Lab 9: **Bipolar junction transistor characteristics and applications**

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and _____Sean Gordon_____

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Lab Section: E

Graded by _____

Score _____

Introduction -
This lab focuses on the introduction of transistors, introducing two models of type npn and pnp. The lab guides the student through several circuits to demonstrate the properties of each model of transistor, as well as using the parameter analyzer to provide a visual graph.

A. Quick measure of β_F and $i_C - v_{CE}$ characteristics with the parameter analyzer
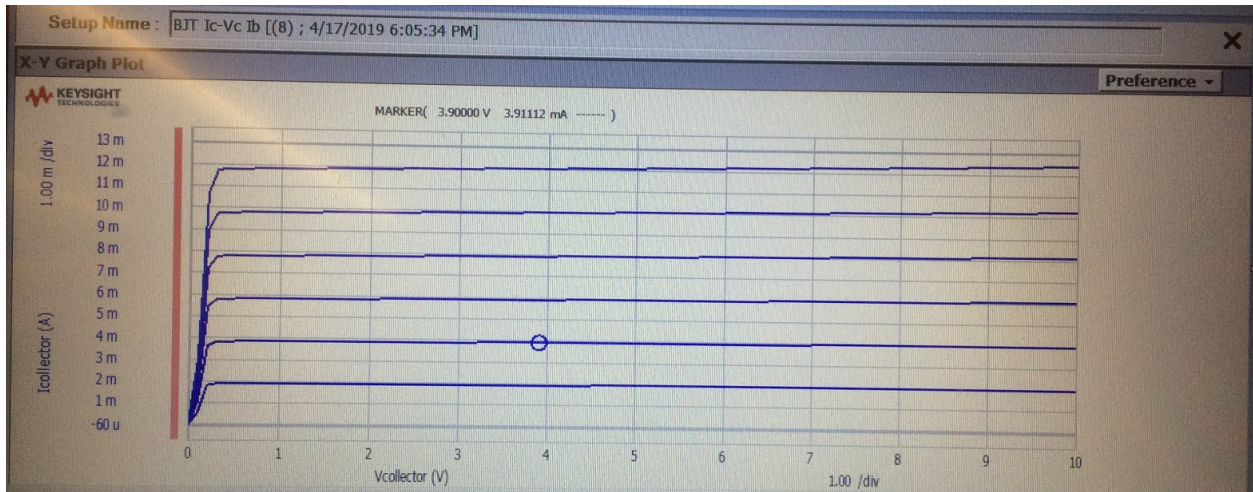
➤ PN2222A -

$V_{RB} = 4.306$	$I_B = 43.1\ \mu A$
$V_{RC} = 8.56$	$I_C = 8.56\ mA$
$\beta_F = 199$	
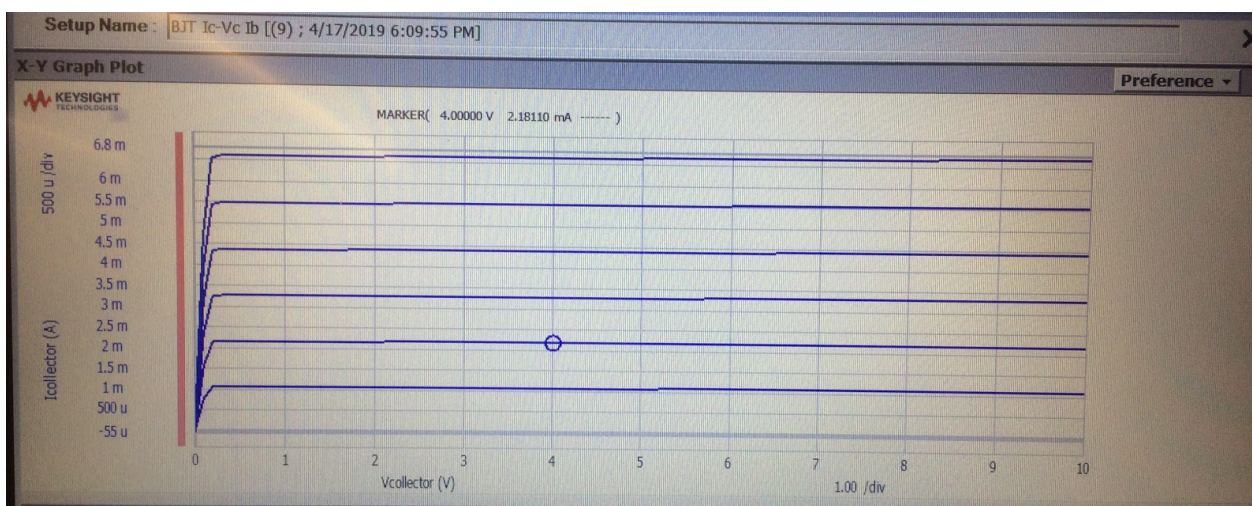
➤ MJE180 -

$V_{RB} = 4.373$	$I_B = 43.7\ \mu A$
$V_{RC} = 4.986$	$I_C = 4.99\ mA$
$\beta_F = 114$	

➢ PN2907

V_{RB} = 4.329 I_B = 43.3 μA

V_{RC} = 6.85 I_C = 6.85 mA

β_F = 158

➢ MJE170

V_{RB} = 4.378 I_B = 43.8 μA

V_{RC} = 8.023 I_C = 8.02 mA

β_F = 183
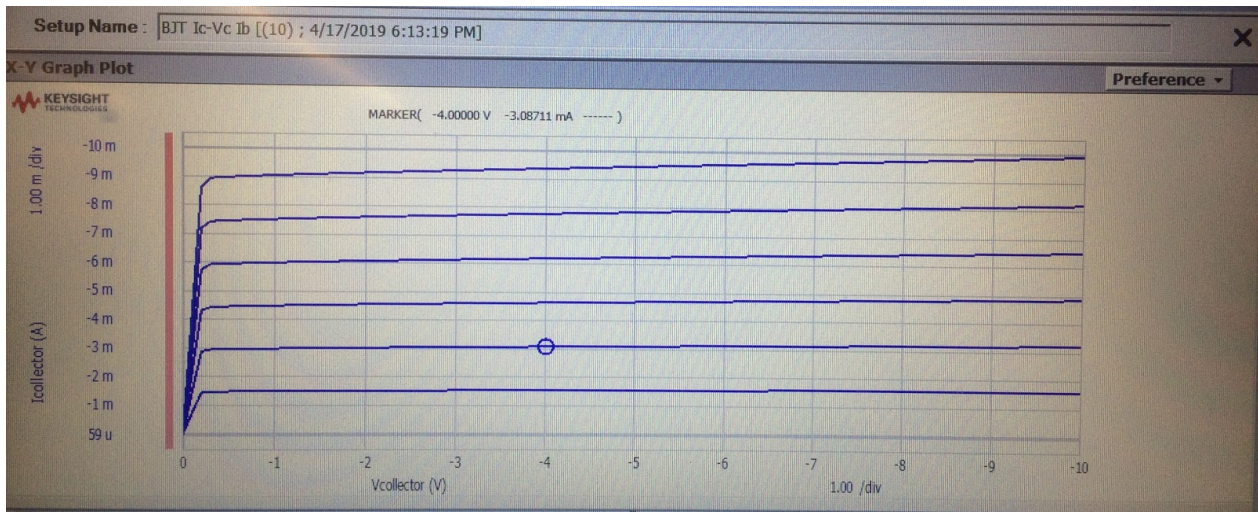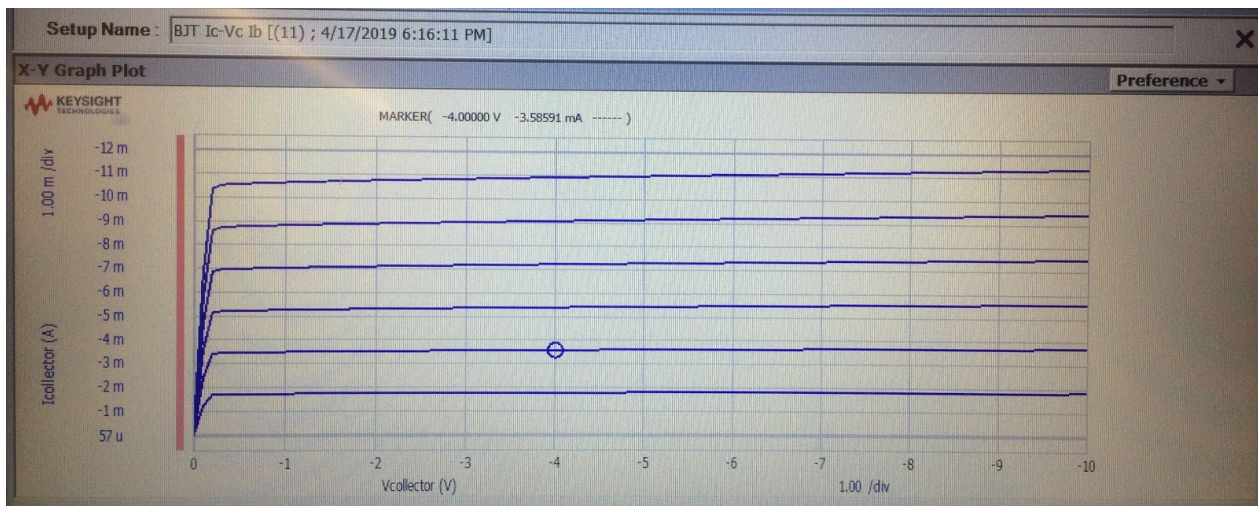
B. Simple BJT circuits

(a)

Measured:

I_B = 6.422 uA	I_C = 1.252 mA	I_E = 1.255mA
V_{BE} = .6334 V	V_{CE} = 5.419 V	

Calculated:

I_B = 6.11 uA	I_C = 1.22 mA	I_E = 1.23 mA
V_{BE} = .7 Vs	V_{CE} = 5.48 V	

(b)

Measured:

I_B = 20.81 uA	I_C = 4.181 mA	I_E = 4.184 m
V_{BE} = .6597 V	V_{CE} = 5.871 V	

Calculated:

I_B = 20.57	I_C = 4.09 mA	I_E = 4.11 mA
V_{BE} = .7 V	V_{CE} = 5.91 V	

(c)

Measured:

I_B = 1.757 mA	I_C = 2.605 mA	I_E = 4.362 mA
V_{BE} = .6922 V	V_{CE} = 23.19 mV	

Calculated:

I_B = 1.81 mA	I_C = 2.55 mA	I_E = 4.3 mA
V_{BE} = .64 V	V_{CE} = 1.25 V	

(d)

Measured:

I_B = 17.17 uA	I_C = 2.705 mA	I_E = 2.719 mA
V_{BE} = 3.961 V	V_{CE} = 4.661 V	

Calculated:

I_B = -16.91 uA	I_C = 2.69 mA	I_E = 2.67 mA
V_{BE} = .62 V	V_{CE} = 4.64 V	

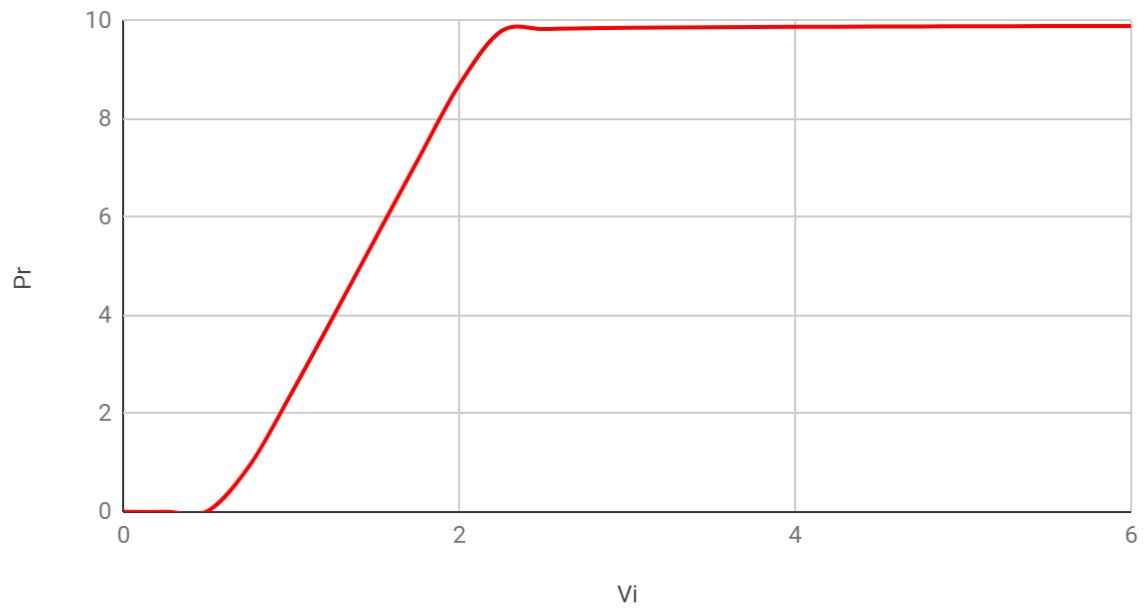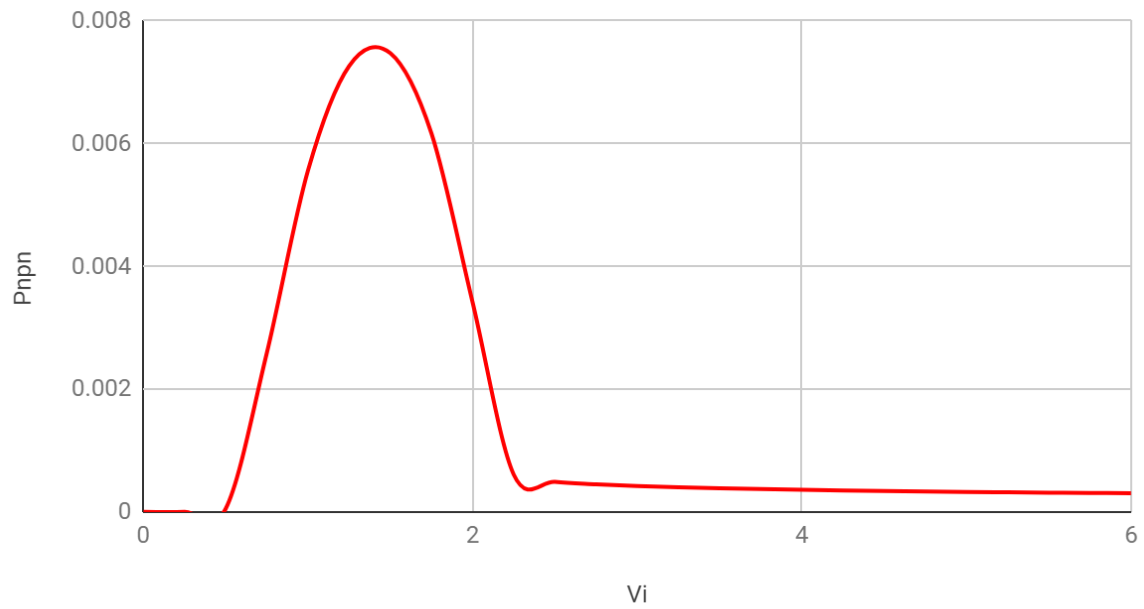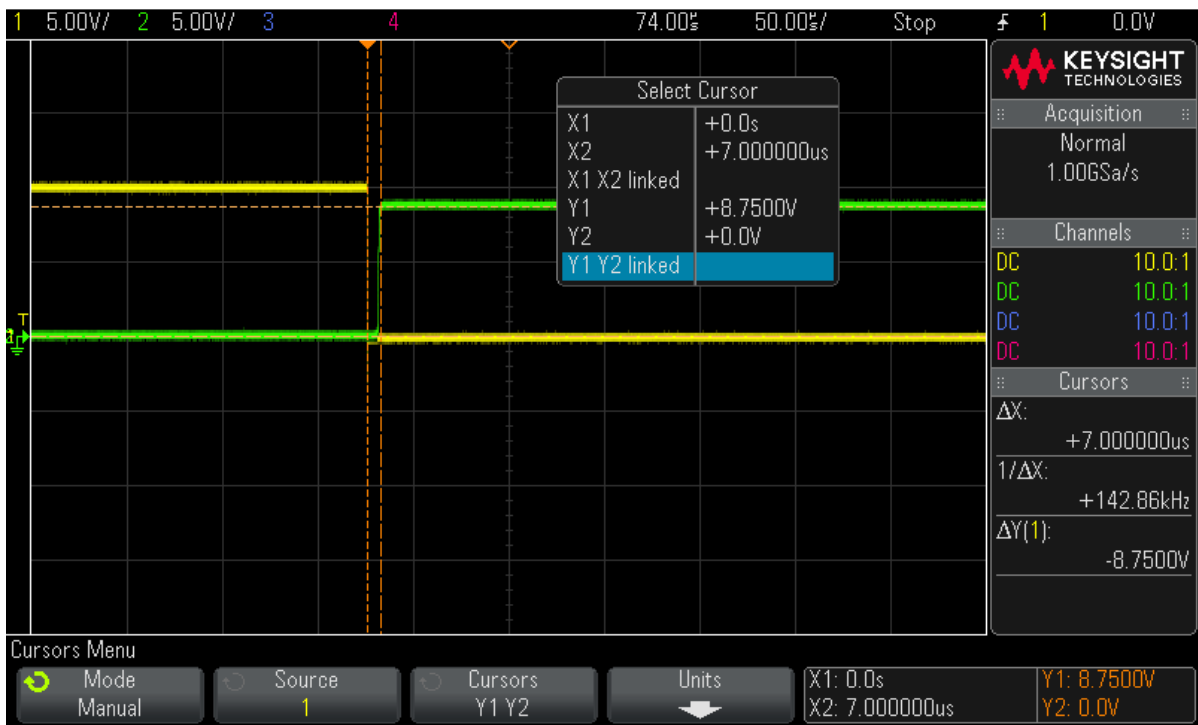**C. BJT as a switch.**
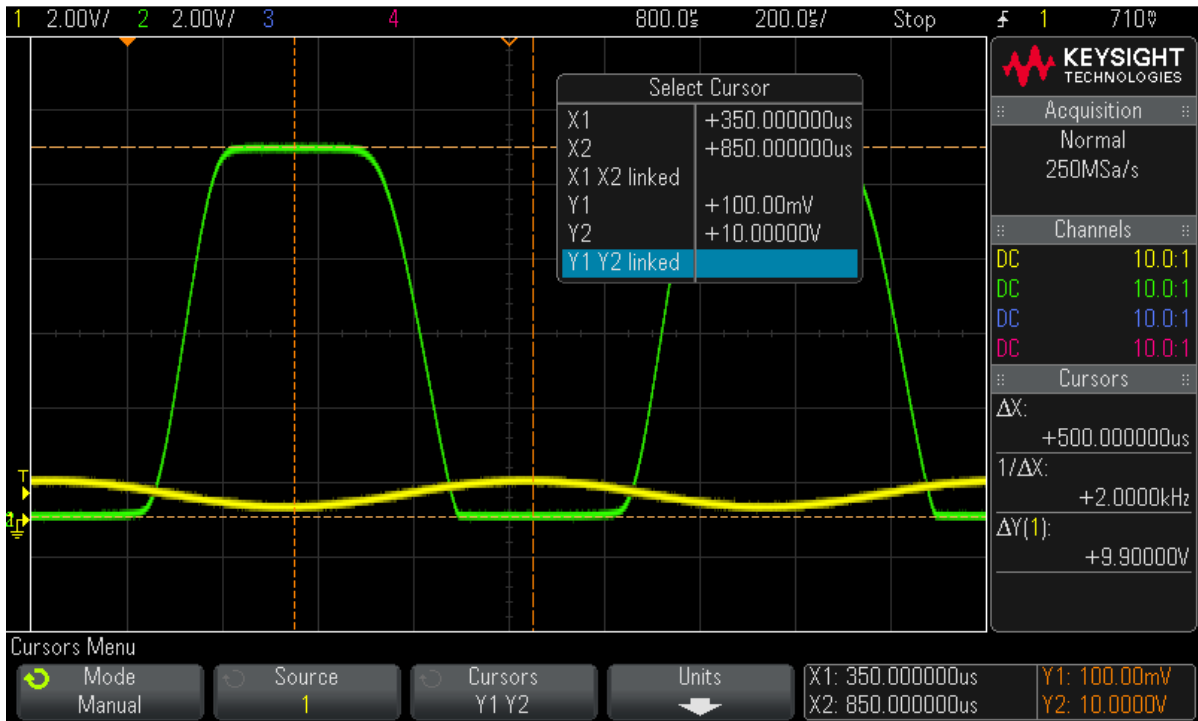
Vi vs Vo
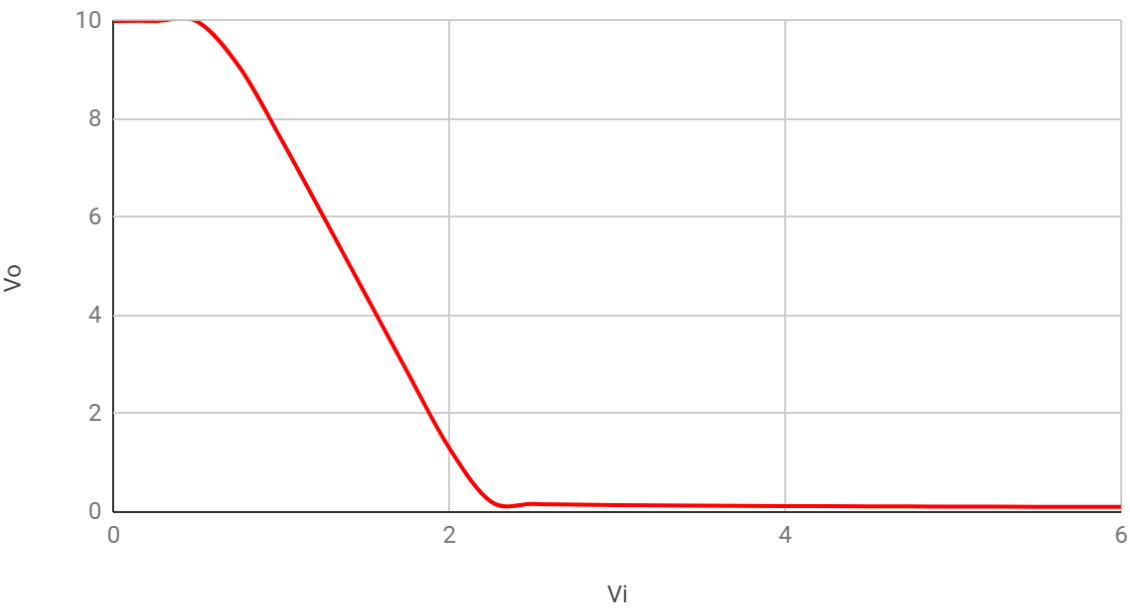
Vi vs Ic
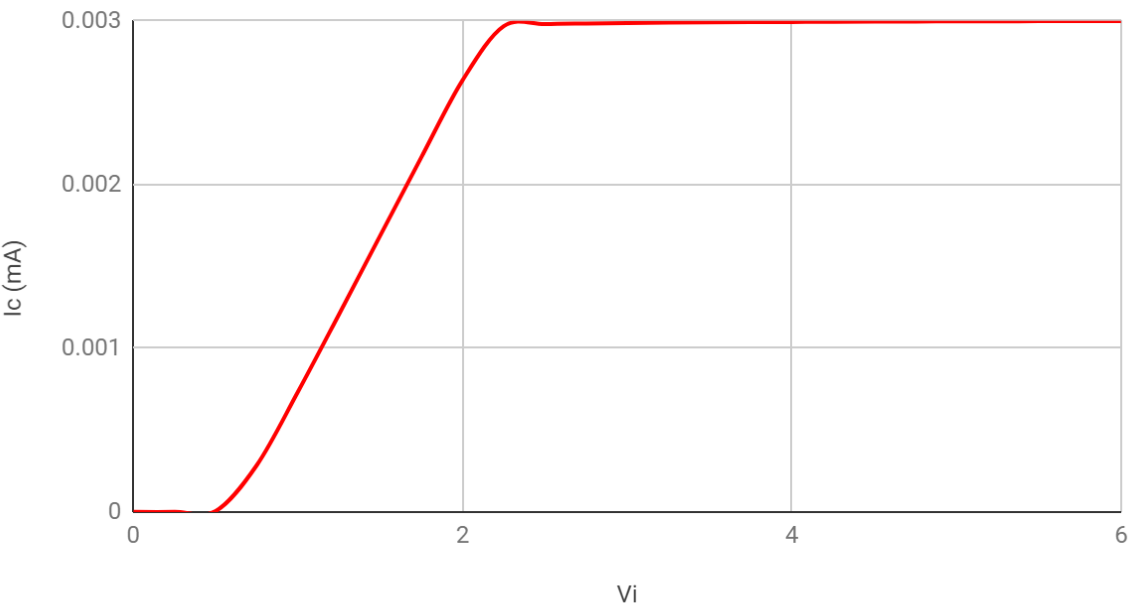
Vi vs Pr

Vi vs Pnpn

Without current booster - $V_o = 2.1$ v $i_o = 33.1$ mA
With current booster - $V_o = 9.83$ v $i_o = 66.9$ mA

D. BJT as an amplifier

AC amplitude = 4.339v, oscillating around a DC voltage of 5v

Conclusion -
This lab was focused on the properties of BJTs, such as the different types and the interactions between the different pins. The lab started with a simple circuit to display the basic properties of npn and pnp transistors, employing the parameter analyzer to expand upon the use of the voltmeter, then moved on to more complicated circuitry displaying different uses of the transistors and requiring measurements of the different components of the selected BJT.