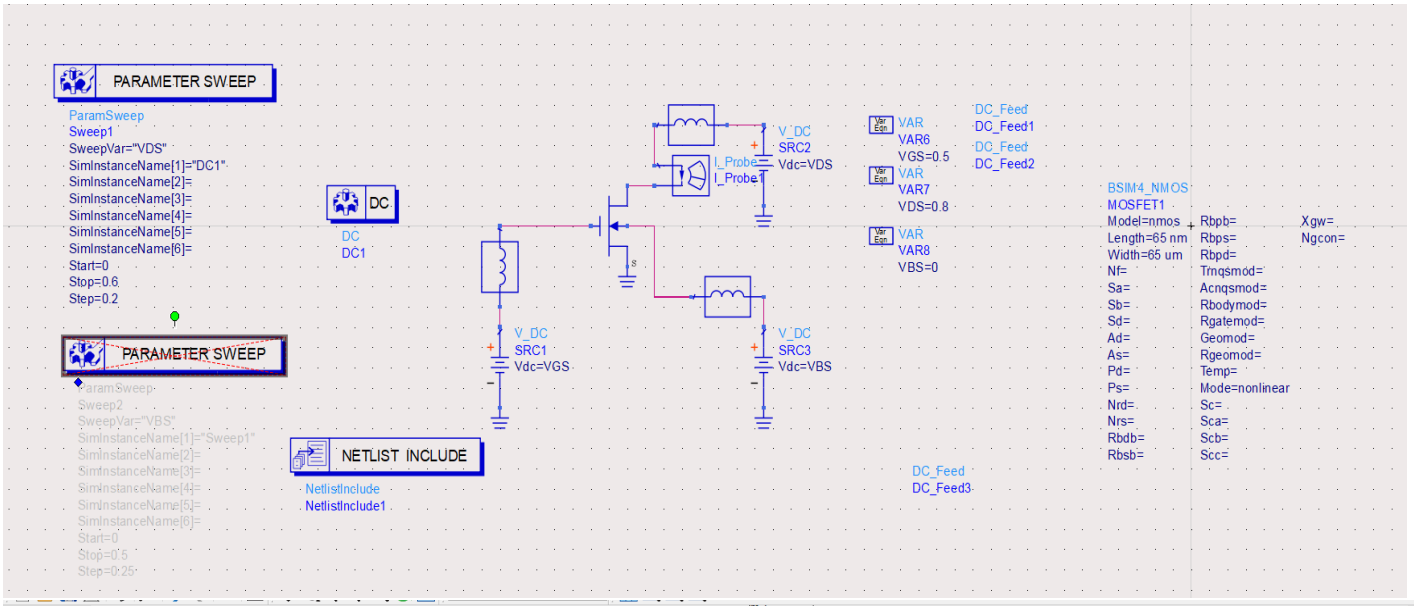
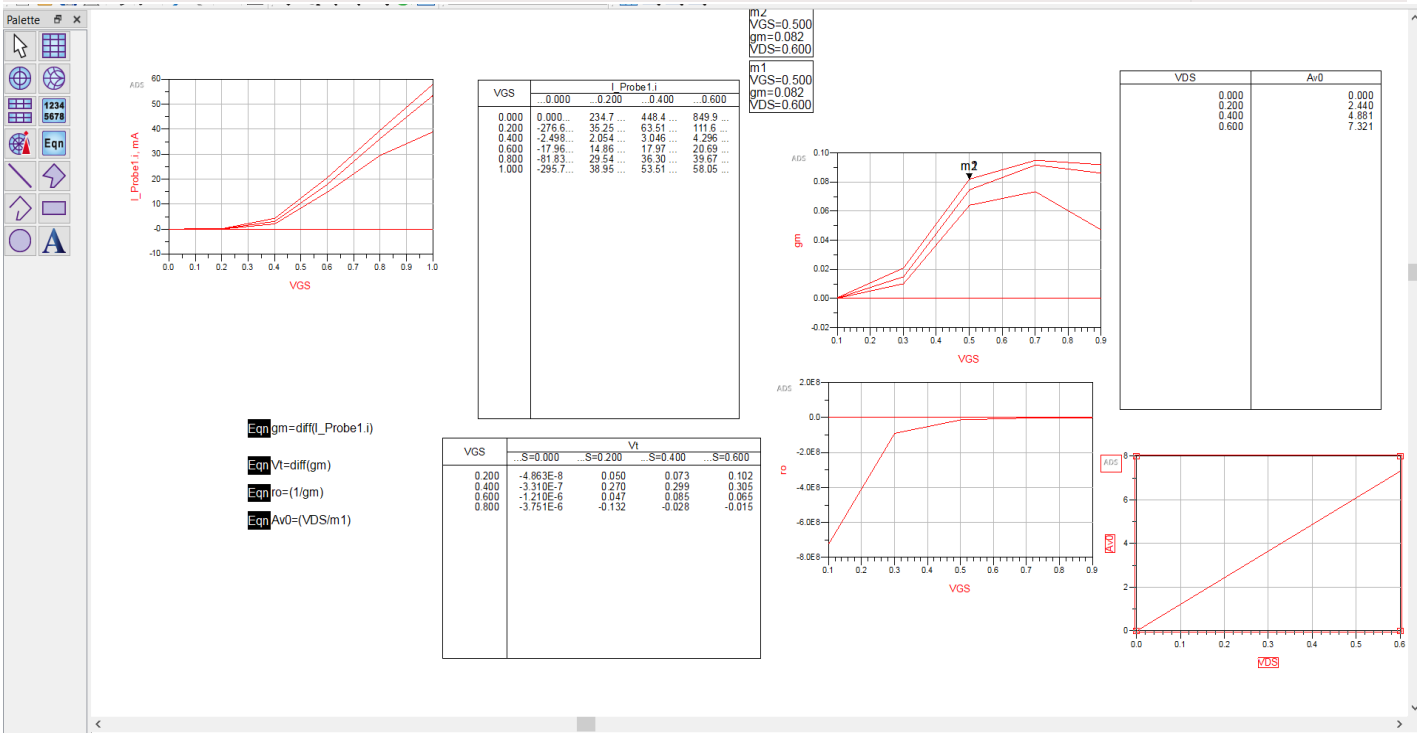
Term Work 1

S. Chandra Moulee – P2VLD21016

1. MOS Device Characteristics:



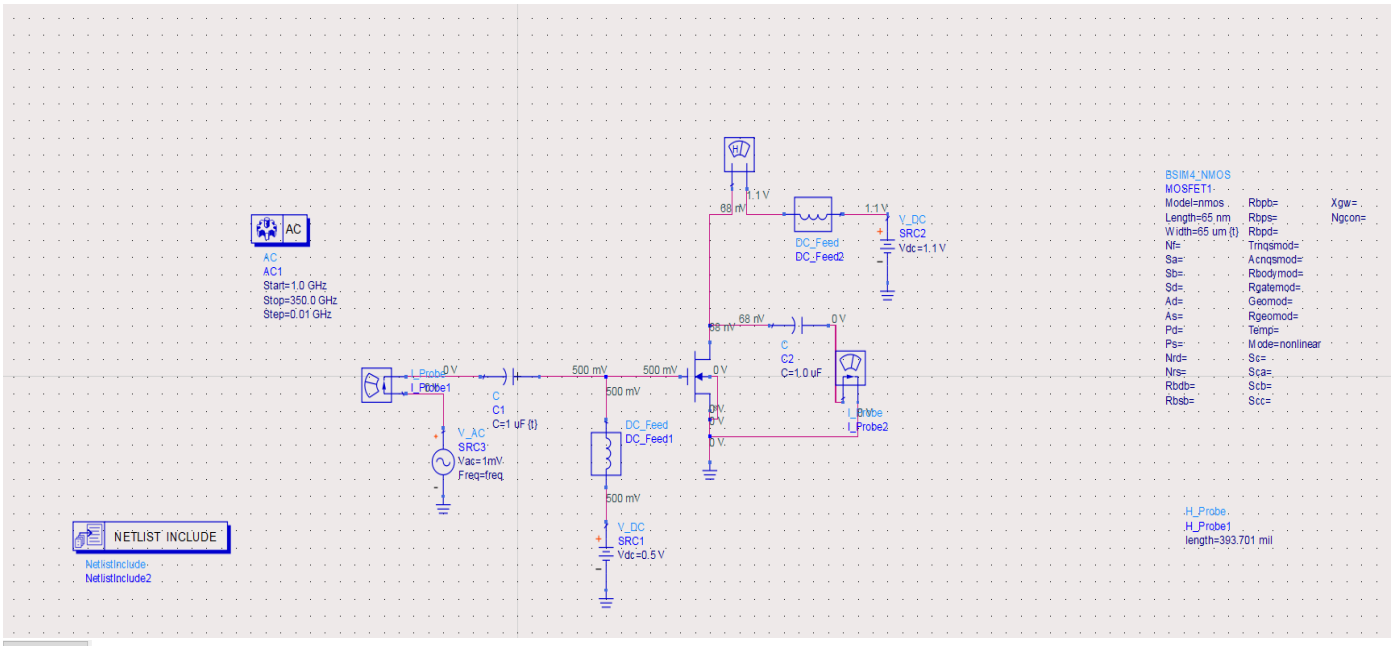


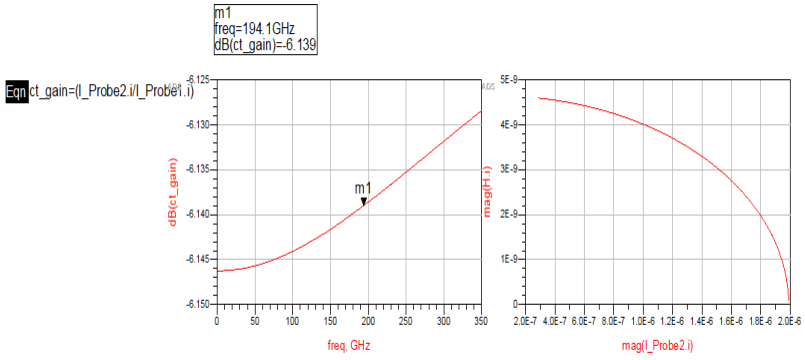
VGS	I_Probe1.i			
	0.000	0.200	0.400	0.600
0.000	0.000	234.7	448.4	849.9
0.200	-276.6	35.25	63.51	111.6
0.400	-2.498	2.054	3.046	4.296
0.600	-17.96	14.86	17.97	20.69
0.800	-81.83	29.54	36.30	39.67
1.000	-295.7	38.95	53.51	58.05

VDS	Av0
0.000	0.000
0.200	2.440
0.400	4.881
0.600	7.321

VGS	Vt			
	S=0.000	S=0.200	S=0.400	S=0.600
0.200	-4.863E-8	0.050	0.073	0.102
0.400	-3.310E-7	0.270	0.299	0.305
0.600	-1.210E-6	0.047	0.085	0.065
0.800	-3.751E-6	-0.132	-0.028	-0.015

2. Frequency Response:

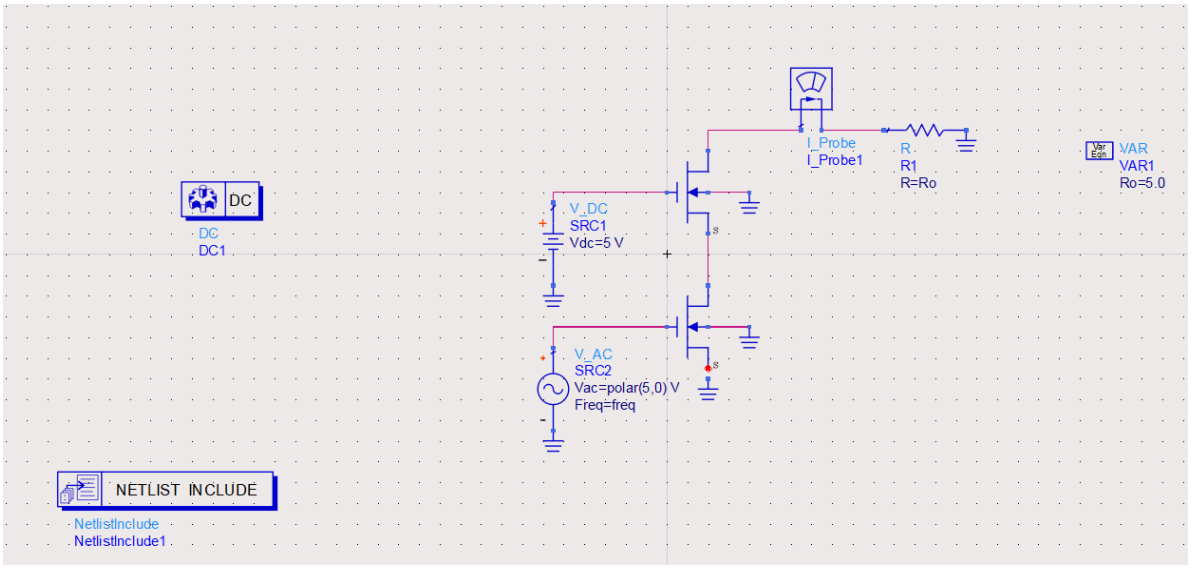


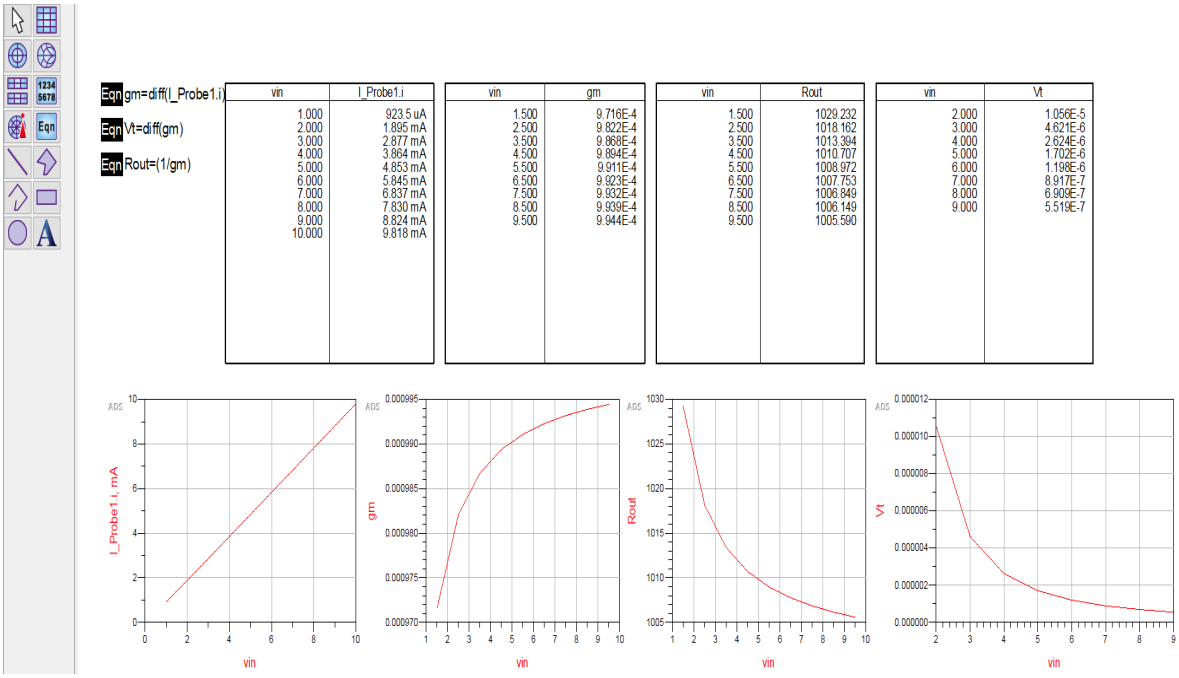


freq	ct_gain
1.000 GHz	0.493 / 0.011
1.010 GHz	0.493 / 0.011
1.020 GHz	0.493 / 0.011
1.030 GHz	0.493 / 0.010
1.040 GHz	0.493 / 0.010
1.050 GHz	0.493 / 0.010
1.060 GHz	0.493 / 0.010
1.070 GHz	0.493 / 0.010
1.080 GHz	0.493 / 0.010
1.090 GHz	0.493 / 0.010
1.100 GHz	0.493 / 0.010
1.110 GHz	0.493 / 0.010
1.120 GHz	0.493 / 0.010
1.130 GHz	0.493 / 0.010

freq	H.i
1.000 GHz	4.590E-9 / -8.335
1.010 GHz	4.589E-9 / -8.417
1.020 GHz	4.588E-9 / -8.499
1.030 GHz	4.587E-9 / -8.581
1.040 GHz	4.586E-9 / -8.663
1.050 GHz	4.585E-9 / -8.745
1.060 GHz	4.584E-9 / -8.827
1.070 GHz	4.583E-9 / -8.909
1.080 GHz	4.582E-9 / -8.991
1.090 GHz	4.581E-9 / -9.072
1.100 GHz	4.580E-9 / -9.154
1.110 GHz	4.579E-9 / -9.236
1.120 GHz	4.578E-9 / -9.318
1.130 GHz	4.577E-9 / -9.399
1.140 GHz	4.576E-9 / -9.481
1.150 GHz	4.574E-9 / -9.562
1.160 GHz	4.573E-9 / -9.644
1.170 GHz	4.572E-9 / -9.725
1.180 GHz	4.571E-9 / -9.807
1.190 GHz	4.570E-9 / -9.888
1.200 GHz	4.569E-9 / -9.970
1.210 GHz	4.568E-9 / -10.051
1.220 GHz	4.567E-9 / -10.132
1.230 GHz	4.565E-9 / -10.214
1.240 GHz	4.564E-9 / -10.295
1.250 GHz	4.563E-9 / -10.376
1.260 GHz	4.562E-9 / -10.457
1.270 GHz	4.561E-9 / -10.538
1.280 GHz	4.559E-9 / -10.619
1.290 GHz	4.558E-9 / -10.700

3. Current source without reference:





Eqn gm=diff(I_Probe1.i)

vin	I_Probe1.i
1.000	923.5 uA
2.000	1.895 mA
3.000	2.877 mA
4.000	3.864 mA
5.000	4.853 mA
6.000	5.845 mA
7.000	6.837 mA
8.000	7.830 mA
9.000	8.824 mA
10.000	9.818 mA

Eqn Vt=diff(gm)

vin	gm
1.500	9.716E-4
2.500	9.822E-4
3.500	9.868E-4
4.500	9.894E-4
5.500	9.911E-4
6.500	9.923E-4
7.500	9.932E-4
8.500	9.939E-4
9.500	9.944E-4

Eqn Rout=(1/gm)

vin	Rout
1.500	1029.232
2.500	1018.162
3.500	1013.394
4.500	1010.707
5.500	1008.972
6.500	1007.753
7.500	1006.849
8.500	1006.149
9.500	1005.590

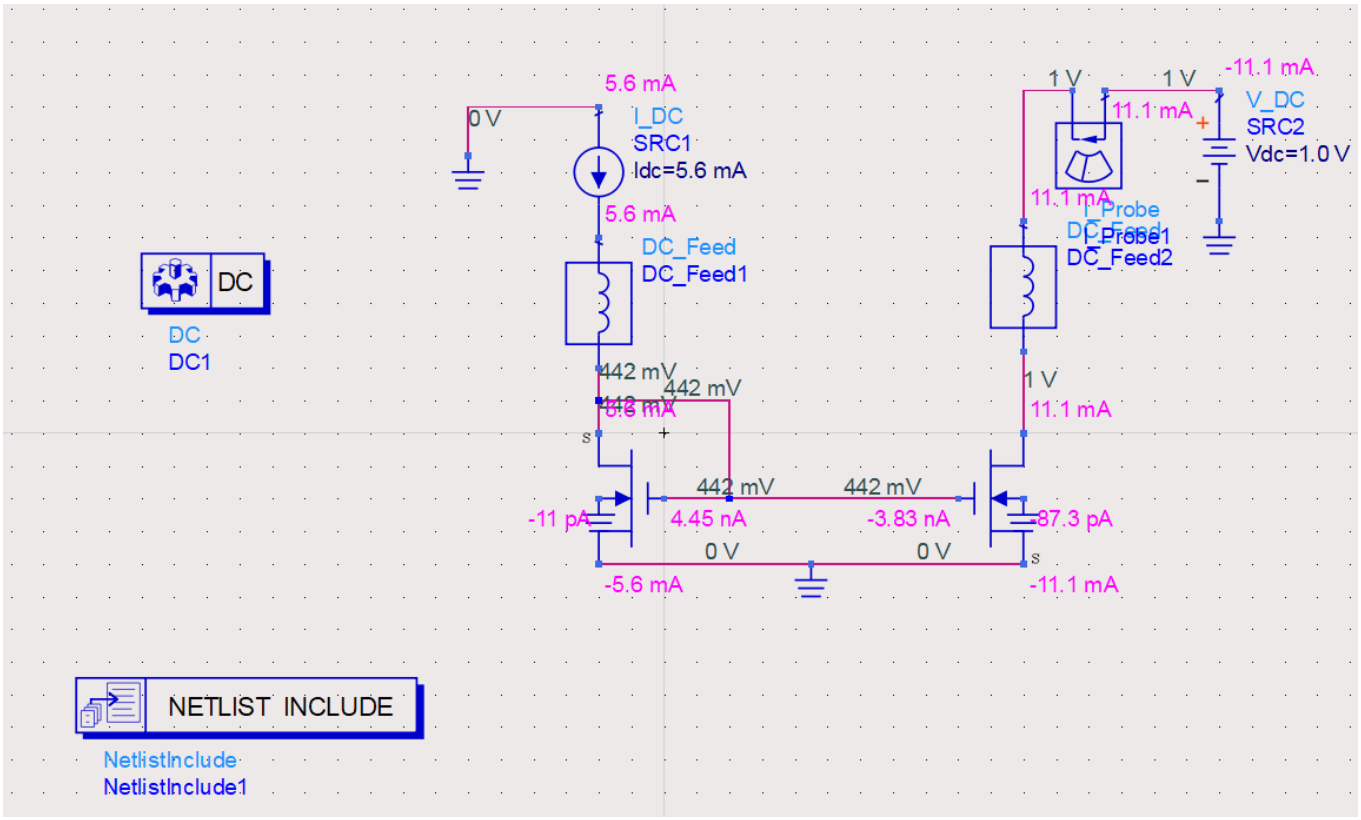
vin	Vt
2.000	1.056E-5
3.000	4.621E-6
4.000	2.624E-6
5.000	1.702E-6
6.000	1.198E-6
7.000	8.917E-7
8.000	6.909E-7
9.000	5.519E-7

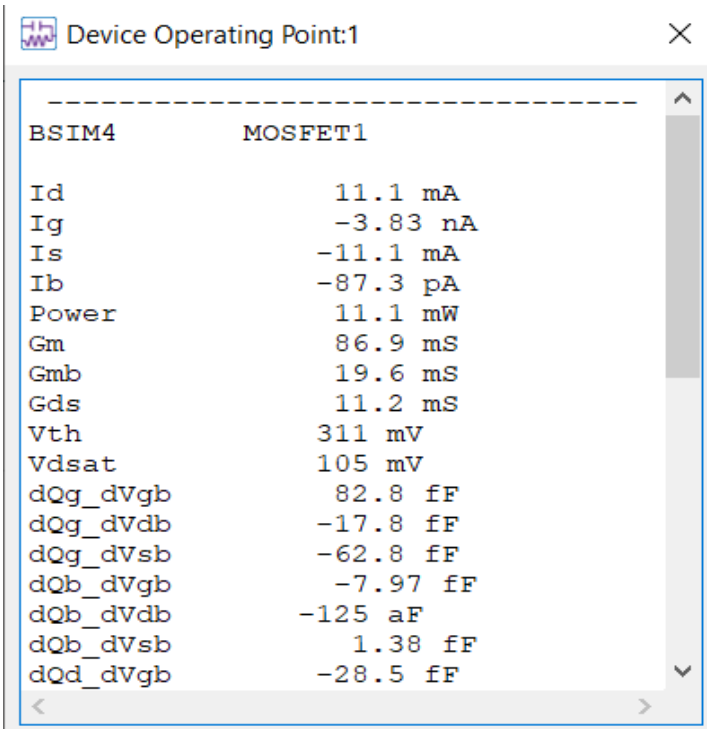
Gm = diff (Iout)

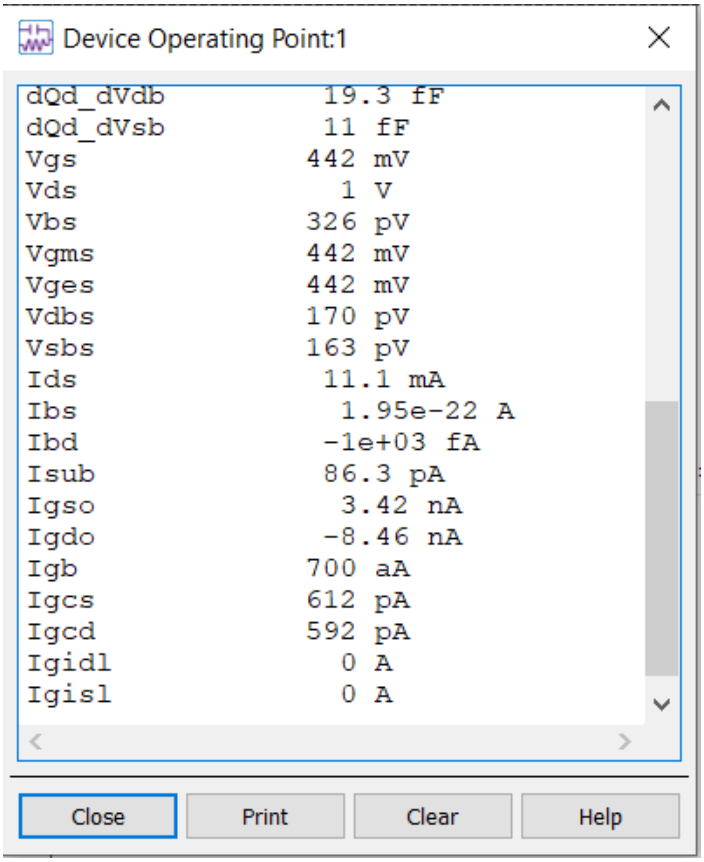
Vt= diff(gm)

Ro=1/gm

4. Current Source with reference:



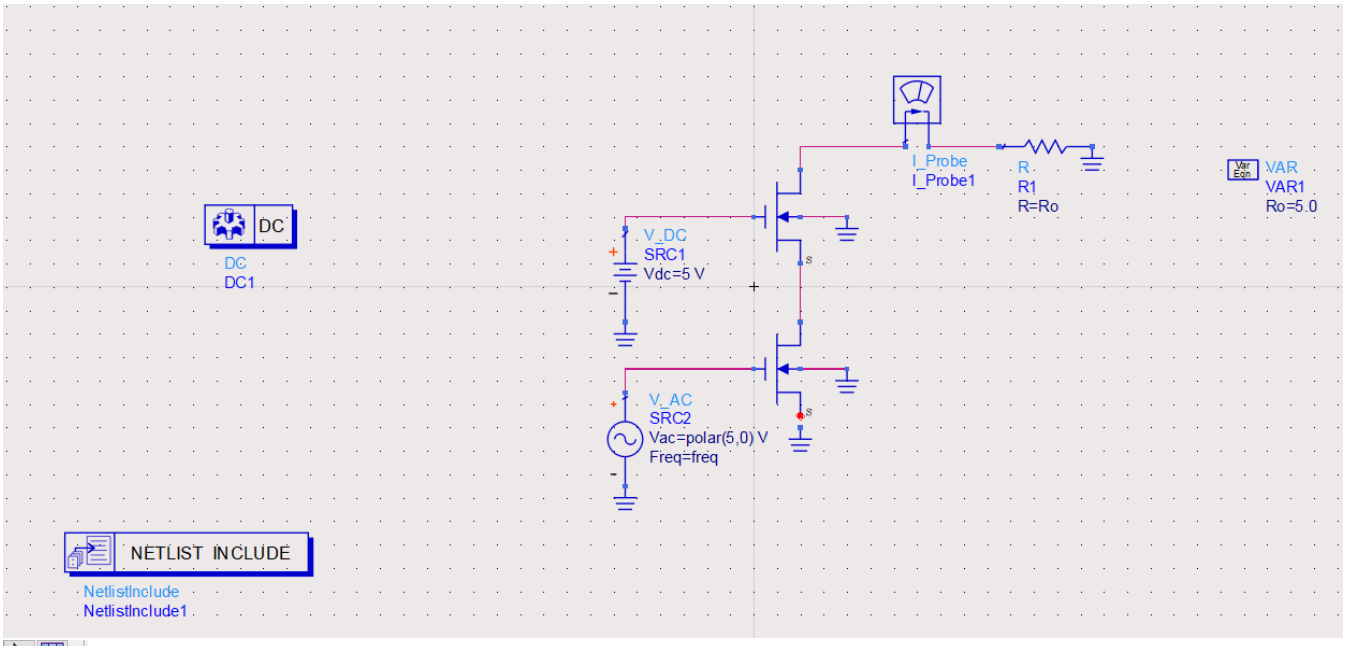


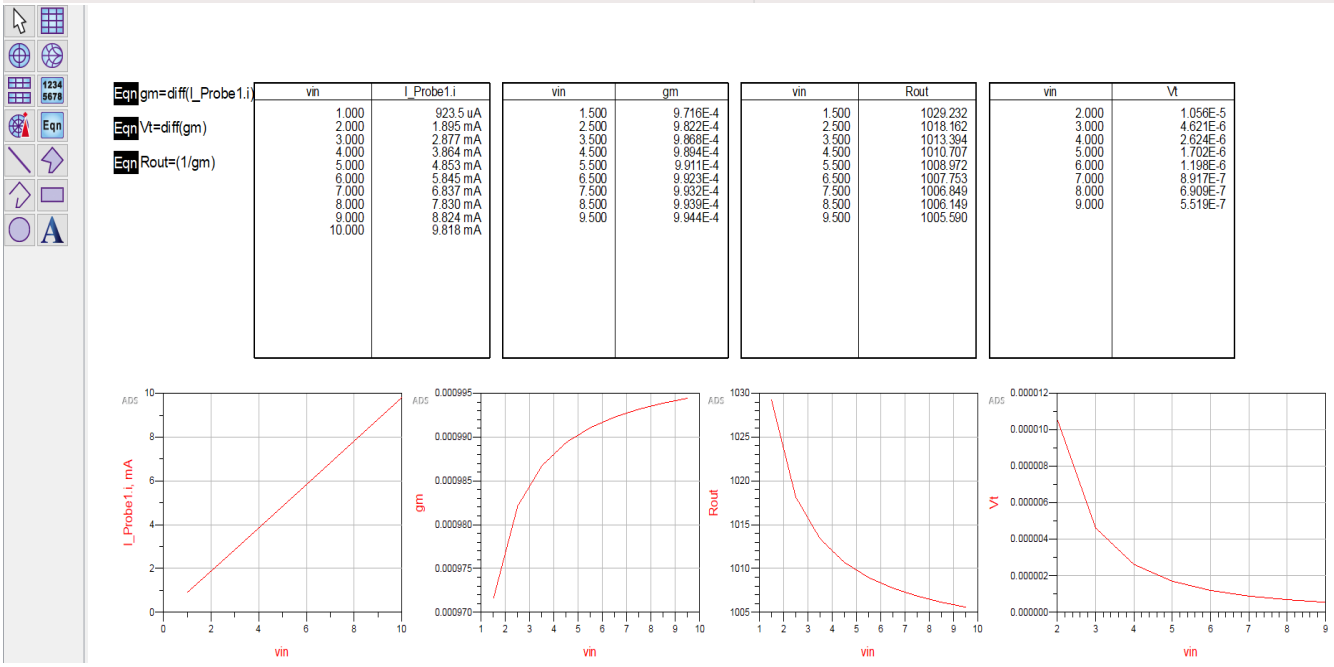


Ro = (1/ (0.04 * gm)) = (1/ (0.04 * 86.9 x 10^-3))

Ro = 287.69 ohms

5. Cascode without reference:





Eqn gm=diff(I_Probe1.i)

vin	I_Probe1.i
1.000	923.5 uA
2.000	1.895 mA
3.000	2.877 mA
4.000	3.864 mA
5.000	4.853 mA
6.000	5.845 mA
7.000	6.837 mA
8.000	7.830 mA
9.000	8.824 mA
10.000	9.818 mA

Eqn Vt=diff(gm)

vin	gm
1.500	9.716E-4
2.500	9.822E-4
3.500	9.868E-4
4.500	9.894E-4
5.500	9.911E-4
6.500	9.923E-4
7.500	9.932E-4
8.500	9.939E-4
9.500	9.944E-4

Eqn Rout=(1/gm)

vin	Rout
1.500	1029.232
2.500	1018.162
3.500	1013.394
4.500	1010.707
5.500	1008.972
6.500	1007.753
7.500	1006.849
8.500	1006.149
9.500	1005.590

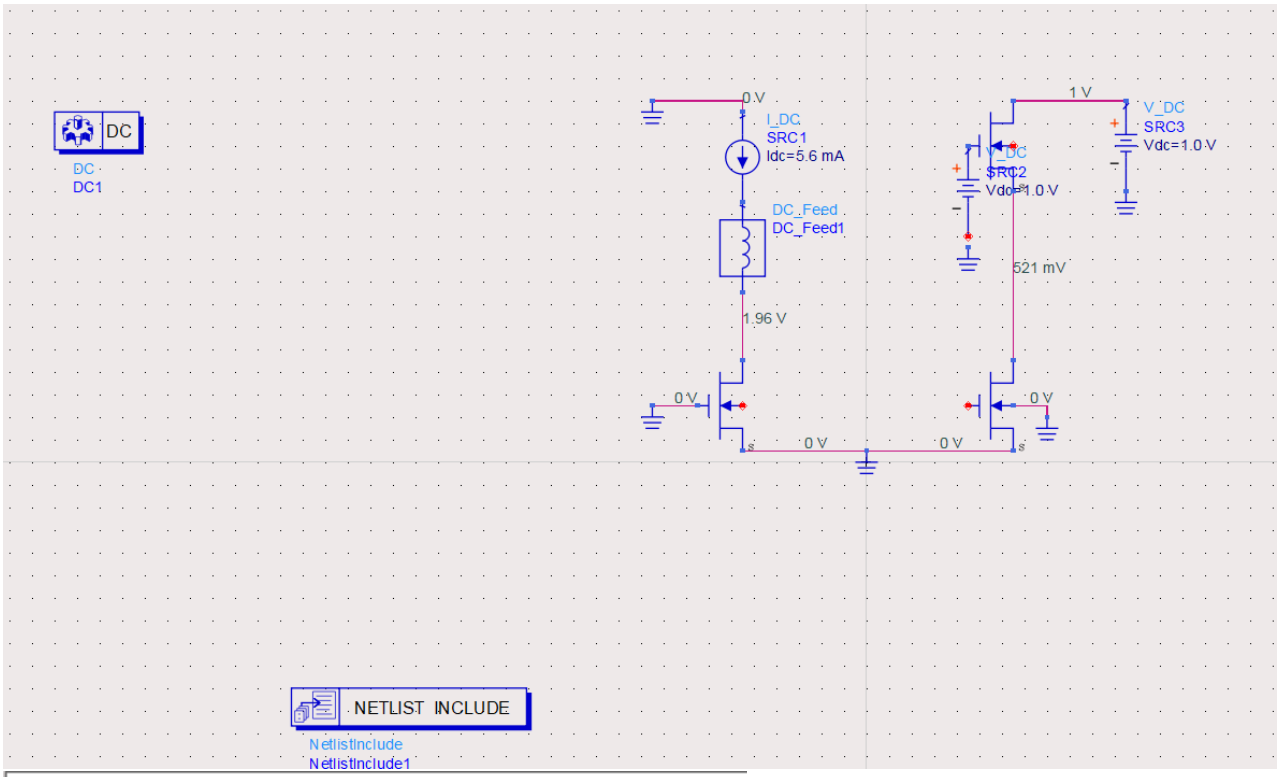
vin	Vt
2.000	1.056E-5
3.000	4.621E-6
4.000	2.624E-6
5.000	1.702E-6
6.000	1.198E-6
7.000	8.917E-7
8.000	6.909E-7
9.000	5.519E-7

Gm = diff (Iout)

Vt= diff(gm)

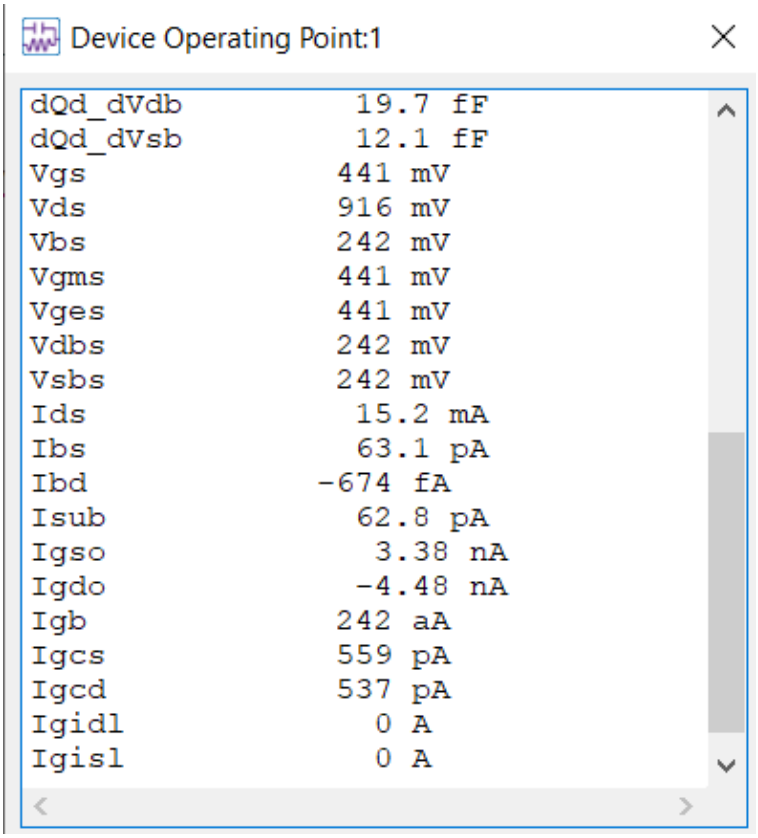
Ro=1/gm

6. Cascode with reference:



Device Operating Point:1

BSIM4	MOSFET2
Id	15.2 mA
Ig	-49.6 fA
Is	-15.2 mA
Ib	-326 fA
Power	14 mW
Gm	94.9 mS
Gmb	24.2 mS
Gds	12.4 mS
Vth	263 mV
Vdsat	121 mV
dQg_dVgb	85.1 fF
dQg_dVdb	-18.1 fF
dQg_dVsb	-64.8 fF
dQb_dVgb	-8.47 fF
dQb_dVdb	-61.5 aF
dQb_dVsb	668 aF
dQd_dVgb	-29.5 fF



Vmin = Vov4 +Vov2

V04 = Vgs4 – Vt = 441 – 263 mV

V02 = Vgs2 – Vt = 755 – 415 mV

Vmin = 518mV

Rout = gm4 * r04 * r02 = 94.9m * (1/ 0.04 * 5.6 x 10^-3)

Rout = 1794.6 ohm