

A report on

Design of a Two Stage Single-Ended Output Op Amp

Vidhi Shah 2016A3PS0169P

Ardra Ayyappath 2016A3PS0261P

Aditya Sharma 2016A8PS0453P

Submitted in partial fulfillment of the course

EEE F313/ INSTR F313 – Analog & Digital VLSI Design



Birla Institute of Technology and Science, Pilani

October-November 2018

Problem Statement

Ques 22.

Design a two stage single-ended output OPAMP (Telescopic + gain stage) for the following specification

a) Analysis of all equations of your design, with a systematic derivation of all transistors W/L ratios and spectre simulation of circuit for the following specifications.

i) Gain ≥ 80 dB

ii) power dissipation $\leq .2\text{mW}$

iii) Output swing $\geq 2\text{V}$

b) Show a biasing circuitry to bias all the voltages in your design (except the input).

c) Use STB analysis to measure the closed loop gain and phase margin.

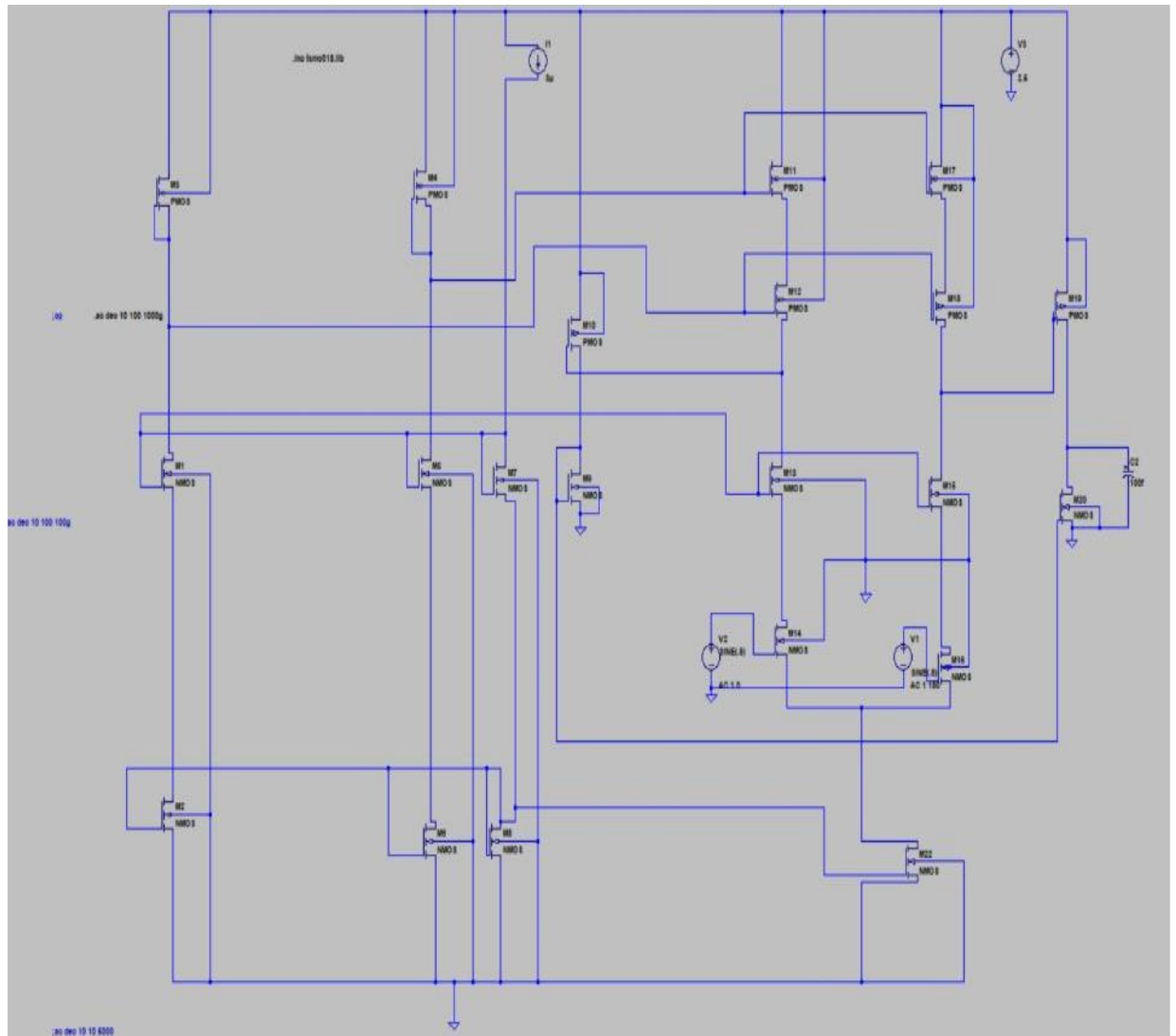
d) Calculate and plot the following parameters for your OPAMP: DC gain, Bode plot for AC gain and phase, CMRR plot, ICMR plot, PSRR plot, slew rate, Output voltage swing (dc + Transient), power consumption, and input and output offset voltage.

Specifications used:

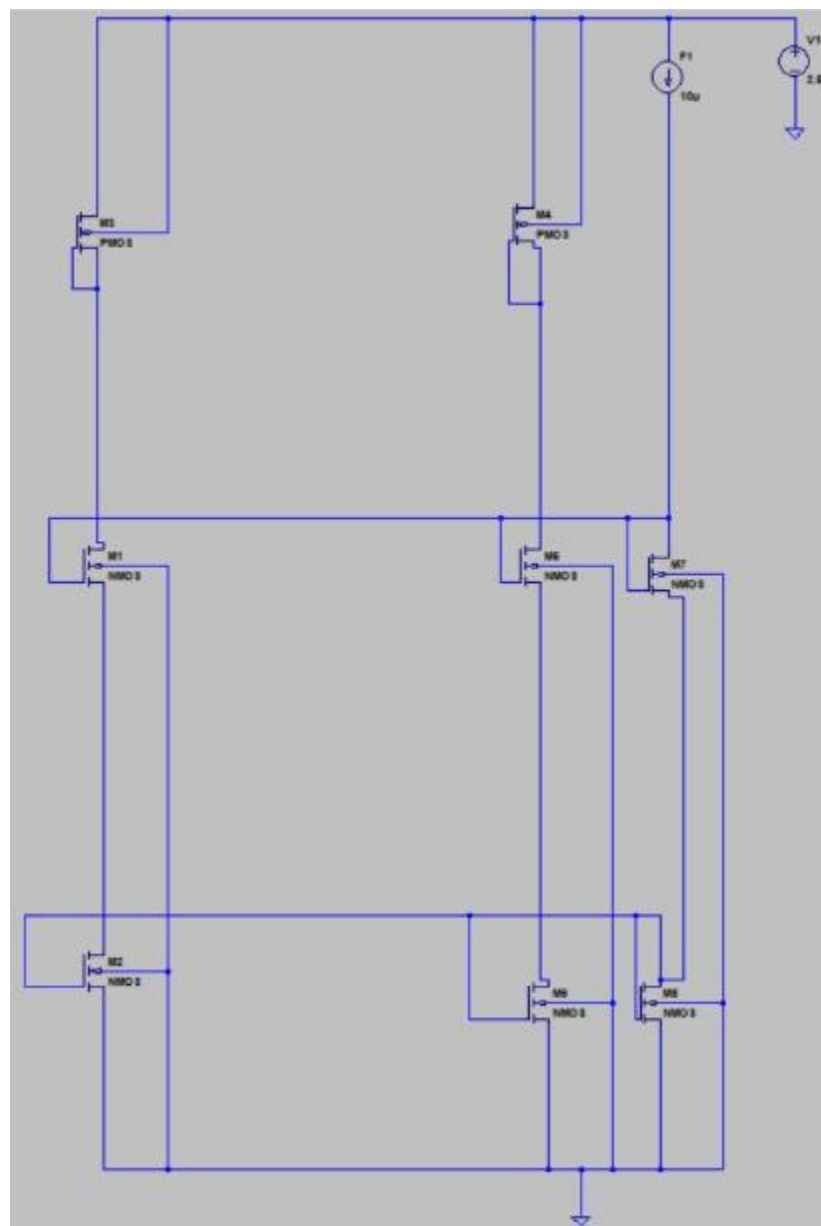
Parameters	Specification
V_{DD}	2.5 V
Technology	TSMC 180 nm technology*
Reference current	Single ideal current source of arbitrary value, with the positive node tied to V_{DD} or negative node tied to ground
C_L	$\geq 100\text{fF}$
Current mirror ratios	≤ 20
Power Dissipation	$< 0.2\text{ mW}$

PART I

1. Circuit Diagram



2. Circuit Diagram for Biasing Circuitry.



PART II

RESULTS : SIMULATIONS AND ANALYSIS

Circuit specifications

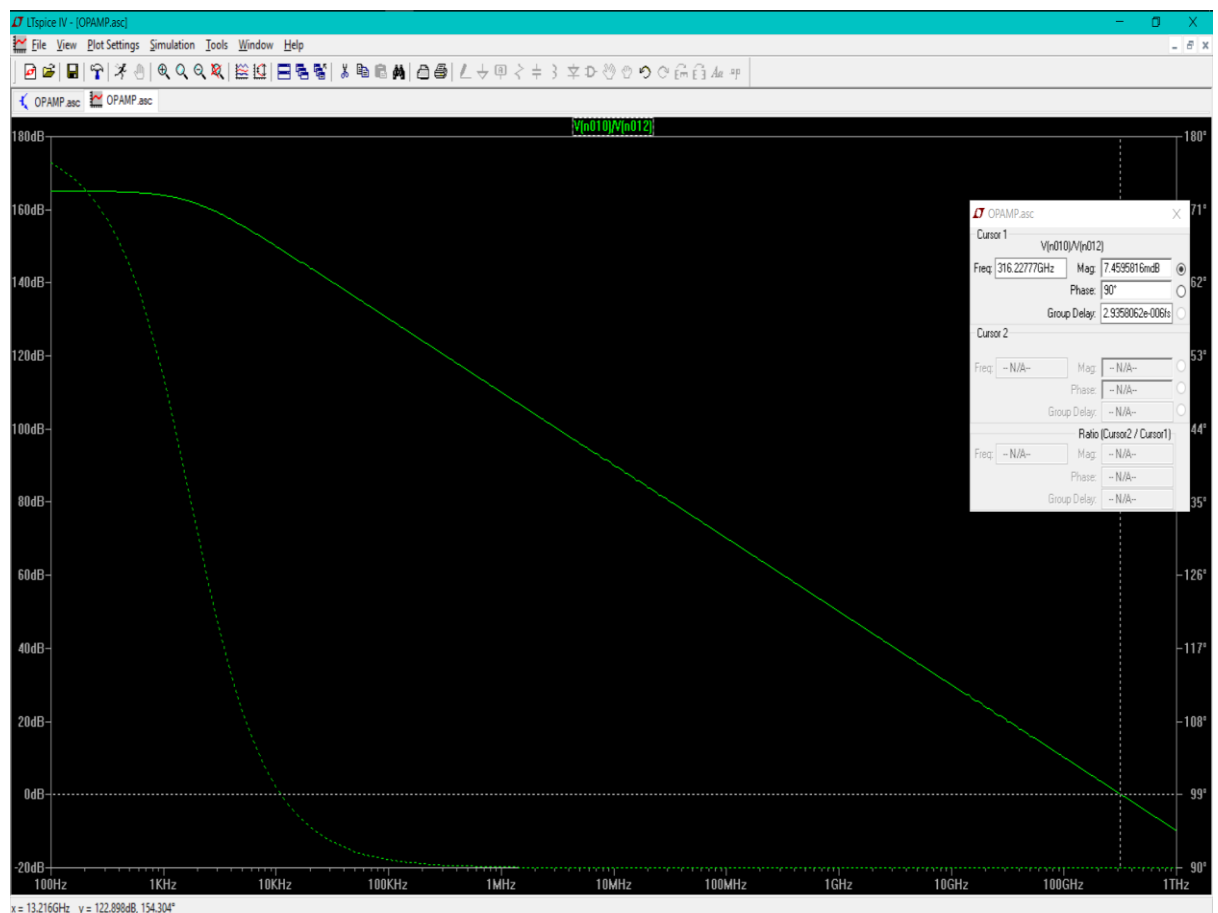
Parameter	Required	Obtained
Gain	80dB	~160 dB
Power dissipation	$\leq .2\text{mW}$	0.193mW
Output swing	$\geq 2\text{V}$	1.1 V

Plots and graphs

1) Bode plot for gain – AC gain and phase margin

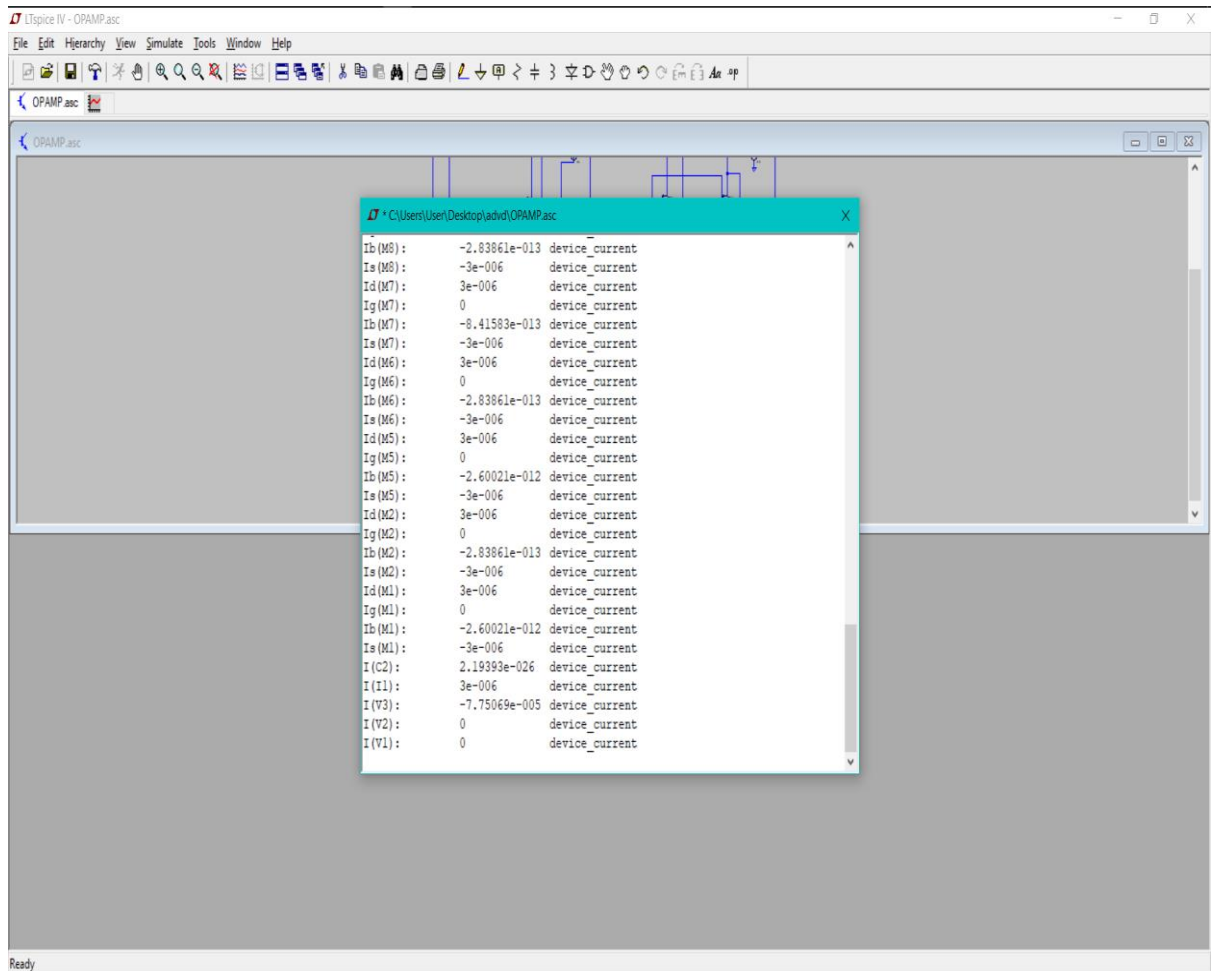
Gain ~ 160 dB

Phase margin = 90^0



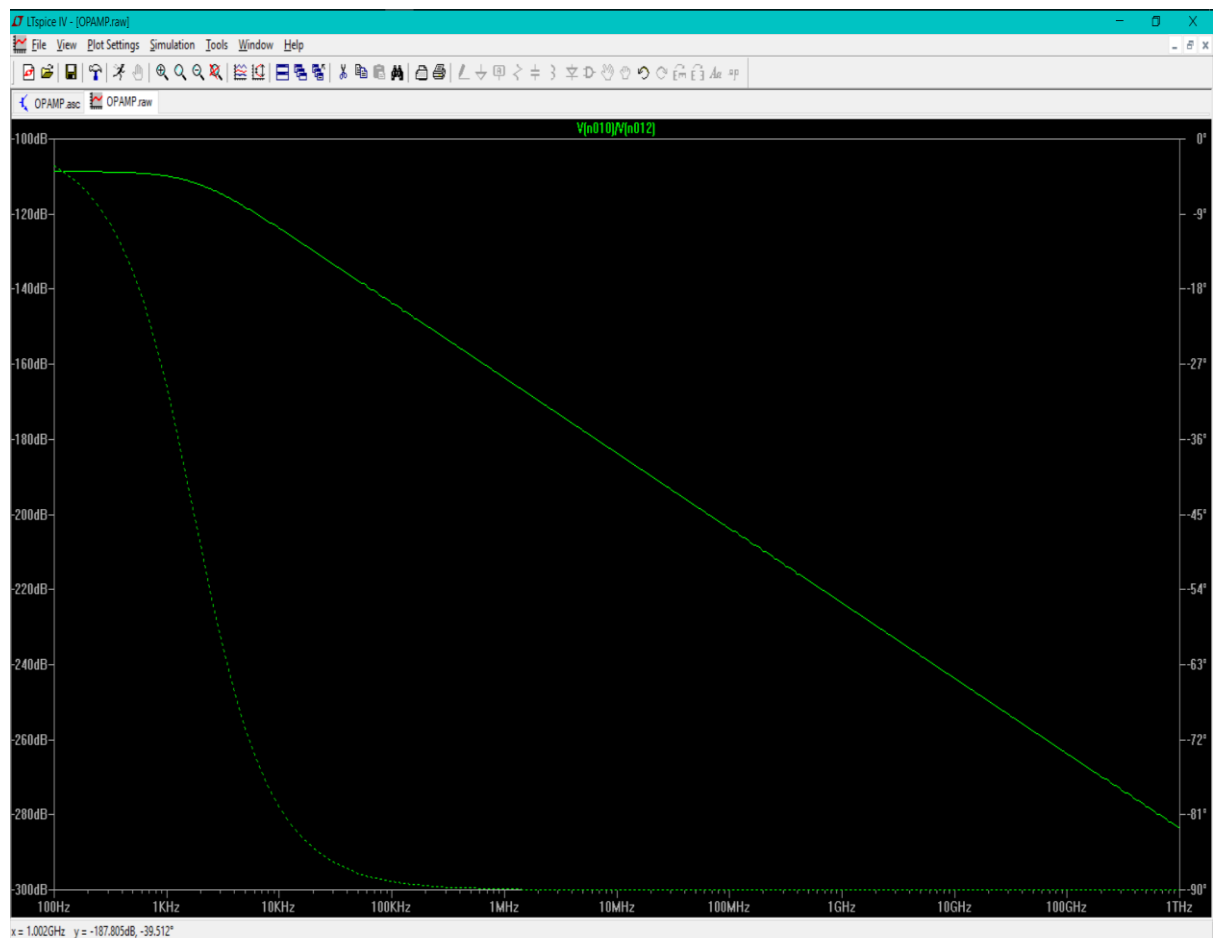
2) Power dissipation

power consumption- 0.193mW

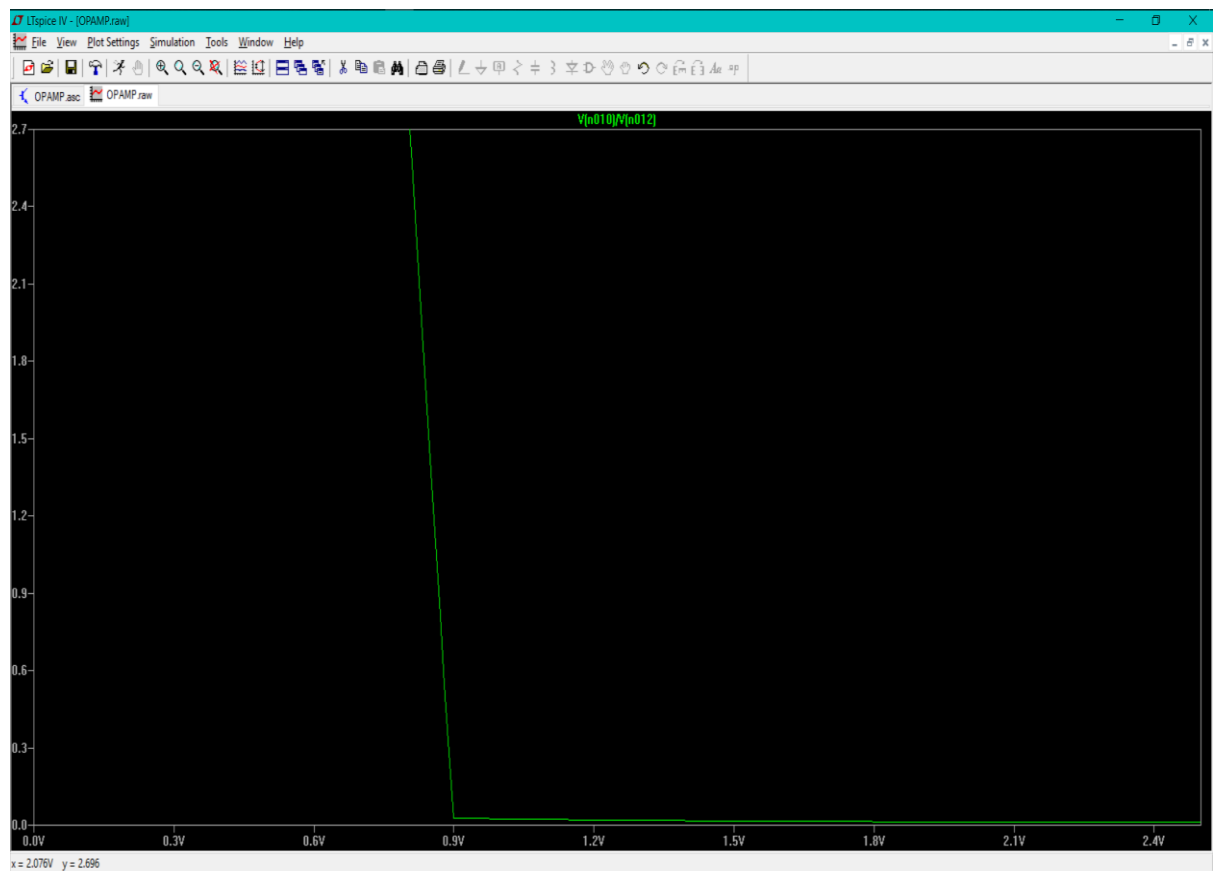


3) CMRR Analysis

$$\text{CMRR} = 165\text{dB} - (-110\text{dB}) = 275\text{dB}$$

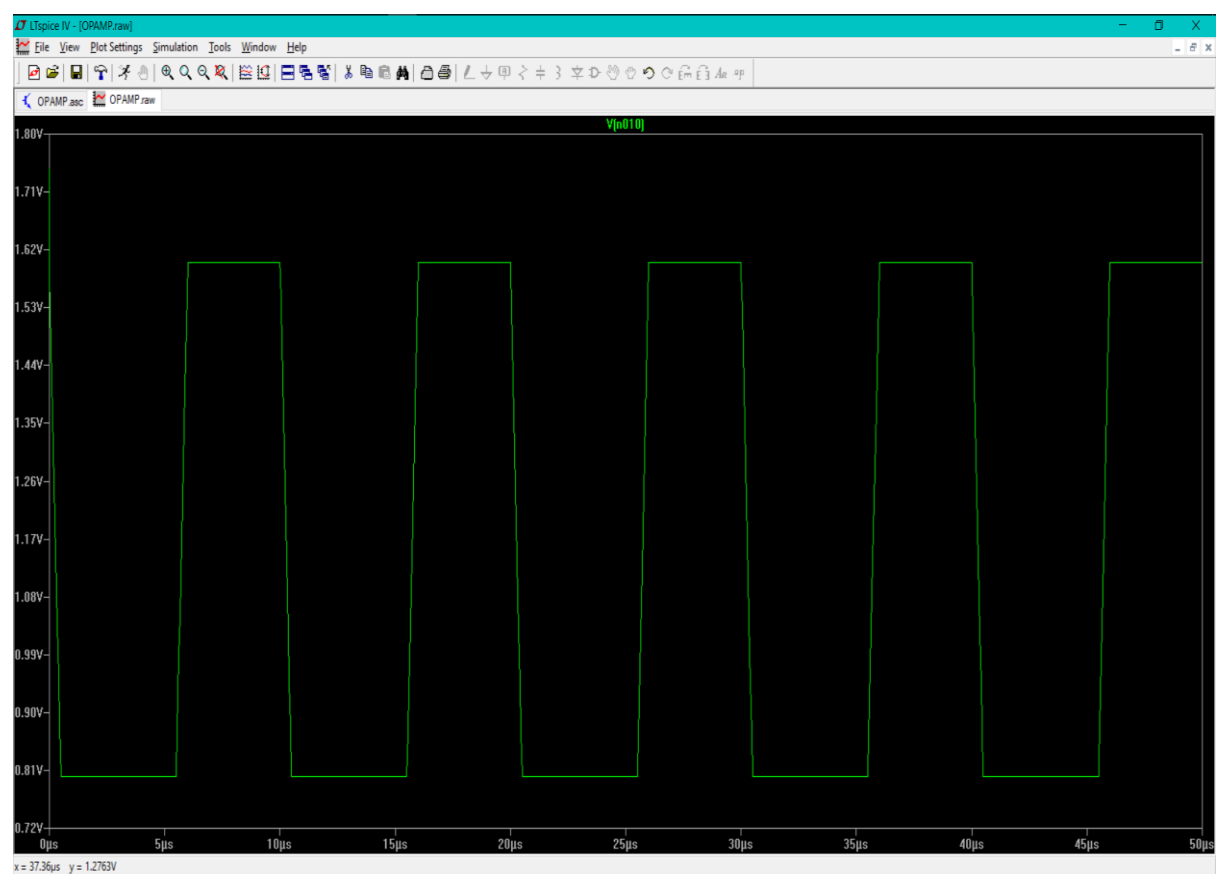


4) DC gain



5) Slew rate

slew rate- 17.3MV/s



6) ICMR

ICMR=.2V OCMR=2.4V

