Design of Detachable Keys Piano using Oscillator Circuit and Fully Differential Operational Amplifier using CMOS and SKY130 PDK technology

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Jan 30, 2022

Abstract

Currently there is no piano, a musical instrument with it's keys detachable i.e dynamic keys based piano. Whenever some musician wants to upgrade their piano with more keys, they need to upgrade the complete piano set. It's not possible to add or remove the keys from the piano to extend or reduce the number of keys based on requirements. The design idea in this reference paper gives the idea of making piano with it's keys detachable using CMOS based oscillator to design a key package for different sounds and Fully Differential Operational Amplifier as audio power amplifier. Both the key package and amplifier are designed by Static CMOS design using eSim and SKY130PDK with 130nm technology.

1. Reference Circuit Details

Detachable keys piano can be mainly viewed as the combinational arrangement of these two circuits:

- CMOS LC Oscillator
- CMOS Fully Differential Operational Amplifier

CMOS LC Oscillator comprises a pair of cross-coupled transistors. This is responsible for the different frequency sound generation.

This model produces the variable, stable frequency output. The two transistors of the oscillator circuit, and its oscillation frequency is controlled by introducing the mos which offers required parasitic capacitance depending on the desired frequency.Output is taken across the voltage divider junction at a node between the two registers connected to the source of one of the transistors.

CMOS Fully Differential Operational Amplifier iis based on the difference close-loop feedback technique and the difference pre-amp. This amplifier is build using folded-Cascode configuration.It consists of input stage difference amplifier,output stage circuit, power source, common-gate amplifier,active load transistor, common-mode feedback circuit, clamping transistors used for reducing the operational amplifier setting time.

2. Reference Circuit

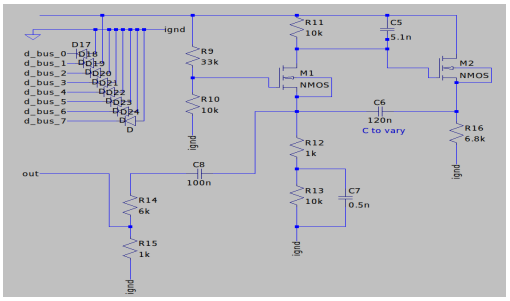


Fig 1. CMOS LC Oscillator

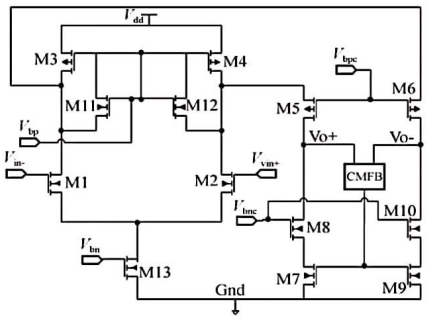
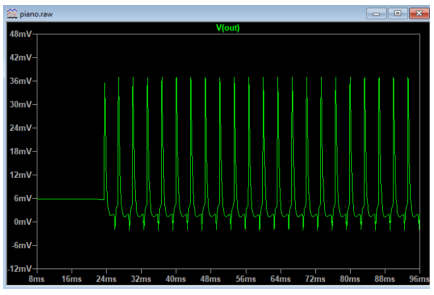


Fig 2. Fully Differential Operational Amplifier

3. Reference Circuit Waveform



References:

[1] Design issues in CMOS differential LC oscillators,IEEE J Solid-State Circuits, 1999; 34(5):717-724

[2] https://www.researchgate.net/publication/231031372_A_high_efficiency_PWM_CMOS_class-D_audio_power_amplifier