

1st question

1st iteration

Allowing m1cm

?

1260mV M3 \rightarrow $\left. \begin{array}{c} \text{---} \\ \text{---} \end{array} \right\} 0.45$

810mV M2 \rightarrow $\left. \begin{array}{c} \text{---} \\ \text{---} \end{array} \right\} 0.45$

990mV M1 \rightarrow $\left. \begin{array}{c} \text{---} \\ \text{---} \end{array} \right\} 0.45$

550mV M0 \rightarrow $\left. \begin{array}{c} \text{---} \\ \text{---} \end{array} \right\} 0.45$

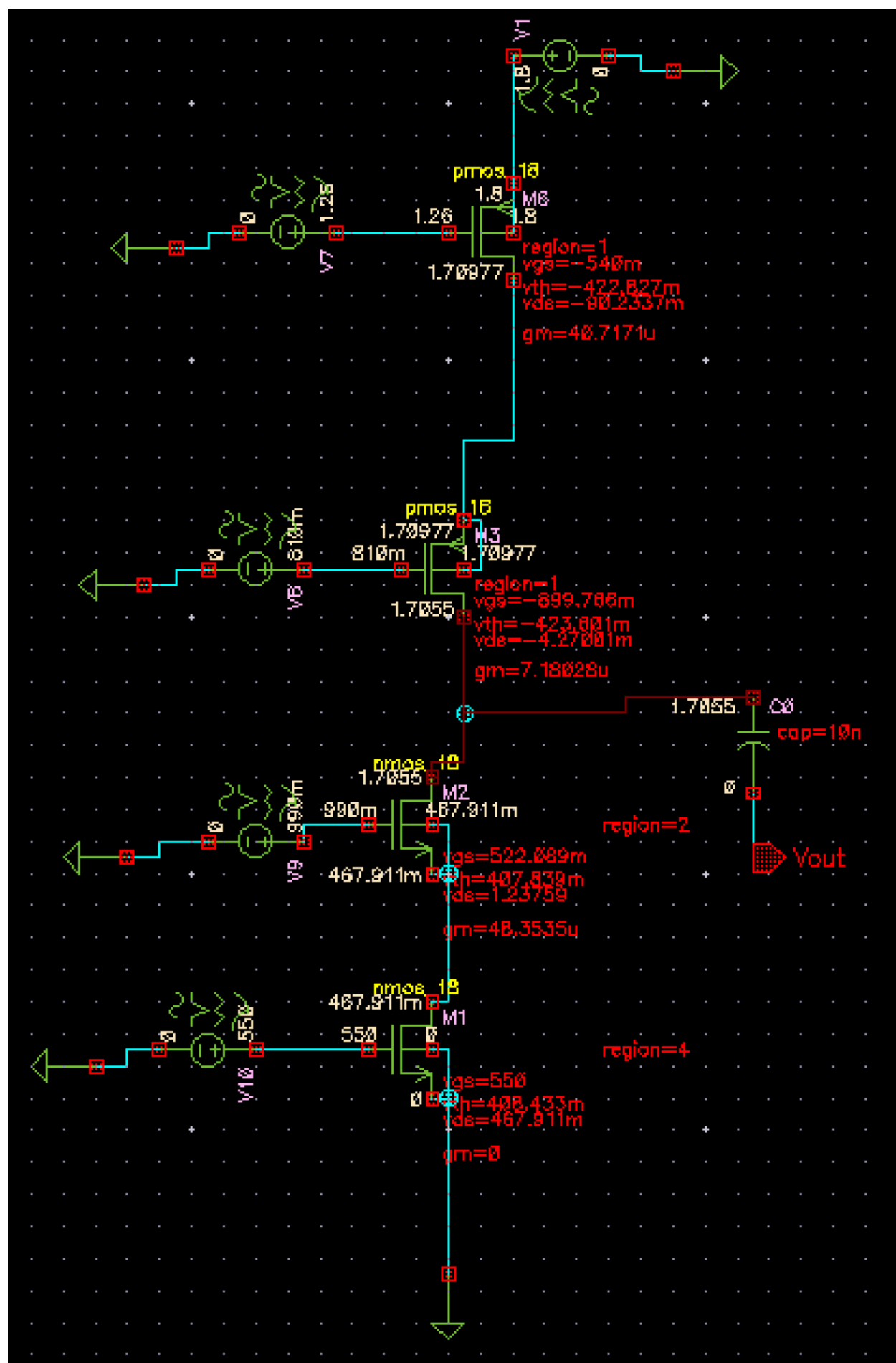
M0 \Rightarrow $V_{DS} = 0.45$
 $V_{GS} = 550\text{mV}$
 $I = 10\mu\text{A}$

M1 \Rightarrow $V_{GS} = 0.45 + 0.09$
 $V_{th} \pm 5\% V_{DD}$
 $V_G \approx 990\text{mV}$

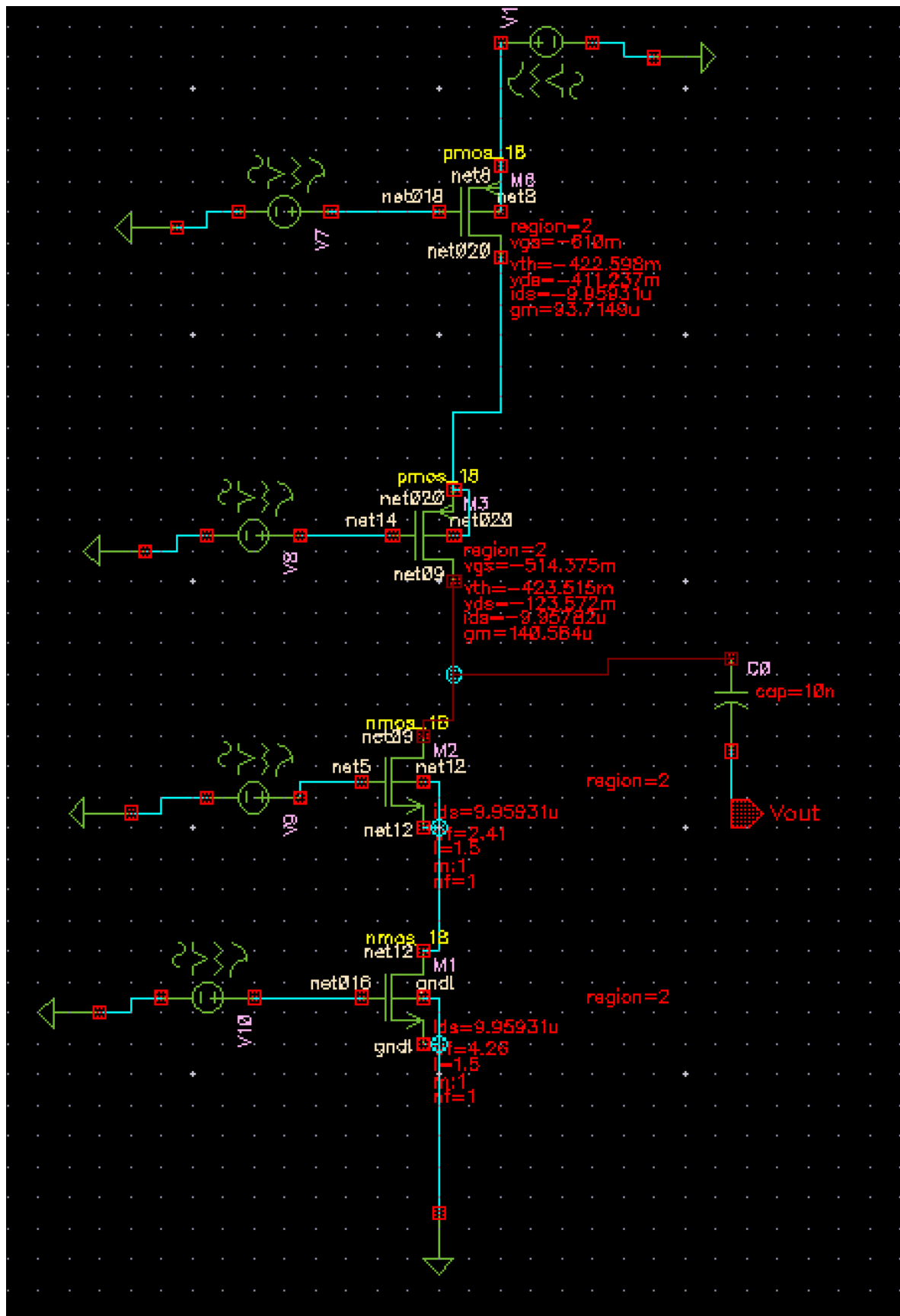
M2 \Rightarrow $V_G = V_S - 0.45 - 0.09$
 $V_G \approx 810\text{mV}$

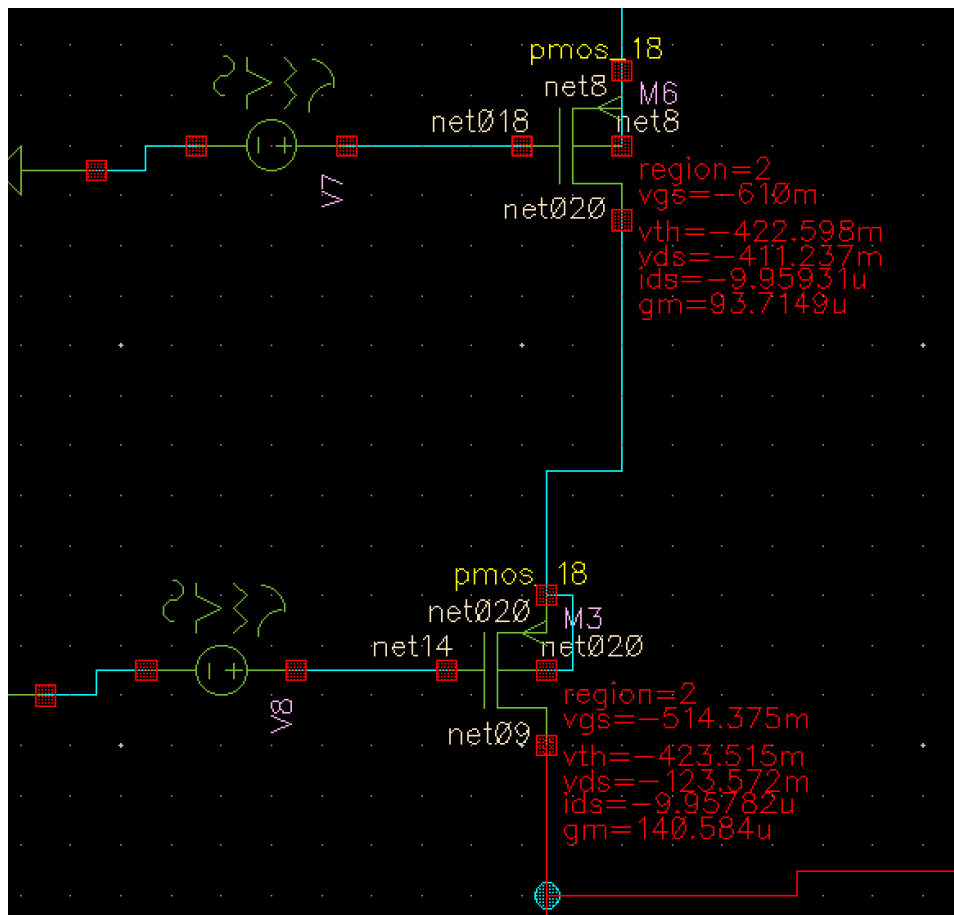
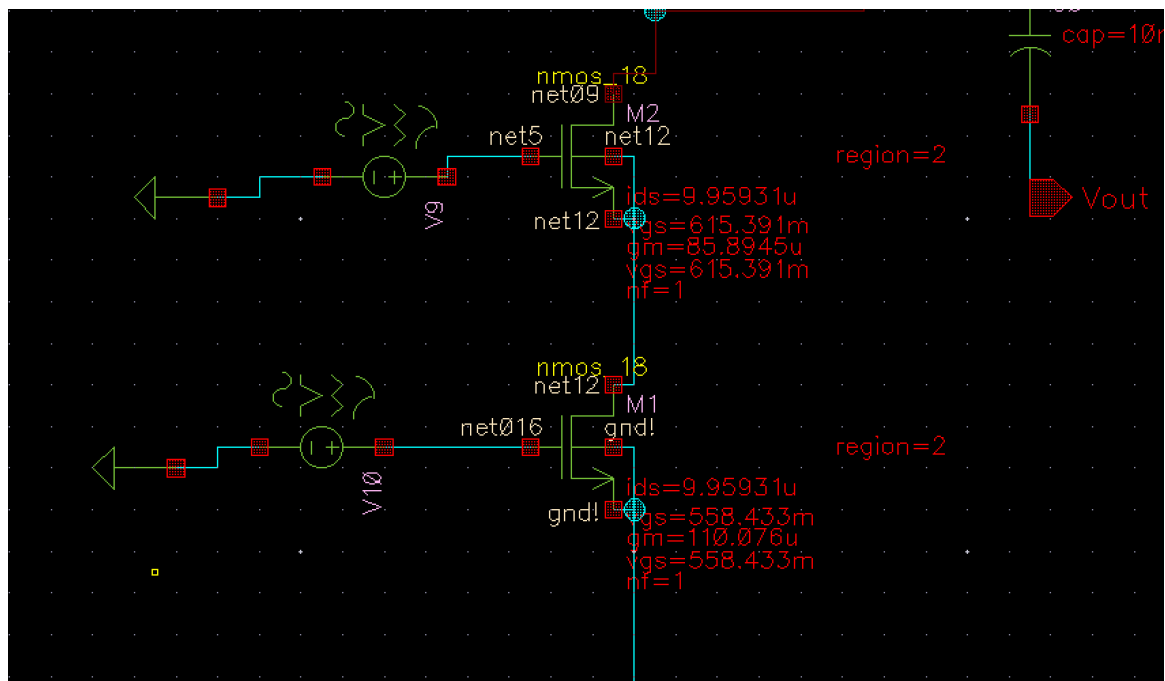
M3 \Rightarrow $V_{GS} = V_S - |V_{th}| - 0.09$
 $V_G = 1.8 - 0.45 - 0.09 =$
 $V_G \approx 1.260\text{mV}$

0.82897

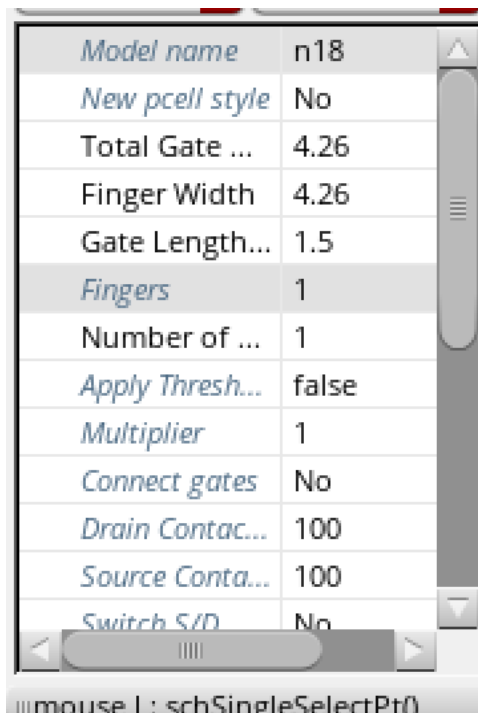


9th iteration





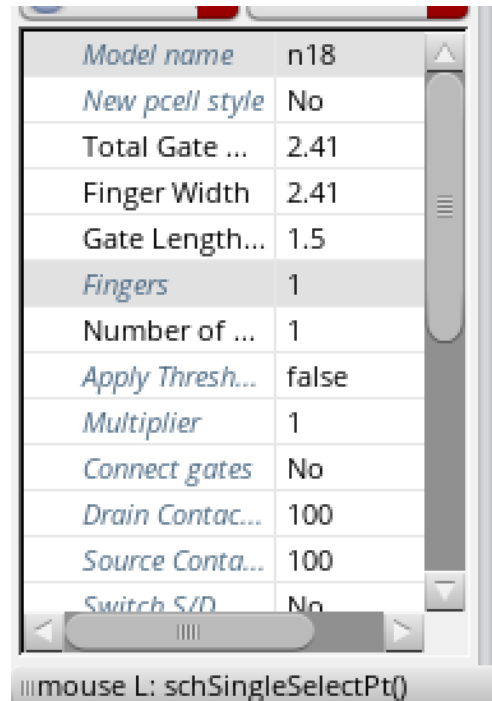
Width and length values for each mosfet:



A screenshot of a MOSFET parameter dialog box. The window title is "Instance". The table lists parameters for model "n18". The "Fingers" row is highlighted. The status bar at the bottom reads "mouse L: schSingleSelectPt()".

<i>Model name</i>	n18
<i>New pcell style</i>	No
Total Gate ...	4.26
Finger Width	4.26
Gate Length...	1.5
<i>Fingers</i>	1
Number of ...	1
<i>Apply Thresh...</i>	false
<i>Multiplier</i>	1
<i>Connect gates</i>	No
<i>Drain Contac...</i>	100
<i>Source Conta...</i>	100
<i>Switch S/D</i>	No

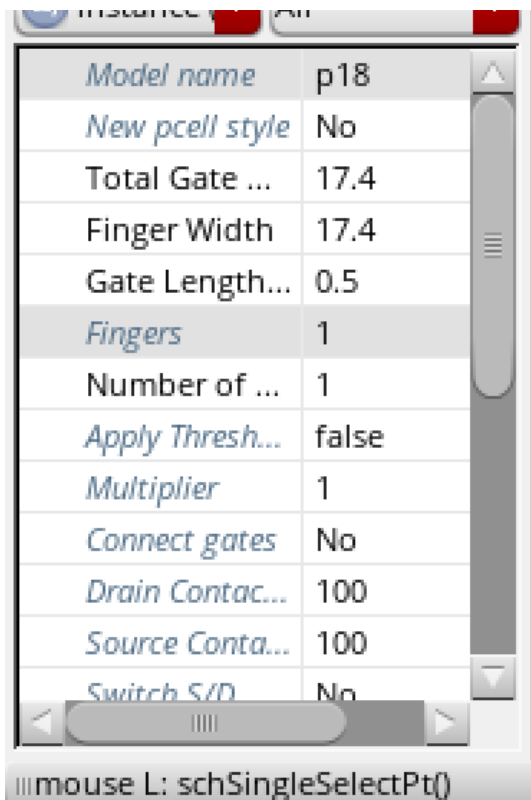
mouse L: schSingleSelectPt()



A screenshot of a MOSFET parameter dialog box, similar to the first one but with different values. The "Fingers" row is highlighted. The status bar at the bottom reads "mouse L: schSingleSelectPt()".

<i>Model name</i>	n18
<i>New pcell style</i>	No
Total Gate ...	2.41
Finger Width	2.41
Gate Length...	1.5
<i>Fingers</i>	1
Number of ...	1
<i>Apply Thresh...</i>	false
<i>Multiplier</i>	1
<i>Connect gates</i>	No
<i>Drain Contac...</i>	100
<i>Source Conta...</i>	100
<i>Switch S/D</i>	No

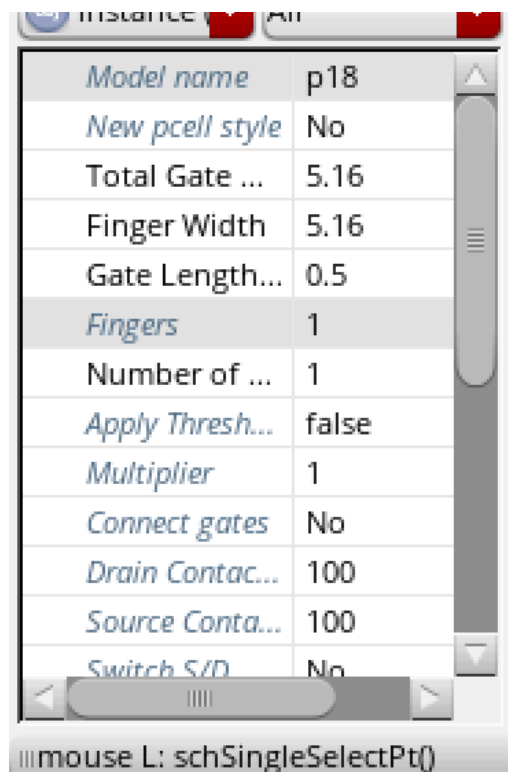
mouse L: schSingleSelectPt()



A screenshot of a MOSFET parameter dialog box for model "p18". The "Fingers" row is highlighted. The status bar at the bottom reads "mouse L: schSingleSelectPt()".

<i>Model name</i>	p18
<i>New pcell style</i>	No
Total Gate ...	17.4
Finger Width	17.4
Gate Length...	0.5
<i>Fingers</i>	1
Number of ...	1
<i>Apply Thresh...</i>	false
<i>Multiplier</i>	1
<i>Connect gates</i>	No
<i>Drain Contac...</i>	100
<i>Source Conta...</i>	100
<i>Switch S/D</i>	No

mouse L: schSingleSelectPt()



A screenshot of a MOSFET parameter dialog box, similar to the third one but with different values. The "Fingers" row is highlighted. The status bar at the bottom reads "mouse L: schSingleSelectPt()".

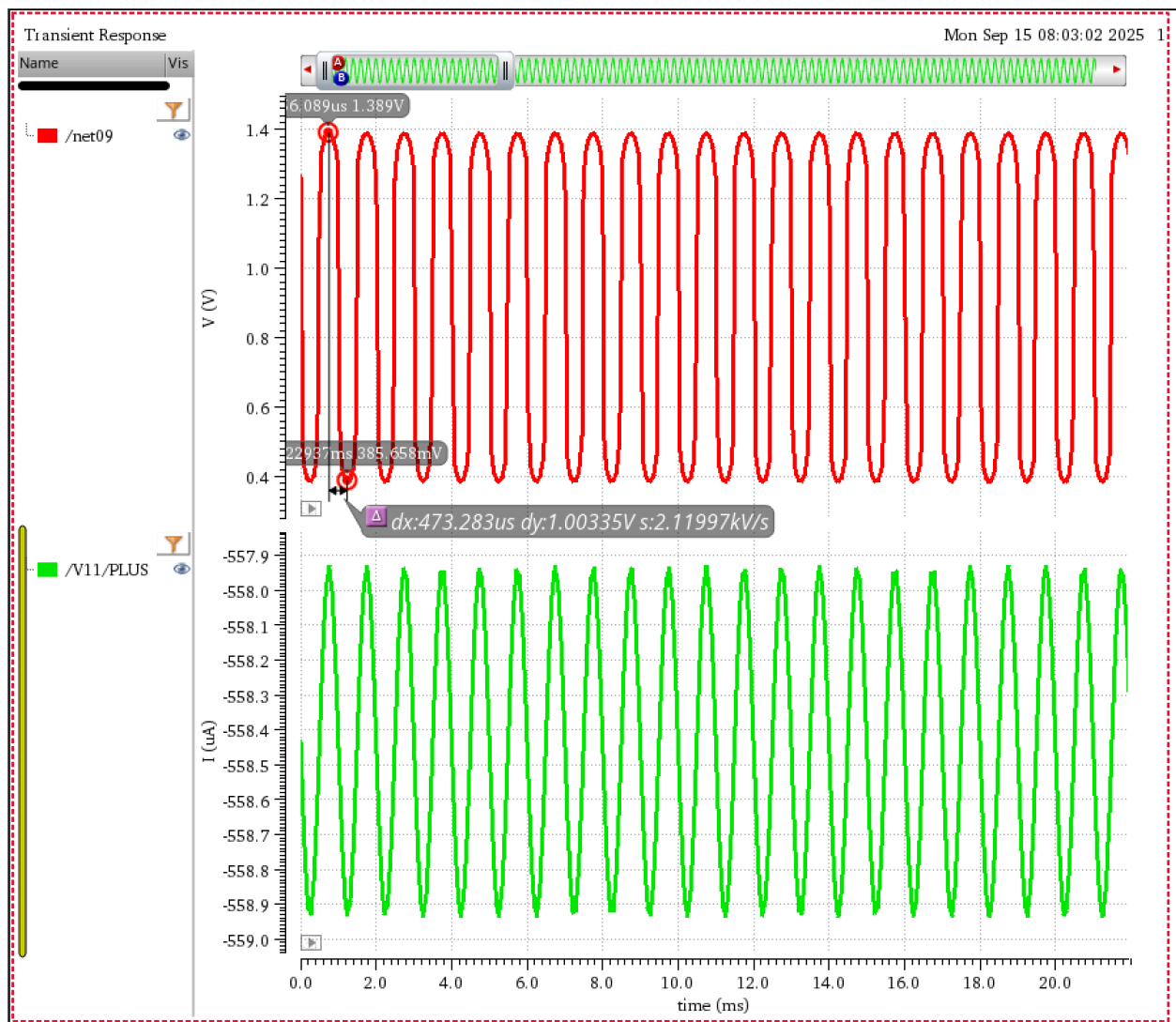
<i>Model name</i>	p18
<i>New pcell style</i>	No
Total Gate ...	5.16
Finger Width	5.16
Gate Length...	0.5
<i>Fingers</i>	1
Number of ...	1
<i>Apply Thresh...</i>	false
<i>Multiplier</i>	1
<i>Connect gates</i>	No
<i>Drain Contac...</i>	100
<i>Source Conta...</i>	100
<i>Switch S/D</i>	No

mouse L: schSingleSelectPt()

Final Biasing voltages

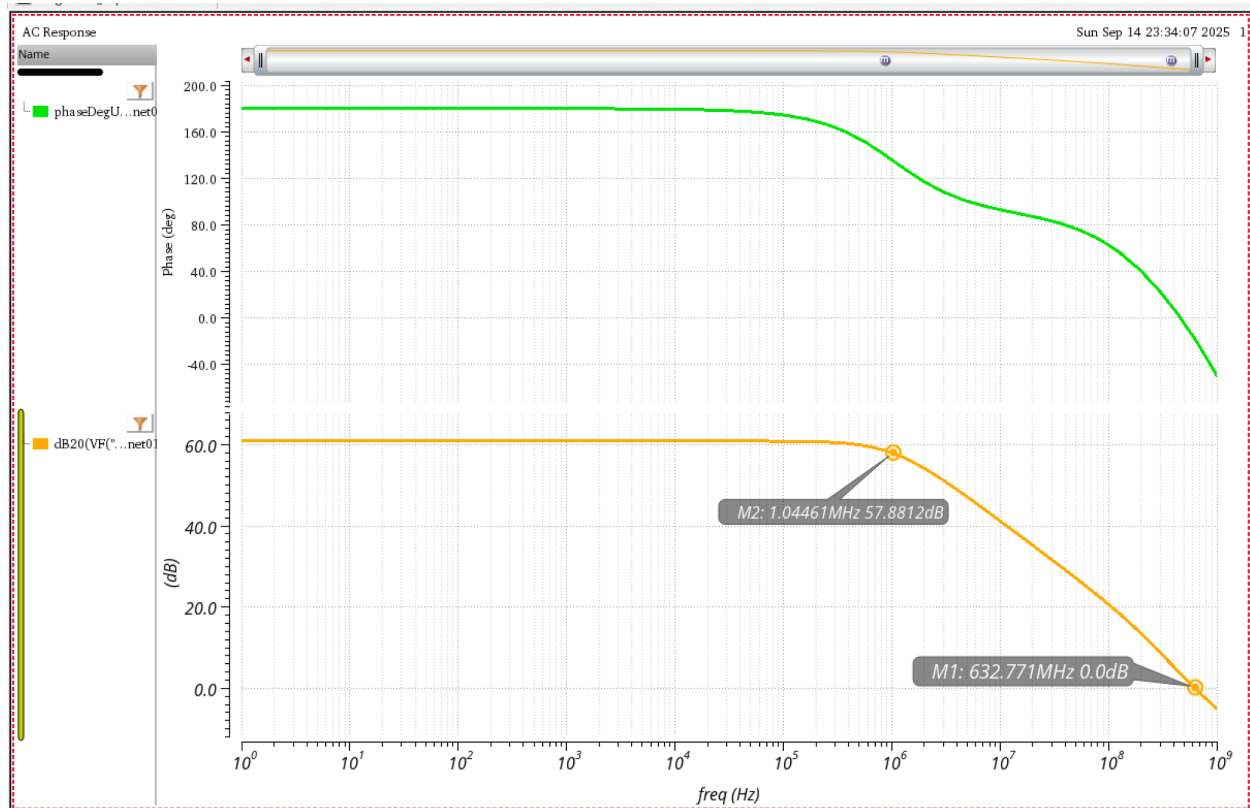
DC voltage	558.433m V
DC voltage	900m V
DC voltage	874.388m V
DC voltage	1.19 V

Transient response:



Input 1mv swing
Output 1.00335v
Gain is 60.8812dB

Ac response:



Peak value



-3db gain => 57.8812db => freq at -3db is 1.04461MHz
Bandwidth = 1.04461MHz

Gain crossover frequency (ω_{gc})

- Where gain = 0 dB.

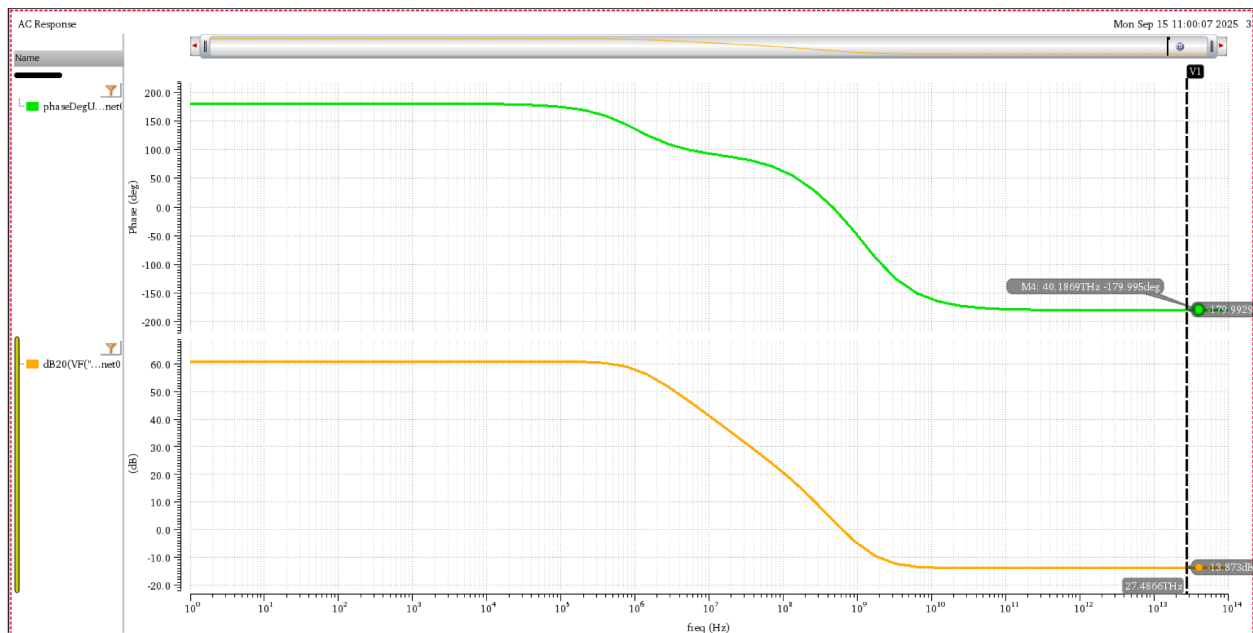
- From the orange curve:
 $F_{gc} \approx 650.8 \text{ MHz}$

At this frequency, the phase (green curve) is:

$$\phi(f_{gc}) \approx -18.9 \text{ degree}$$

Phase Margin (PM):

$$PM = 180^\circ + \phi(f_{gc}) = 180 - 18.9 \approx 161.1 \text{ degree}$$



Phase crossover frequency (ω_{pc})

- Where **phase = -180°** .
- Looking at my phase plot (green), it never reaches $-180 \Rightarrow$

Maybe the **phase never crosses -180°** , so **Gain Margin (GM) is infinite (system stable with respect to gain)**.

or

Or if we consider the approximation
 phase Going to -179.995 at 27.486 THz freq

Gain at phase crossover frequency where phase = -180° : $G(f_{pc}) \approx -13.873 \text{ dB}$

$$GM = -G(f_{pc}) = -(-13.873 \text{ dB}) = 13.82 \text{ dB}$$

Mosfet	W/L	Vgt	Vbias	gm	gds
M0	2.84	0.150	558.4	110u	1.2u
M1	1.606	0.207	900	85u	178n
M2	34.6	0.90	874	140u	13.9u
M3	10.32	0.187	1.2	93u	1.06u

