Faculty of Engineering and Technology

Electrical and Computer Engineering Department

ENEE2103

Circuits and Electronics Lab

Experiment No.7

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

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Section: 2

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Set output amplitude zero and frequency to one

We are going to use in this part the Pot as shown below. To know to which direction the arrow will be directed, we will set dc =0 and we will simulated it in pspice if the set in pot equal to zero then the arrow is directed to the ground else it will be directed to between the two resistors.

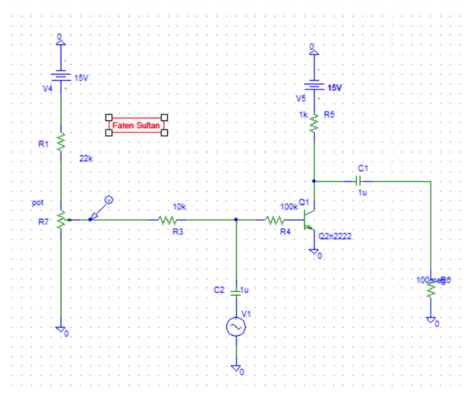

Figure 1:COMMON EMITTER TRANSISTOR AMPLIFIER.1

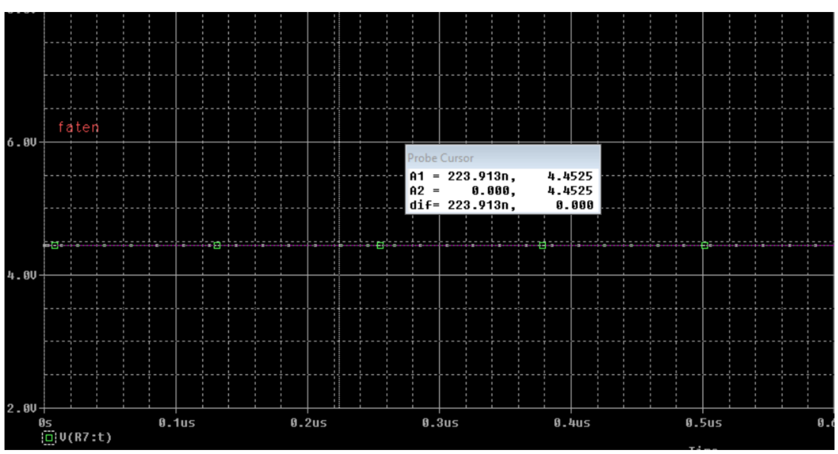

Figure 2:vout for the first part.

Since the set is equal to 4 “greater than zero “the arrow will be directed to between the two resistors and by this it will allow the voltage to be passed to the circuit

Vout=4.4525V

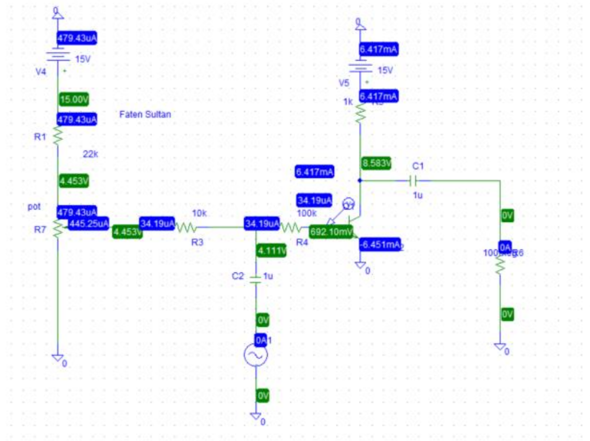

Figure 3: COMMON EMITTER TRANSISTOR AMPLIFIER.2

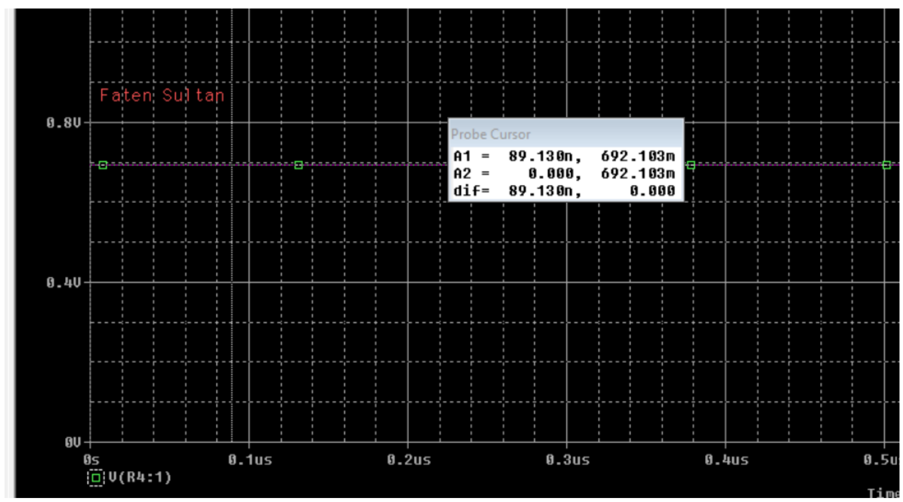

Figure 4: simulate for COMMON EMITTER TRANSISTOR AMPLIFIER.2

Measuring Vc, VBE, VCE, Ic, IB:

- ➔ Vc = 8.583 v
- ➔ VBE = 692.103 mv
- ➔ VCE = Vc - VE = 8.583 - 0 = 8.583v
- ➔ Ic = 6.417 mA
- ➔ IB = 34.19 uA

Note: $V_{ce} = V_c$ and $V_{be} = V_b$ since V_e= 0V

Now , If we put the Voltage marker in these position we will get the following simulation

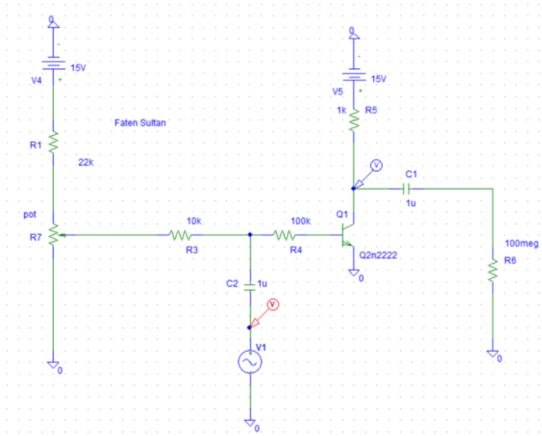

Figure 5: COMMON EMITTER TRANSISTOR AMPLIFIER 3

The result output will be:

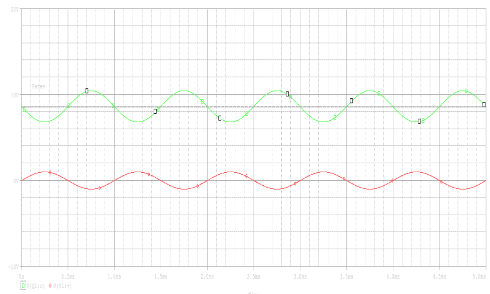

Figure 6:Vout with changing the voltage markers

The Vout is resulted from a phase shift from the input Green graph equals to 8.5825V and that is the same as dc value as a result we change the voltage detector to:

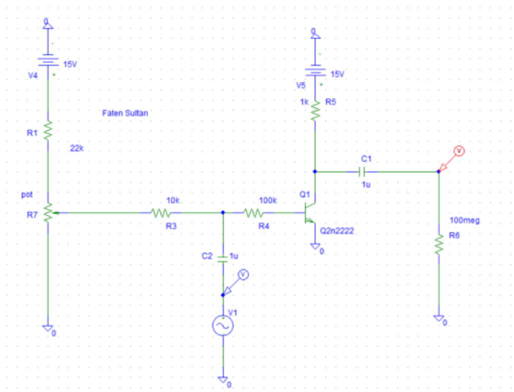

Figure 7: Adjust amplitude of Vi(t)

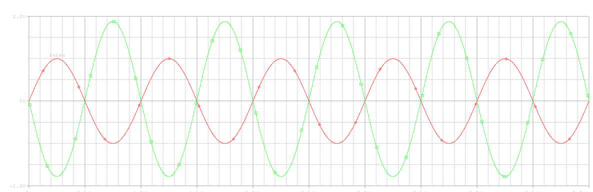

Figure 8:Vo when Vi(t) = 1V

This circuit is common emitter that caused a phase shift by 180 degree.
To calculate voltage gain we used the cursors:

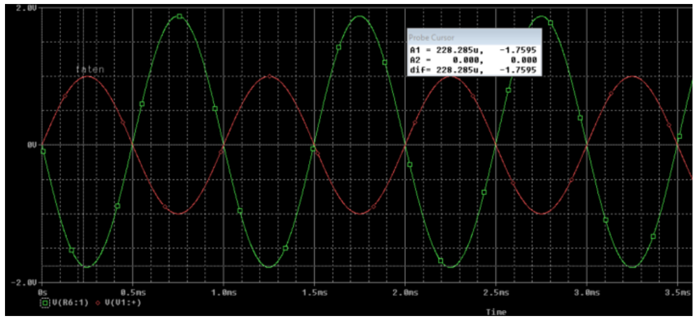

Figure 9:Vo when Vi(t) = 1V with curcor measuring

Change the voltage input peak to obtain Vout = 4V

We want to change the voltage input peak to obtain Vout = 4V..
So when Vampl =1 gives me 1.77595 then 4/1.7595= 2.273 we set Vampl in Vin to 2.273V and we obtain the following:

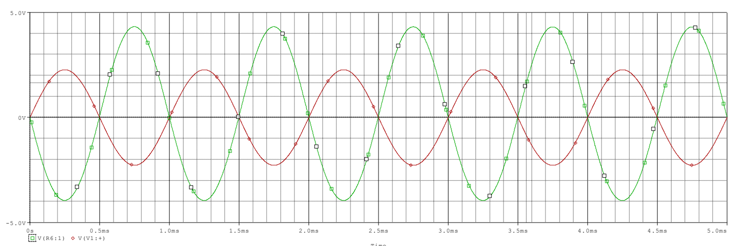

Figure 10:output peak = 4V

Voltage Gain

Voltage gain= 1.7595V as Vo(t) / Vi(y) $=\frac{4}{2.273}$

We use VRMs to make it easier to find gain

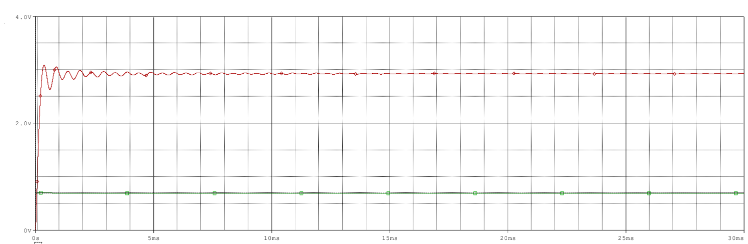

Figure 11:rms V(t)o/ rmsV(t)b

Av (experimentally) = rms V(t)o/ rmsV(t)b= 2.88/688.63=0.0041v

Remove the 100k resistor and see calculating voltage gain

We remove the resistor that exist befor BJT and the simulation was as shown below:

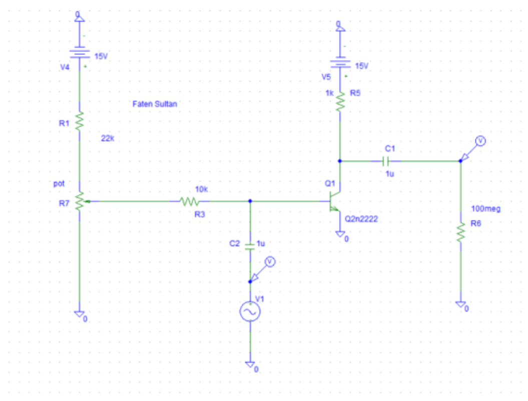

Figure 12: Remove the 100k resistor

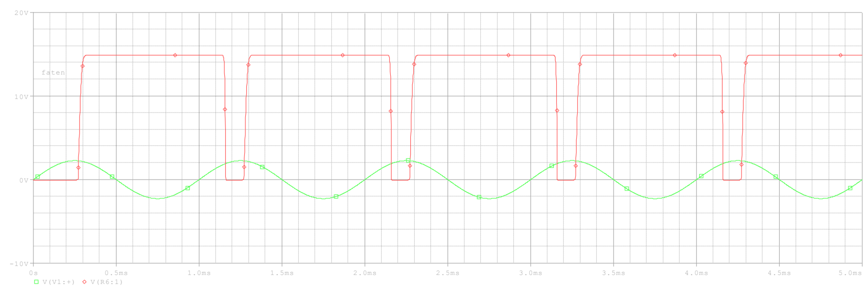

Figure 13:Gain when R= 100k is removed.

The reason the graph is looking like this is that the circuit is no longer act as amplifier, instead BJT is in either cut off region or in saturation region in other words the transistor act as a switch.

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Part two: COMMON COLLECTER TRANSISTOR (AMPLIFIER):

Here we don't have phase shift.
We connect a resistor with 100meg to represent the circuit as an open circuit

Set the circuit as shown below

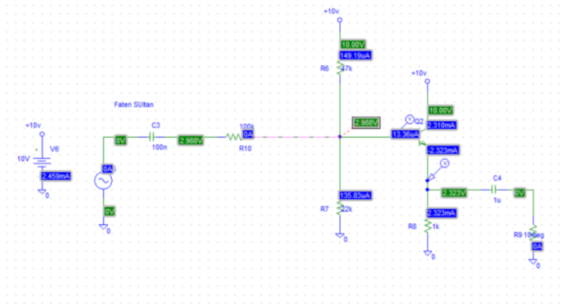

Figure 14:CCT amplifier.

Measuring Vc, VBE, VCE, Ic, IB:

Vb = 2.988
Vbe = 2.988 – 2.323 = 0.7
Vc=10V
Ib=13uA
Ic=2.3mA

Perform Bias Point

To obtain a voltage output = 2V
We set amplitude for voltage input to 1 and we realized that the voltage gain is 0.116728
Then to obtain 2V → 2/0.117= 17

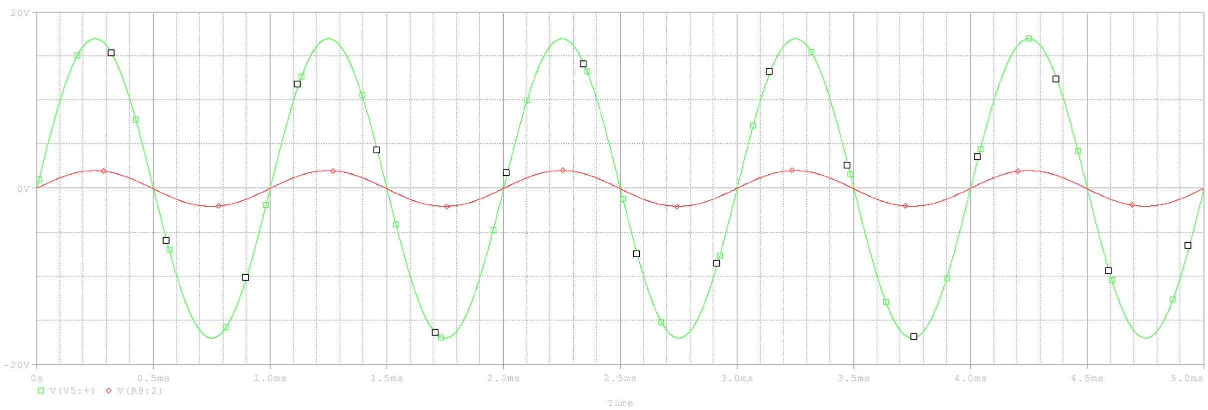

Figure 15: When v(t)op-p=2v.

To find the amplitude of the input voltage, the voltage gain must be found. The voltage gain is found by setting the amplitude of input voltage to 1 V and measuring the output.
Vi(t) and Vo(t):

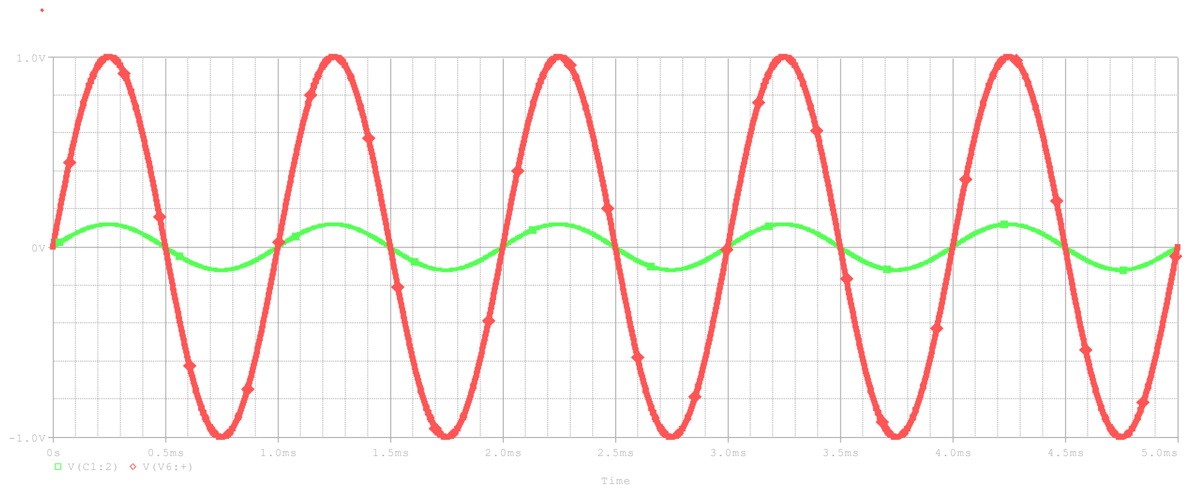

Figure 16: Voltage gain on 1v input in CC circuit

The voltage gain Av:

$AV = \frac{Vo}{Vi} = \frac{0.119236}{0.9998} = = 0.11926$

Since the output is 2 V peak-peak, then the amplitude is 1 V.

Vi$= \frac{Vo}{Av} = \frac{1}{0.11926} = = 8.385$ v

Vi(t) and Vo(t) and Av:

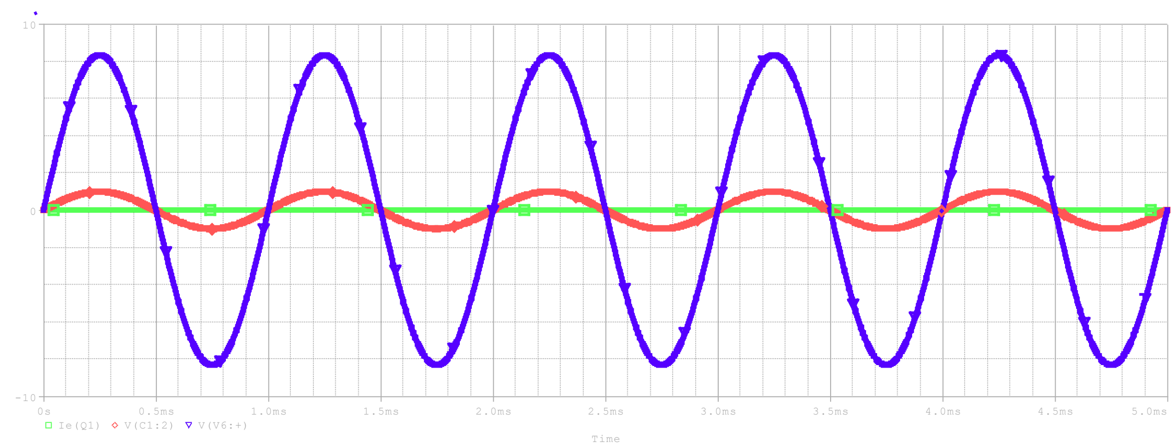

Figure 17:required vin to get vout peak 2v

Ii(t) and Io(t) and Ai:

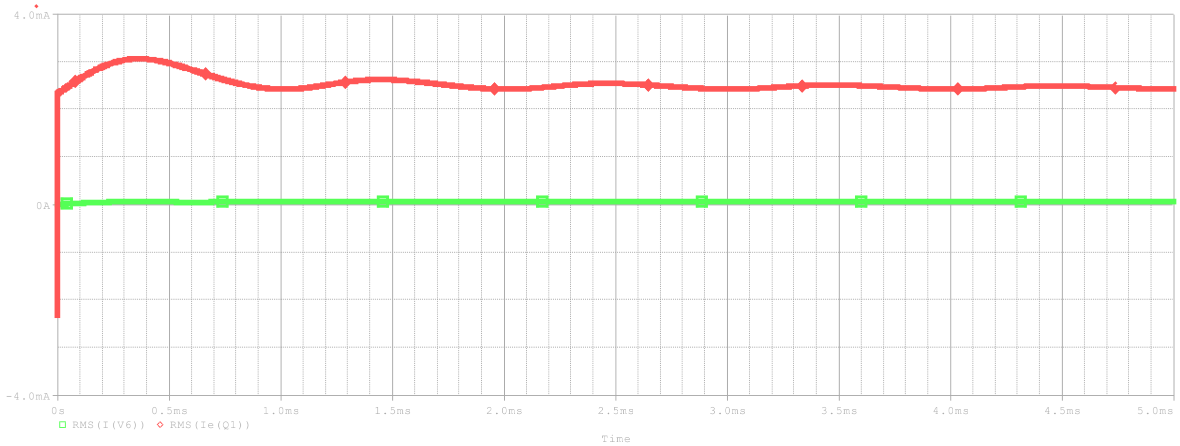

Figure 18:Current rms for input and output

The current gain Ai:

$Ai = \frac{Io}{Ii} = \frac{101.858*10^{\wedge}-9}{74.560*10^{\wedge}-6} =$ = 1.36612 * 10^-3

The input impedance Zi:

$Zi = \frac{Vi}{Ii} = \frac{8.3837}{74.56*10^{\wedge}-6} =$ = 112442.328326 Ω

Vt(t) and It(t):

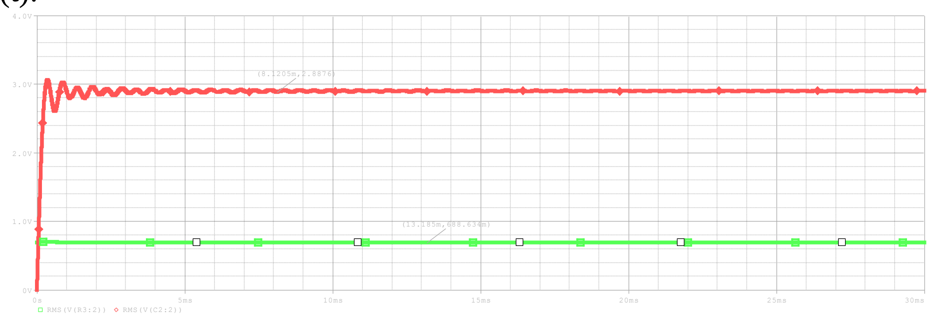

Figure 19:the output voltage and current

The output impedance Zo:

$Zo = \frac{Vo}{Io} = \frac{8.3832}{43.336*10^{\wedge}-3} =$ =193.4465 Ω

V100k_RMS(t):

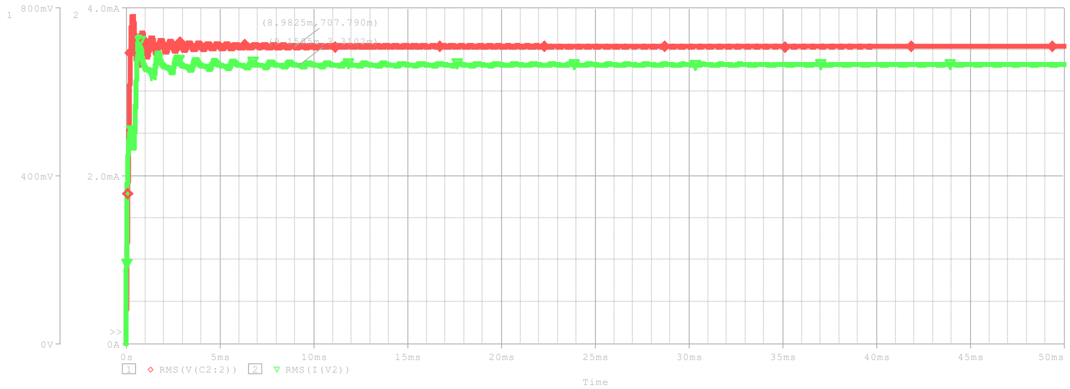

Figure 20:rms values for 100k resistor

Table 1 Quantity & Measured Values

Quantity	**Measured values**
V_{in}	**8.3837 v**
V_{out}	**1.0009 v**
V_{100k_RMS}	**7.2891 v**
i_{out}	**101.858 nA**
	Calculated values
$A_V=V_{out}/V_{in}$	**0.119386**
$i_{in} = V_{100k\_RMS} /100k$	**72.891 uA**
$A_i=i_{out}/i_{in}$	**1.3974 * 10^-3**
$Z_{in}=V_{in}/i_{in}$	**115016.9431 Ω**
$Z_{out}=V_T/i_T$	**193.4465 Ω**