

Note: Use the device parameters and spice models given in the class handout

Design an amplifier which will be used as a programmable-gain element in the analog to digital converter shown in Figure 1. Your amplifier must meet the following specs:

1. Single sided supply between 2 and 5.5V.
2. Input between 0 and 1V
3. Output to within 0.3V of the supply rails.
4. 1pF capacitive load.
5. Digitally controlled gain of 1, 2, 4, 8, or 16, accurate to 0.1% assuming perfect capacitors
6. Phase margin >45 degrees under all gain settings

Projects are to be done individually by students. You are encouraged to discuss your ideas with other students, and help each other with your designs, but there are limits. **Do** help each other debug SPICE problems, but **Don't** share SPICE decks. **Do** work together on topologies, formulas, and design ideas, but **Don't** jointly agree on what all the saturation voltages, drain currents, and W/L values should be.

The report format must be as follows:

Cover page (1 page)

Your name and SID, followed by a short datasheet with the specified performance, your hand-calculated performance, SPICE simulated performance, and a reference to the page number where the supporting documentation (SPICE decks & plots, analysis) can be found.

Schematic diagram (1 page)

Annotated with W/L, V_{dsat} , and I_d for all devices.

Supporting documentation (no page limit, but please keep it concise and clear!)

Prove to me that your claims on page 1 are true. In a real datasheet, this would be done using measurements – we'll just rely on SPICE.

Grading

Meeting performance specifications

Accuracy of hand calculations vs. simulation

Figure of merit: (unity-gain BW)/(total supply current)

Early turn-in bonus: 10% extra credit if turned in by Friday 12/9/05 at 5pm.

