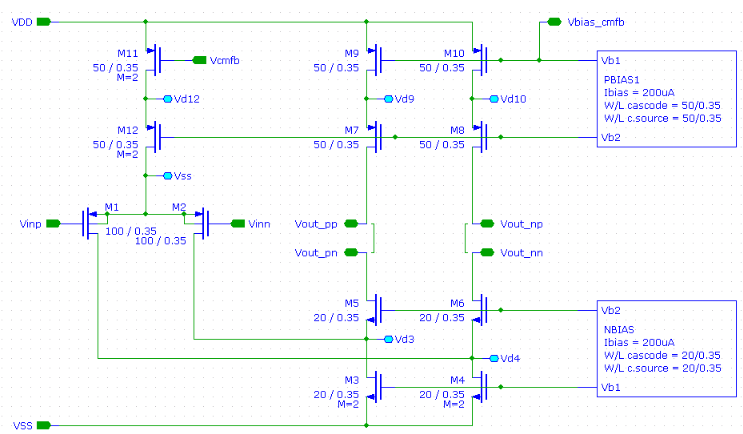
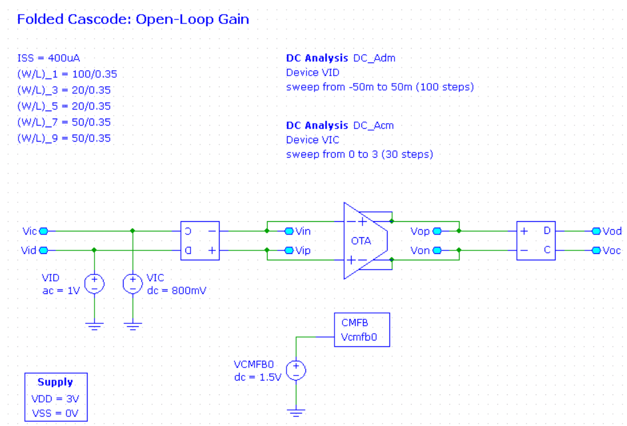
Folded Cascode

- Good general purpose OTA
- Analysis
  - Bias
  - Gain
  - Input capacitance
  - Frequency response
  - Feedback, stability
  - Settling time
  - Noise
  - Common-Mode Feedback
- Design
  - Specifications
  - Circuit parameters

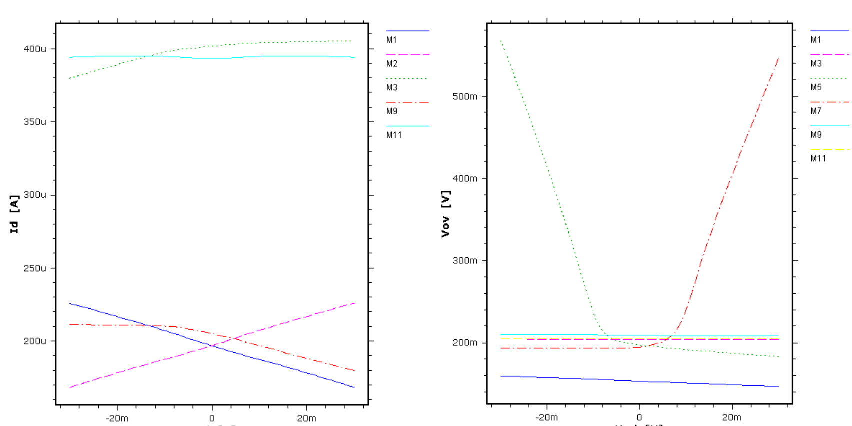
Schematic



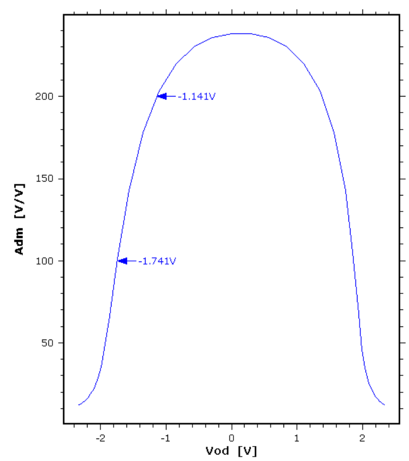
DC Gain, Bias



Bias … Differential Inputs

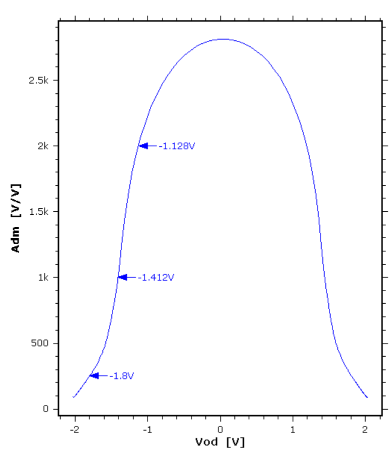


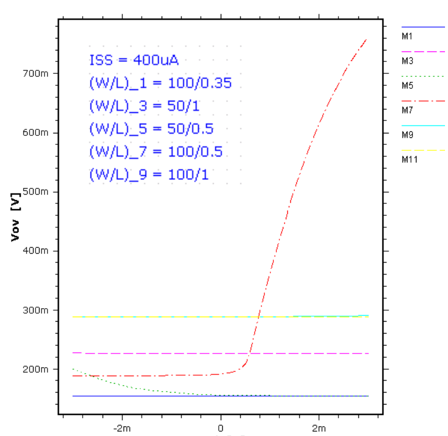
Low Frequency Gain, A_{dm}



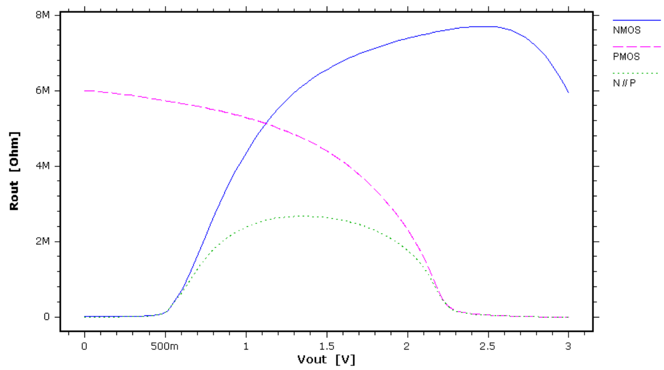
- Gain / Output Range tradeoff
- Increasing A_{dm}:
  - Moderate:
    - Increase L
    - Affects V_{ov}, phase margin
  - Substantial:
    - Double Cascode
    - Gain boosting
    - Multi-stage cascade

Increased A_{dm}



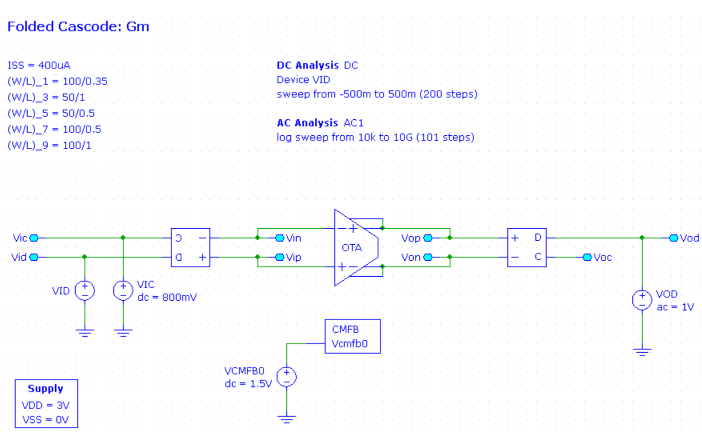


Output Resistance

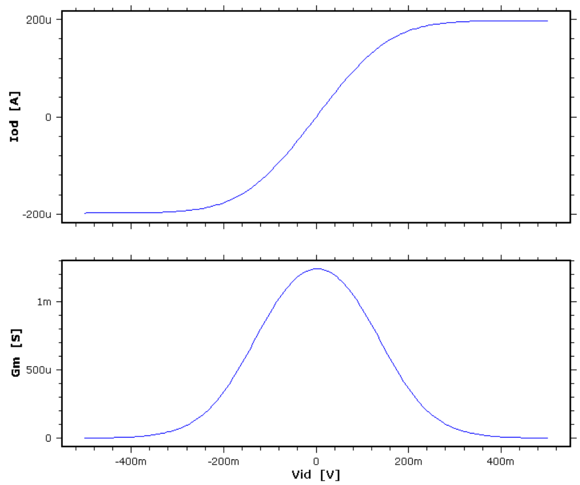


Beware of imbalance between NMOS and PMOS current source

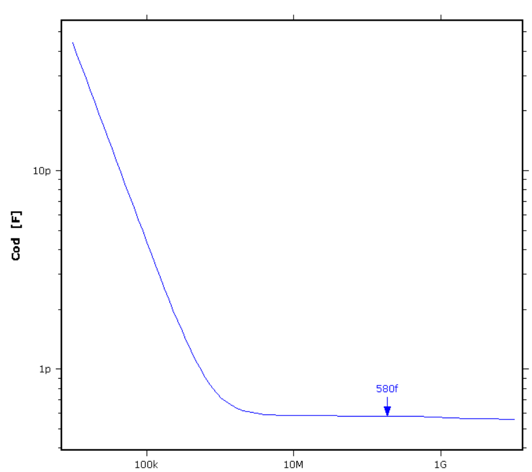
Gm, Cod Test Circuit



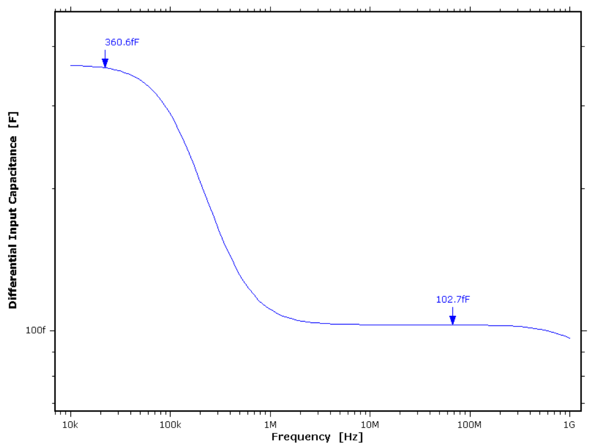
Transconductance



Differential Output Capacitance



Differential Input Capacitance



C_{GS1}
$= 2/3\ C_{ox}\ W\ L$
$= 117$ fF

Miller effect significantly increases C_{id} at low frequency

Cascoding M1, M2 helps (at the expense of reduced input common-mode range)

Frequency Response (A_{dm})