

Circuit Simulation Project

<https://esim.fossee.in/circuit-simulation-project>

Name of the participant :MADHUMITHA G

Title of the circuit :

DESIGN AND ANALYSIS OF CMOS TRANSIMPEDANCE AMPLIFIER WITH VOLTAGE AMPLIFICATION FOR HIGHER BANDWIDTH AND LOW NOISE LEVEL

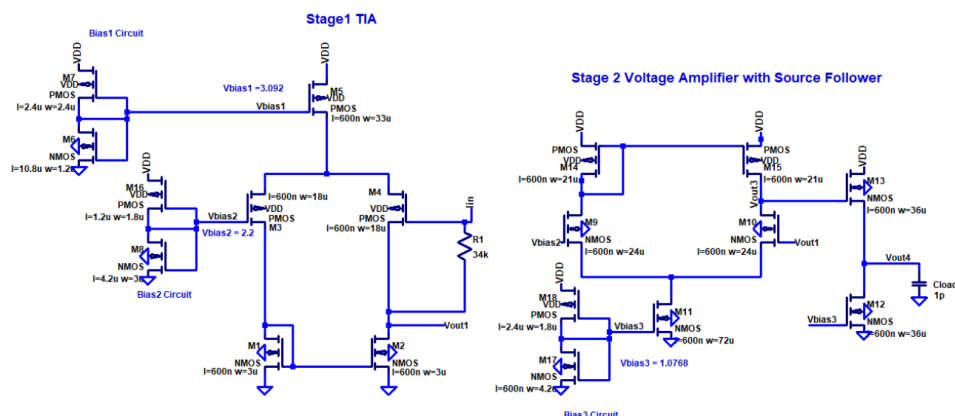
Theory/Description :

Avalanche photodiodes (APDs) are highly sensitive, high speed semiconductors that effectively convert light to electricity via the emission of free carriers when exposed to light. APD's have a wide range of applications including measuring distances, range finding, and as receivers in optical fiber communications where data is transmitted via pulses of light through an optical fiber. These applications include the need for transimpedance amplifiers to convert the current generated by the APD into a voltage.

EXPECTED DESIGN CRITERIA:

- Total gain: First Stage – 30k Ω (Transimpedance amplifier, TIA) and Second Stage 10–20x V/V ,nearly 300K to 600k total gain
- TIA Bandwidth minimum of 250 MHz
- Input referred noise: < 5 pA/ $\sqrt{\text{Hz}}$ but preferably 1.5 pA/ $\sqrt{\text{Hz}}$
- 1.5 – 2 V output

Circuit Diagram(s) :



Results (Input, Output waveforms and/or Multimeter readings) :

INPUT AND OUTPUT WAVEFORMS:

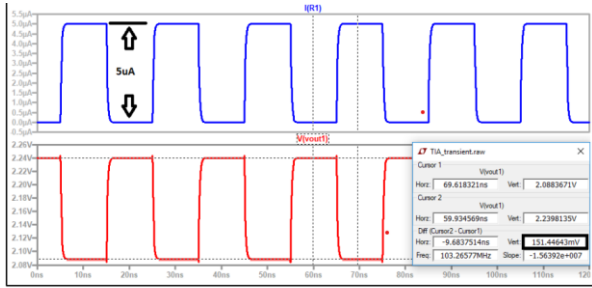


Figure 5 TIA transient analysis input current with output voltage

TRANSIENT ANALYSIS:

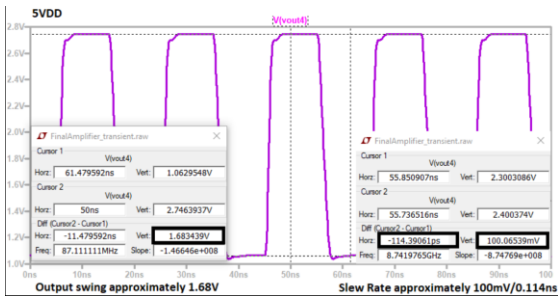


Figure 14 Final design transient response

FREQUENCY RESPONSE PLOT:

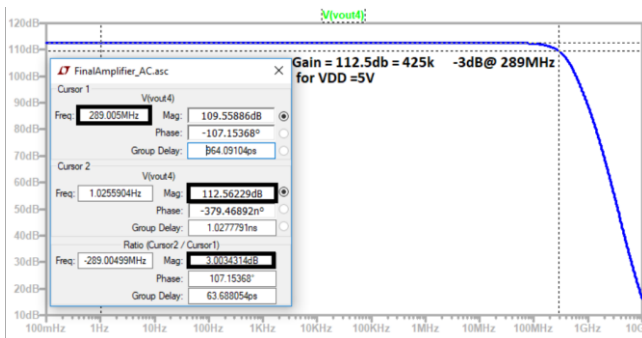


Figure 13 AC response for 5V power supply with 1pF load

Source/Reference(s) :

- Title of the paper: CMOS TRANSIMPEDANCE AMPLIFIER
- Author(s): ERIC MONAHAN
- Link: https://cmosedu.com/jbaker/students/eric/CMOS_TIA.pdf