

ECE 523/421 – Analog Electronics

Lecture 8: Analog IC Building Blocks: Current Sources

Payman Zarkesh-Ha

Office: ECE Bldg. 230B

Office hours: Tuesday 2:00-3:00PM or by appointment

E-mail: pzarkesh@unm.edu

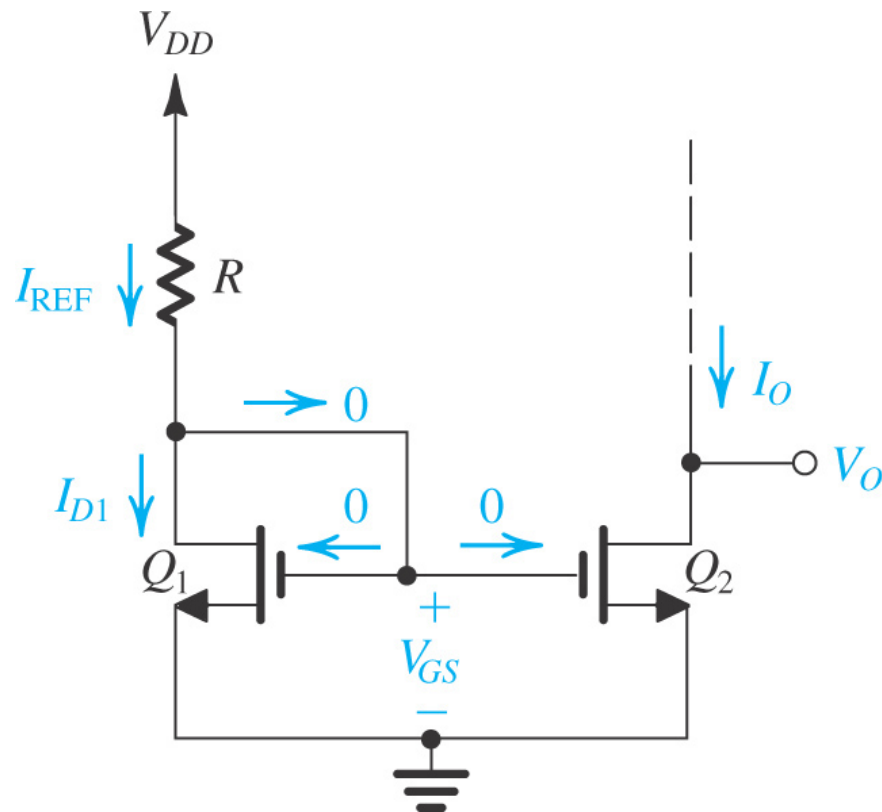
Review of Last Lecture

- ☐ **Cascode Amplifiers and Current Sources**
- ☐ **Cascode in CMOS, BJT, and BiCMOS**

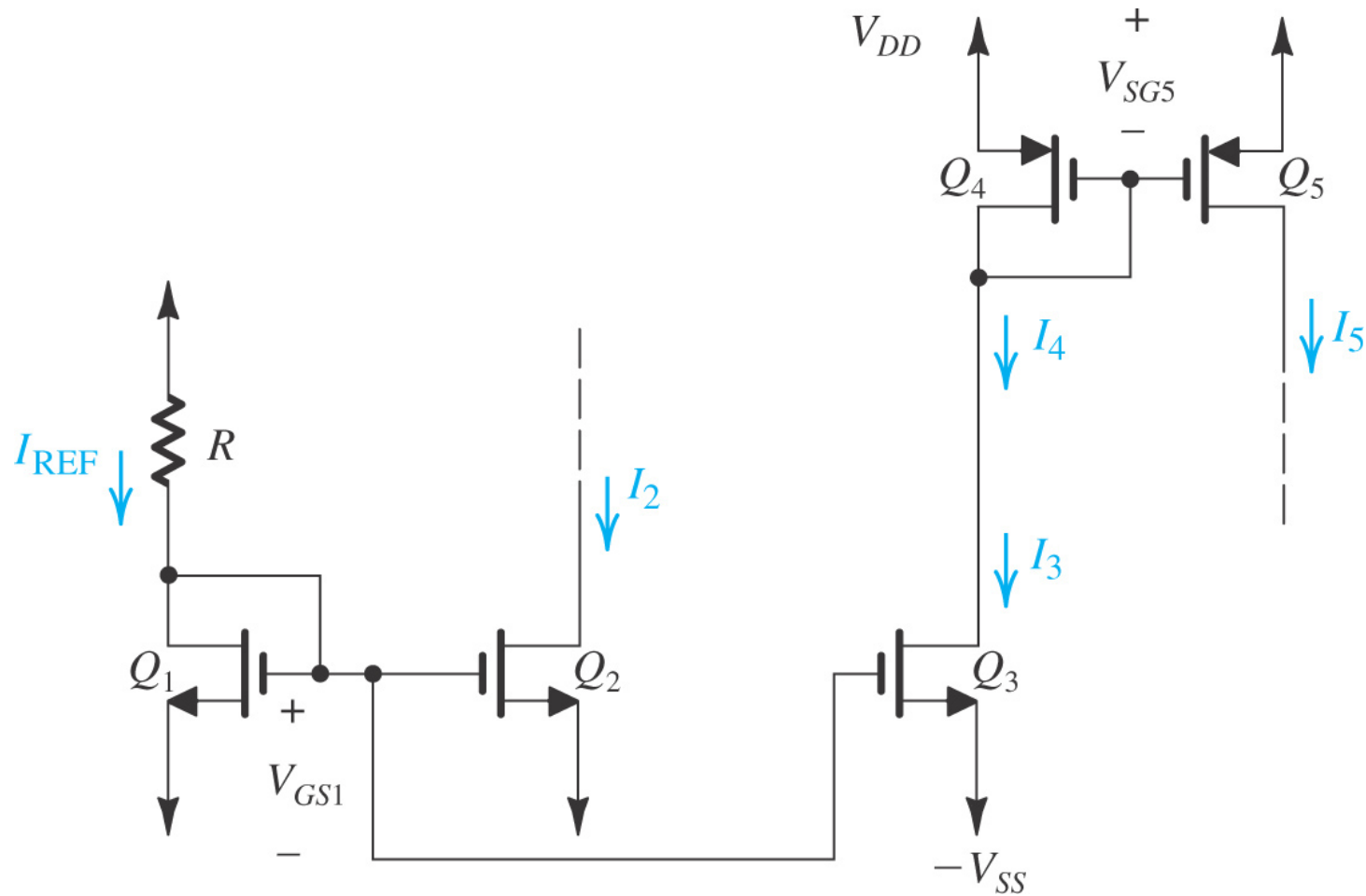
Today's Lecture

- ☐ **Current Mirror Circuits**
- ☐ **Current Steering Circuits**

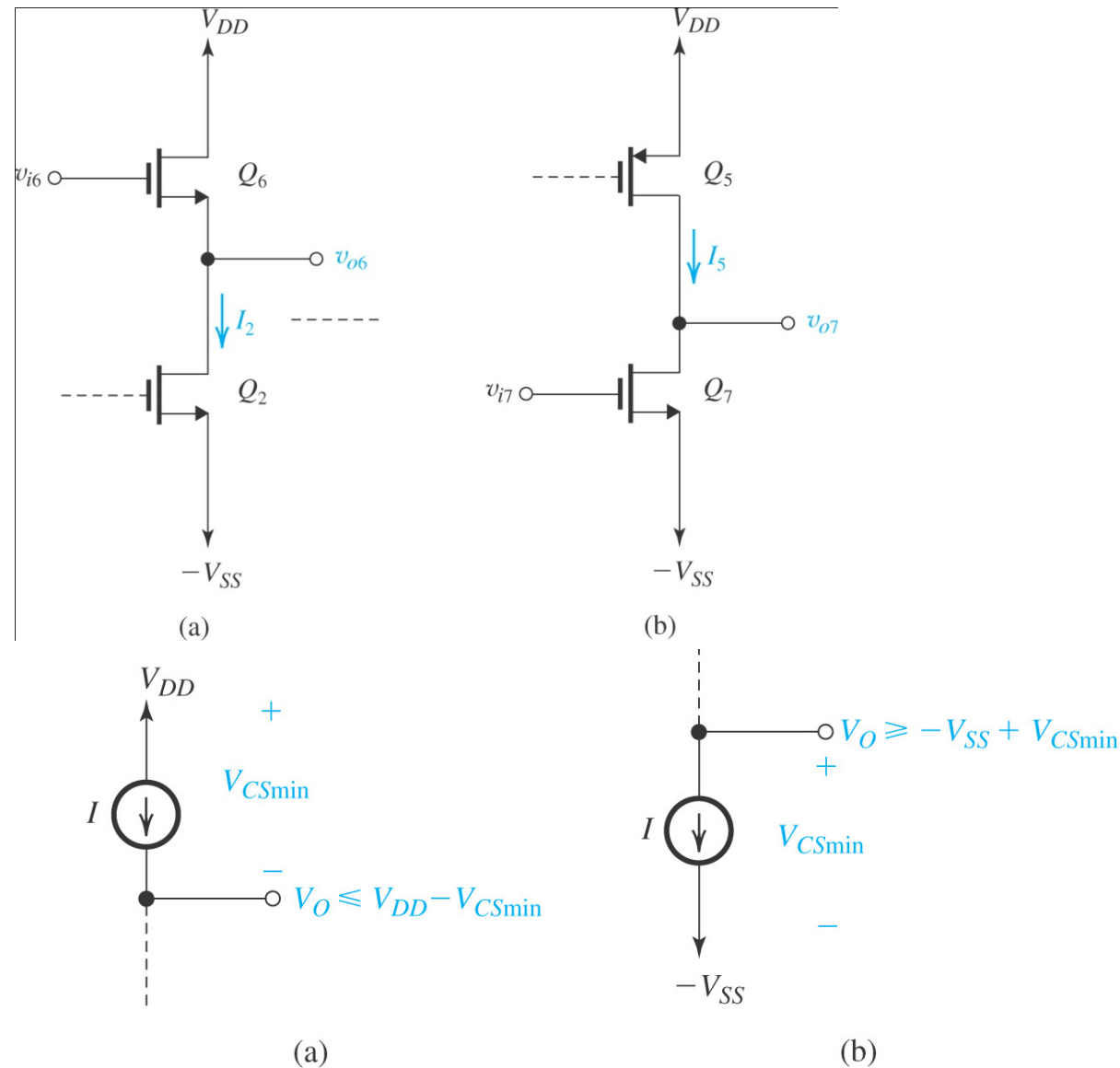
Current Mirror / Current Source



Current Steering Circuits

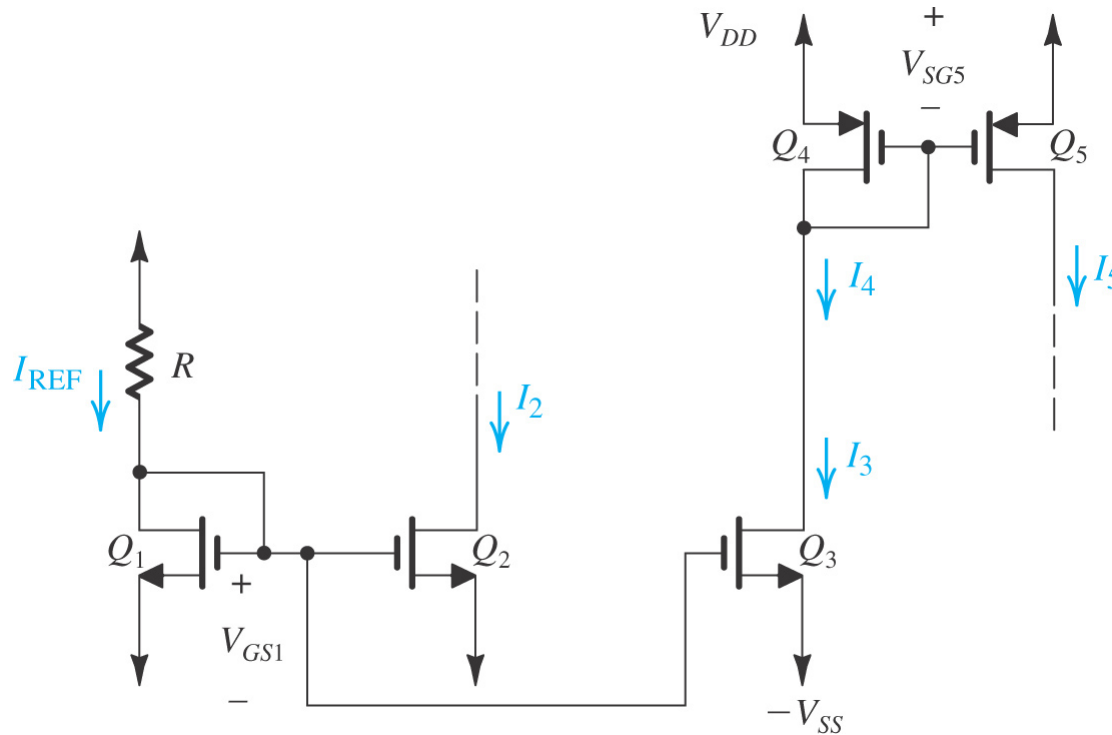


Example: Current Source Design

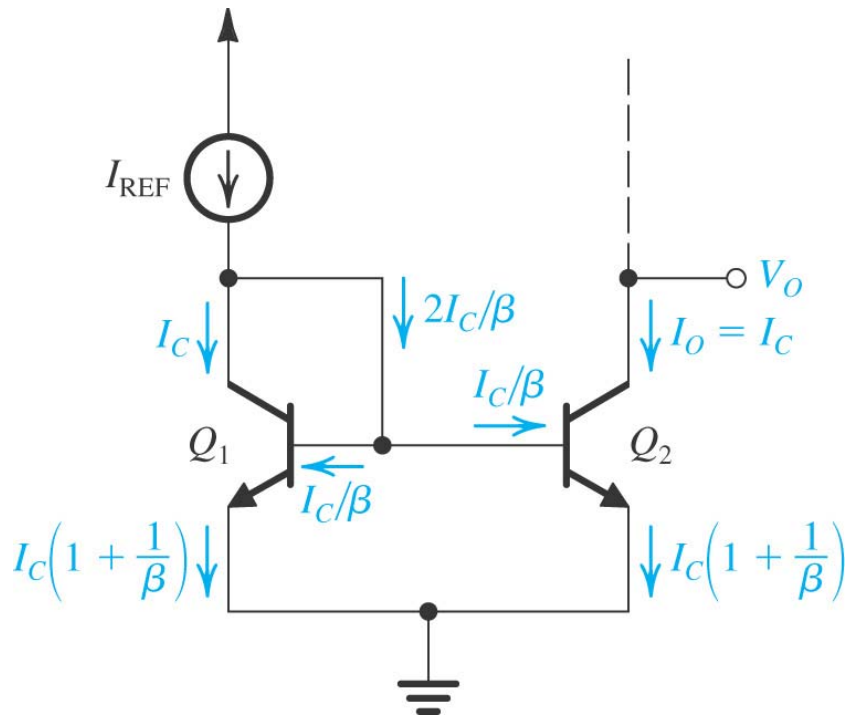


Example: CMOS Current Steering

- 1) For the following current steering circuit let $V_{DD}=V_{SS}=1.5\text{ V}$, $V_{tn}=0.6\text{ V}$, $V_{tp}=-0.6\text{ V}$, all channel lengths $=1\text{ }\mu\text{m}$, $k'_n=200\mu\text{A/V}^2$, $K'_p=80\mu\text{A/V}^2$, $\lambda=0$. For $I_{REF}=10\mu\text{A}$ find the width of all transistors such that $I_2=60\mu\text{A}$, $I_3=20\mu\text{A}$, and $I_5=80\mu\text{A}$, considering that $V_{CSmin}=0.2\text{V}$ for Q_2 and Q_5 .

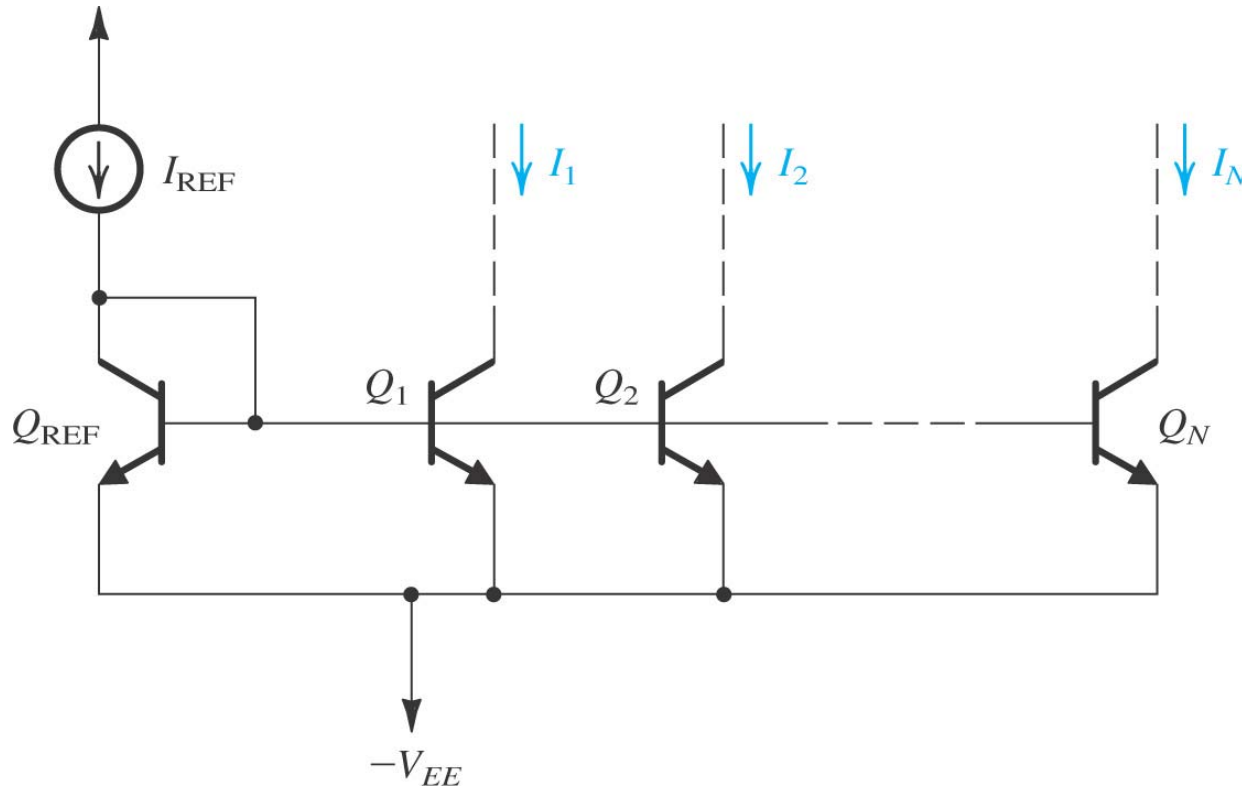


Bipolar Current Mirror



$$I_O = I_{REF} \left(\frac{m}{1 + \frac{m+1}{\beta}} \right) \left(1 + \frac{V_O - V_{BE}}{V_{A2}} \right)$$

N Output Bipolar Current Mirror



$$I_1 = I_2 = \dots = I_N = \frac{I_{REF}}{1 + \frac{N+1}{\beta}}$$

Bipolar Current Steering Circuit

