BIRZEIT UNIVERSITY

Faculty of Engineering & Technology
Electrical & Computer Engineering Department

ENEE2103

PreLab#06

BJT Transistor As an Amplifier, CE, CC, CB Connection

Prepared by : Tareq Shannak

ID Number : 1181404

Instructor : Dr. Alhareth Zyoud

Teaching Assistant : Mahdi Salem

Section : 5

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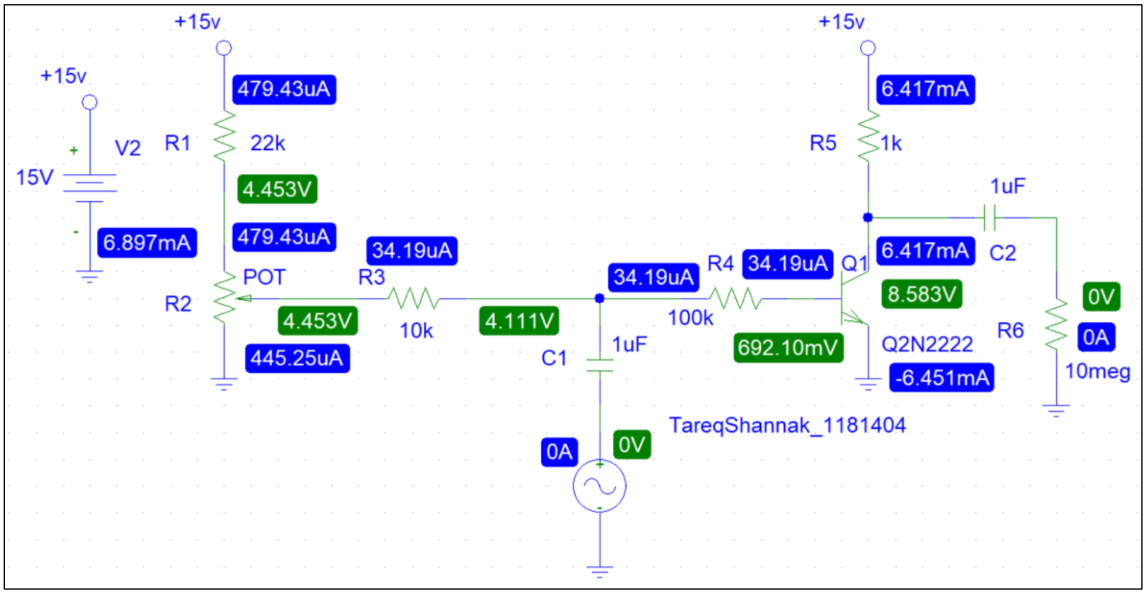
Part One

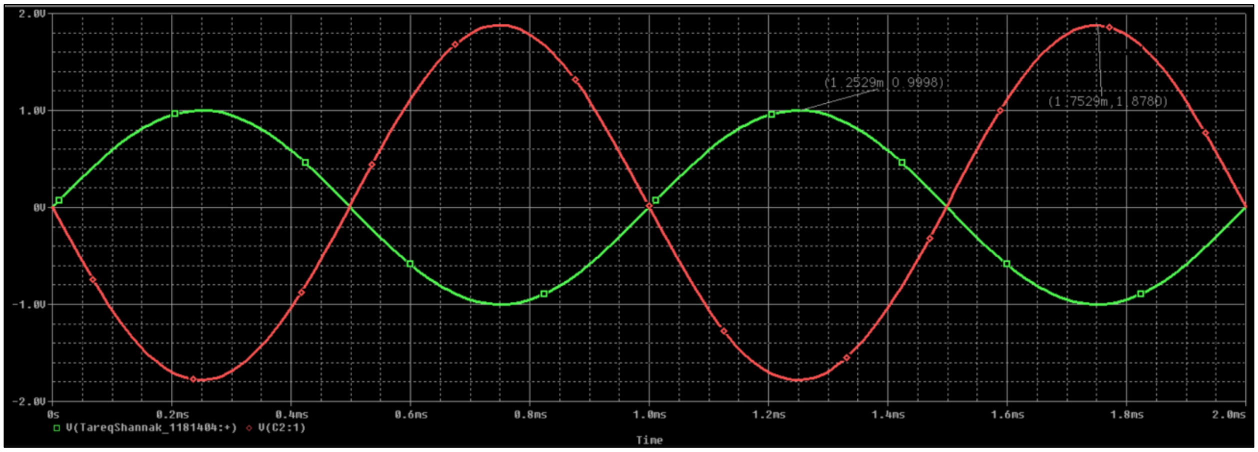
Initially set $V_i(t)$ amplitude to 0, set the potentiometer value to 10 k and its set value to 0. Set sinusoidal source to 1 kHz and amplitude to zero.



Measure V_C, V_{BE}, V_{CE}, I_C, I_B

V_C	**8.583 V**
V_{BE}	**692.1 mV**
V_{CE}	**8.583 V**
I_C	**6.417 mA**
I_B	**34.19 µA**

Adjust amplitude of $V_i(t)$ to 1 V and measure $V_o(t)$

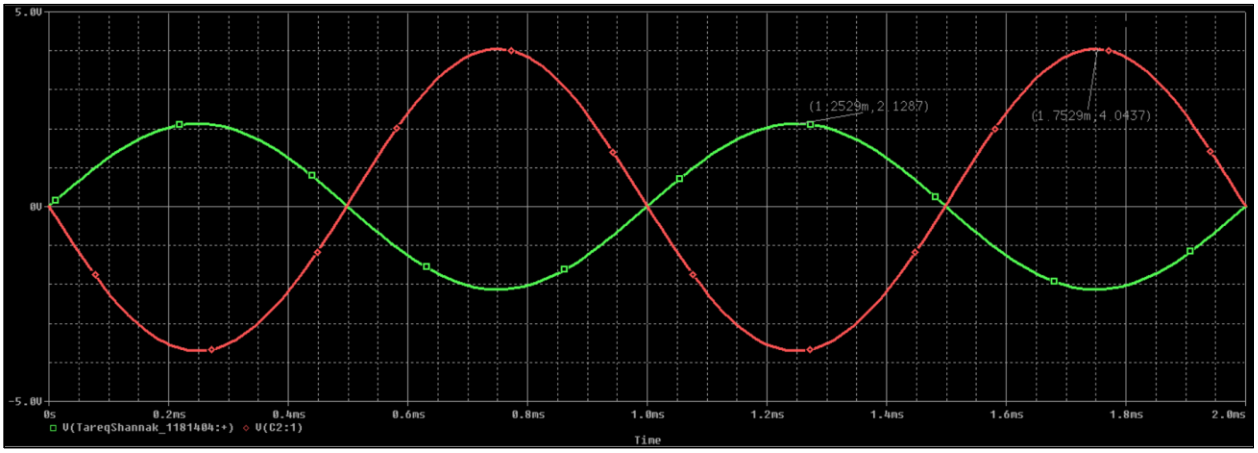


$$V_O(t) = 1.878\,V, Voltage\ Gain\ A_V = \frac{1.878}{0.9998} = 1.8784$$

Change peak of $V_i(t)$ such that $V_o(t)$ =4V

$$Voltage\ Gain\ A_V = 1.8784 \quad \rightarrow 1.8784 = \frac{V_O(t)}{V_i(t)}$$

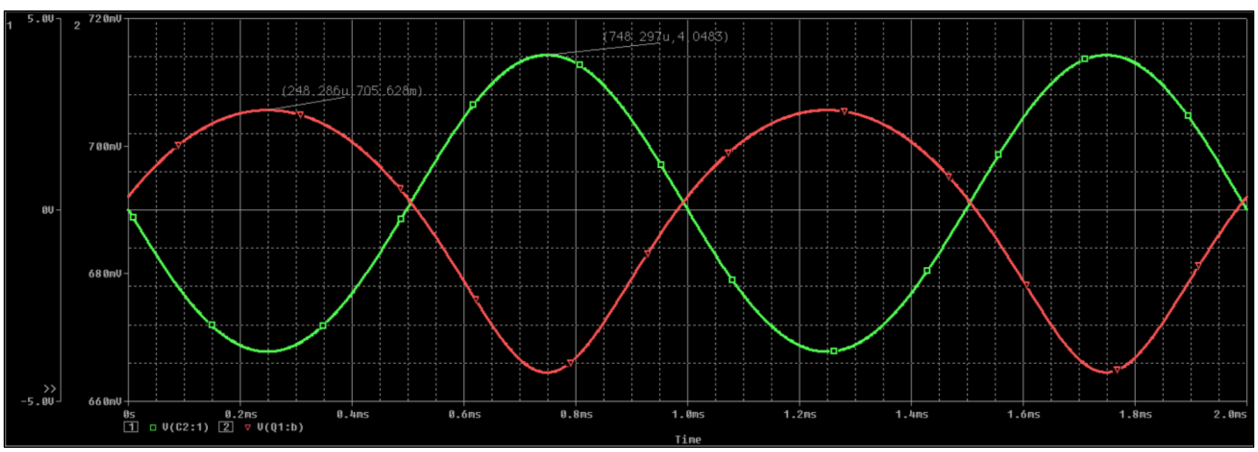
$$\rightarrow V_i(t) = \frac{4}{1.8784}\ V = 2.129\ V$$



Calculate the voltage gain of the transistor

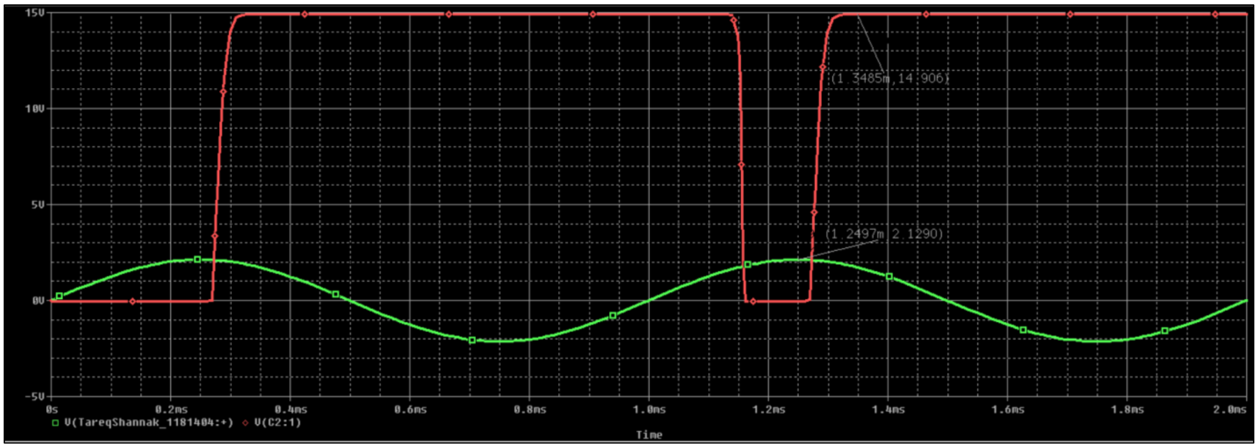
$$Voltage\ Gain\ A_V = \frac{1.878}{0.9998} = 1.8784$$

Calculate $A_{v1} = V_o(t)/ V_B(t)$



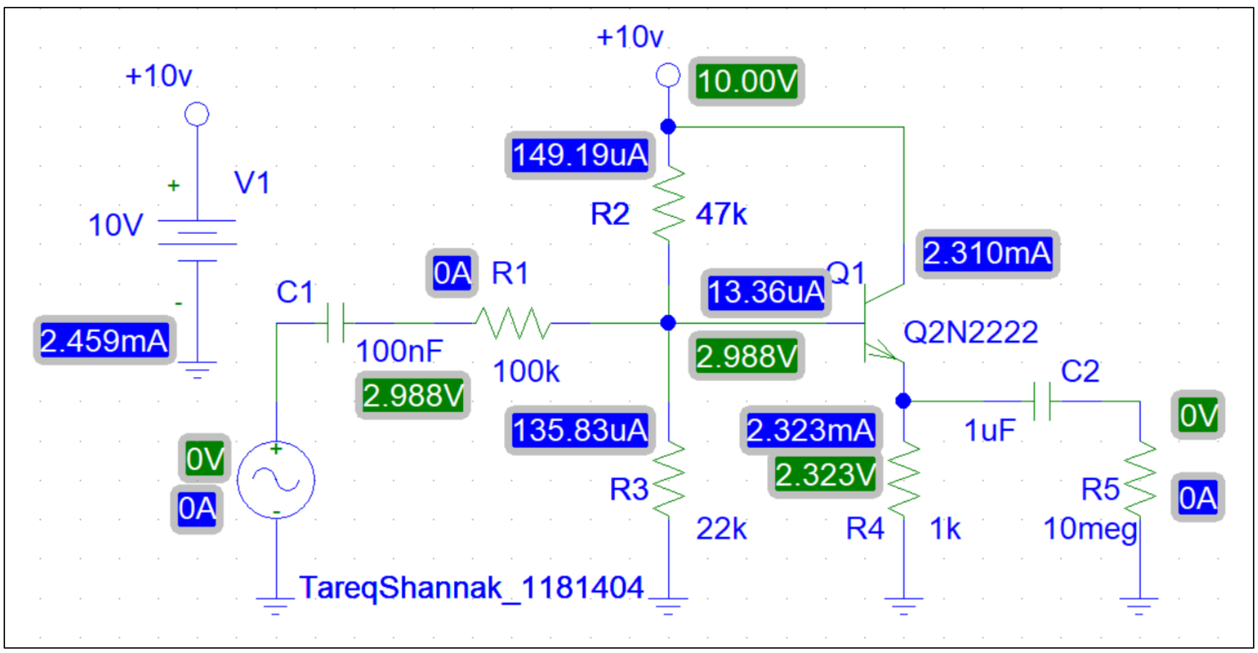
$$A_{V1} = \frac{V_O(t)}{V_B(t)} = \frac{4.0483}{705.628m} = 5.737$$

Remove the 100k resistor and see what happens to voltage gain



$$A_V = \frac{V_O}{V_i} = \frac{14.906}{2.129} \approx 7$$

Part Two: Common Collector Transistor Amplifier



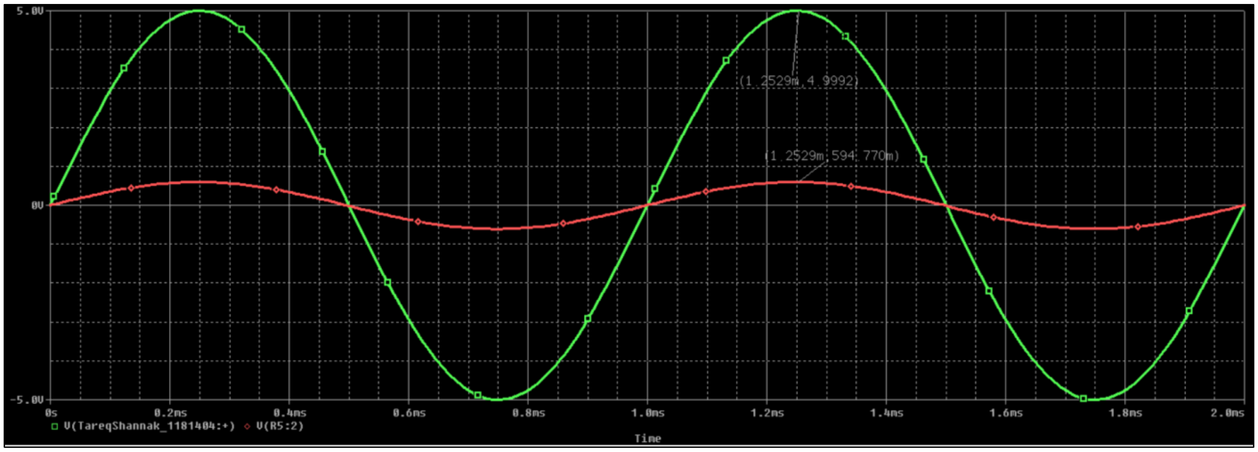
Measure V_B, V_C, I_B, I_C

V_B	**2.988 V**
V_C	**10 V**
I_B	**13.36 µA**
I_C	**2.31 mA**

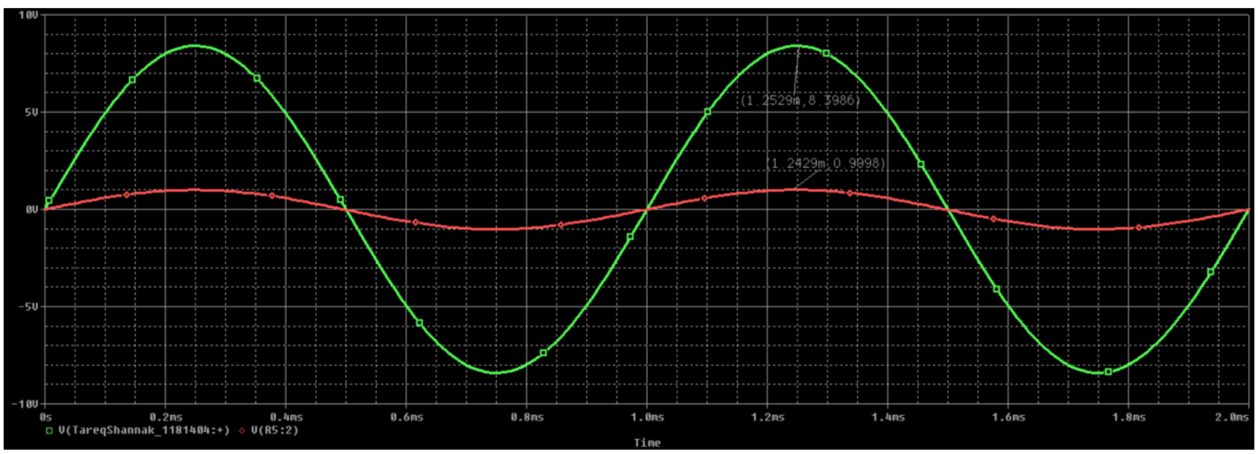
Adjust the amplitude of the sine wave generator until an output amplitude from the amplifier is about 2 volts peak-to-peak. (Make sure the waveform is undistorted).

$$Let\ V_{in} = 5\ V \rightarrow V_{out} = 594.77\ mV$$

$$A_V = \frac{594.77\ m}{4.9992} = 0.119$$



$$If\ we\ need\ V_{out} = 1, V_{in} = \frac{V_{out}}{A_V} = \frac{1}{0.119} \approx 8.4\ V$$



$$V_{out} = 0.9998\ V \approx 1\ V \rightarrow V_{out} = 2\ V\ peak\ to\ peak$$

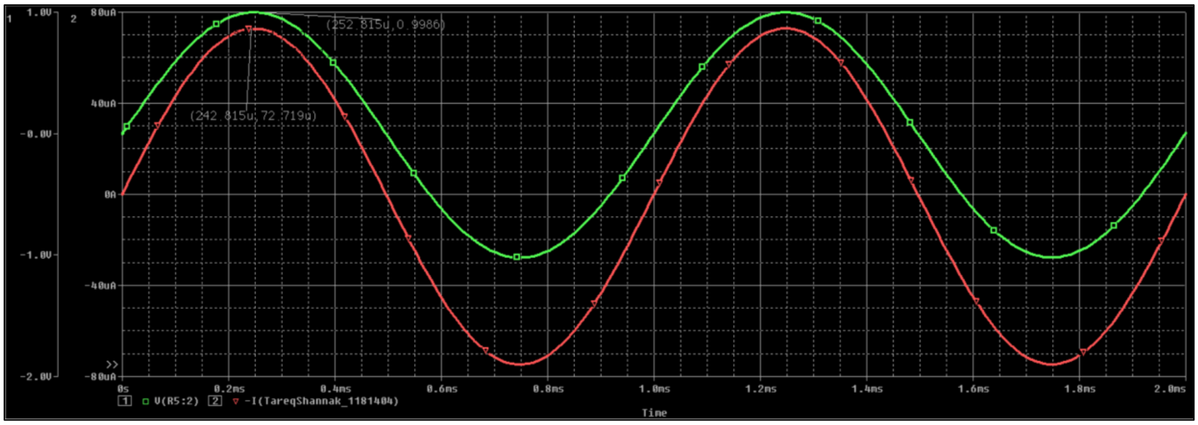
Measure the ac input voltage needed to achieve this output

$$V_{in} \approx 8.4\ V$$

Calculate the voltage gain A_v

$$A_V = 0.119$$

Measure the input and output currents and calculate A_i



$$I_{in} = 72.719\ uA, V_{out} = \ 0.9986\ V \ \rightarrow \ I_{out} = 0.9986\ mA$$

$$A_i = \frac{I_{out}}{I_{in}} = \frac{0.9986\ mA}{72.719\ uA} = 13.732$$

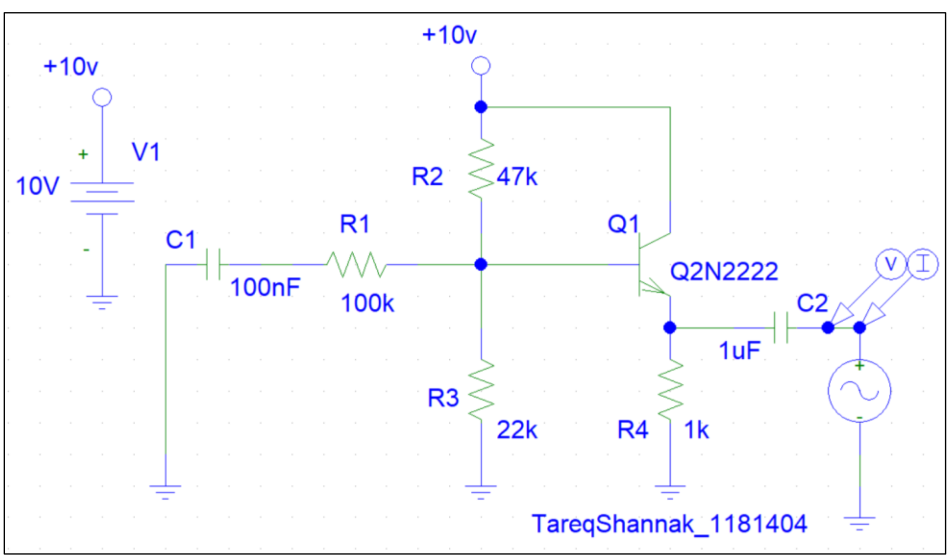
Calculate the current gain A_i

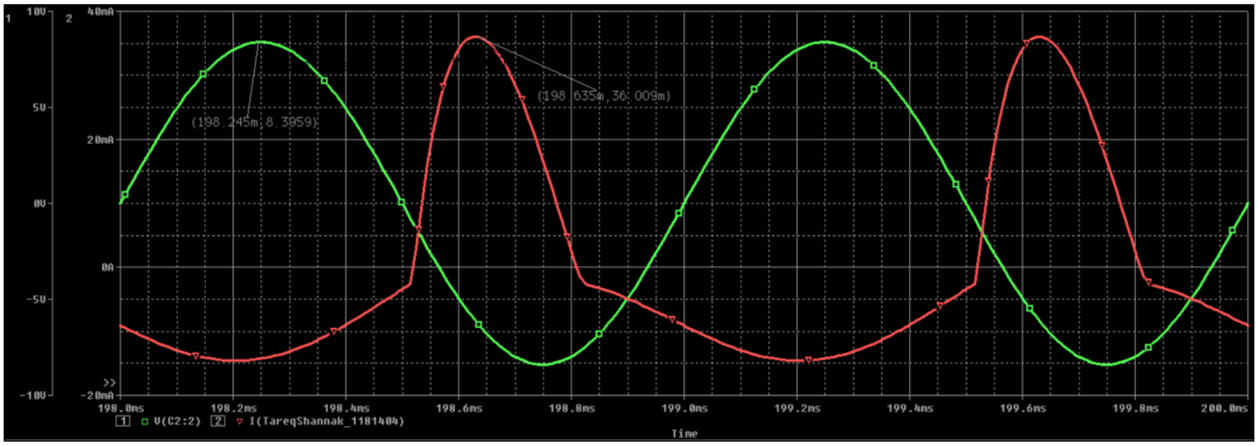
$$A_i = \frac{I_{out}}{I_{in}} = 13.732$$

Estimate Z_i from I_i and V_i values

$$Z_i = \frac{V_i}{I_i} = \frac{8.4\ V}{72.719\ uA} = 115.513\ k\Omega$$

To find the output impedance of the amplifier, you should take off the input sine wave generator and replace it with a short circuit, then you have to connect the generator to the output (emitter) via a capacitor, and measure its output voltage and current.





$$V_o = 8.3959\ V$$

$$I_o = 36.009\ mA$$

$$Z_o = \frac{V_o}{I_o} = \frac{8.3959\ V}{36.009\ mA} = 233.16\ \Omega$$

Quantity	Measured Values
V_{in}	8.4 V
V_{out}	0.9986 V
I_{in}	72.719 µA
I_{out}	0.9986 mA
	Calculated Values
A_V	0.119 (< 1)
A_i	13.732 (> 1)
Z_{in}	115.513 KΩ (High)
Z_{out}	233.16 Ω (Low)