Abu Dhabi University

Electronic Devices and Circuits

Lab Report 4
BJT's Biasing Modes

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Section 1

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Abstract

In this lab we were educated in Biasing a Bi-polar Junction Transistor so that it is in active or saturation mode. We were also introduced to the calculations involved in calculating all important values using the given properties of the diode.

1 Introduction

Bi-polar Junction Transistor (BJT) is doped with two types of material known as p-type material and n-type material. There are two types of BJTs:-

- NPN Transistor P - Base Transistor.
- PNP Transistor N - Base Transistor.

In an NPN transistor, P-type material is lightly doped with holes (tri-valent doping), N-type emitter material is heavily doped with electrons (penta-valent doping), and N-type collector material is doped with electrons.

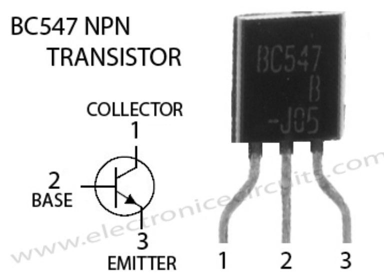

Figure 1: This picture is taken from : http://quarkstream.files.wordpress.com/2012/05/bc547-npn-transistor-pin-configuration-top-view-diagram1.jpg

Saturation Mode In this mode both of the junctions of the transistor are forward biased and since a typical transistor junction comprises of silicon, the voltage across it will be 0.7V. So the total Voltage will be 1.4V across Collector and Emitter.

Cut-off Mode In this mode both of the junctions of the transistor are backward biased and no current flows through any of the connections of the transistor (Collector,Base,Emitter).

Active Mode In active mode, one of the junction of the transistor is forward biased while the other is backward biased. Commonly, the Emitter-Base junction is forward biased and the Collector-Base junction is backward biased.

2 Experiment Set-up

The Experiment Set-up was setup in two exercises.

2.1 Exercise 1 - Active Mode

At active mode, we connect the base collector in reverse bias and the base emitter in forward bias to prove the relation between the base current and collector current as the following:
$I_C = \beta\ I_B$.
$I_E = (\beta + 1)I_B$.
$I_E = I_B + I_C$.

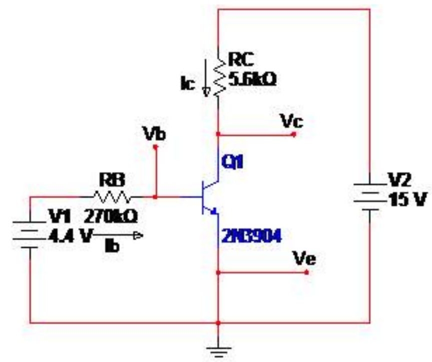

Figure 2: Third clamping circuit's output

2.2 Exercise 2 - Saturation Mode

At saturation mode , we connect both base collector and base emitter in forward base to prove the relation between base current and collector current as following:
$I_C = \beta\ I_B$.
$V_{CE} = 0.2V$.

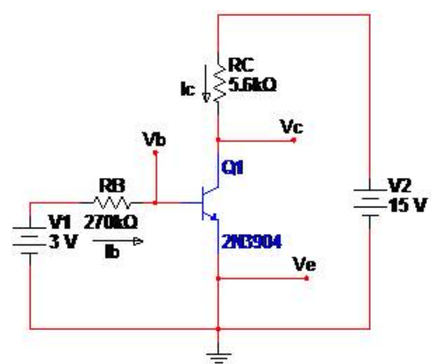

Figure 3: Third clamping circuit's output

3 List of Equipment used

- Function Generator.

- Oscilloscope.
- Function Generator's Crocodile Clip Cable.
- Oscilloscope Probe.
- Breadboard.
- Breadboard Cables.
- Resistors.
- BJT NPN Transistor (2N3904).

4 Procedure

4.1 Exersice 1

In Active Mode We connect the base collector in reverse bias and the base emitter in forward bias to prove the relation of the current through the collector and emitter. The relation that we have prove is :
$I_C = \beta\ I_B$.
$I_E = (\beta + 1)I_B$.

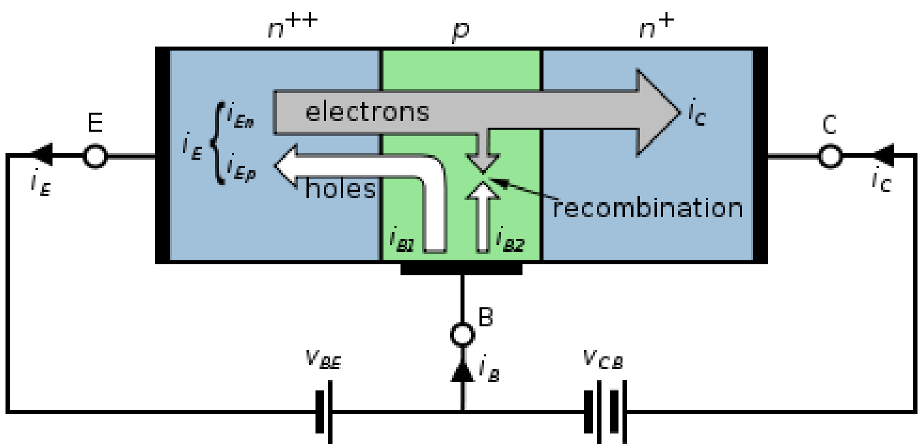

Figure 4: Figure taken from wikipedia explaining Active mode of the transistor.

- We connected 3V from breadboard to resistor (270k) to the bias of transistor.
- We connected the red wire of the function that carry 15 volt to the resistor(5.6k) and then connected to the collector.
- We took the black wire from the function generator(ground) and wire from the ground of the breadboard to the emitter.
- We use Multimeter to find the currents and voltages..

4.2 Exersice 2

In Saturation Mode We connect the base collector in forward bias and the base emitter in forward bias to prove the relation of the current through the collector and emitter. The relation that we have prove is :

- We connected 4.4V from breadboard to resistor (270k) to the bias of transistor.
- We connected the red wire of the function that carry 15 volt to the resistor(5.6k) and then connected to the collector.
- We took the black wire from the function generator(ground) and wire from the ground of the breadboard to the emitter.
- We use Multimeter to find the currents and voltages..

5 Results and Discussions

The following are results. The Explanation is given in the caption below.

Figure 5: Almost 0A current is flowing into Base

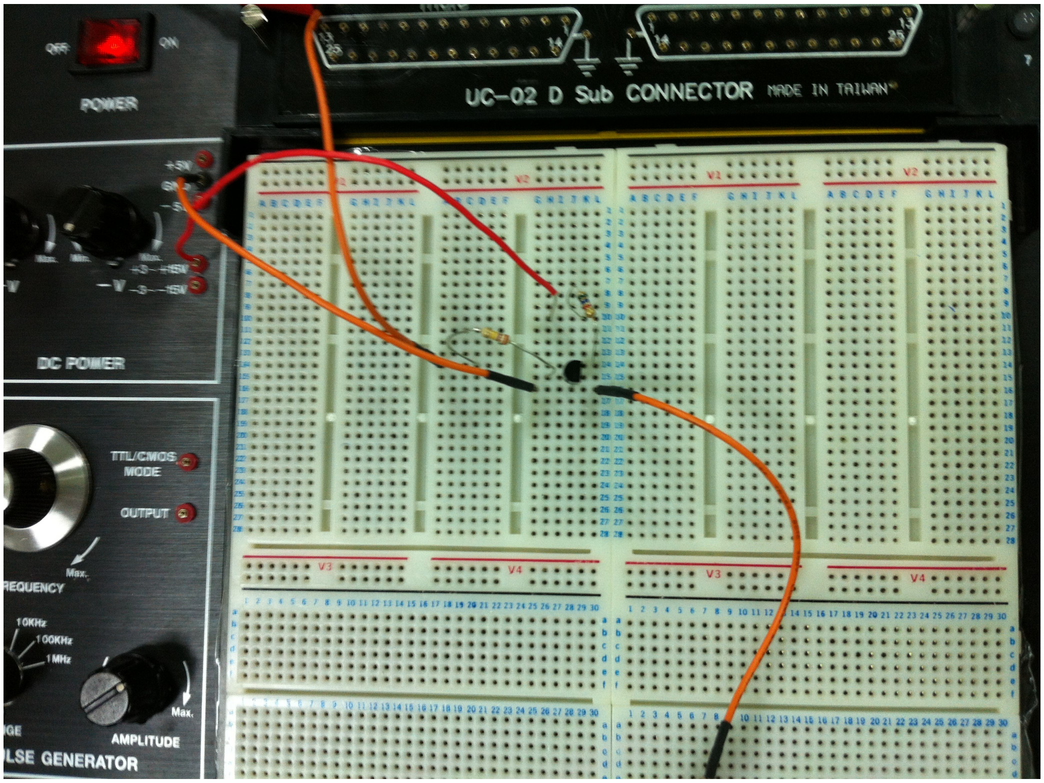

Figure 6: The circuit all made up

Figure 7: The DC power supply providing 3.0V constant

Figure 8: Measuring the current

Figure 9: Measuring the voltage

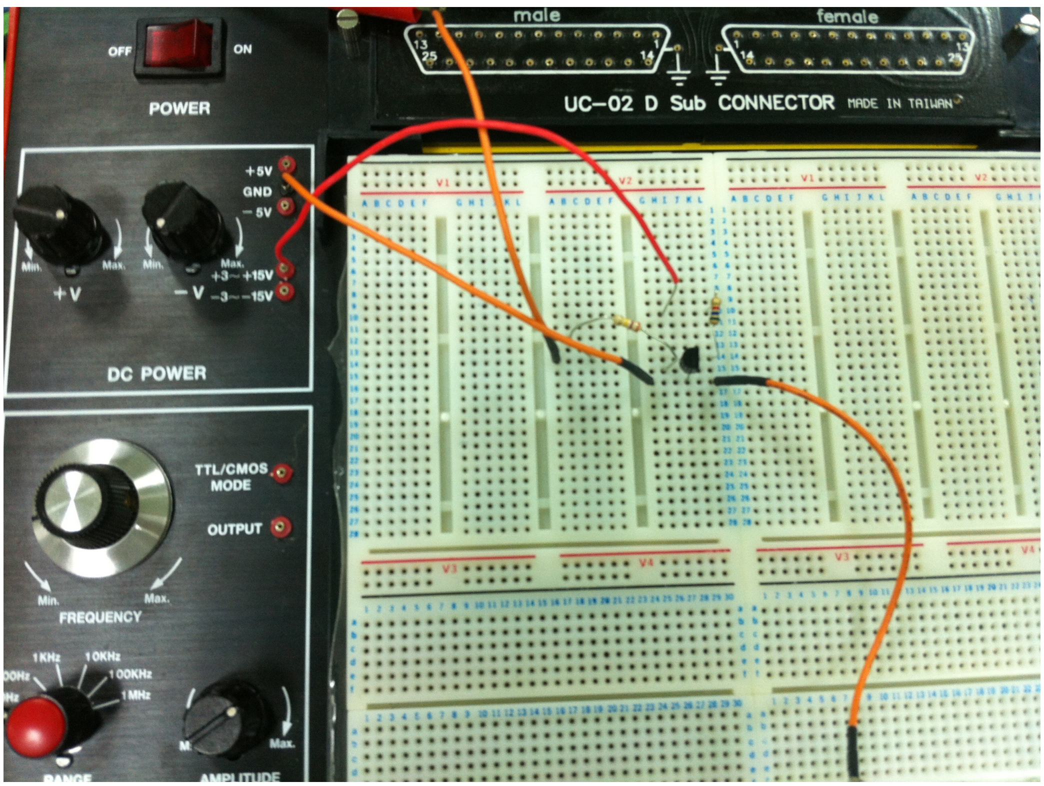

Figure 10: Changing the DC supply to bias the transistor

Figure 11: Very small potential measured

6 Conclusion

We conclude that when the transistor at active mode the following is true:-

- $I_C = \beta I_B$.
- $I_E = (\beta + 1)I_B$.
- $V_{BE} = 0.7V$.

We conclude that when the transistor at saturation mode the following is true:-

- I_C ¡ β I_B.
- $V_{CE} = 0.2V$.

7 Team Dynamics

Report/Member	Weight/Grade	Obaidullah	Salem	Hezam
Abstract	20%	65%	15%	15%
Introduction	10%	0%	50%	50%
Procedure Part 1	10%	100%	0%	0%
Procedure Part 2	10%	0%	100%	0%
Procedure Part 3	10%	0%	0%	100%
Results Part 1	10%	100%	0%	0%
Results Part 2	10%	0%	100%	0%
Results Part 3	10%	0%	0%	100%
Conclusion	10%	0%	50%	50%
Claimed Contribution		**33%**	**33%**	**33%**
Contribution Validation Penalty		**0%**	**0%**	**0%**
Overall Contribution		**33%**	**33%**	**33%**
Overall Grade with Quality	**100%**	**100.0%**	**100.0%**	**100.0%**