

**TITLE :** "Design and Simulation of a High-Gain, Low-Power Fully Differential Amplifier with Common-Mode Feedback for High-Speed ADCs"

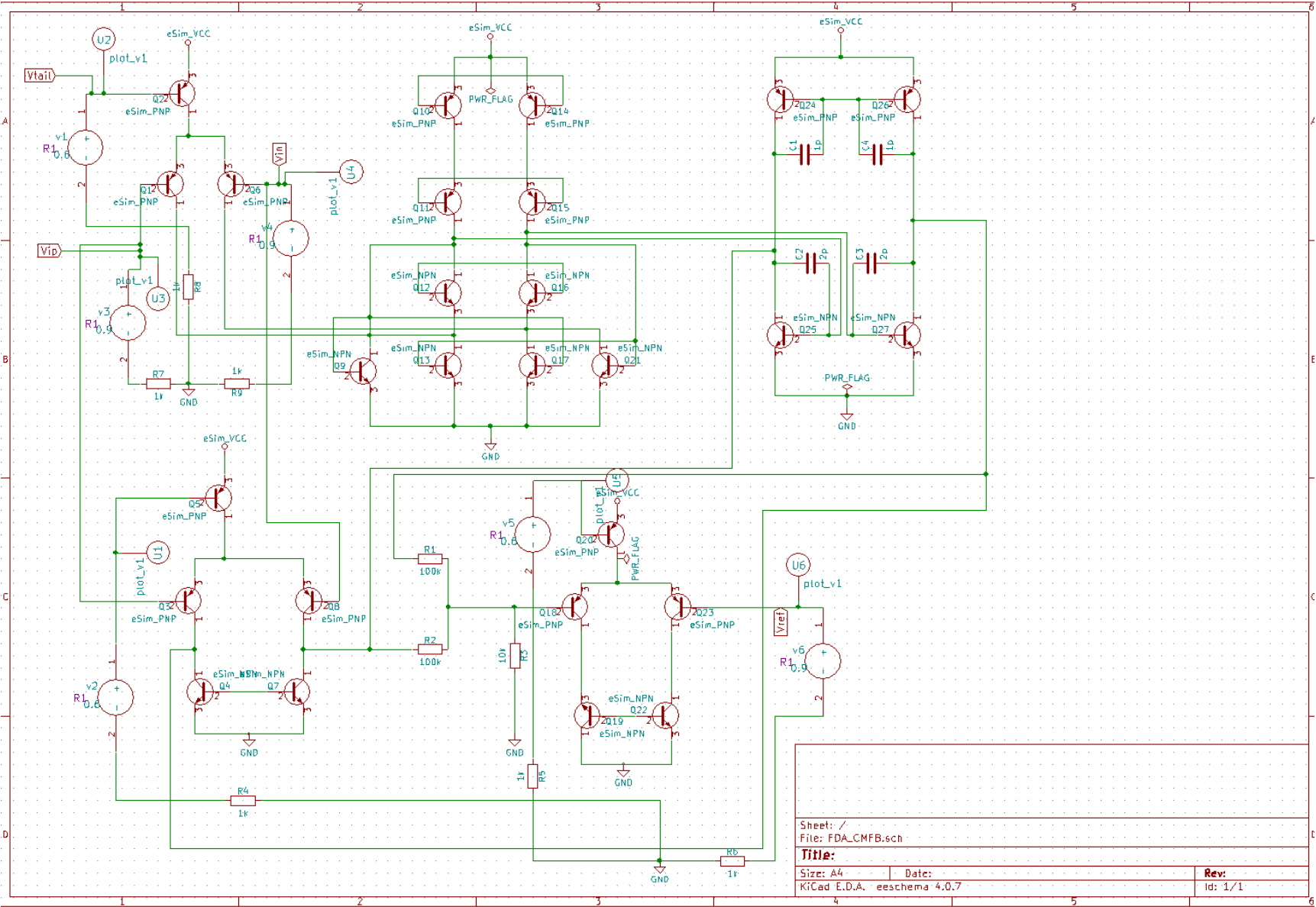
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**PROBLEM STATEMENT:** Design and simulate a fully differential amplifier (FDA) with common-mode feedback (CMFB) in a 180 nm CMOS process, optimizing for high gain (83 dB), low power (<1mW), and wide bandwidth (111 MHz). Compare performance metrics (GBW, phase margin, CMRR) with prior works to validate its suitability for high-speed analog-to-digital converters (ADCs).

**ABSTRACT :** This project presents the design and simulation of a high-gain, low-power FDA with CMFB for high-speed, high-precision ADC applications. The circuit employs a folded cascode input stage for wide common-mode range, a common-source output stage for low impedance, and a CMFB loop to stabilize the output DC level. Designed in a 180 nm CMOS process with a 1.8 V supply, the amplifier achieves a gain-bandwidth product (GBW) of 111 MHz, a differential DC gain of 83 dB, and a phase margin >60°. Simulations in eSim/NGSPICE validate robust performance across process corners, with Monte Carlo analysis confirming low noise and high linearity. The results demonstrate superior figure-of-merit (FOM) compared to existing designs, making it ideal for next-generation data converters.

**SCHEMATIC DIAGRAM:** A Circuit Schematic of a Fully Differential amplifier with common feedback consisting of the input stage, feedforward stage, CMFB stage and the output stagewith npn and pnp transistor using e-sim as shown below.



## **PUBLICATIONS:**

- 1. TITLE:** "A High-Gain, Low-Power Fully Differential Amplifier with CMFB for High-Speed ADCs"  
**AUTHOR:** Yi Zhang  
**CONFERENCE:** 2024 IEEE 7th International Conference on Automation, Electronics and Electrical Engineering (AUTEEE).  
**LINK:** [A High-Gain, Low-Power Fully Differential Amplifier with Common-Mode Feedback for High-Speed and High-Precision Analog-to-Digital Converters](#)
- 2. TITLE:** "Deep-Cryogenic Voltage References in 40-nm CMOS"  
**AUTHOR:** Homulle, H., Sebastiano, F., & Charbon, E.  
**JOURNAL:** IEEE Solid-State Circuits Letters, 2018.  
**LINK:** [Deep-Cryogenic Voltage References in 40-nm CMOS](#)
- 3. TITLE:** "Design of CMOS Fully Differential Multipath Two-Stage OTA"  
**AUTHOR:** Hashemi, Z., & Yargholi, M.  
**JOURNAL:** Integration, 2024.  
**LINK:** [Design of CMOS fully differential multipath two-stage OTA with boosted slew rate and power efficiency](#)