two stage operational amplifier

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Abstract

The Operational Amplifier (Op-Amp) is a fundamental building block in Mixed Signal design. Two stage Op-Amp is one of the most commonly used Op-Amp architectures. . Most CMOS Op-Amps are designed for specific on-chip applications and are only required to drive capacitive loads of a few pf. In this paper design of a two stage fully differential CMOS operational amplifier is presented. The procedure in this paper is to design a two stage CMOS operational amplifier and to do transient and ac analysis for the implemented circuit. In this paper we used skywater130 pdk i.e., 130nm technology. The circuit was designed using esim tool .

1 Reference Circuit Details

Operational amplifiers (Op-Amps) are basic building blocks of a wide range of analogue and mixed signal systems. Basically, Op-Amps are voltage amplifiers being used for achieving high gain by applying differential inputs. As new generations of CMOS technology tend to have shorter transistor channel length and scaled down supply voltage, the design of Op-Amps stays a challenge for designers. An operational amplifier is a direct-coupled high-gain amplifier usually consisting of one or more differential amplifiers. The operational amplifier is a versatile device that can be used to amplify dc as well as ac input signals and was originally designed for performing mathematical operations.. In two stage CMOS Op–Amps because of two dominant poles the phase margin could easily reach to less than the amount which is just enough for stable operation. This serious problem should be taken care of by designers, otherwise there is a good possibility that the Op-amp output will oscillate and instead of an amplifier it will become an oscillator. In some applications the gain and/or the output swings provided by cascade op-amps are not adequate. In such cases, we resort to "two stage" Op-Amps, with the first stage providing a high gain and the second, large swing. Opamps are of two types namely inverting Opamp and non-inverting Opamp with two inputs and single output. Two stage opamp is having 2 inputs namely vin1 and vin2 for giving positive and negative voltages. In this paper the specification which becomes the target is the (W/L) ratio .

2 Reference Circuit

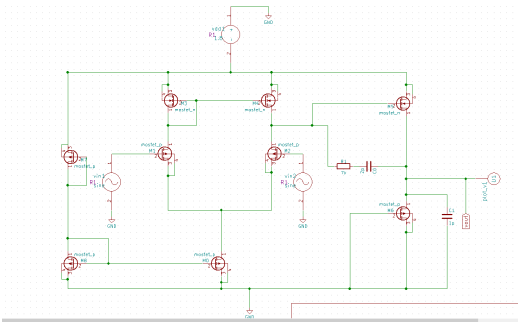

Figure 1: Reference circuit diagram.

3 Reference Circuit Waveforms

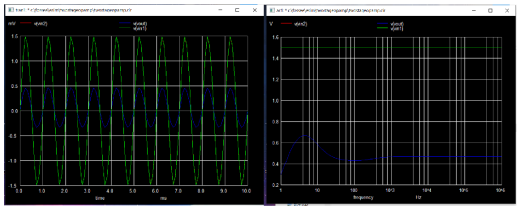

Figure 2: Reference waveform.

References

[1] C. L. M. H. K. D. A. V. N. Kavyashree and M. P. Sunil. design and implementation of two stage cmos operational amplifier using 90nm technology. https://ieeexplore.ieee.org/document/8068601denied.