

Design of two stage op-amp

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Abstract

This project presents two stage operational amplifier and the topology of the circuit is that of standard CMOS op-amp. Study is conducted on room temperature using the ESim tool. Operational amplifiers are the main building blocks of an IC designing. The advantage of two stage opamp is that it has a good gain, high output swing, low noise and good bandwidth. The two stage opamp has first stage as differential stage and the second stage as common source amplifier stage. The op-amp is used in wide variety of applications such as voltage follower, current to voltage converter, active rectifier, integrator, differentiator etc.

2 Implemented Circuit

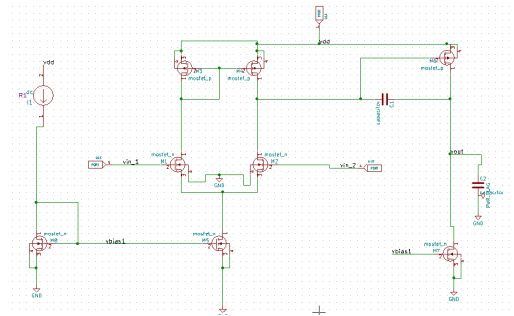


Figure 1: Implemented circuit diagram.

3 Implemented Waveforms

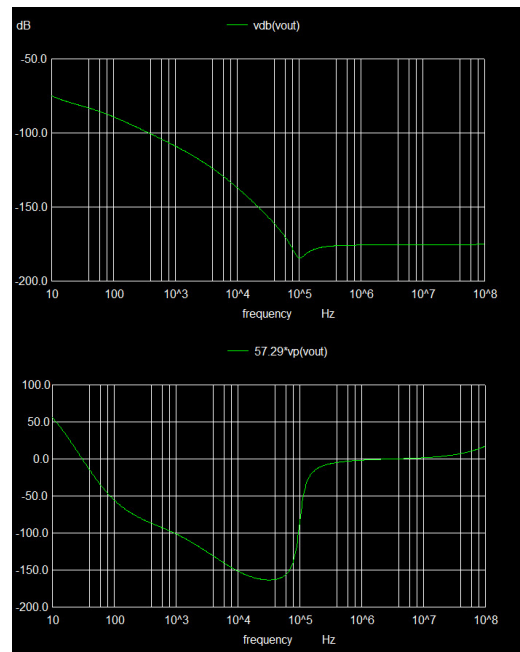


Figure 2: Implemented waveform.

1 Circuit Details

The specifications for the circuit are as follows:- 1) Gain= 1000, 2) GBW = 30MHz, 3) Phase margin should be taken greater than 60 deg, 4) Slew rate = 20V/m 5) ICMR= 0.8 to 1.6 , 6) Load capacitance = 2pF, 7) Power dissipated should be less than 300uW. The aim is that the design meets the same gain required by the specification. The CMOS operational amplifier consists of three subsections namely differential gain stage, second gain stage and bias strings. The differential stage provides the maximum gain of the op-amp. The compensation capacitance (CC) is placed between first stage and second stage. The compensation capacitance (CC) provides the stability to the op-amp. The second stage is nothing more than the current sink inverter. It is a common mode stage which increases the DC voltage gain and improve the output signal swing for a given power supply voltage. The circuit design in this project consist an n-channel input pair and the op-amp has dual polarity voltage supply Vdd and Vss so that the given signals can swing above and below ground. At the output the capacitance is to be connected. The design of two stage op-amp includes all the process parameters into account and which contribute in performance of overall gain of the system. High gain,bandwidth, and good power supply rejection ratio (PSRR) and common mode rejection ratio (CMRR) are some of the desired features of a good operational amplifier.

References

- [1] H. KT. Design of two stage op-amp. <https://www.youtube.com/watch?v=xk6xNfA8vXc>.
- [2] D. H. S. A. Y. H. Priyanka T. Design and implementation of two stage operational amplifier. <https://www.irjet.net/archives/V4/i7/IRJETV4I7657.pdf>.