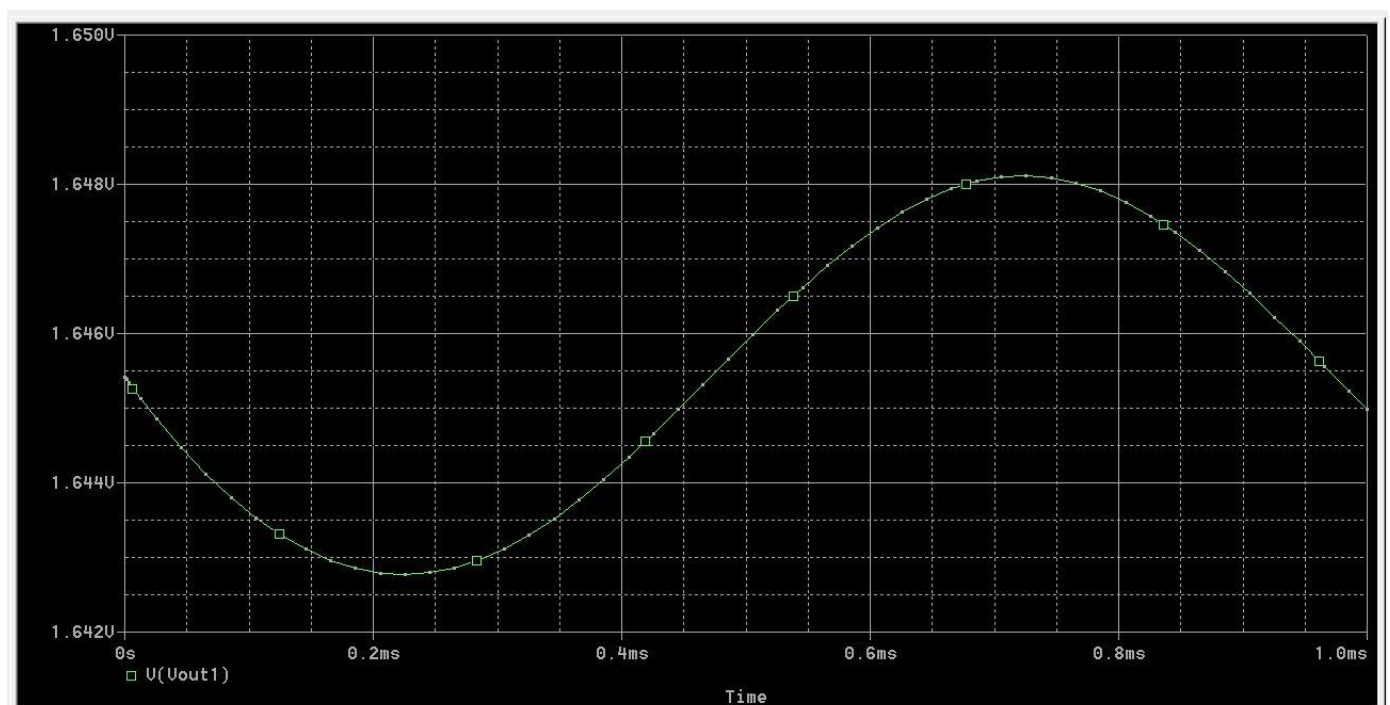
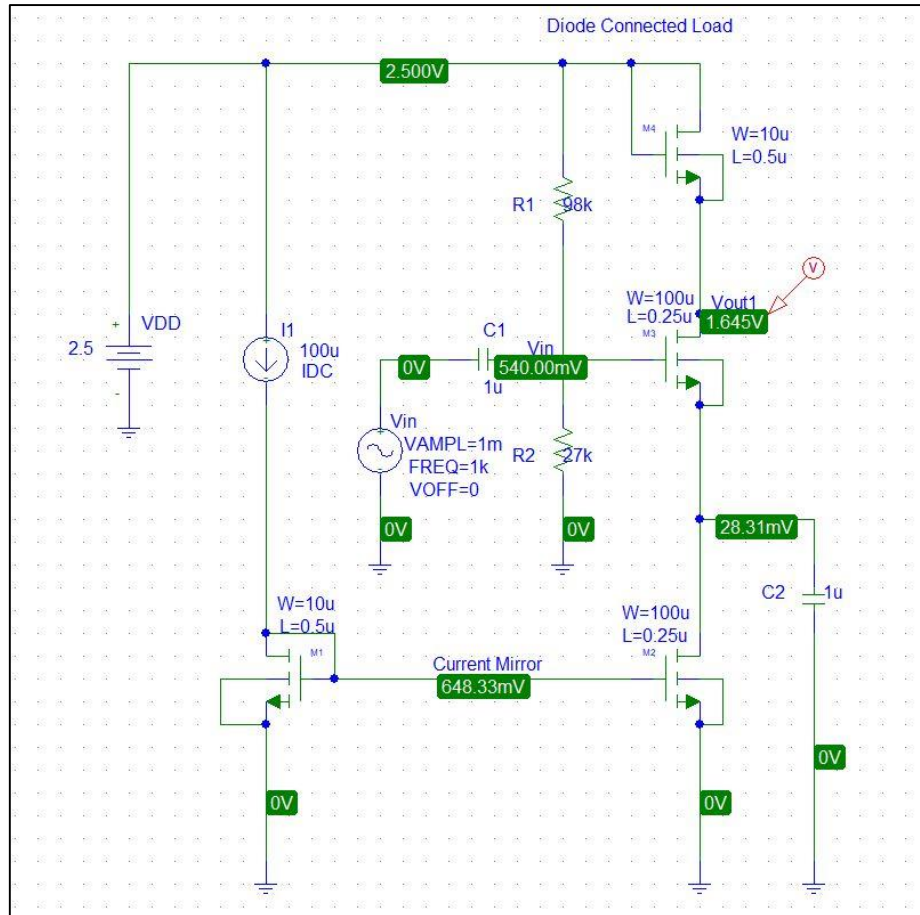


## Electronic Circuits 1 Project 2

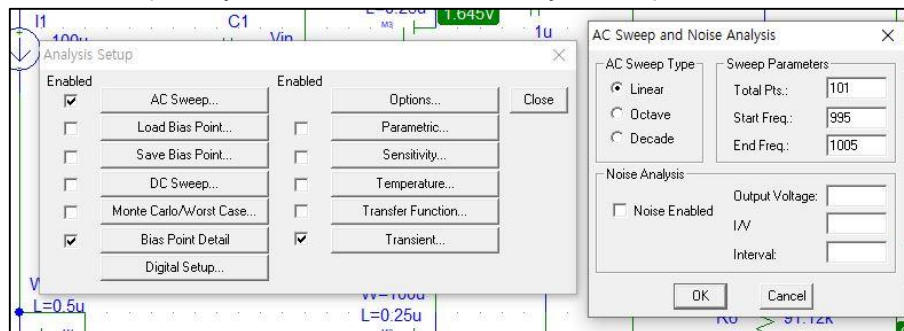
### Problem 1

The screenshot of the schematic for this problem is shown below. The transient graph is shown below.

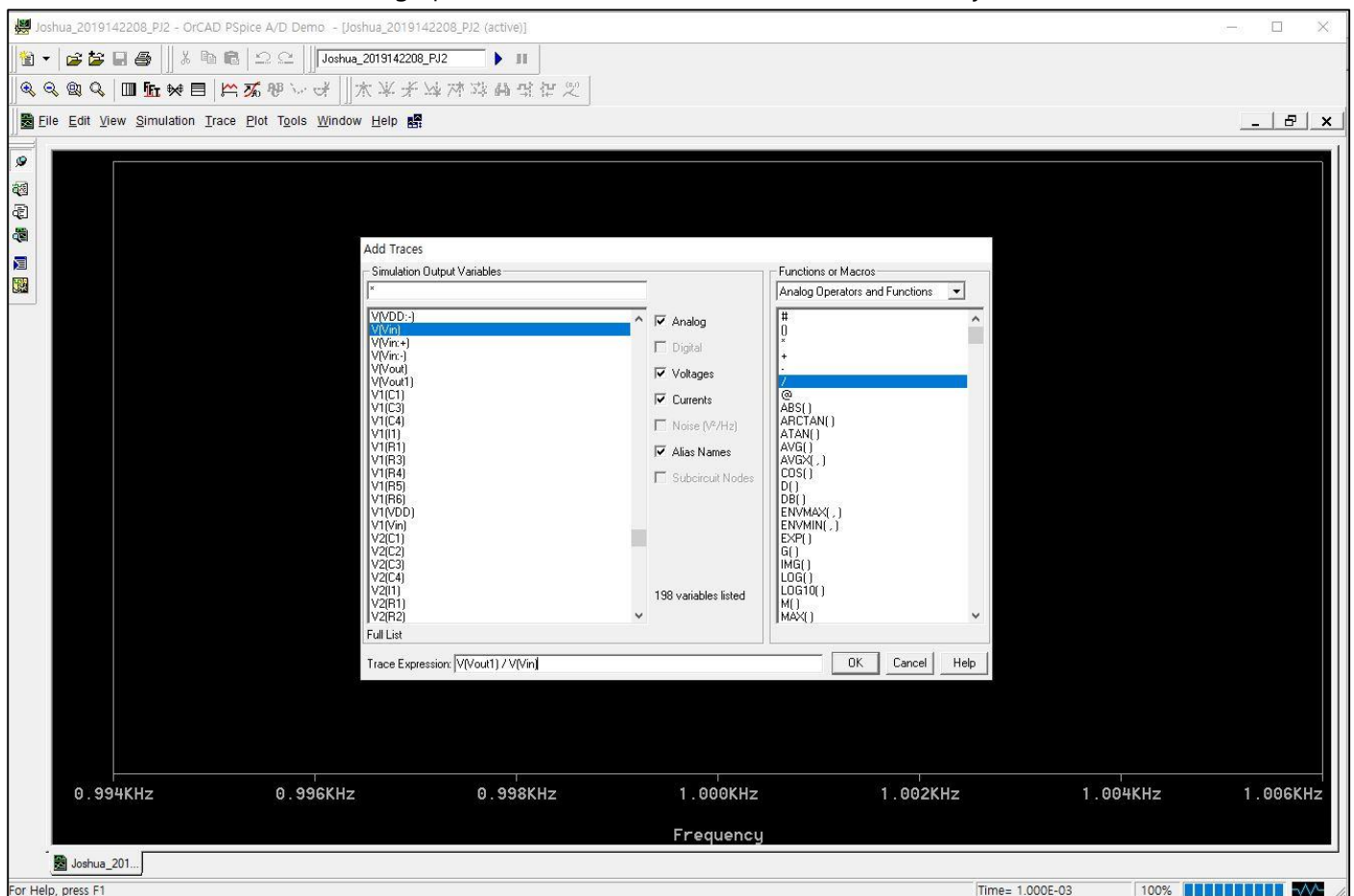


To calculate for the voltage gain, we use AC Sweep Analysis. Although AC sweep analysis is commonly used for analyzing circuit parameters with changing AC signal frequency, we can use this technique as it allows us to analyze small signals (AC) and isolate DC signals on the circuit. We analyze the circuit at 1000 Hz to obtain desired values. The steps on how to perform this are as follow.

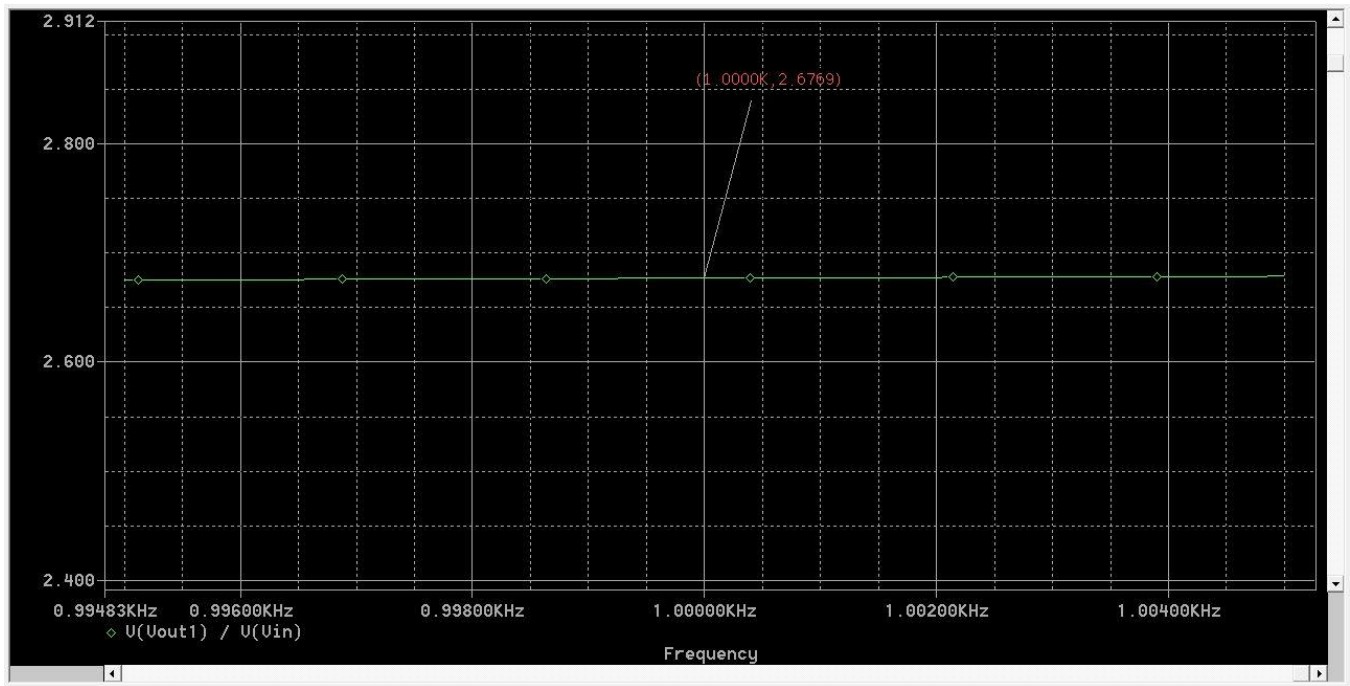
1. We set up the AC sweep analysis simulation on the analysis setup.



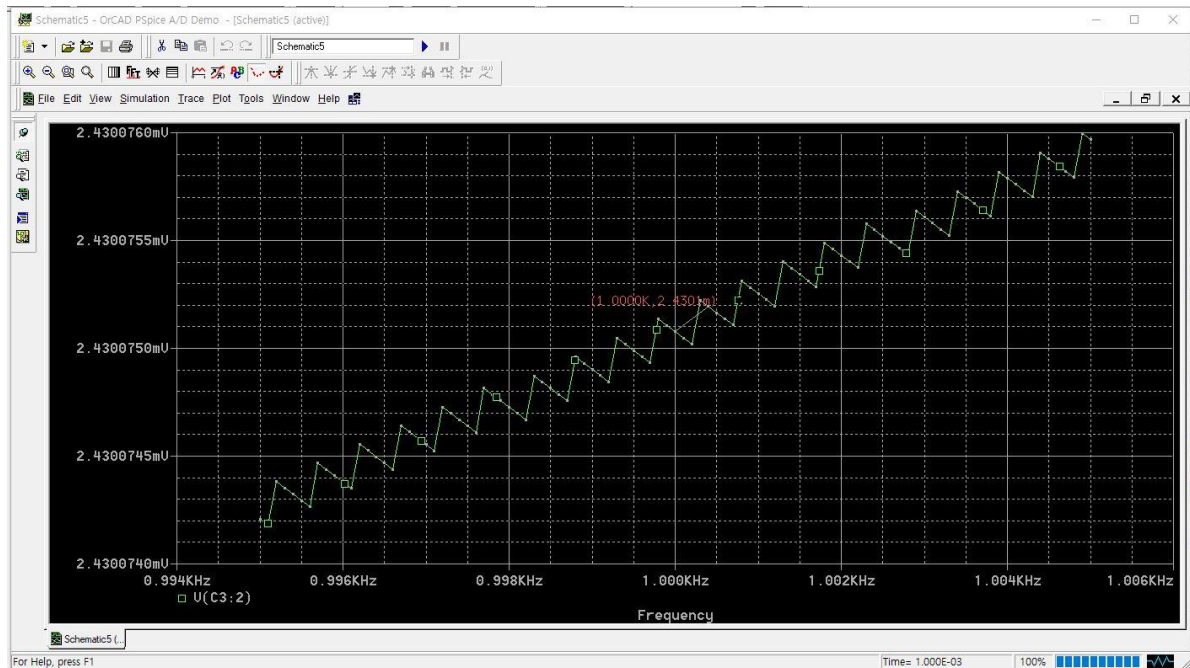
2. We remove all traces on graph and add trace such that we divide  $V_{out1}$  by  $V_{in}$ .



3. Once the trace is plotted, we hover over to 1000 Hz line and obtain value on the graph. As we can see on the figure below, **the AC signal gain at the output port of the Diode Connected Load stage is 2.6769**, which is above the minimum requirement of 2.5.

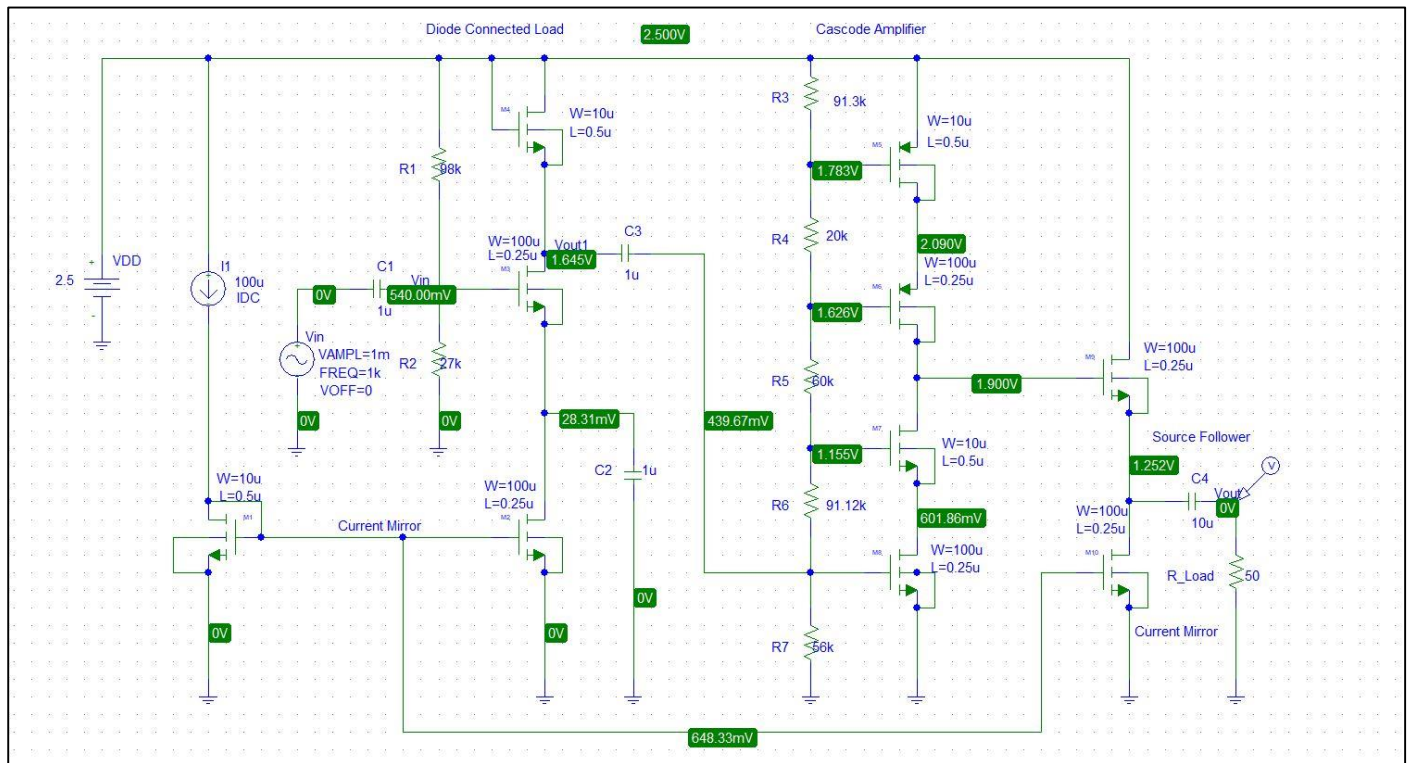


We notice that there is a capacitor (C2) between the diode connected stage and the current mirror. By adding this capacitor, we allow the small signal model to avoid the current mirror M3 on the source side of M2 as M3 acts as a degenerative resistor which lowers the gain. This can be shown by the result of the AC sweep when we remove the C2 capacitor.

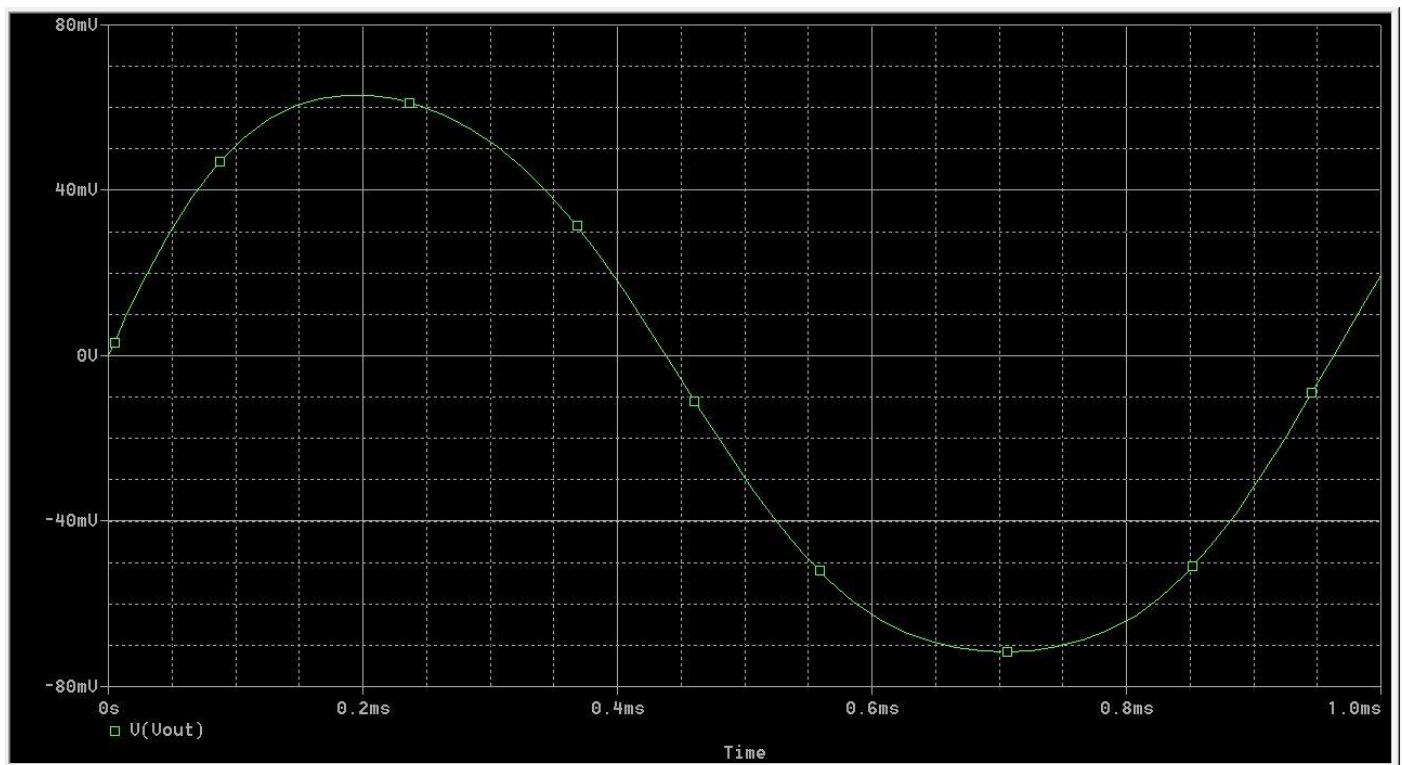


## Problem 2

The following figure shows the schematic with the appropriate values for the resistors, and the W/L values of the transistors, and the DC bias at nodes.



The resulting transient graph at the Vout is shown below.





The screenshot displays the OrCAD PSpice A/D Demo interface. The main window shows a Bode plot for the magnitude of the transfer function  $U(V_{out}) / U(V_{in})$  versus Frequency. The plot is a straight line, indicating a constant gain across the frequency range shown. A specific point on the line is highlighted with the coordinates (1.0000K, 82.428).

Frequency (KHz)	Magnitude (dB)
0.994K	82.37
0.996K	82.38
0.998K	82.39
1.000K	82.40
1.002K	82.41
1.004K	82.42
1.006K	82.43

The software interface includes a menu bar (File, Edit, View, Simulation, Trace, Plot, Tools, Window, Help) and a toolbar with various icons for file operations, simulation, and plotting. The status bar at the bottom indicates the simulation time is 1.000E-03 and the plot is at 100% zoom.

[illegible]

As we can see, with 2.158 mA current at VDD, the **total power consumption of this entire circuit is 5.4 mW**, which is below limit of 6 mW.