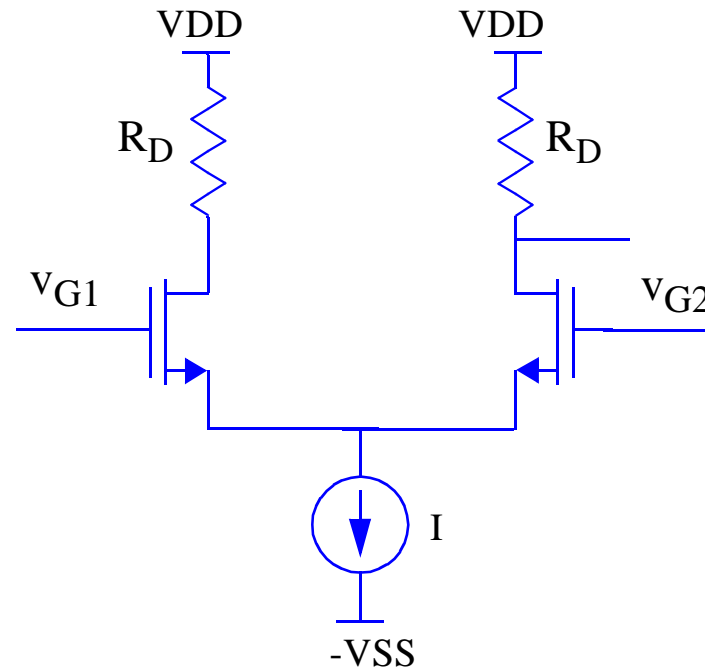


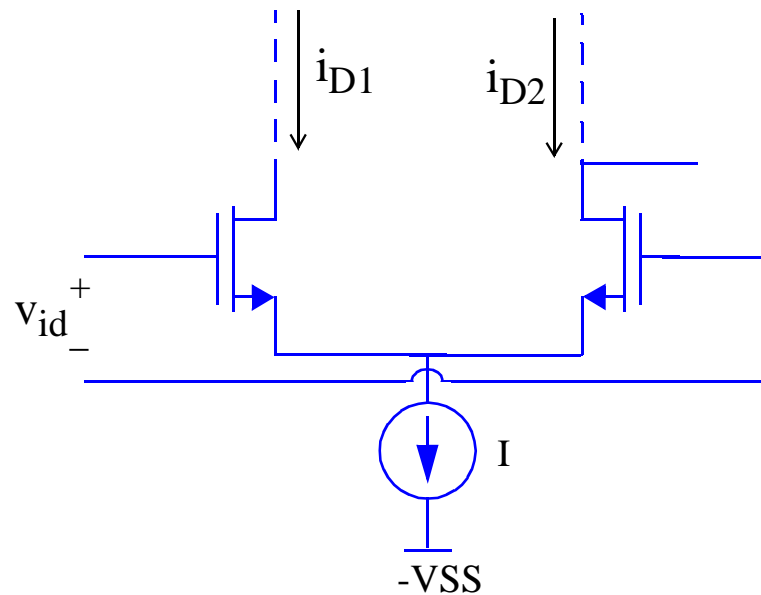
Basic FET Differential Amplifier

- R_D 's are chosen to maintain transistors in saturation
- V_S takes on whatever value is necessary so that currents sum to "I" with given input voltages

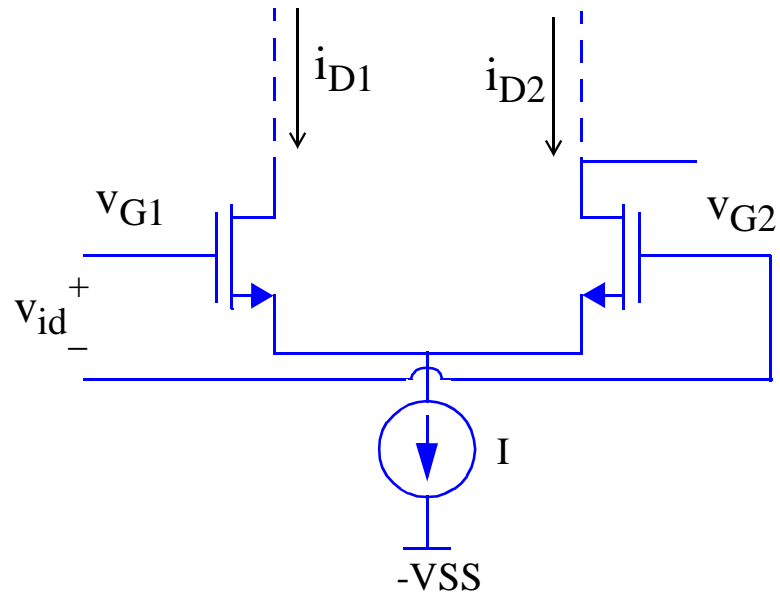


Basic FET Differential Amplifier

- In general we'd consider body effect, but we're ignoring it here
- Assume perfectly matched transistors

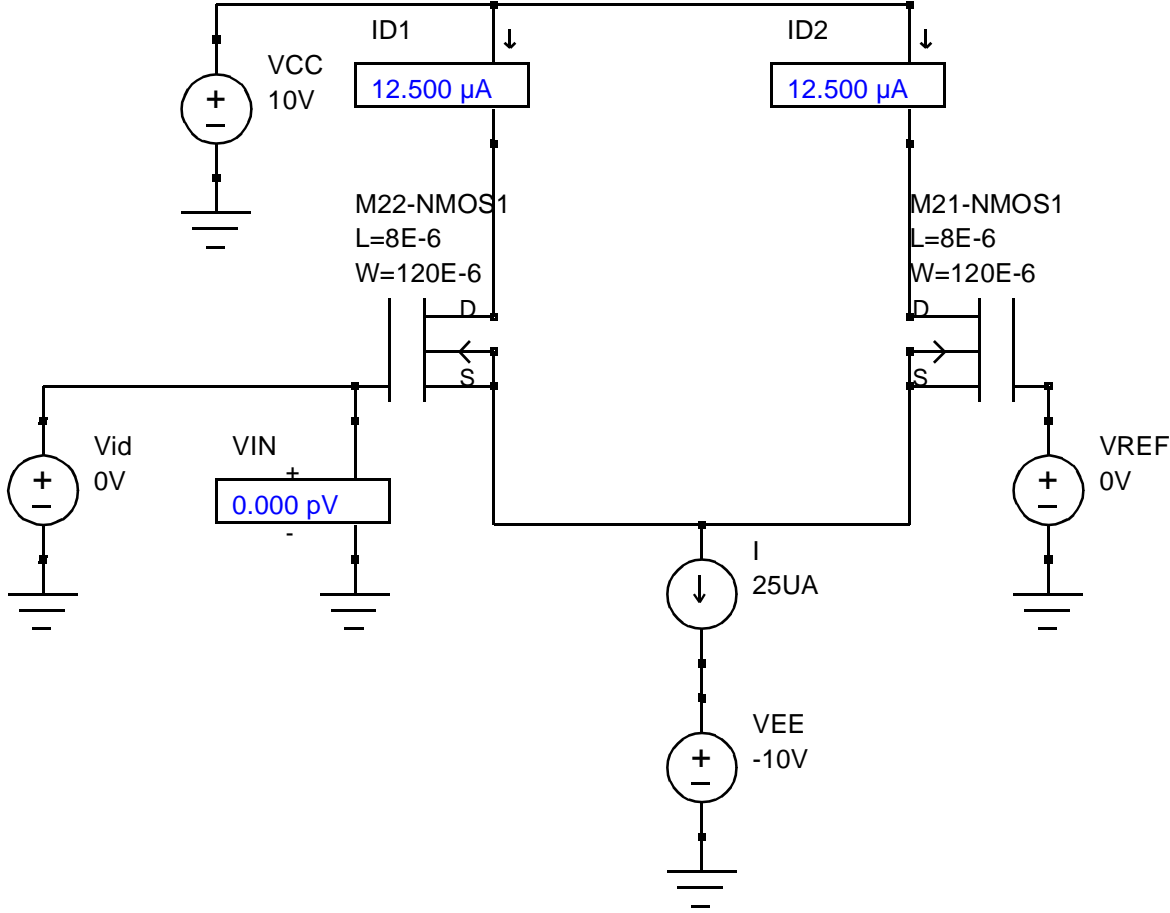


Large Signal Response



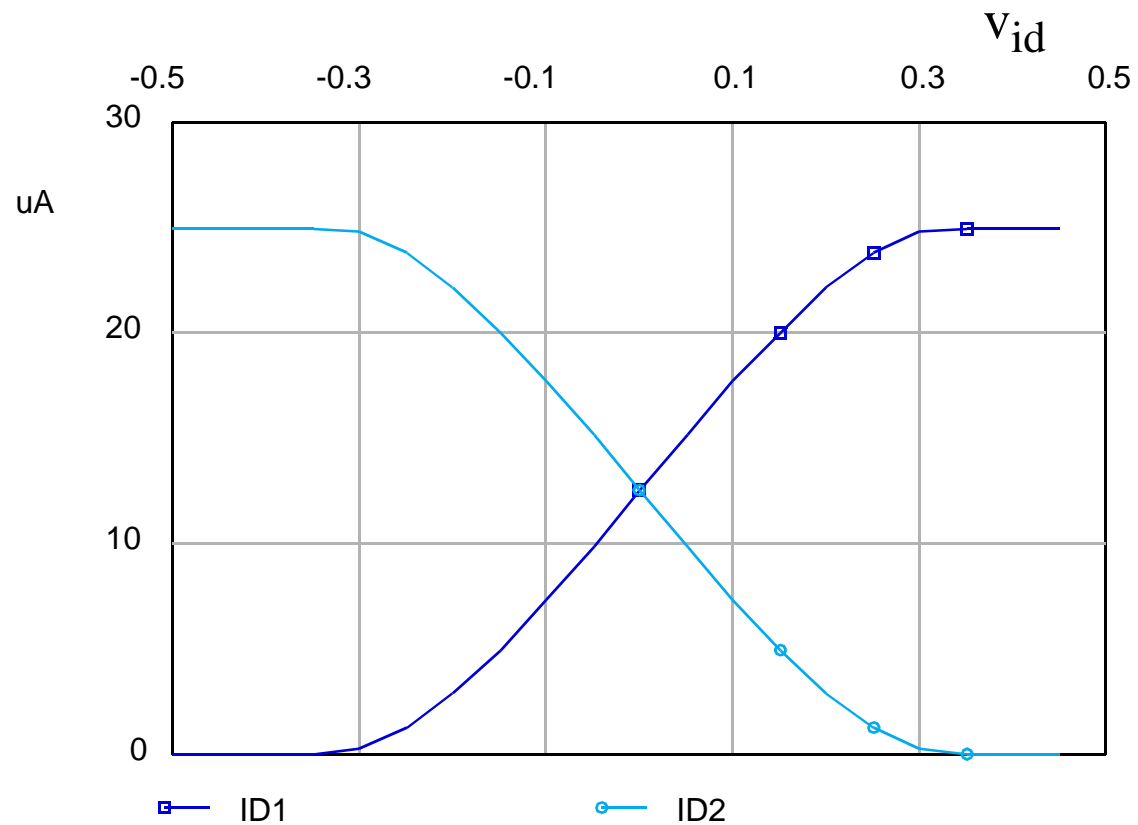
Large Signal Response

Switch Example



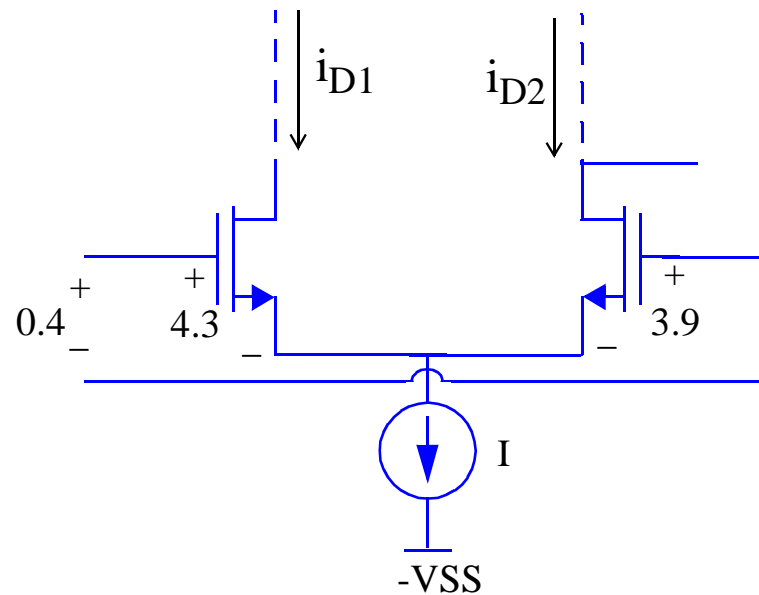
dc Characteristic

- The differential amplifier behaves like a current switch
- What is the slope of these curves an indication of?



dc Bias Point

- As we did with BJT differential amplifiers, we can consider the dc voltage and ac changing inputs separately

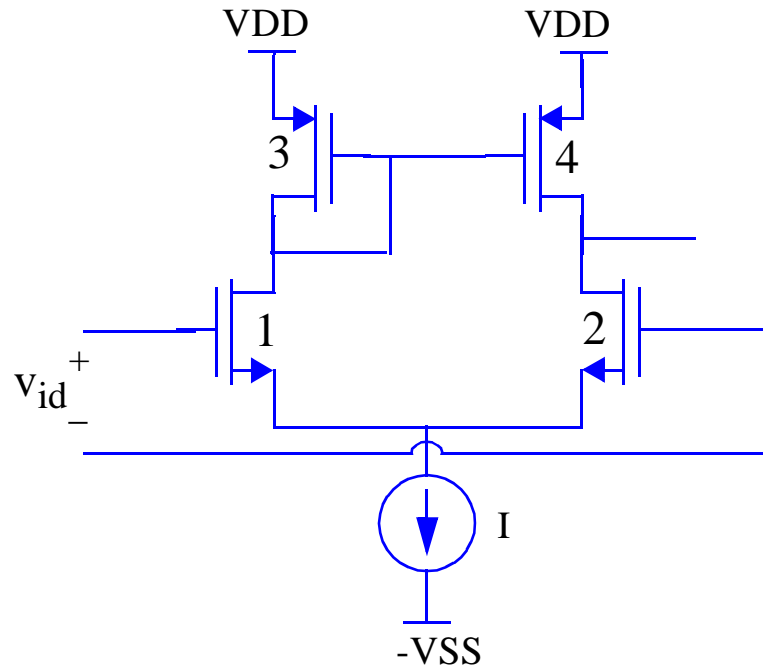


Small Signal ac Response

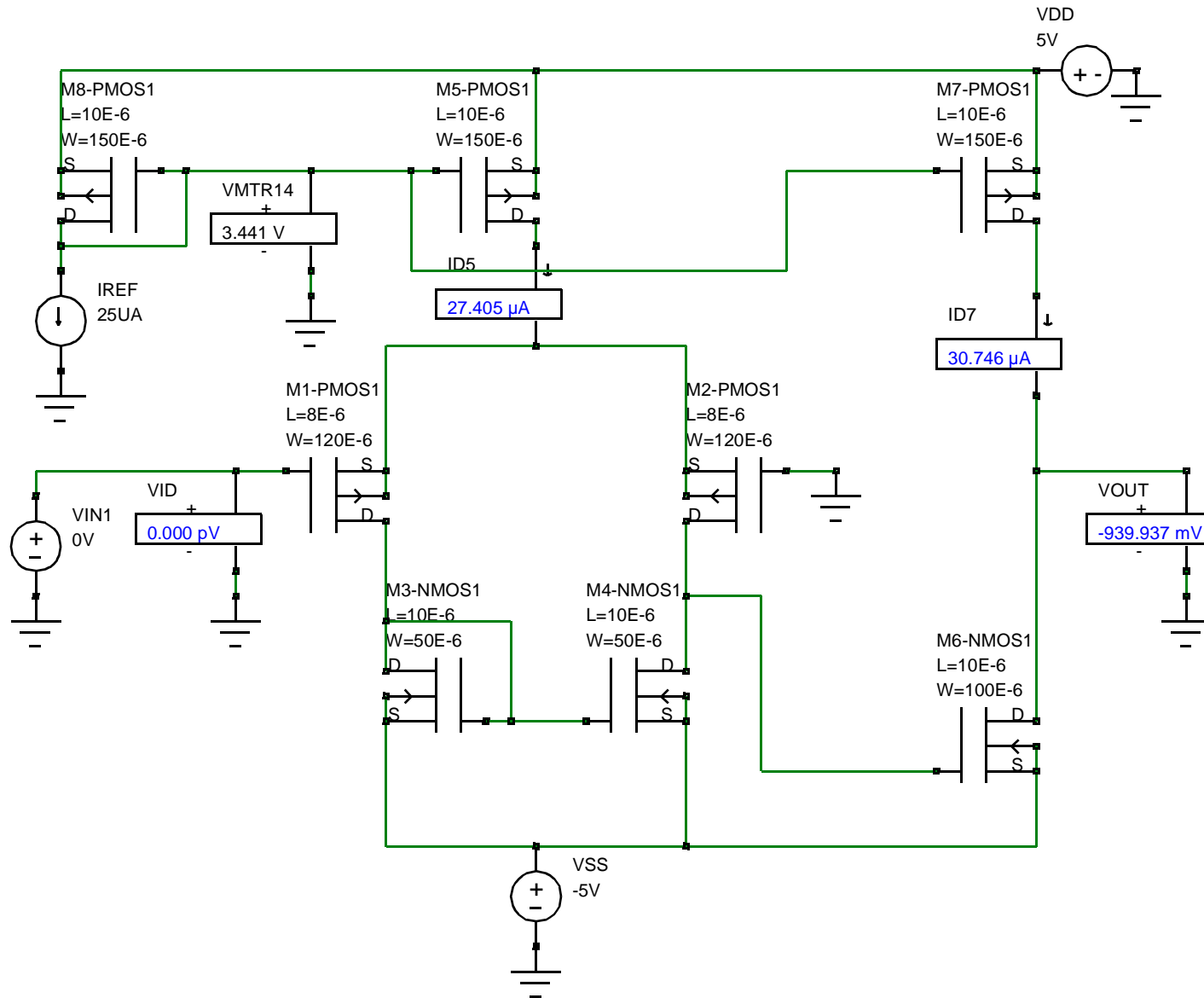
$$i_{D1} = \frac{I}{2} + \sqrt{2KI} \cdot \frac{v_{id}}{2} \cdot \sqrt{1 - \frac{(v_{id}/2)^2}{I/(2K)}} \quad i_{D2} = \frac{I}{2} - \sqrt{2KI} \cdot \frac{v_{id}}{2} \cdot \sqrt{1 - \frac{(v_{id}/2)^2}{I/(2K)}}$$

Active Loads

- MOS diff amp loads are generally transistors on ICs



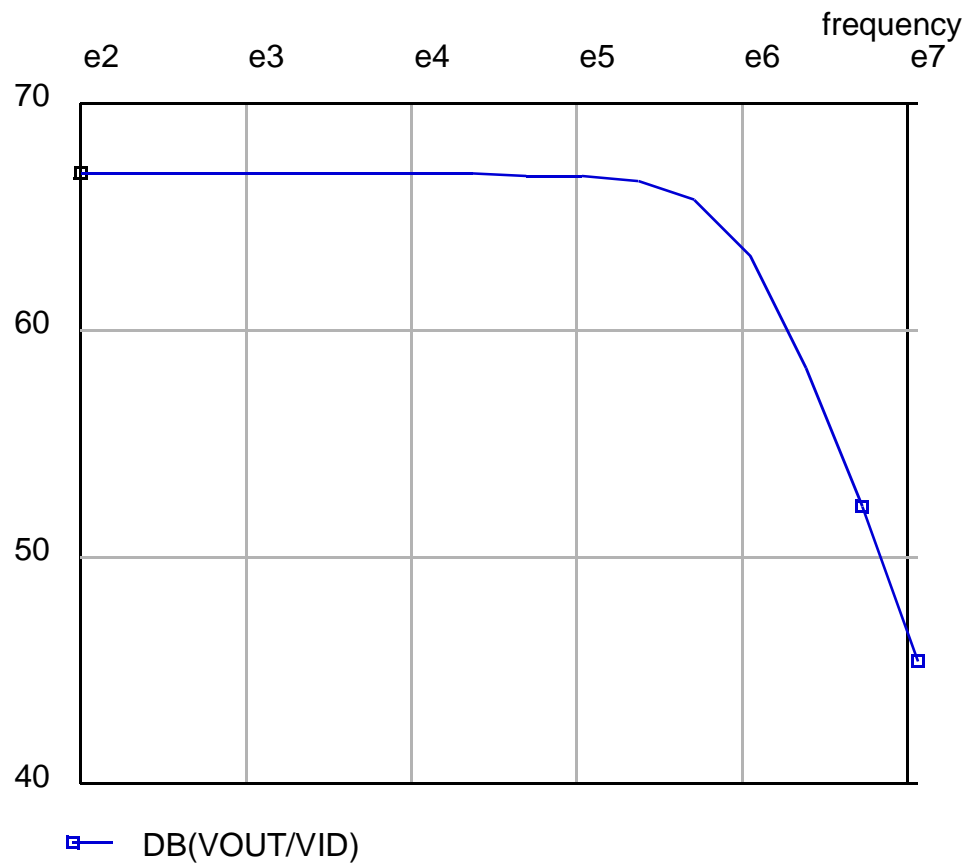
Two Stage OpAmp



Two Gain Stages

Two Stage OpAmp

- The overall gain is the product of the two stage gains



Compensation

