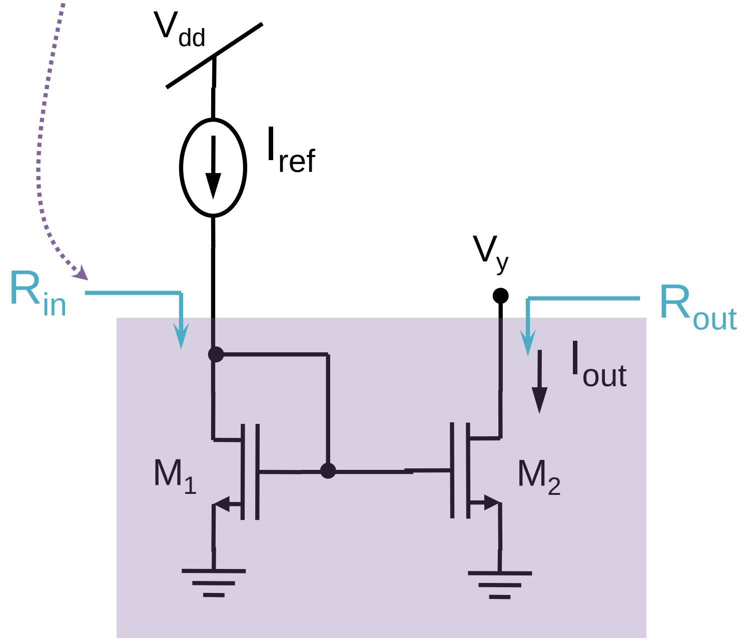
Basic Current Mirror → Chp #7

- MOS Based

* Remember $I_D = \frac{K_n'}{2}\frac{W}{L}(V_{GS} - V_{th})^2(1 + \lambda V_{DS})$

* Assume $\mu_{01} = \mu_{02}$, $V_{th_1} = V_{th_2}$ } M_1 & M_2 matched transistors!



$$\left(W/L\right)_2 = N \cdot \left(W/L\right)_1$$

DC Behavior

$$\frac{I_{out}}{I_{ref}} = \frac{(W/L)_2}{(W/L)_1}\frac{(1 + \lambda V_{ds2})}{(1 + \lambda V_{ds1})}$$

Gain error due to channel length modulation!

$\lambda = 0$

$$\frac{I_{out}}{I_{ref}} \approx \frac{(W/L)_2}{(W/L)_1} = N$$

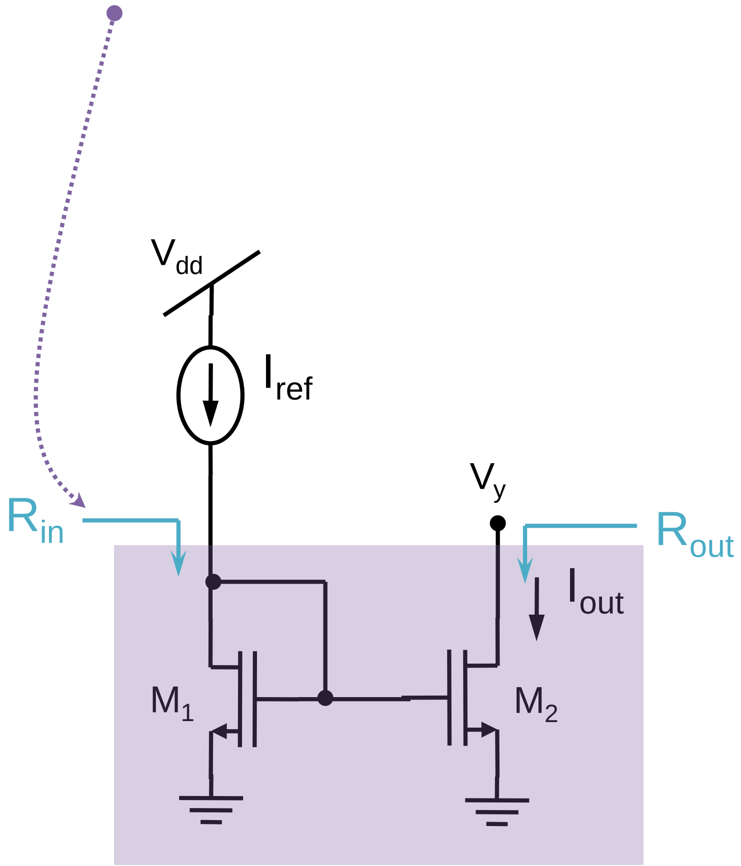
AC Behavior

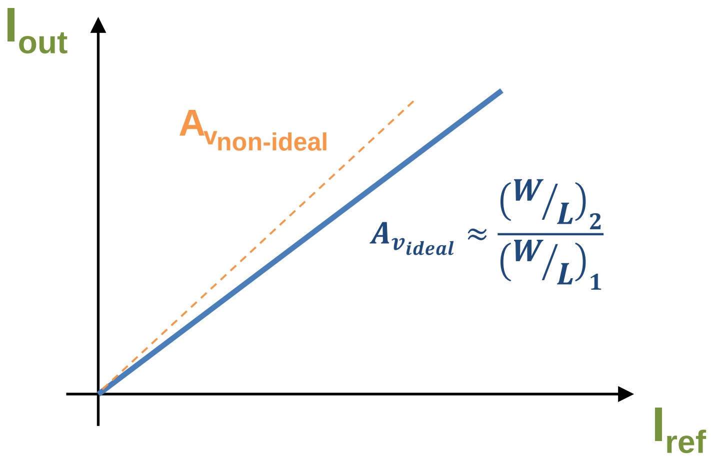
$$R_{in} = \frac{1}{g_{m1}}$$

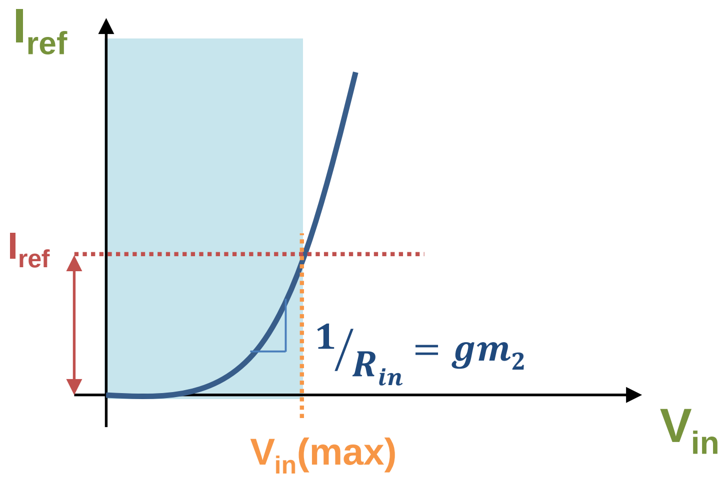
$$R_{out} = r_{02}$$

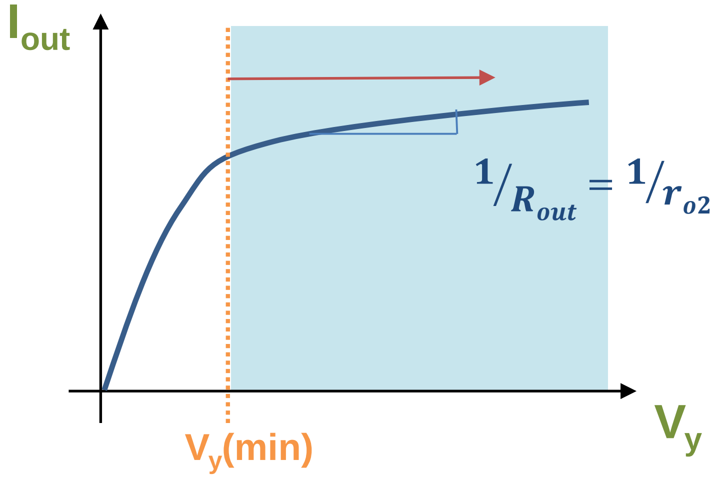
$$A_i \approx \frac{(W/L)_2}{(W/L)_1}$$

MOS Current Mirror







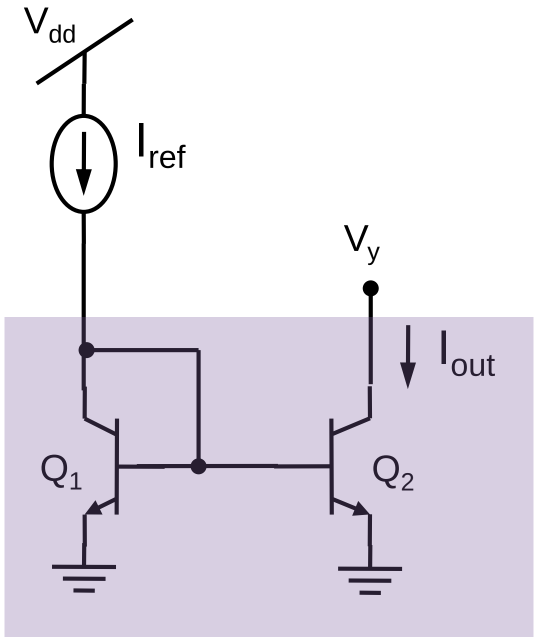


Basic Current Mirror

- BJT Based

* Remember $I_C = I_S e^{\frac{V_{BE}}{V_T}}\left(1 + \frac{V_{CE}}{V_A}\right)$

$I_S \propto A_E$



$A_{E2} = N \cdot A_{E1}$

DC Behavior

$$\frac{I_{out}}{I_{ref}} = N \cdot \frac{1}{\left(1 + \frac{N+1}{\beta}\right)}$$

Gain error due to non-zero base currents

$\beta = \infty$

$$\frac{I_{out}}{I_{ref}} \approx \frac{A_{E2}}{A_{E1}} = N$$

AC Behavior

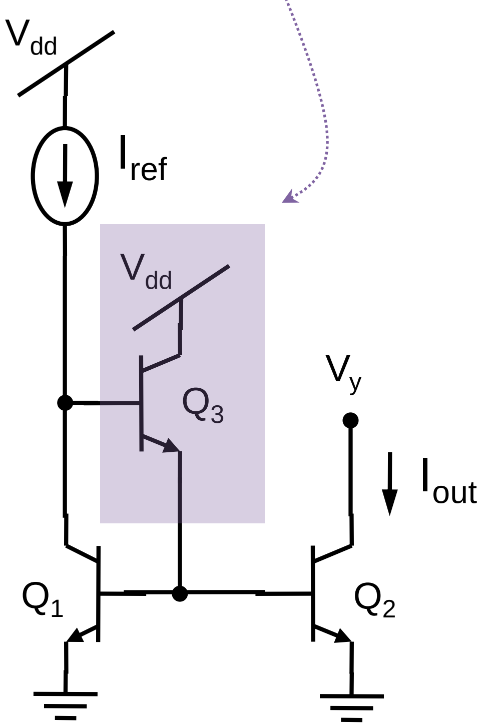
$$R_{in} = \frac{1}{g_{m1}}$$

$$R_{out} = r_{02}$$

$$A_i \approx \frac{A_{E2}}{A_{E1}}$$

BJT Current Mirror

- β Compensation



DC Behavior

$$\frac{I_{out}}{I_{ref}} = N \cdot \frac{1}{\left(1 + \frac{N+1}{\beta(\beta+1)}\right)}$$

Beta effective is much larger!

$\beta = \infty$

$$\frac{I_{out}}{I_{ref}} \approx \frac{A_{E2}}{A_{E1}} = N$$

Comparison