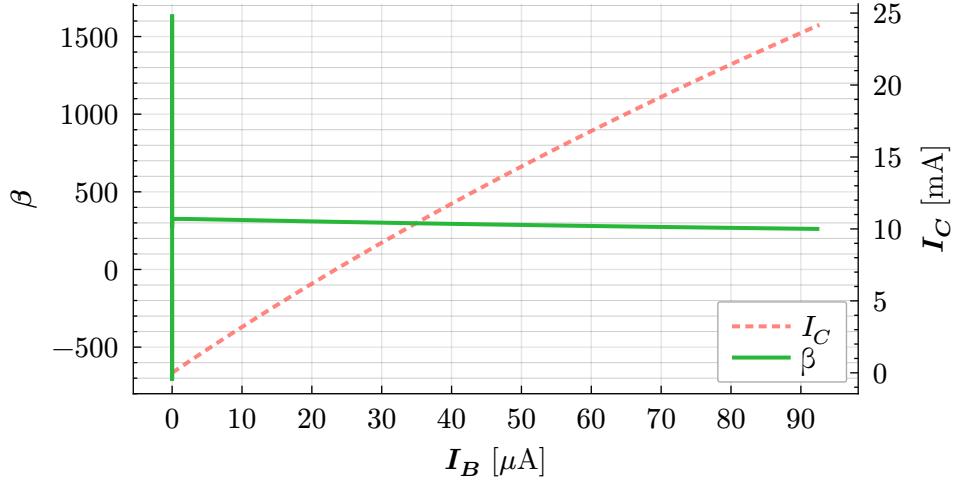


Figure 3: Simulated  $\beta$  and  $I_C$  over  $I_B$

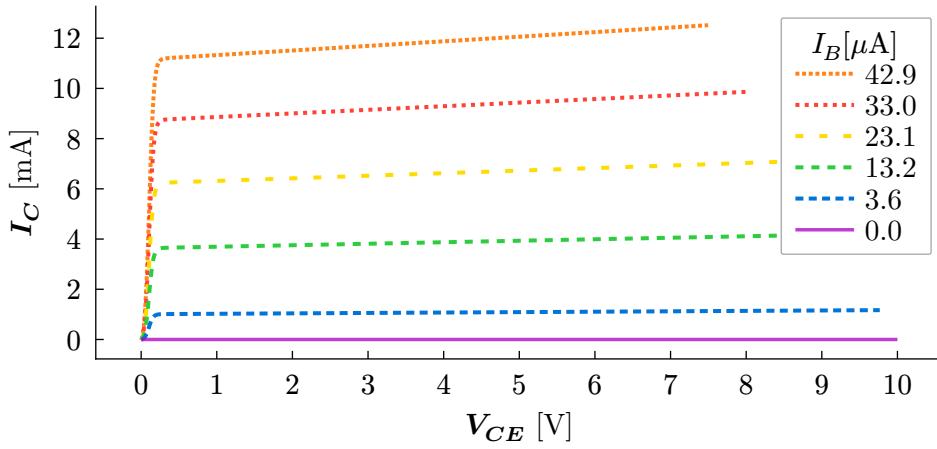


Figure 4: Simulated input characteristics

### Text Questions:

- (d) the very first values are  $\beta \approx -1$ , then there are really high values up to 1700 and low values to  $-700$ , which happen due to really small numbers in the divisor. For slightly higher voltages, the value for  $\beta \approx 320$ .
- (f) Beta is not constant as we can see in Figure 3, instead it slowly goes from  $\beta \approx 320$  to  $\beta \approx 260$ .
- (i)

$I_B$ [μA]	Early voltage [V]
0.0	0.618 <sup>1</sup>
3.6	-61.009
13.2	-39.105
23.1	-23.927
33.0	-16.814
42.9	-12.803

The bigger  $I_B$ , the bigger the early voltage, as seen in Table 1.

Table 1: Early Voltages

<sup>1</sup>This value is difficult to calculate, as  $I_C$  is so close to 0V for the entire time when  $I_B \approx 0V$ .

**Conclusion:**

We successfully simulated the BC547B bipolar characteristics under different voltages and calculated its early voltages.

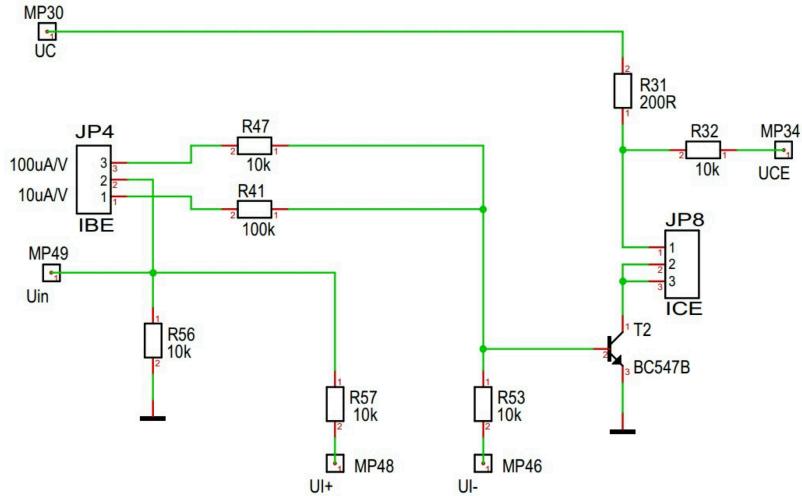
**2.2.2. Measurement****Introduction****Circuit Diagrams:**

Figure 5: Schematic of the *BJT characteristics* circuit

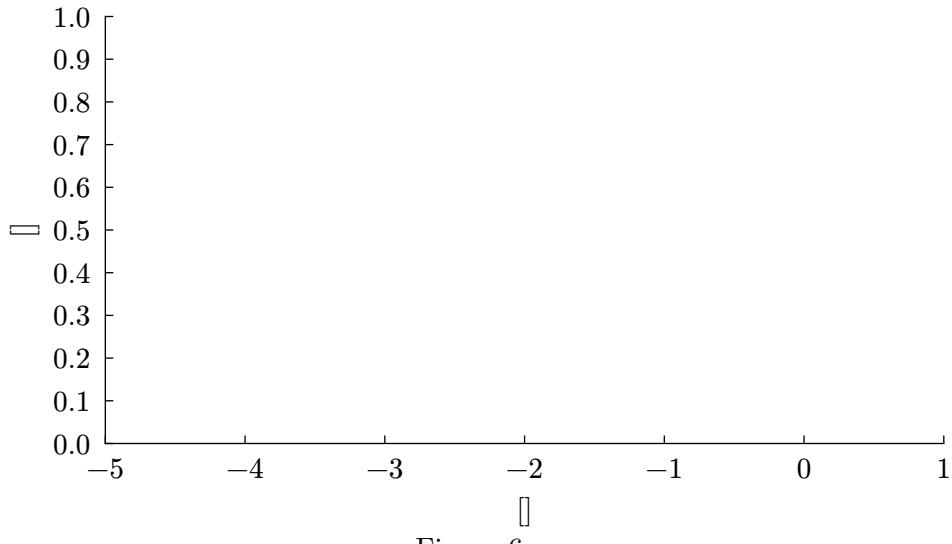
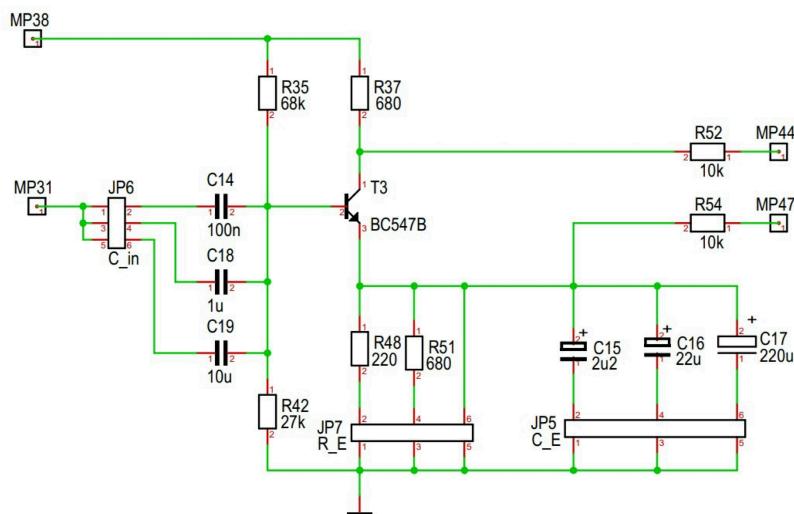
**Plots:**

Figure 6:

**Text Questions:****Conclusion****2.3. Common Emitter Amplifier****2.3.1 Simulation****Introduction****Circuit Diagrams:****Plots:****Text Questions:****Conclusion:****2.3.2. Measurement****Introduction****Circuit Diagrams:**Figure 7: Schematic of the *BJT Amplifier* circuit

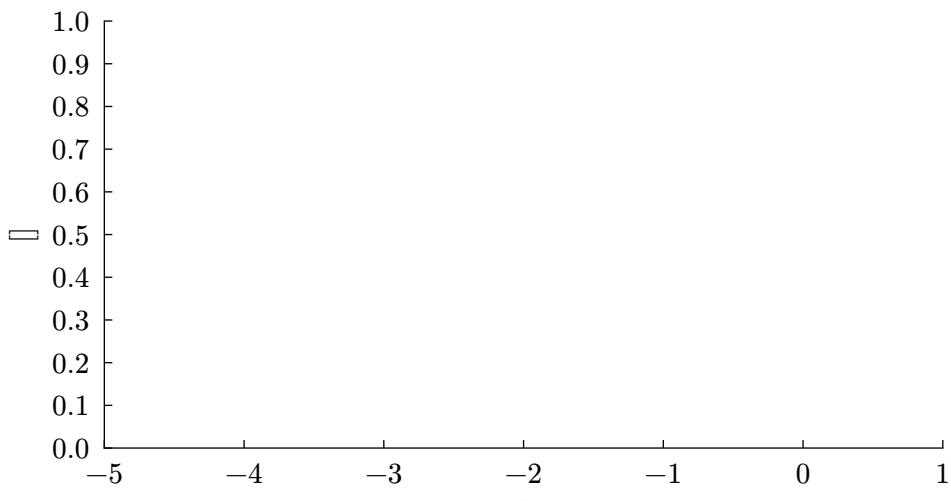
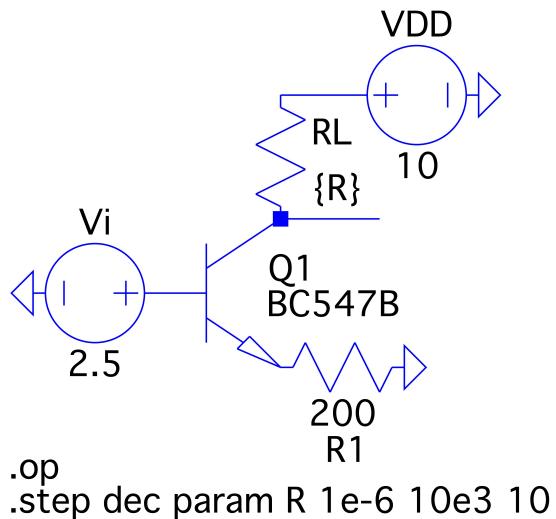
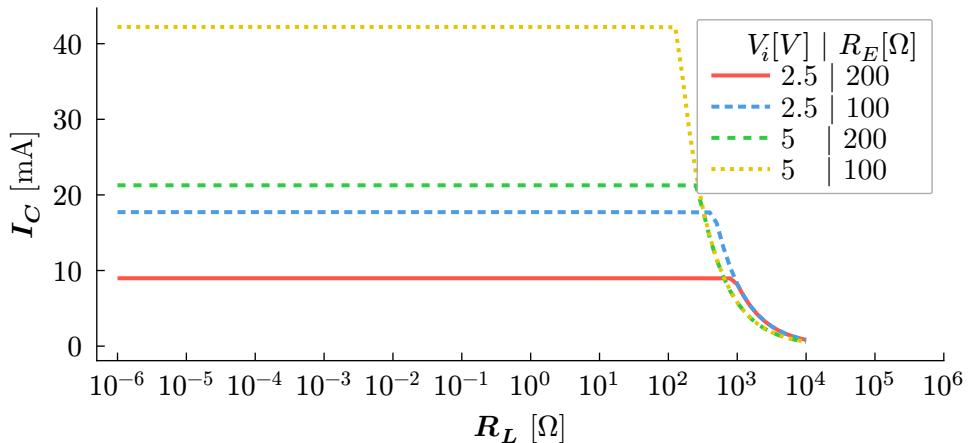
**Plots:**

Figure 8:

**Text Questions:****Conclusion****2.4. Current source****2.4.1 Simulation****Introduction**

The goal was to simulate and characterize a bipolar-based current source.

**Circuit Diagrams:**Figure 9: LTSpice circuit diagram with  $R_E = 200\Omega$  and  $V_i = 2.5V$

**Plots:**Figure 10: Current through  $R_L$  with different values for  $R_L$ **Text Questions:**

(g)

$V_i$ [V]	$R_E$ [ $\Omega$ ]	$I_{C(\max)}$ [mA]
2.5	200	09.98
2.5	100	17.72
5	200	21.27
5	100	42.21

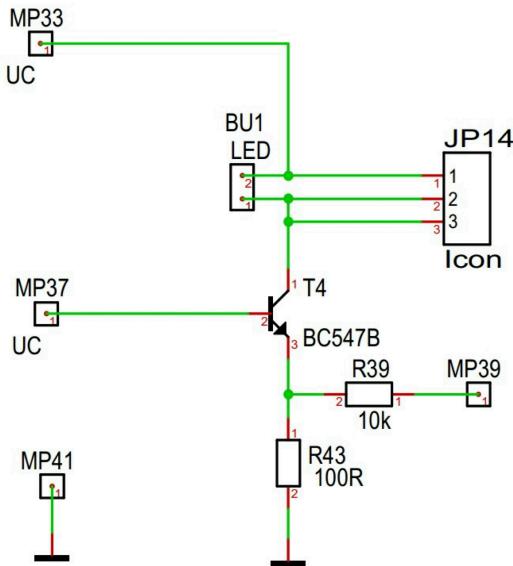
**Conclusion:****2.4.2. Measurement****Circuit Diagrams:**

Figure 11: Schematic of the BJT current source circuit

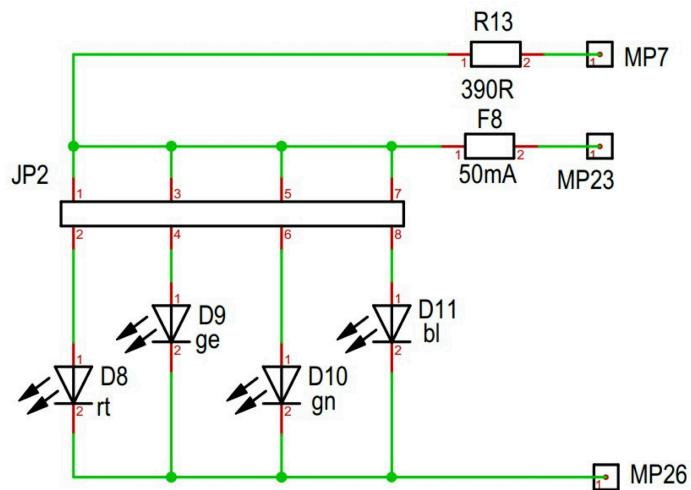


Figure 12: Schematic of the *diode characteristics* circuit

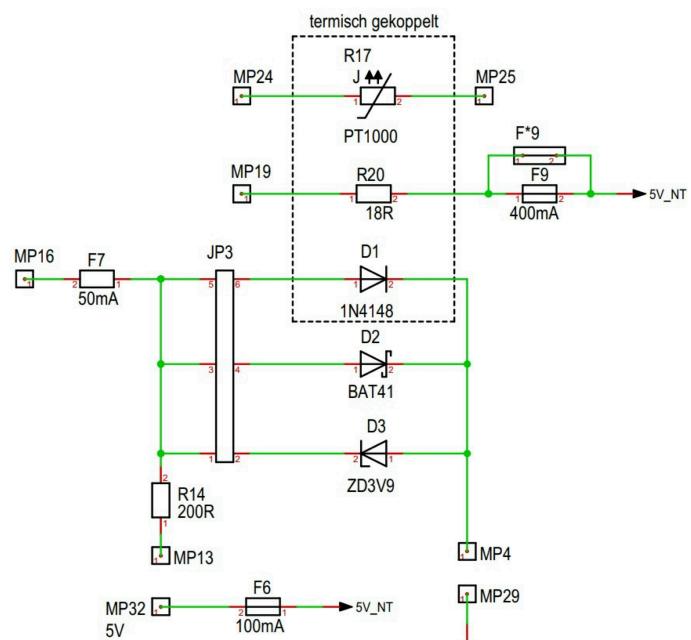


Figure 13: Schematic of the *LED characteristics* circuit

## Plots:

## Text Questions:

## Conclusion