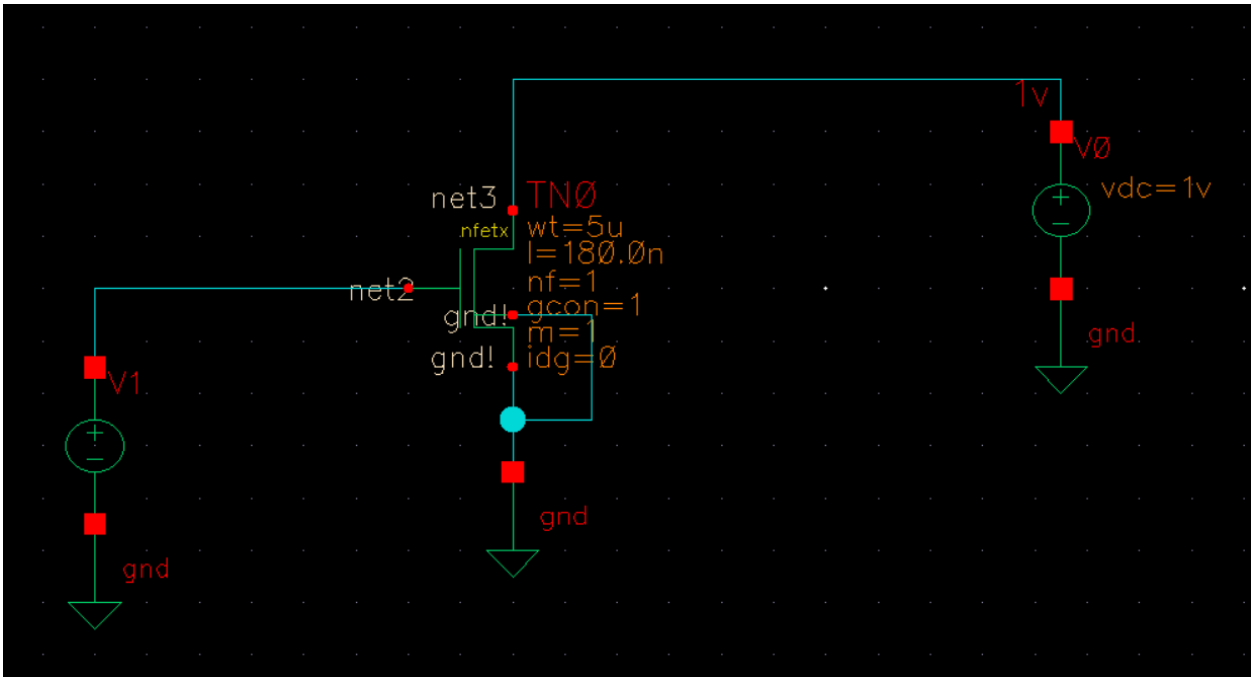
Matthew Loden

ECEN 474

Lab01

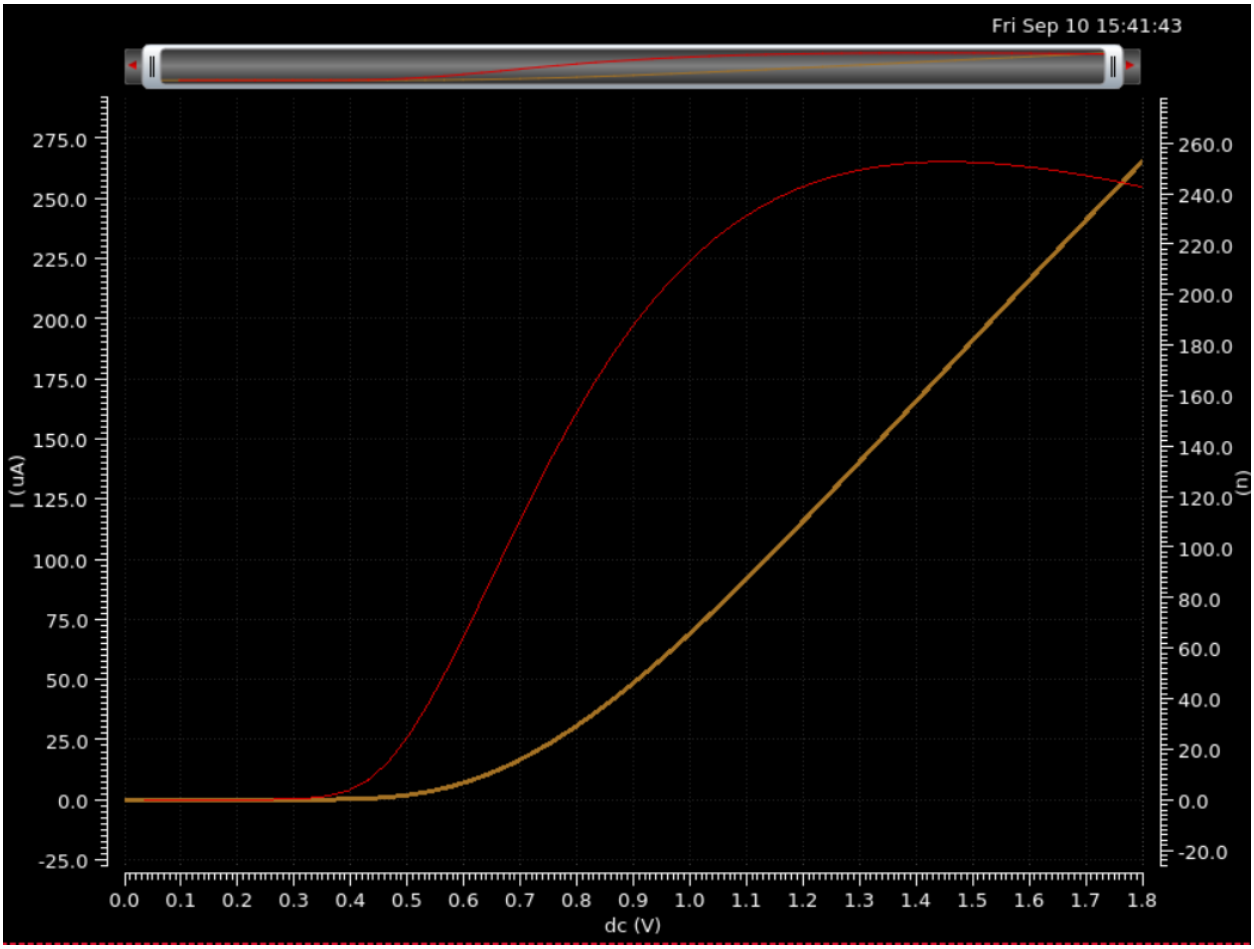
Part 1: NMOS w/ Length = 180 nm

Schematic Used for part 1-3 values of width and length changed depending on a,b,c:

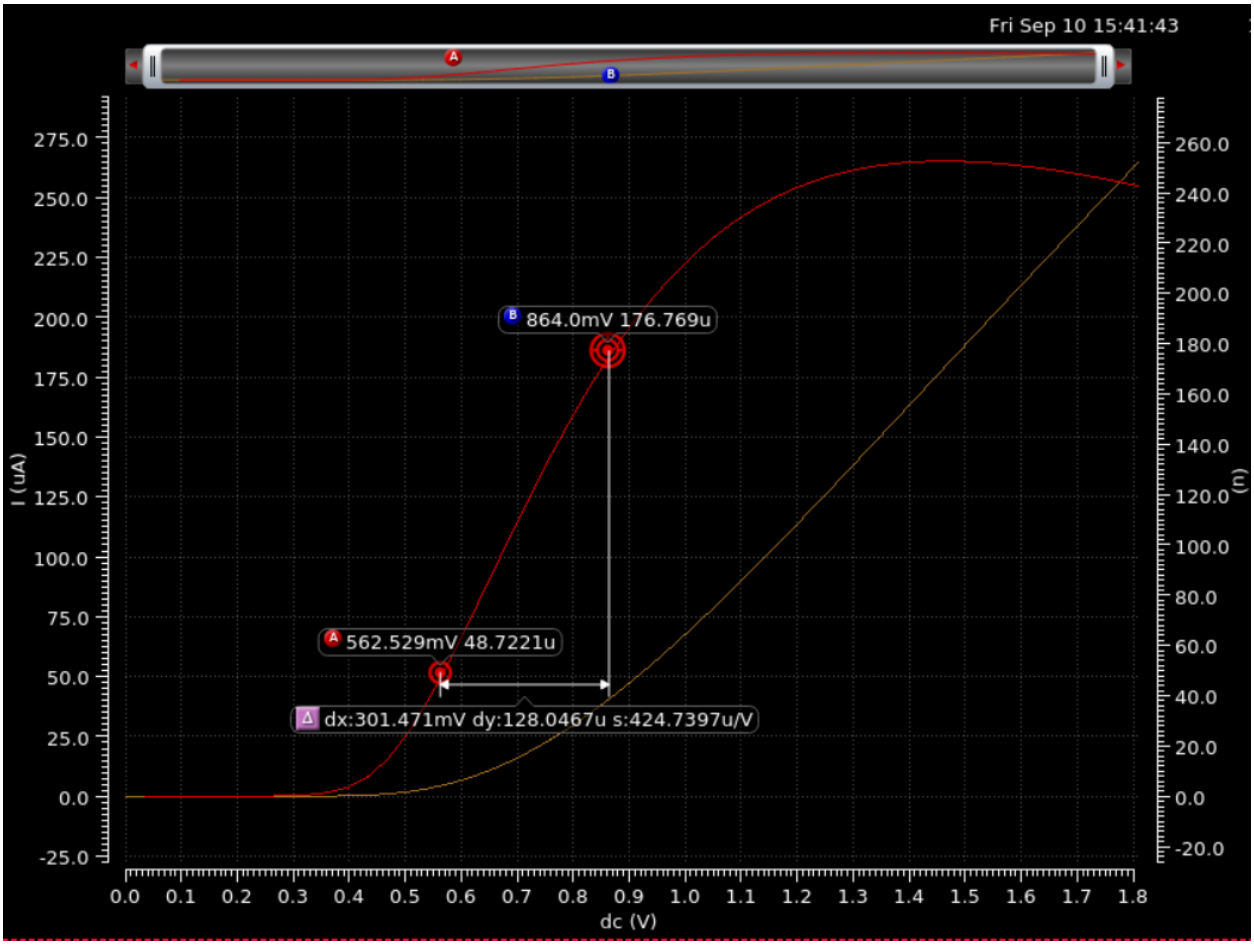


a.)

Id plot:

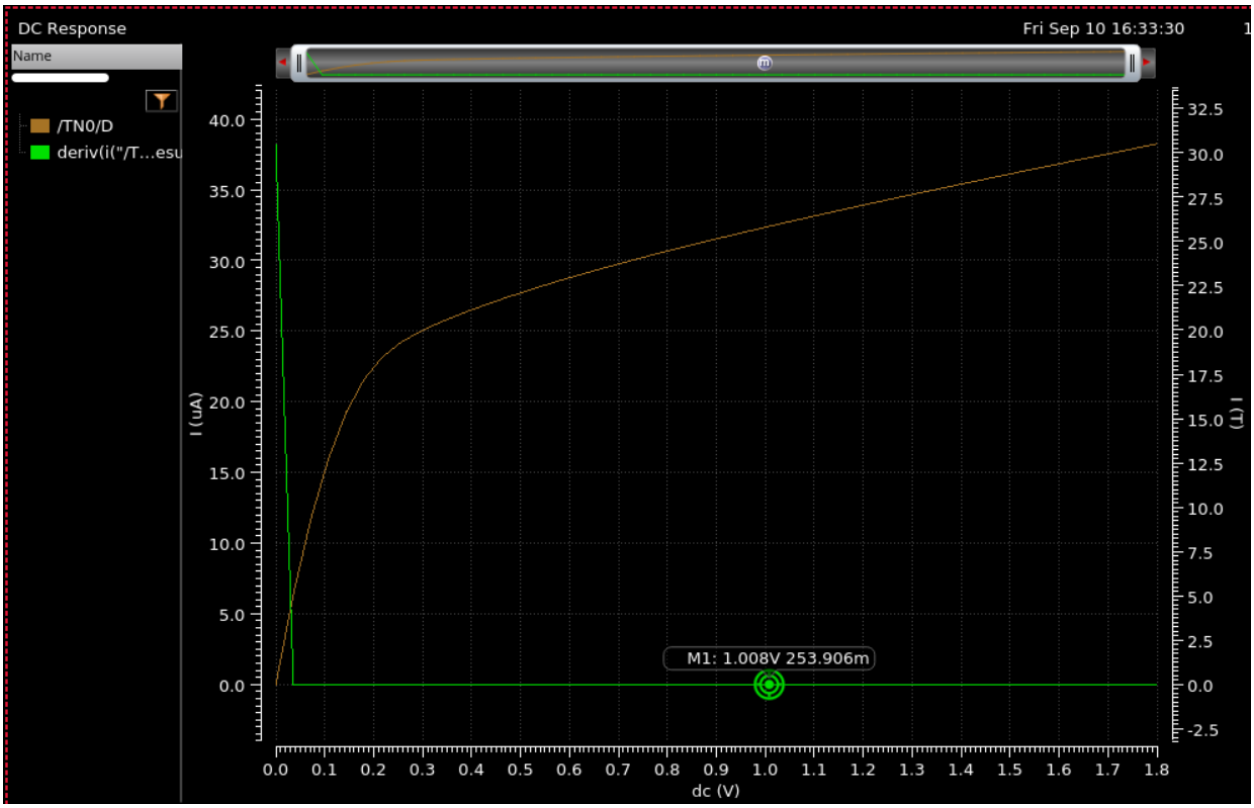

Fri Sep 10 15:41:43
I (uA)
dc (V)
275.0
250.0
225.0
200.0
175.0
150.0
125.0
100.0
75.0
50.0
25.0
0.0
-25.0
260.0
240.0
220.0
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8

Slope:

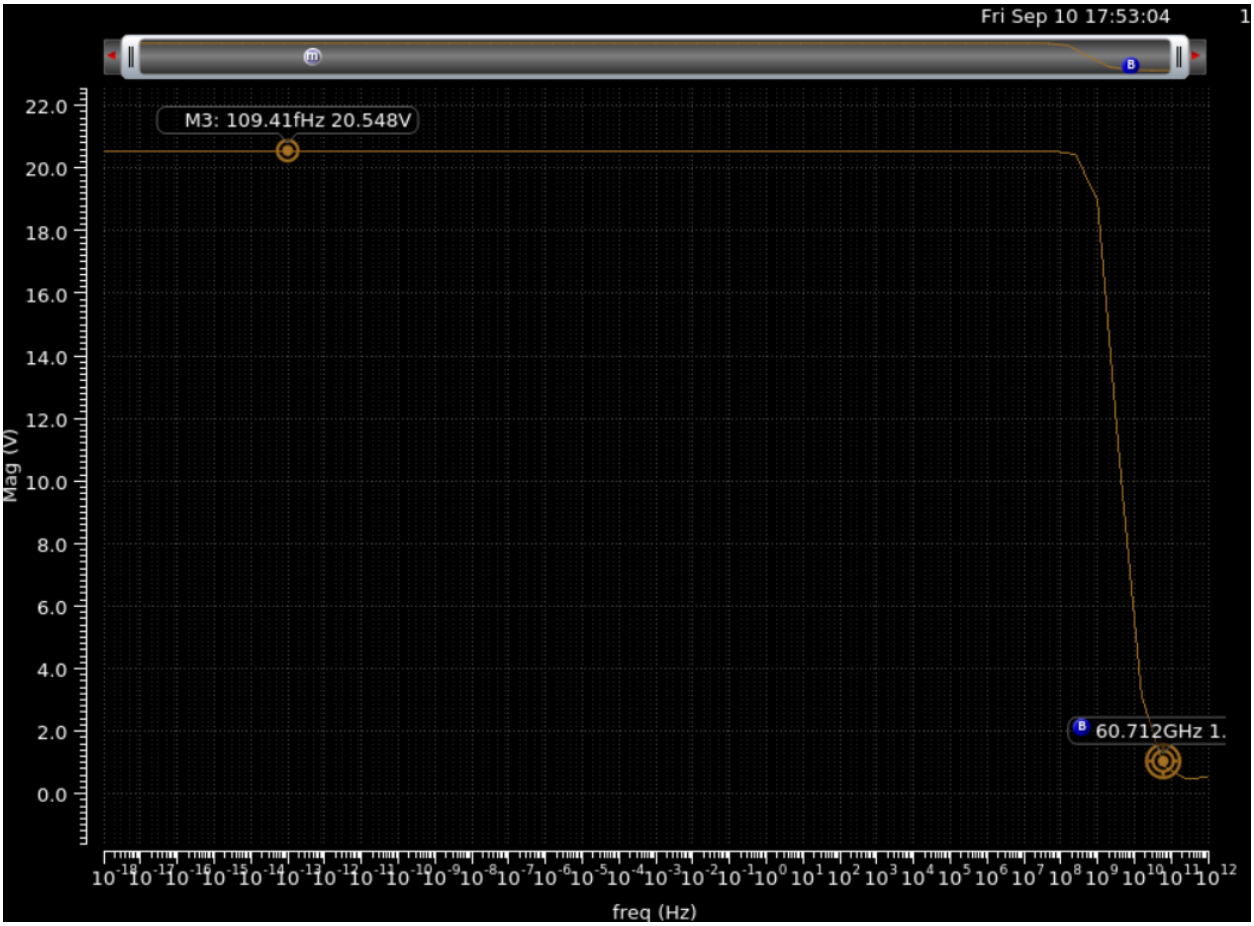

Fri Sep 10 15:41:43
B 864.0mV 176.769u
A 562.529mV 48.7221u
dx:301.471mV dy:128.0467u s:424.7397u/V
I (uA)
dc (V)

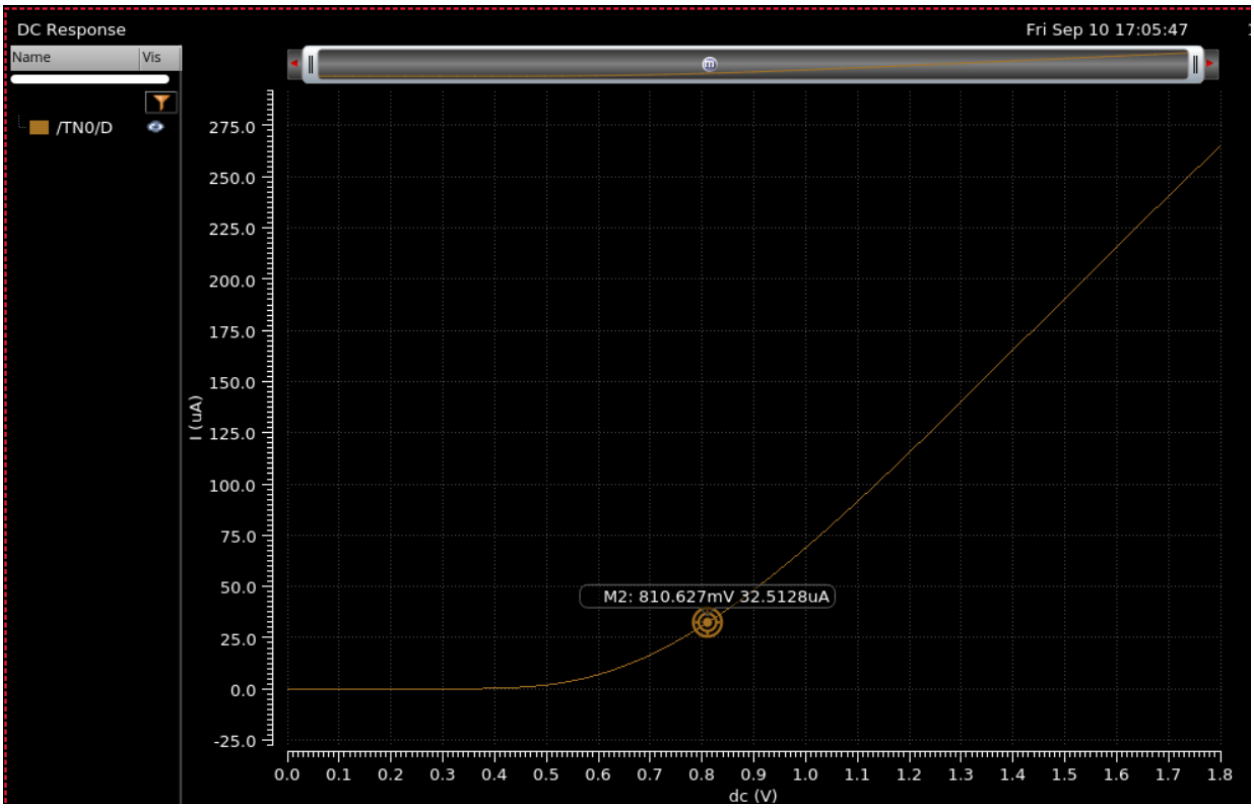
b.)

dv


DC Response
Fri Sep 10 16:33:30
Name
/TN0/D
deriv(i("/T...esu
I (uA)
I (T)
dc (V)
M1: 1.008V 253.906m
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
-2.5
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8

c.)

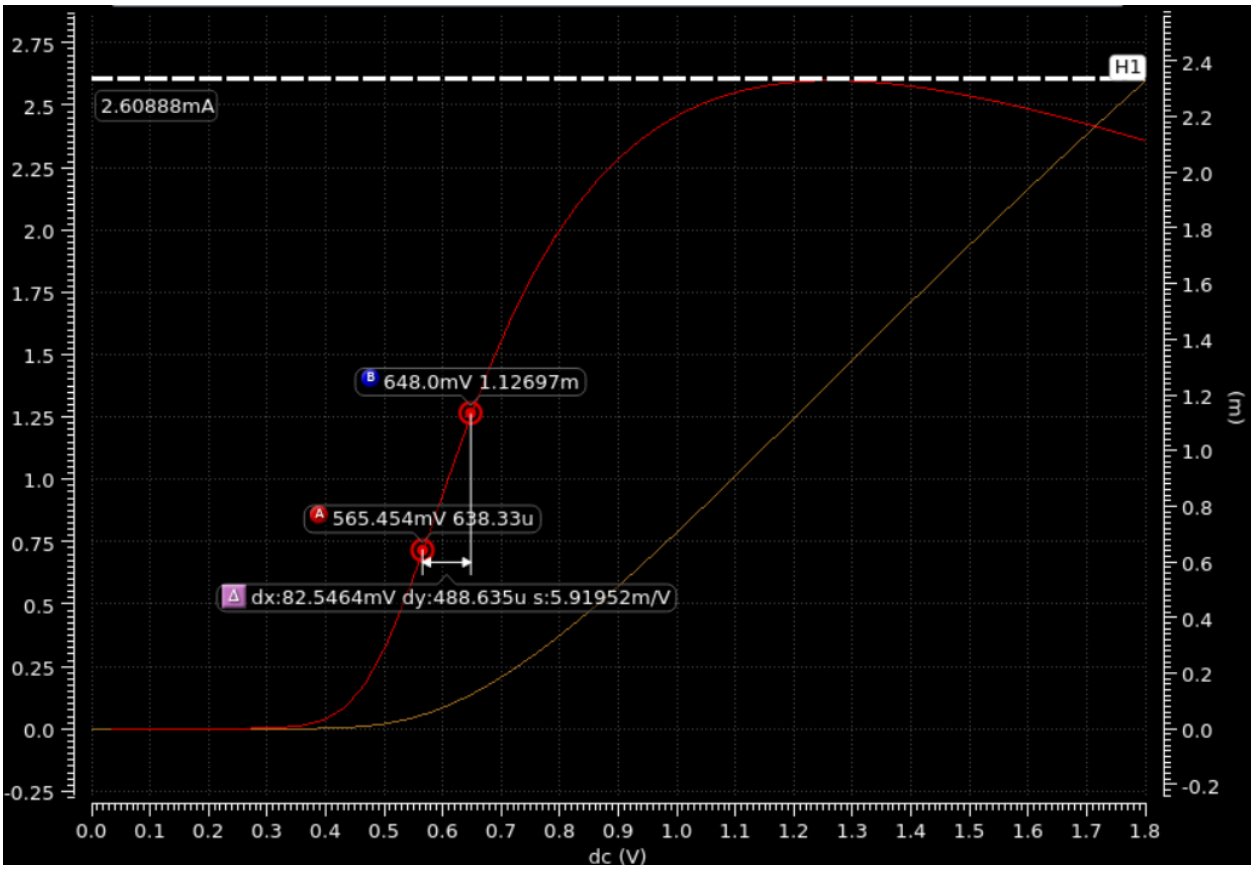

Fri Sep 10 17:53:04
M3: 109.41fHz 20.548V
60.712GHz 1.
Mag (V)
freq (Hz)


DC Response
Fri Sep 10 17:05:47
Name
Vis
/TN0/D
275.0
250.0
225.0
200.0
175.0
150.0
125.0
100.0
75.0
50.0
25.0
0.0
-25.0
I (uA)
M2: 810.627mV 32.5128uA
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8
dc (V)

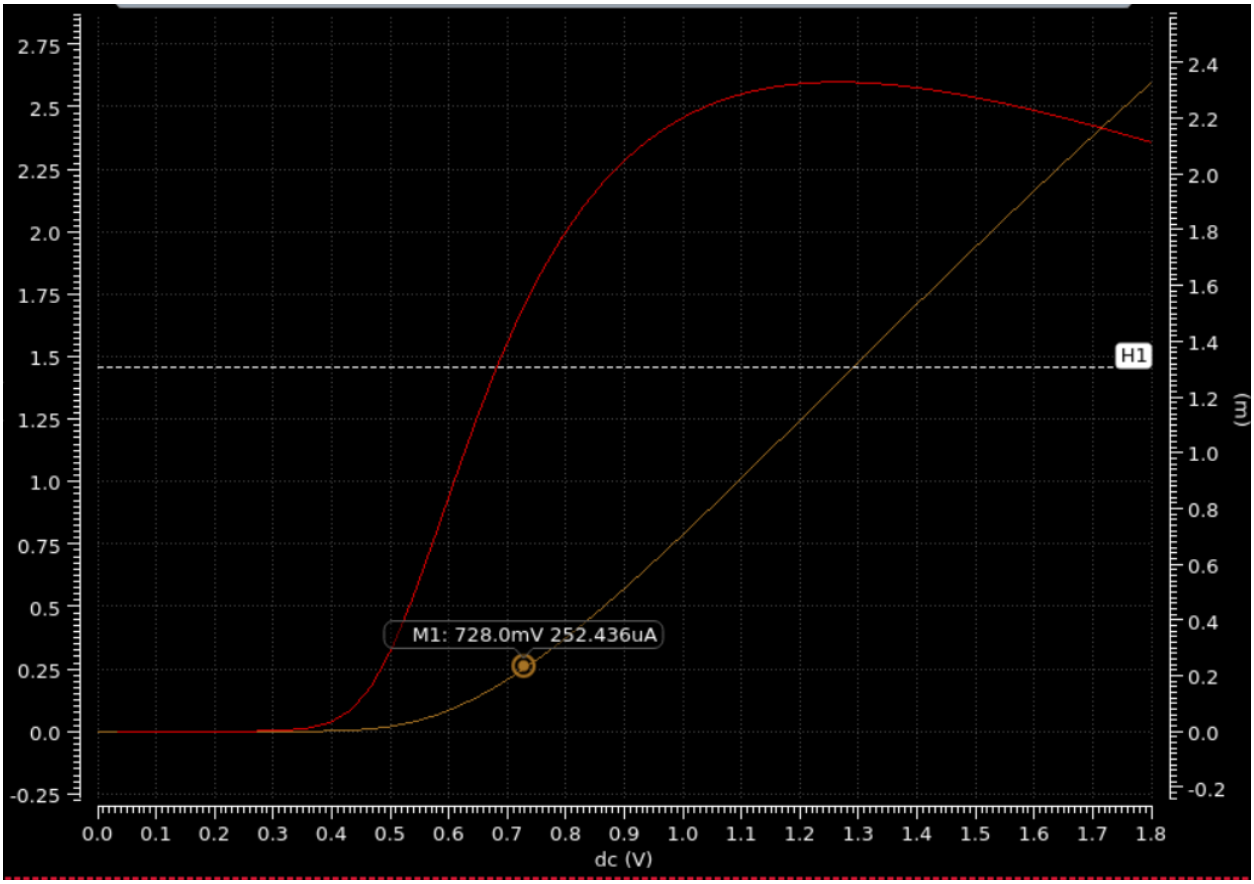
2.)

a.)

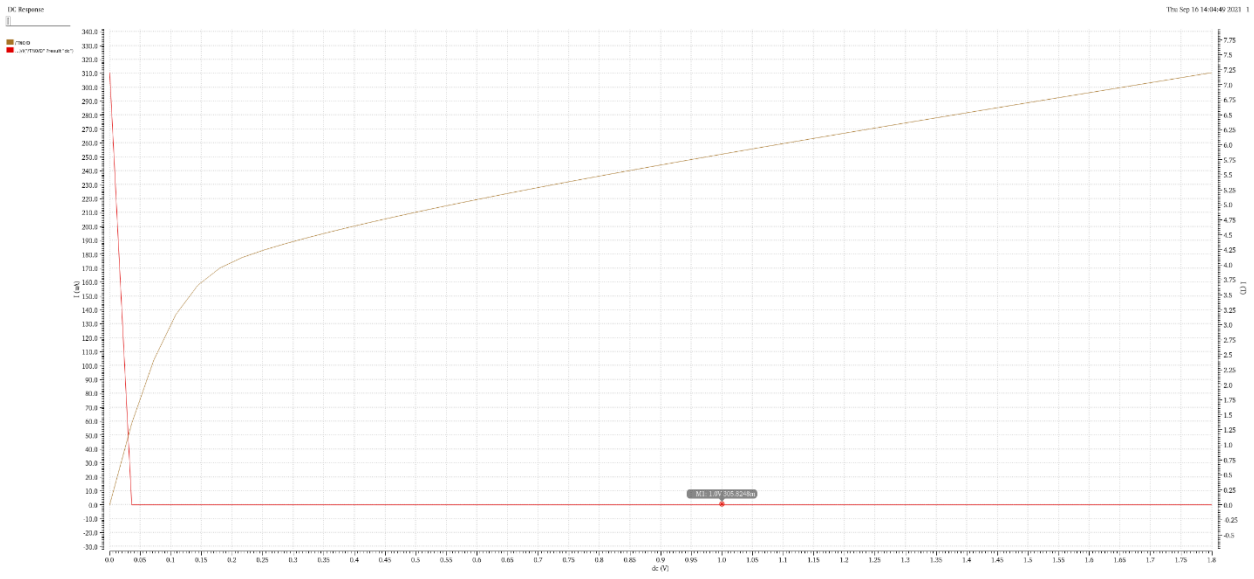
ID Plot


H1
2.60888mA
B 648.0mV 1.12697m
A 565.454mV 638.33u
Δ dx:82.5464mV dy:488.635u s:5.91952m/V
dc (V)
(m)

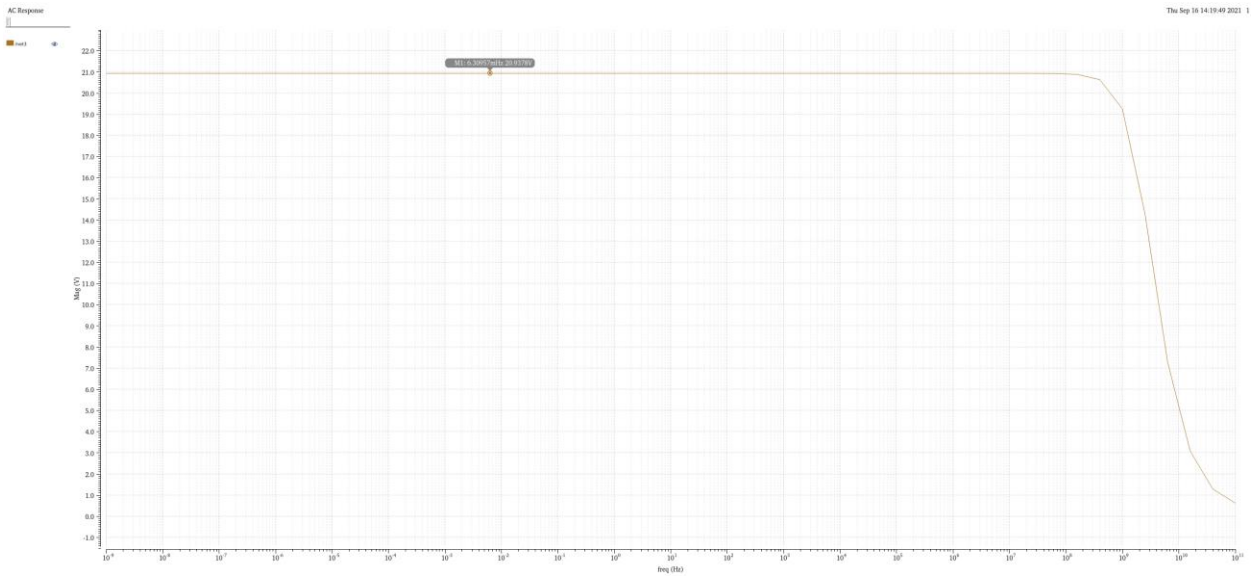
For part c



b.)

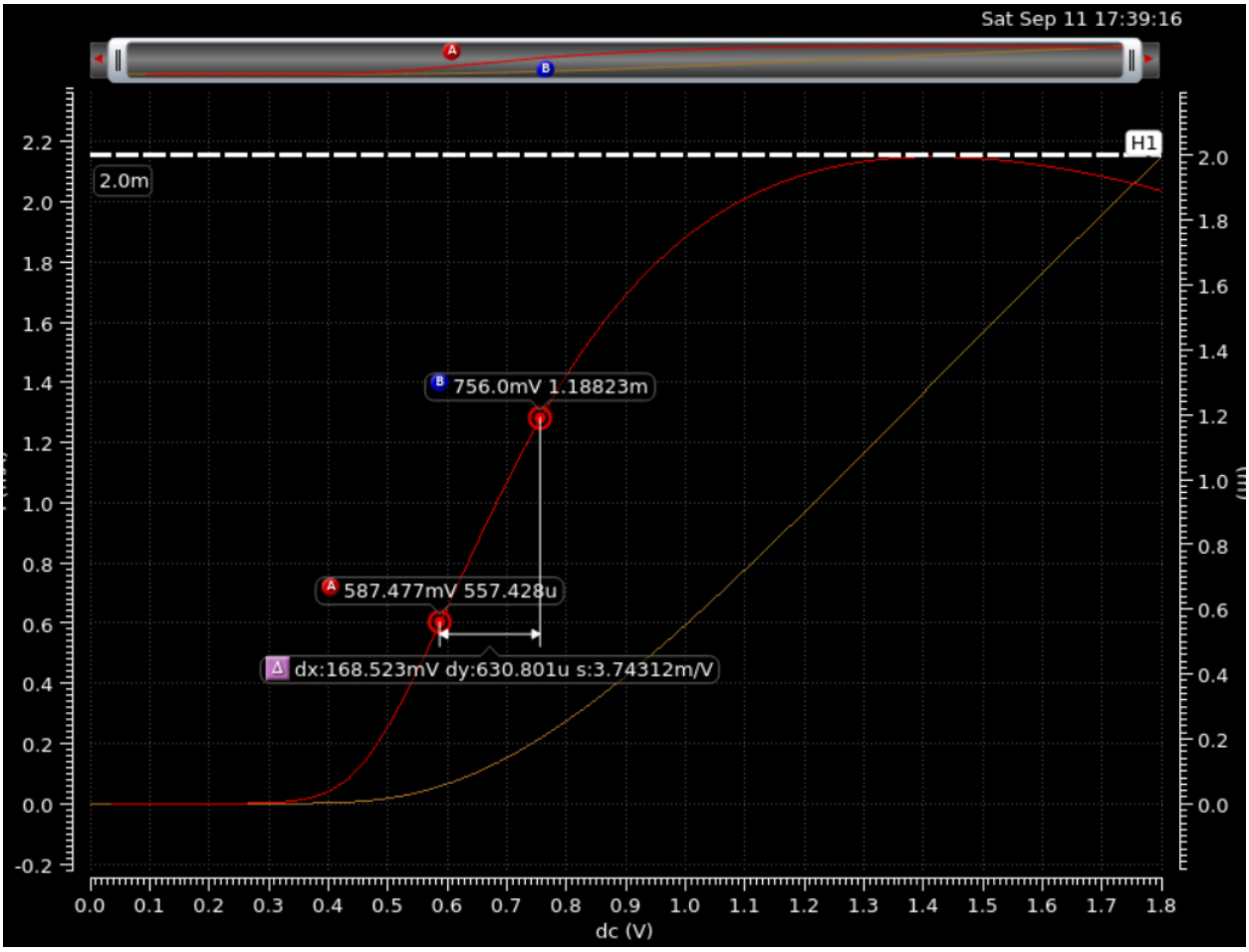


c.)

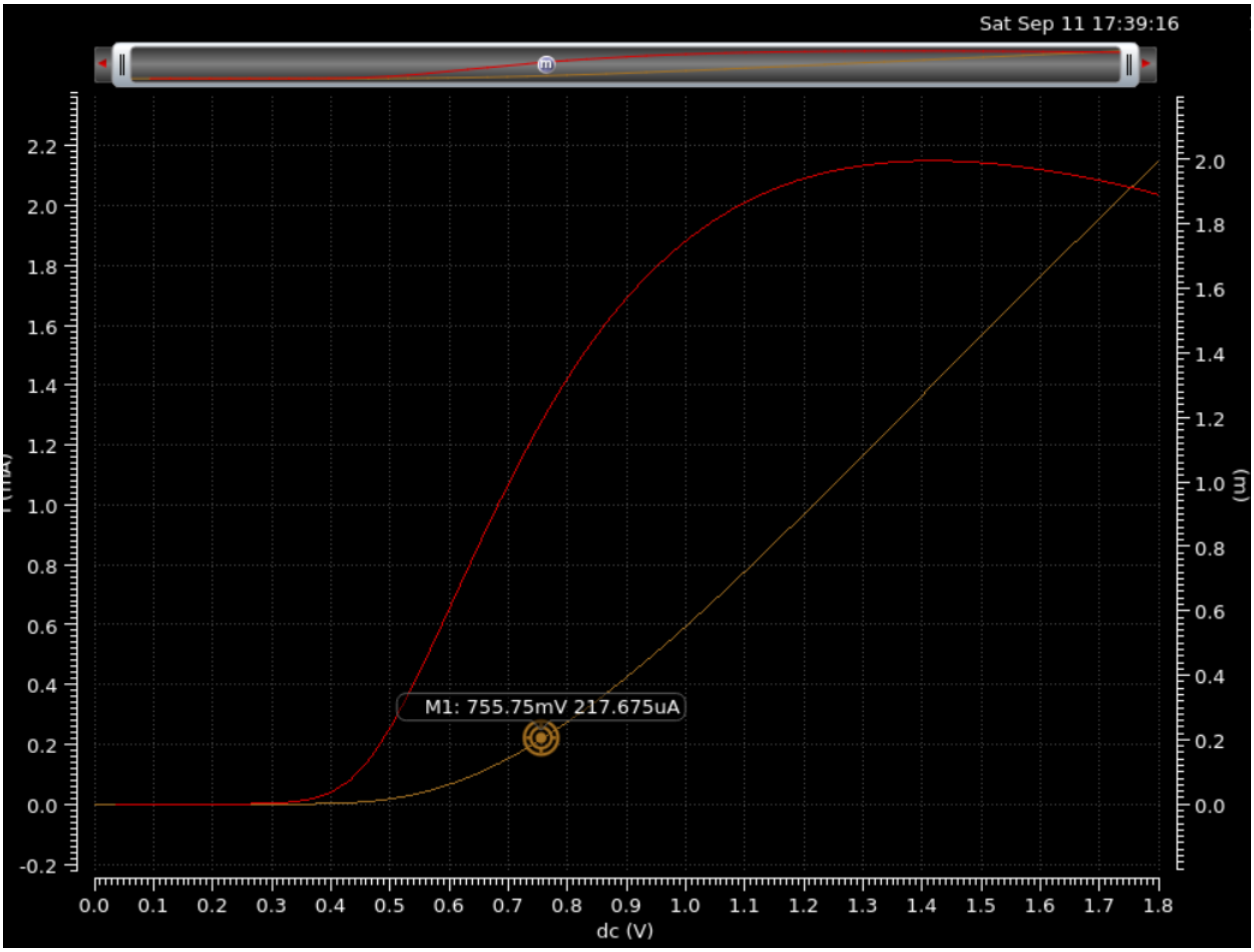

AC Response
Thu Sep 16 14:19:49 2021
Mag (V)
freq (Hz)

3.)

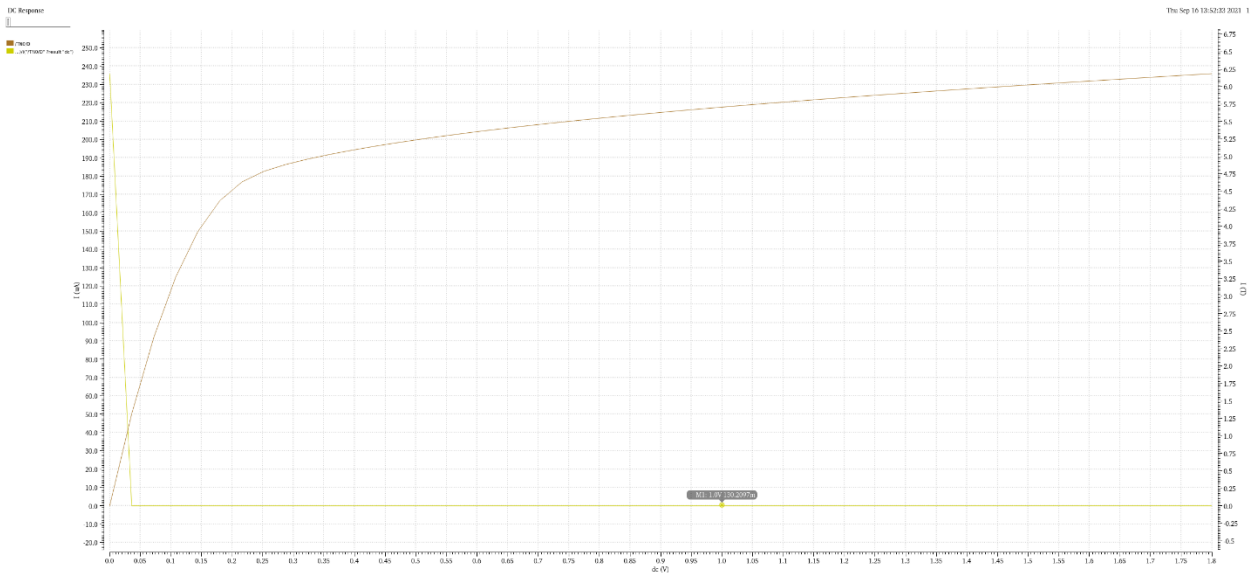
a.)


Sat Sep 11 17:39:16
H1
2.0m
B 756.0mV 1.18823m
A 587.477mV 557.428u
Δ dx:168.523mV dy:630.801u s:3.74312m/V
dc (V)

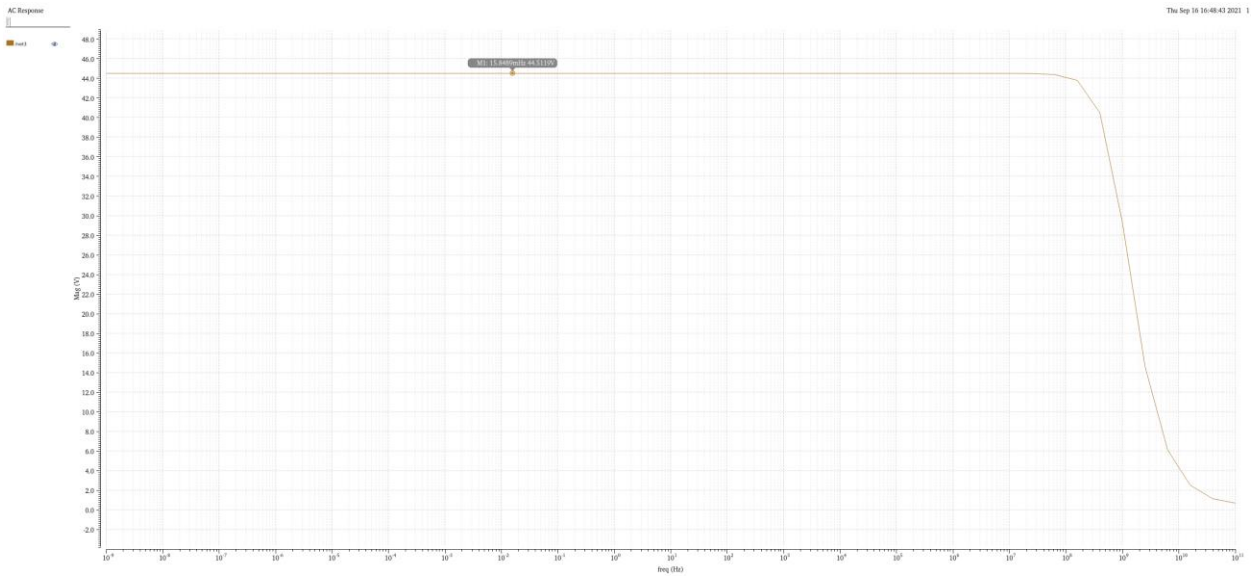
For part c.)



b.)



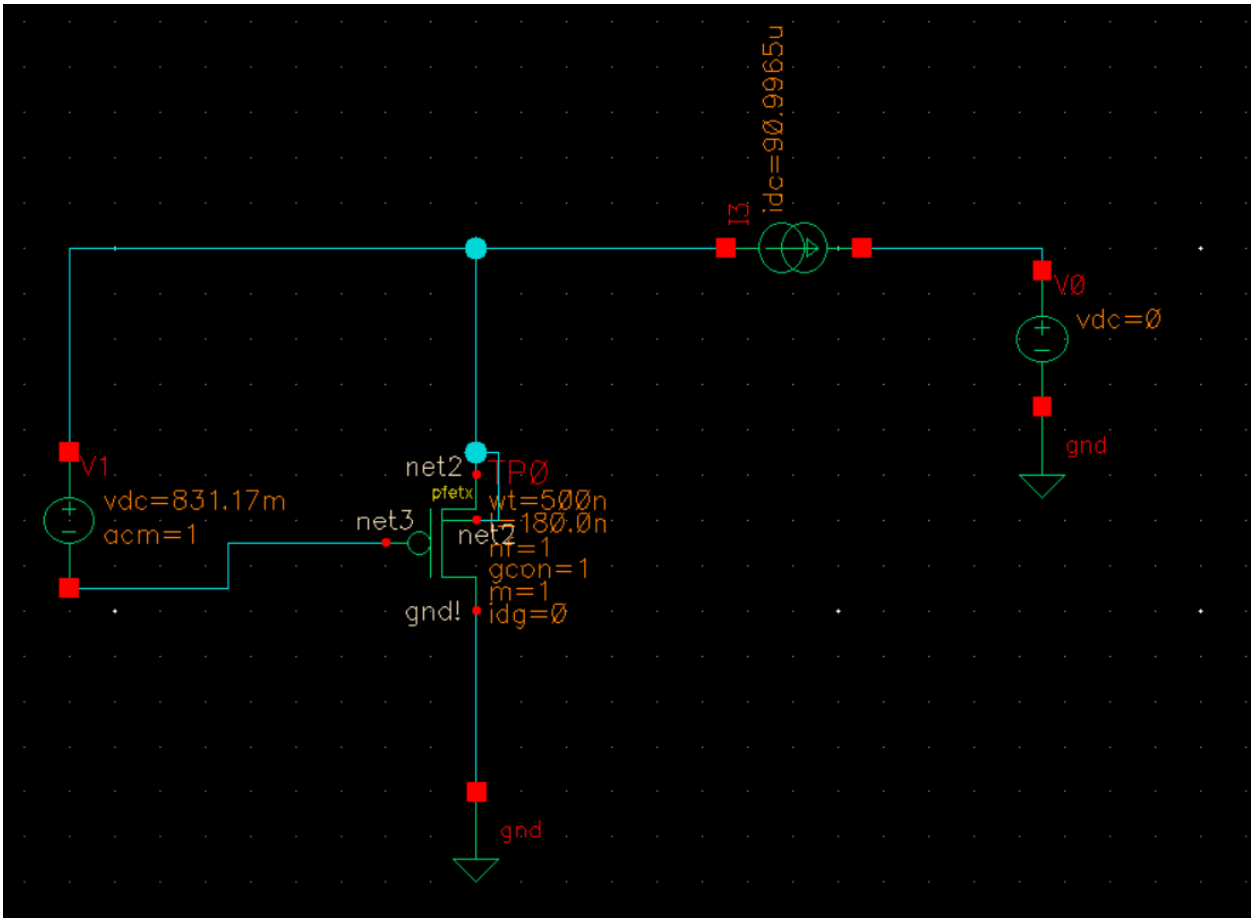
c.)



End NMOS transistor section

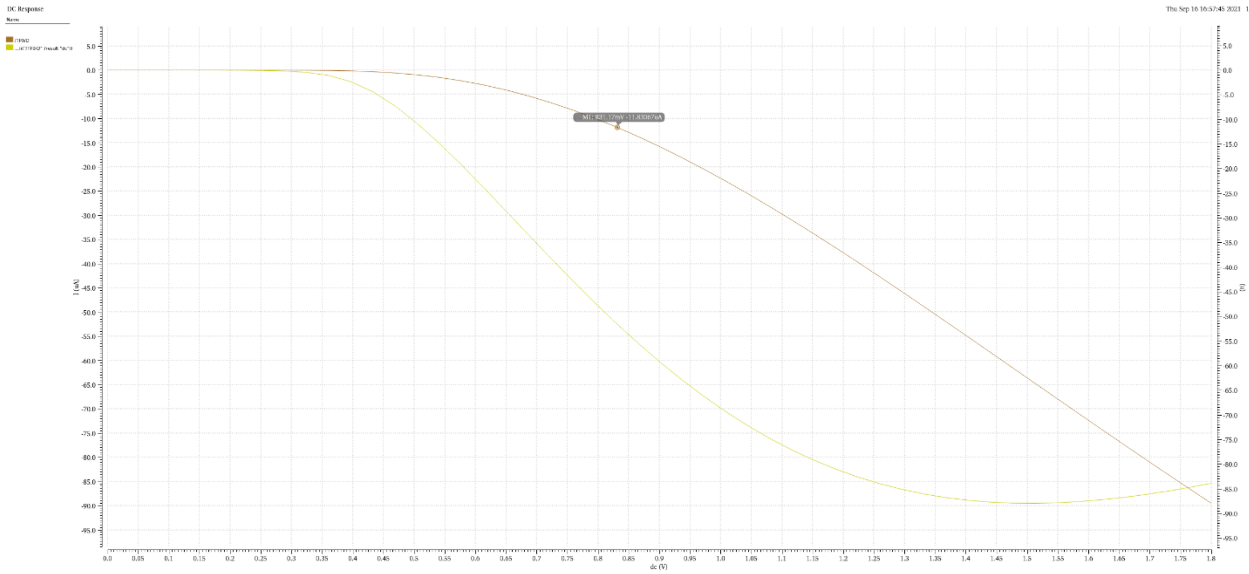
The NMOS transistors had differences depending on the width and length of the transistor. The initial change in width resulted in a significant increase in the amount of current through the system for the larger transistor. The change in length created a much larger gain for the system.

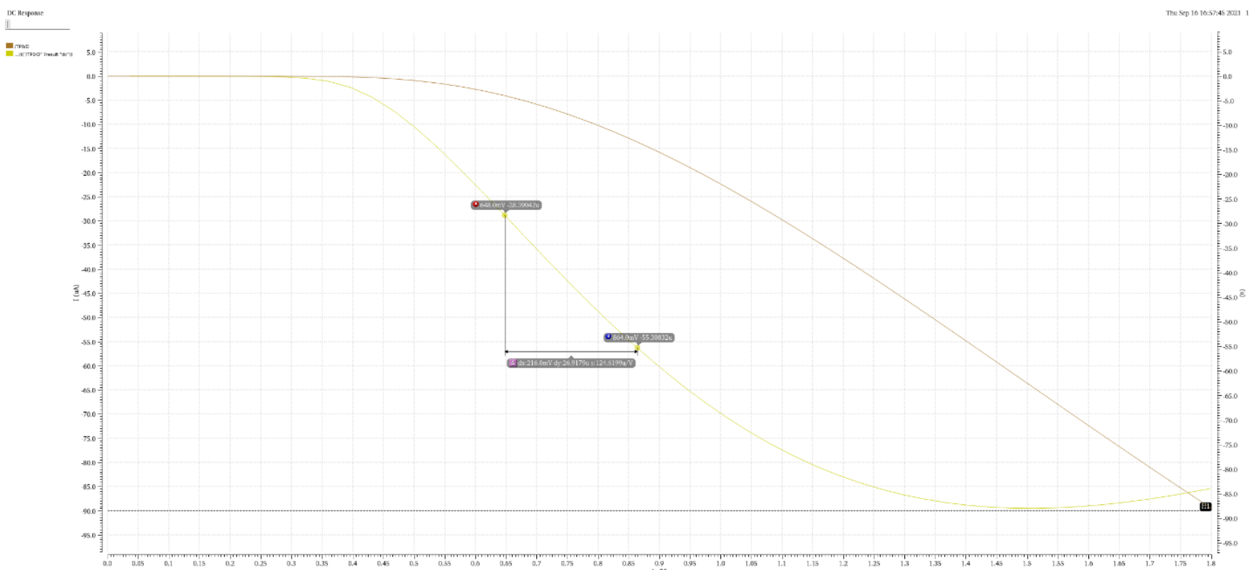
PMOS Information Schematic


I3
idc=99.9995u
V0
vdc=0
gnd
V1
vdc=831.17m
acm=1
net2
TP0
pfetx
wt=500n
lt=180.0n
net3
net2
nf=1
gcon=1
m=1
gnd!
idg=0
gnd

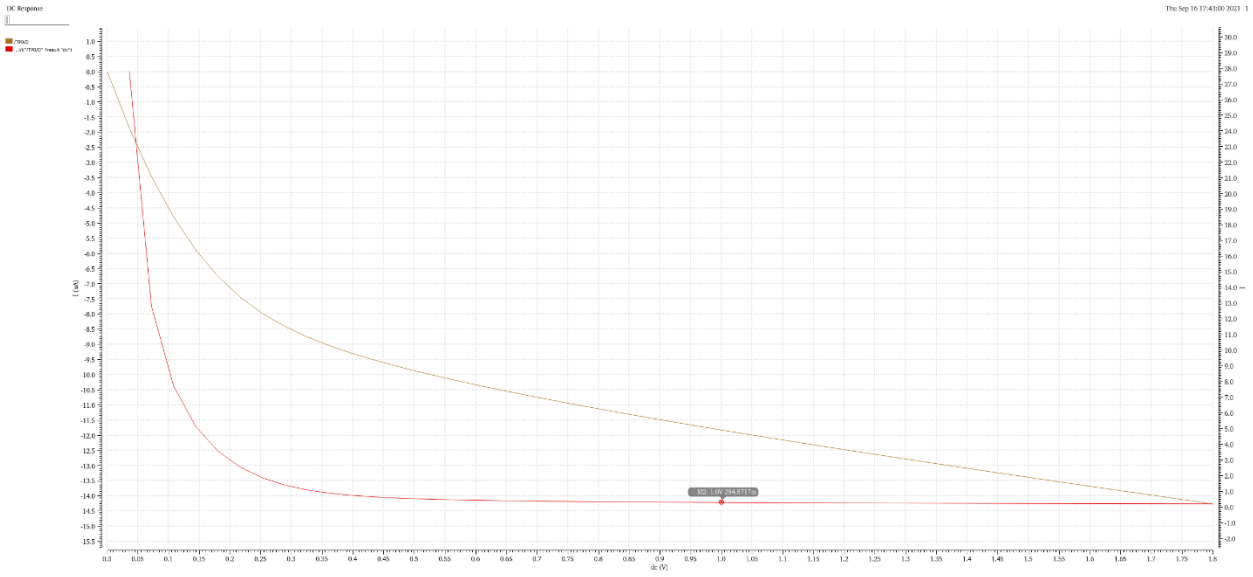
4.)

a.)


DC Response
Thu Sep 16 16:57:48 2021 1
I (uA)
dc (V)

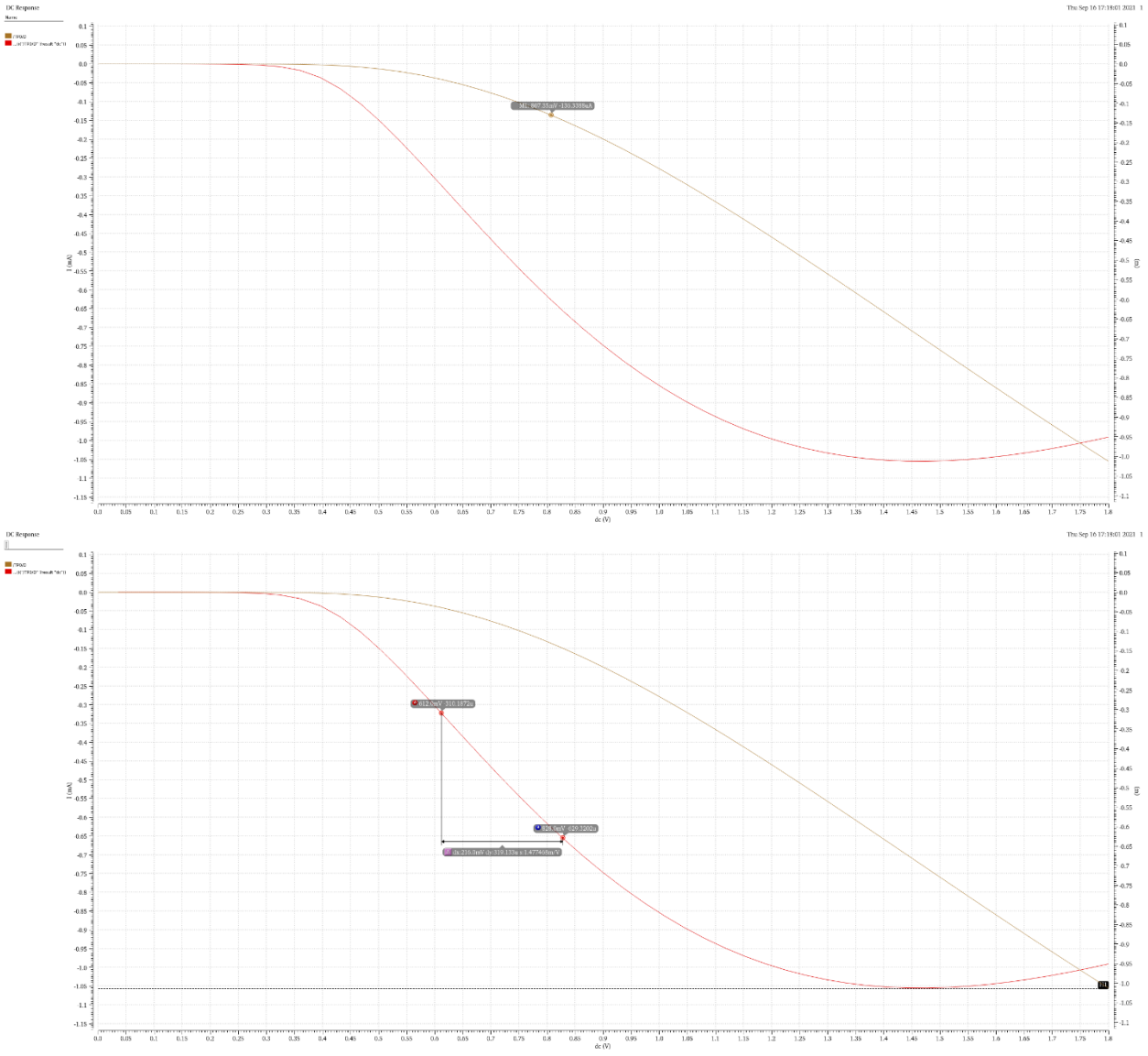

DC Response
Thu Sep 16 16:57:48 2021 1
648.0mV -28.39042u
864.0mV -55.30832u
dx:216.0mV dy:26.9179u s:124.6199u/V
I (uA)
dc (V)

b.)

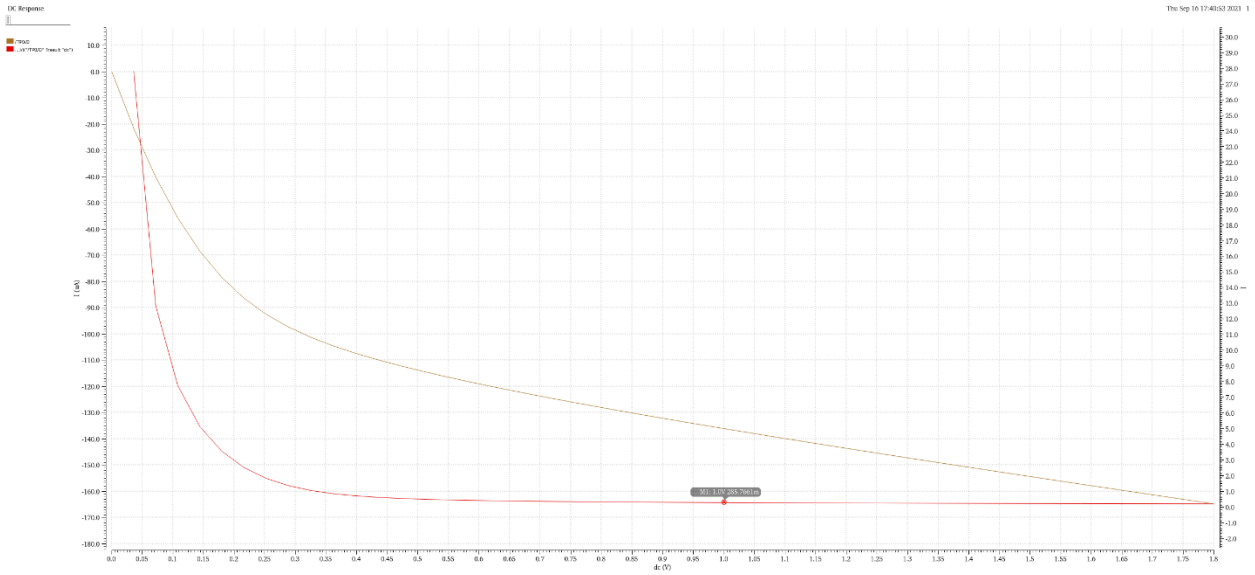


5.)

a.)

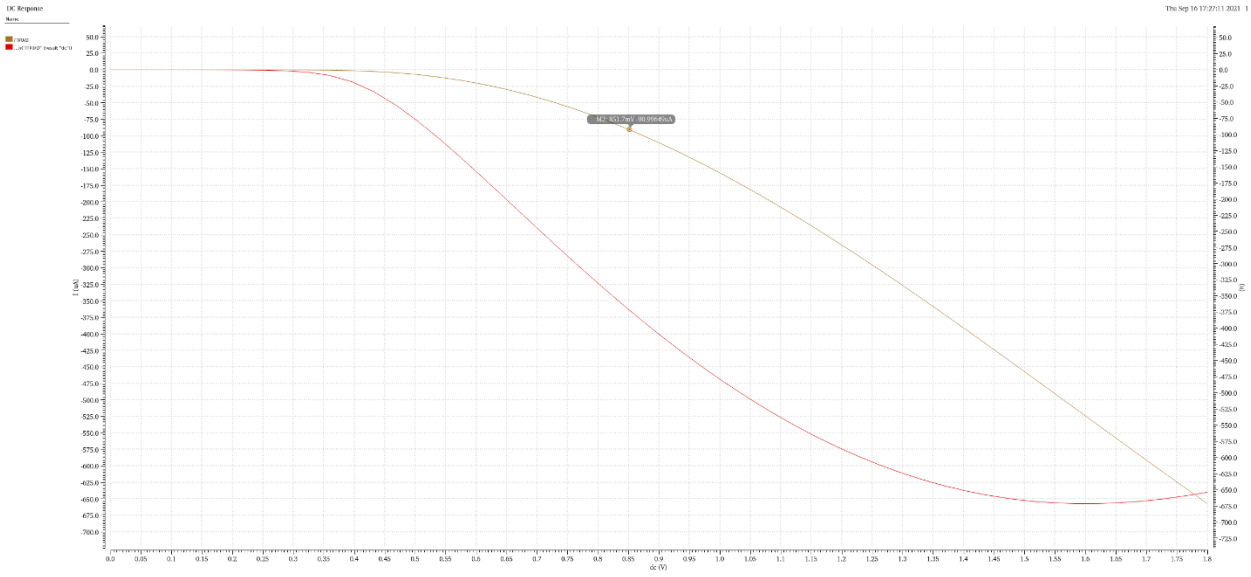


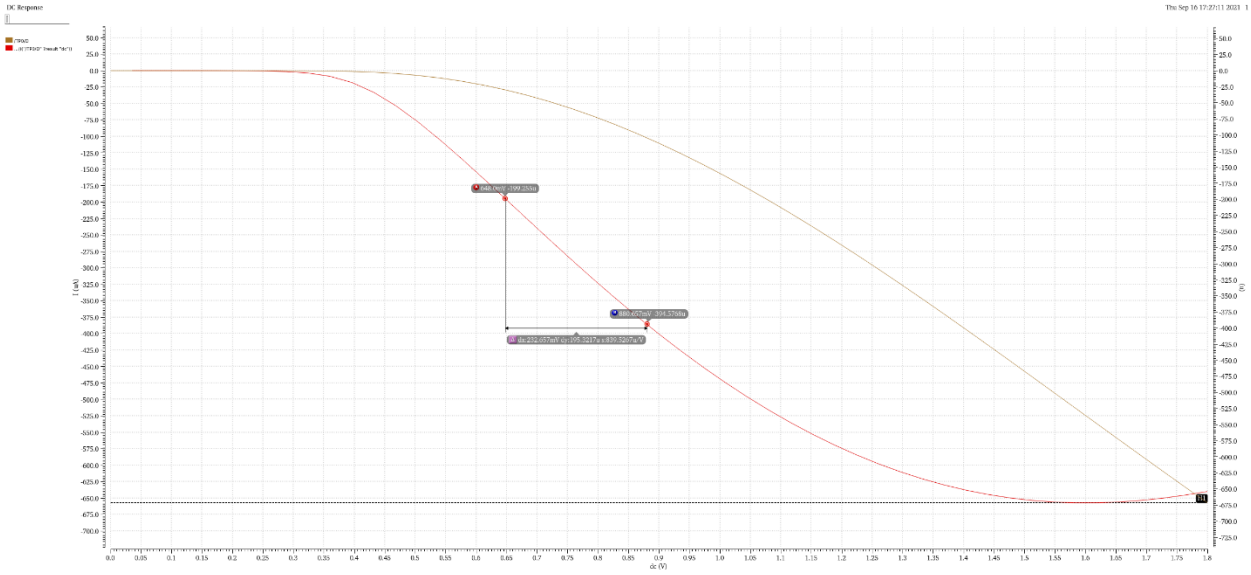
b.)



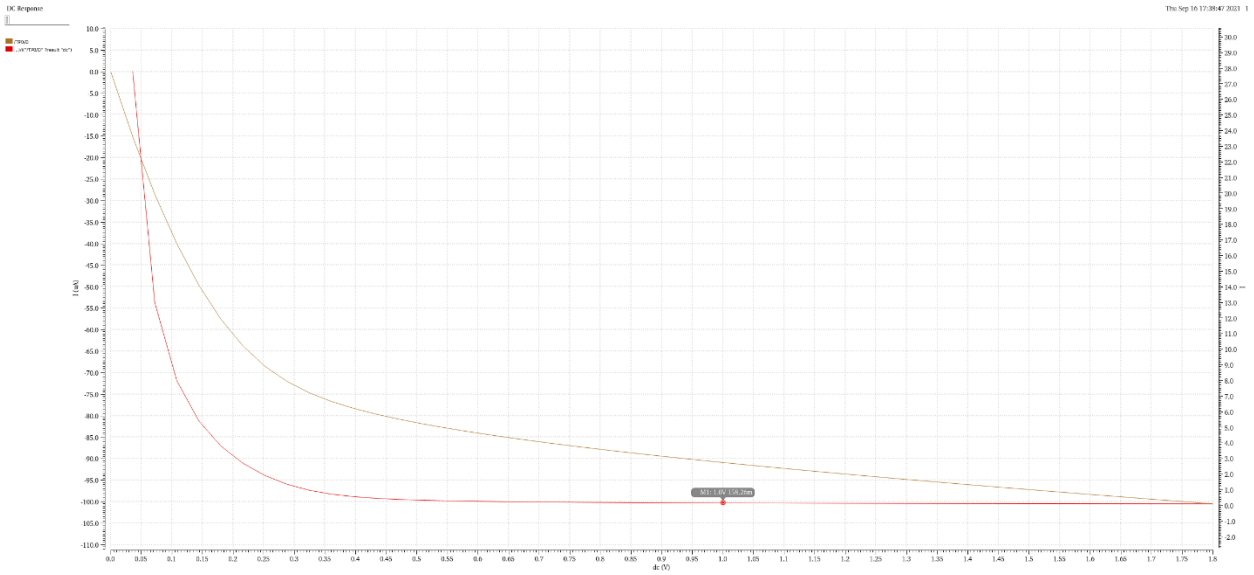
6.)

a.)

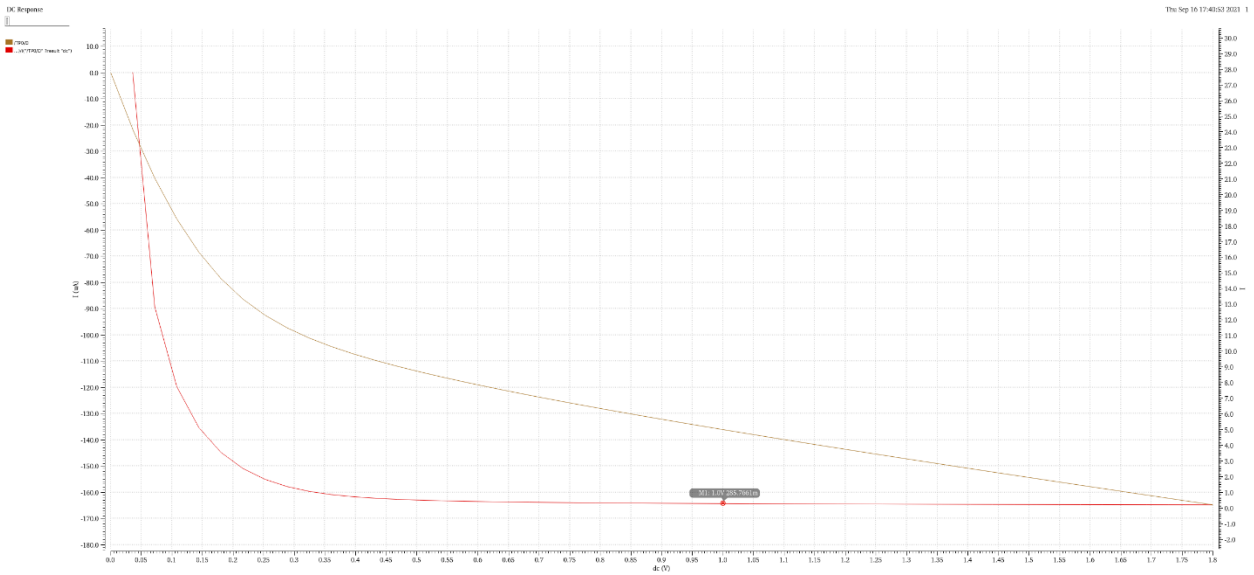

DC Response
Thu Sep 16 17:27:11 2021 1
M2: 851.7mV -80.996465nA
I (mA)
dc (V)


DC Response
Thu Sep 16 17:27:11 2021 1
I (mA)
dc (V)

b.)



b.)



Unfourtunatly My computer lost the ability to run ADE_L commands for some reason so I was not able to capture the values for part c for the PMOS transistors…

```
-
(sevRunEngine sevSession(hiGetCurrentWindow()))
ERROR (ADE-3023): Cannot run simulations because the spectre executable is not found in the specified 'UNIX $PATH' setting.
        Perform the following steps to specify the simulator executable path:
        1.Download and install the required tool version from http://downloads.cadence.com:
        -    For analog simulations, download and install MMSIM
        -    For AMS simulations, download and install INCISIVE
        2.After the installation is complete, set the tool installation path in your $PATH as below:
          set path= $<MMSIM_INSTALLATION_PATH>/bin/:$<INCISIVE_INSTALLATION_PATH>/tools/bin:
          $<IC_INSTALLATION_PATH>/tools/bin:$path
nil
```

The PMOS devices were all similarly different from each other mirroring the NMOS devices differences we found in the previous section. The main difference between the PMOS and NMOS was that the amount of current typically gained was smaller than the equivalent gains found in the NMOS. The

changes to the width were such that the larger transistors had a much higher current gain than the smaller transistor. The length change created a much larger gain of the system while keeping the lambda value almost identical.