Universidade do Vale do Itajaí
Computer Engineering
Basic Electronics

Eight Assignment for Basic Electronics

Student: Lucas Mateus Gonçalves
Teacher Advisor: Walter Antonio Gontijo

October
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Eight Assignment for Basic Electronics presented for the class of the Eight of October, 2021.

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Conteúdo

1 Objective

The analysis of multiple *NPN* transistors and their operation regions.

2 Introduction

This paper will describe the *Characteristic Curve*, or operation regions of multiple transistors based on the following circuit.

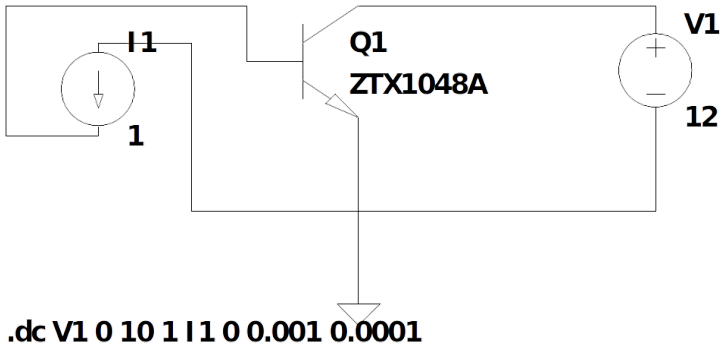

Figura 1: The following circuit shows the `ZTX1048A` transistor, but multiple will be tested. The simulation parameters are: `V1[0V-10V]`, `I1[0A-0.001A]`.

3 Simulations

The simulator *LTSpice XVII* was used to test the following transistors.

- 2N3904, from *NPX* manufacturer, $Ic[mA] = 200$
- 2N4124, from *Fairchild* manufacturer, $Ic[mA] = 200$
- ZTX1048A, from *Zetex* manufacturer, $Ic[mA] = 5000$

3.1 2N3904

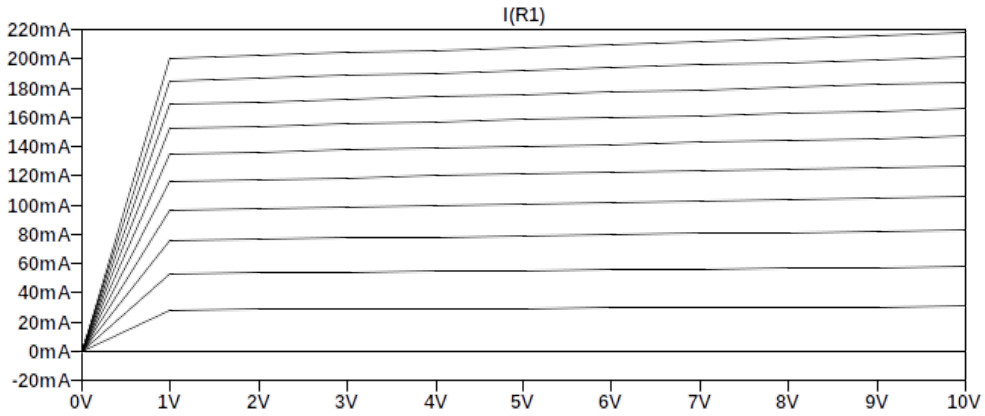

Figura 2: Collector Current (Ic) = $200mA$, Collector Emmiter Voltage (Vceo) = $40V$ at 25°C.

3.2 2N4124

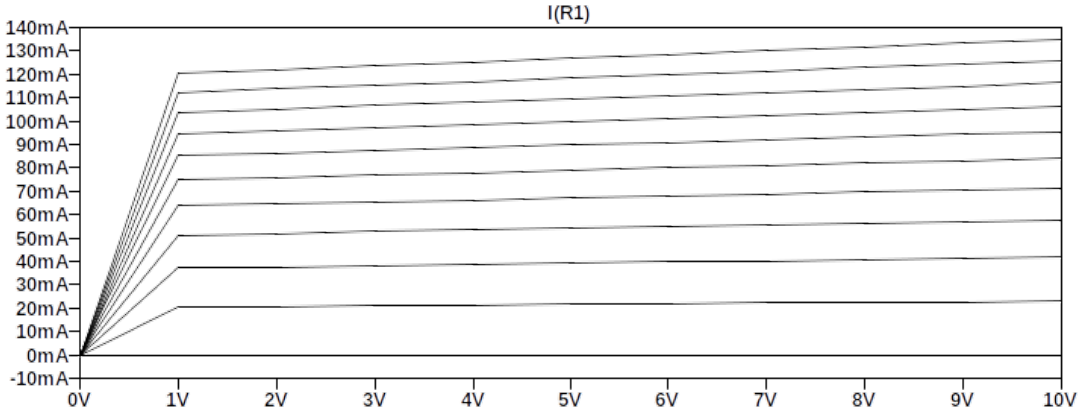

Figura 3: Collector Current (Ic) = $200mA$, Collector Emmiter Voltage (Vceo) = $25V$ at 25°C.

3.3 ZTX1048A

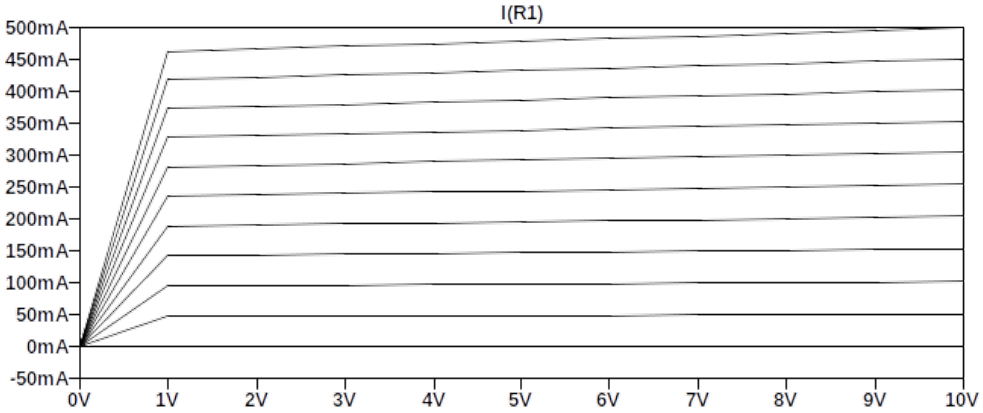

Figura 4: Collector Current (Ic) = $5000mA$, Collector Emmiter Voltage (Vceo) = $17V$ at 25°C.

4 Exctracting useful data from graphs

The transistor under analysis will be the *Fairchild's* `2N4124`.

The graph shows the current through the collector through to the emitter.It is not shown, but every line refers to a base to emitter current of $0.11mA$ from $0.0A$.

Taking the top most line, where the base to emitter current is $1mA$, and at $10V$ collector to emitter voltage, the α and β can be calculated as.

$$\beta = \frac{I_C}{I_B} = \frac{130mA}{1mA} = 130$$

Do note that neither α or β have units, they are ratios.

$$\alpha = \frac{\beta}{\beta + 1} = \frac{130}{130 + 1} = 0.9924$$

The same equations can be used in every point in the *active, or linear* regions.