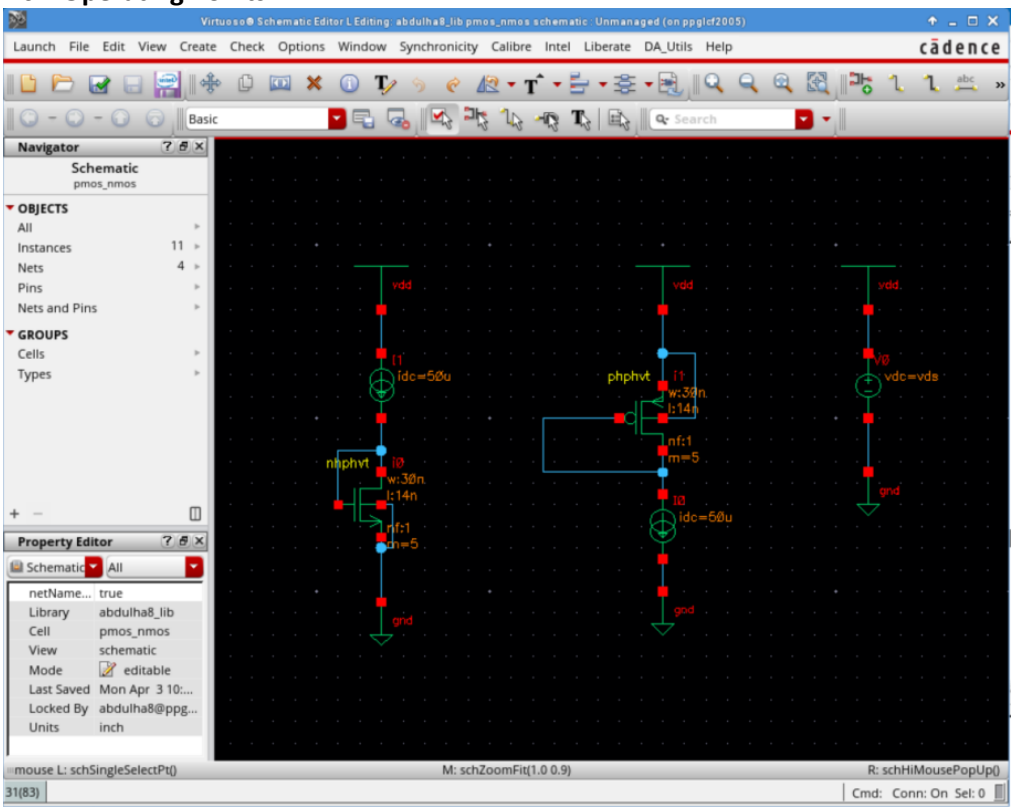
Specifications:

- VDD = 1.8V
- Av ≥ 70dB
- CL = 10pF
- PM = 60°
- SR = 10V/µs
- ICMR+ = 1.6V
- ICMR− =1V
- GB ≥ 10MHz

Dc – Operating Points



NMOS:

• W/L=30n*5/14n (mult of 2)

• βeff = µnCox(W/L) = 1.737m

• 1.72m = µnCox (30∗5/14)

• µnCox =1.737m/10.71= 162.18u

• Vthn = 366mV

PMOS:

- W/L = 30n*5/14n (mult of 5)
- βeff = μpCox(W/L) = 1.727m
- 1.476m = μpCox (30n*5 / 14n)
- μpCox =1.727m/10.71= 161.25u
- Vthp = 335.9mV

Design of Two Stages Op-Amp based on the Specs:

- C_C = 0.22 C_L , C_c >2.2pF , C_c =5pF

- I_5 = SR · CC
- I_5 = 10/1μ · 5p = 50μA

- $gm_{1,2}$ = GB × CC × 2π
- $gm_{1,2}$ = 10M × 5pF × 2π
- $gm_{1,2}$ = 314.15μ
- $(W/L)_{1,2}$ = $(314.15\mu)^2/2(25\mu).(\ 162.18u)$= 12.17≈ 12

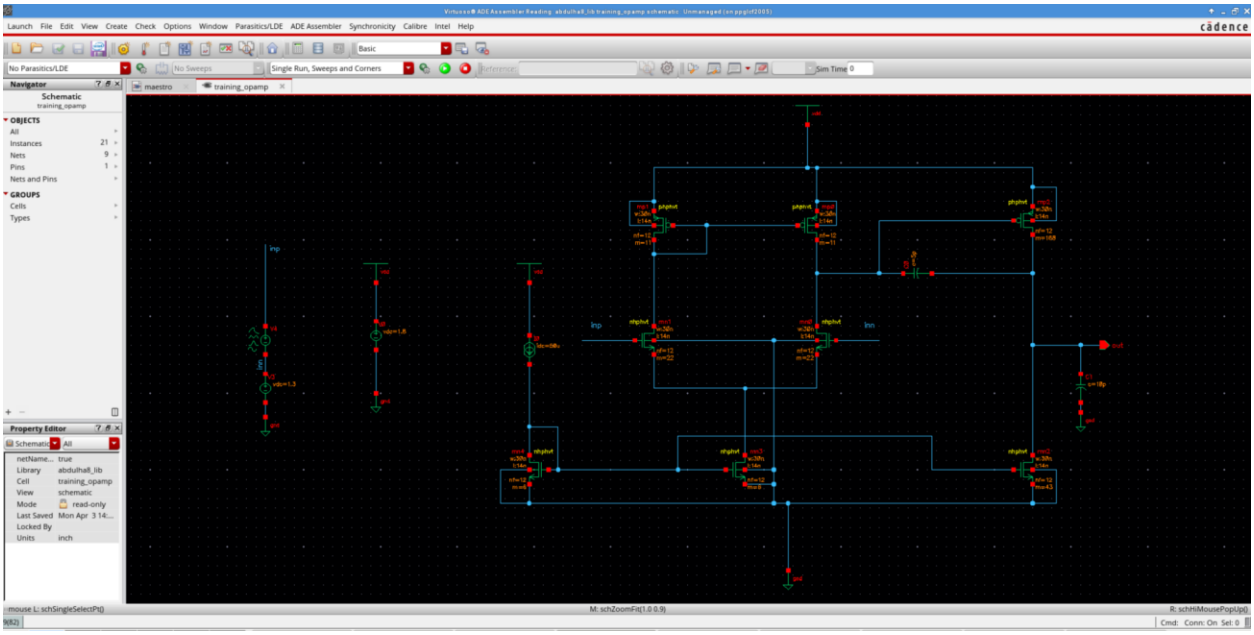
- $(W/L)_{3,4}$ = $\frac{2(25)}{161.25(1.8-1.6-335.9\text{mV}+366\text{mV})^2}$ = 5.85≈ 6

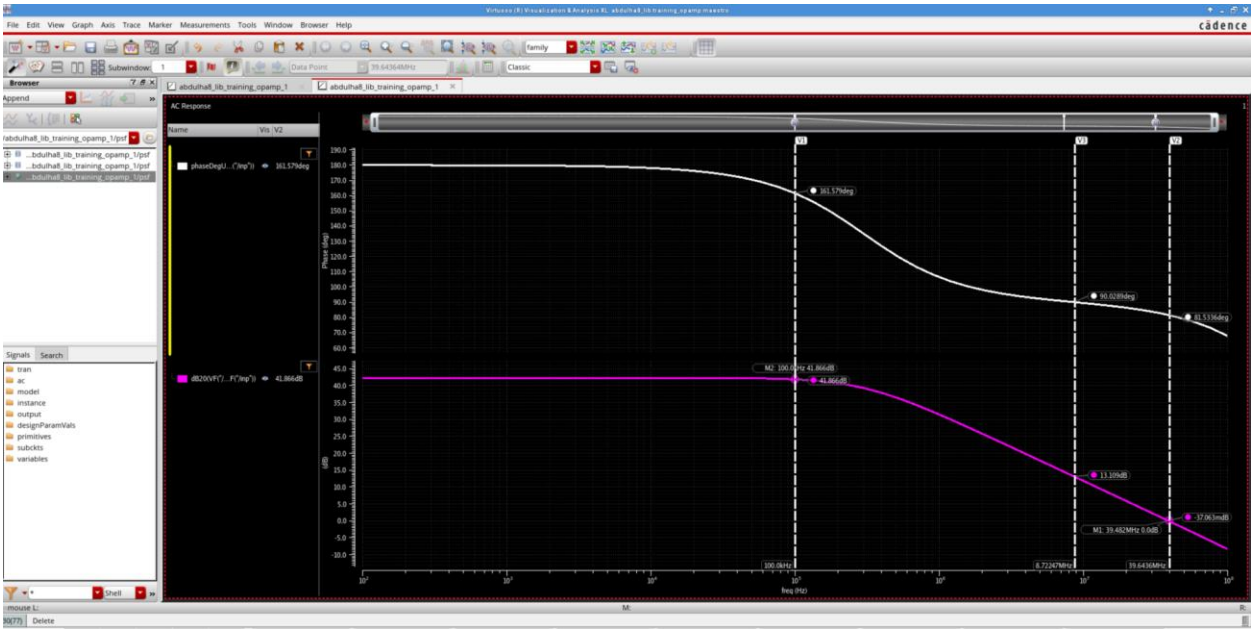
- V_{DSAT5} ≥ 1- $\sqrt{\frac{2(25)}{(162.18)(12)}} - 0.366 = 0.4737 \approx 0.5$
- $(W/L)_5$ = $\frac{2(50)}{(162.18)(0.5)^2}$ = 2.378≈ 2.4

gm6 = 10(314.15μ) = 3.1415m

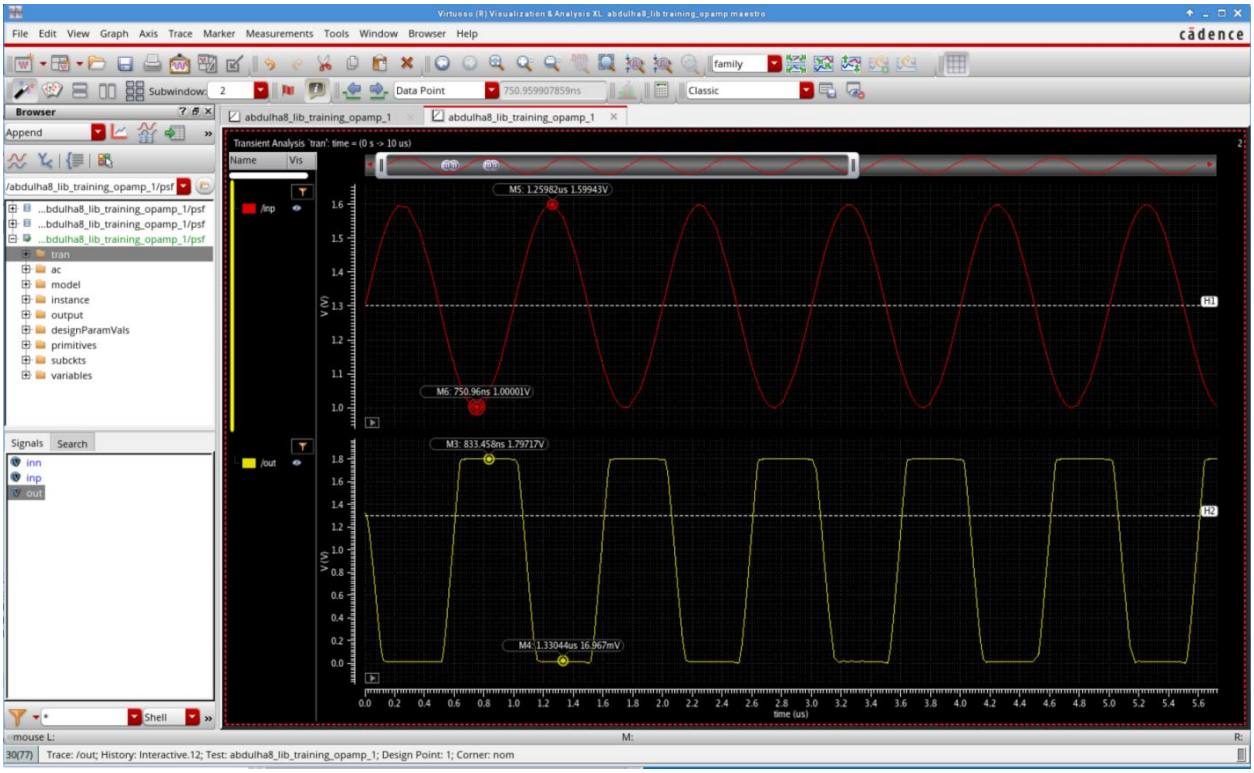
- gm_4 = $\sqrt{2(25) * 161.25\text{u} * 6}$ = 219.9 μ
- $(W/L)_6$ = $\frac{3.1415\text{m}}{219.9\ \mu} * 2$ = 28.57 ≈ 29

- $I_{6,7} = 10 \times 29/6 = 48.33\mu A$
- $(W/L)_7 = \frac{48.33}{50}$ x 2.4= 2.319





Gain = 41.86dB


Virtuoso (R) Visualization & Analysis XL: abdulha8_lib training_opamp maestro
File Edit View Graph Axis Trace Marker Measurements Tools Window Browser Help
cadence
Browser
Append
/abdulha8_lib_training_opamp_1/psf
...bdulha8_lib_training_opamp_1/psf
...bdulha8_lib_training_opamp_1/psf
...bdulha8_lib_training_opamp_1/psf
tran
ac
model
instance
output
designParamVals
primitives
subckts
variables
Signals
Search
inn
inp
out
abdulha8_lib_training_opamp_1
abdulha8_lib_training_opamp_1
Transient Analysis 'tran': time = (0 s -> 10 us)
Name
Vis
/inp
/out
M5: 1.25982us 1.59943V
M6: 750.96ns 1.00001V
M3: 833.458ns 1.79717V
M4: 1.33044us 16.967mV
H1
H2
V (V)
time (us)
Shell
mouse L:
M:
R:
30(77)
Trace: /out; History: Interactive.12; Test: abdulha8_lib_training_opamp_1; Design Point: 1; Corner: nom