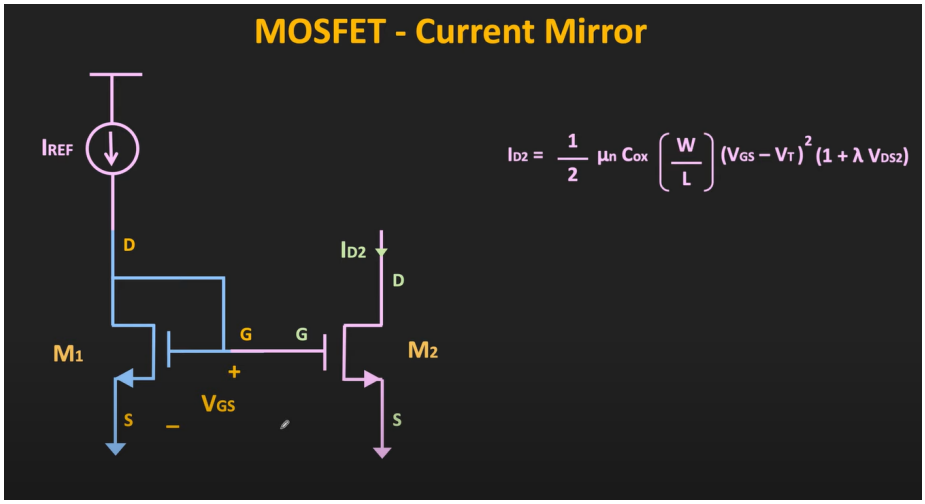
# 1 Working of a Regular Current Mirror

Useful Youtube Video




I want to point out that the regular current mirror, M1 is diode connected so it always stays in saturation. Its drain current equation without channel length modulation ($\lambda = 0$) is

$$V_G = V_D$$
$$I_{D1} = \frac{1}{2}\mu_n C_{ox}\,(W/L)\,(V_{DS} - V_t)^2$$

We see that the free variables are $I_{D1}$ and $V_{DS}$, current source $I_{REF}$ is used to set $I_{D1}$, which sets $V_{DS}$, which sets $V_G$. On the other side, M2's drain current ($\lambda = 0$) is

$$I_{D2} = \frac{1}{2}\mu_n C_{ox}\,(W/L)\,(V_{GS} - V_t)^2$$

The only moving variable is $V_{GS}$. This is saying that $I_{D2}$ can be set by $V_G$ only, and M2's drain current doesn't depend on $V_{DS}$ of M2!!
However this is no longer true once channel length modulation is introduced. $\lambda$ brings a small deviation when setting $I_{D2}$ to be our $I_{REF}$, but it's still pretty close.