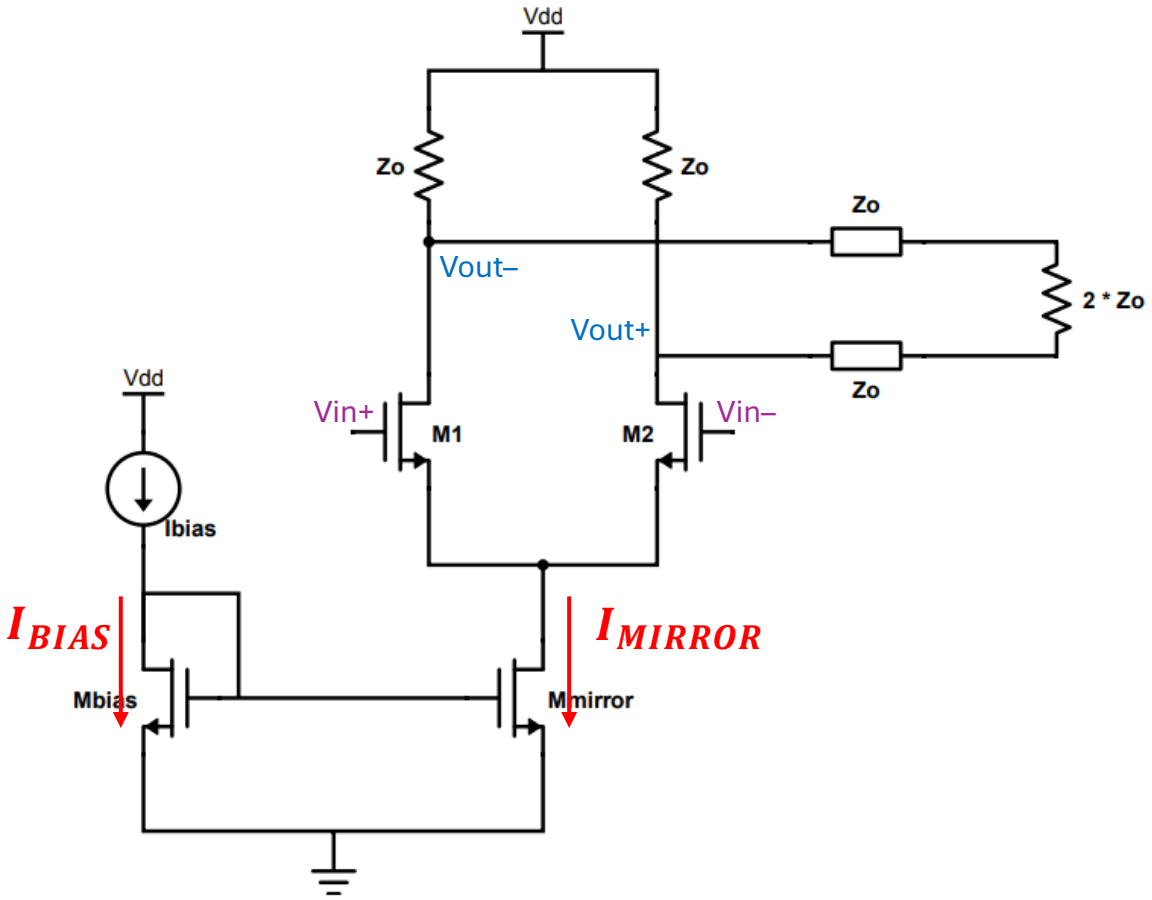
Tx Driver - CML

Notes on devices’ initial sizing

Notes

- Start with DC Analysis.
  a) Set $V_{IN+} = V_{dd}$ & $V_{IN-} = \mathrm{GND}$.
  b) Ensure that $I_{MIRROR} = I_{BIAS}$.



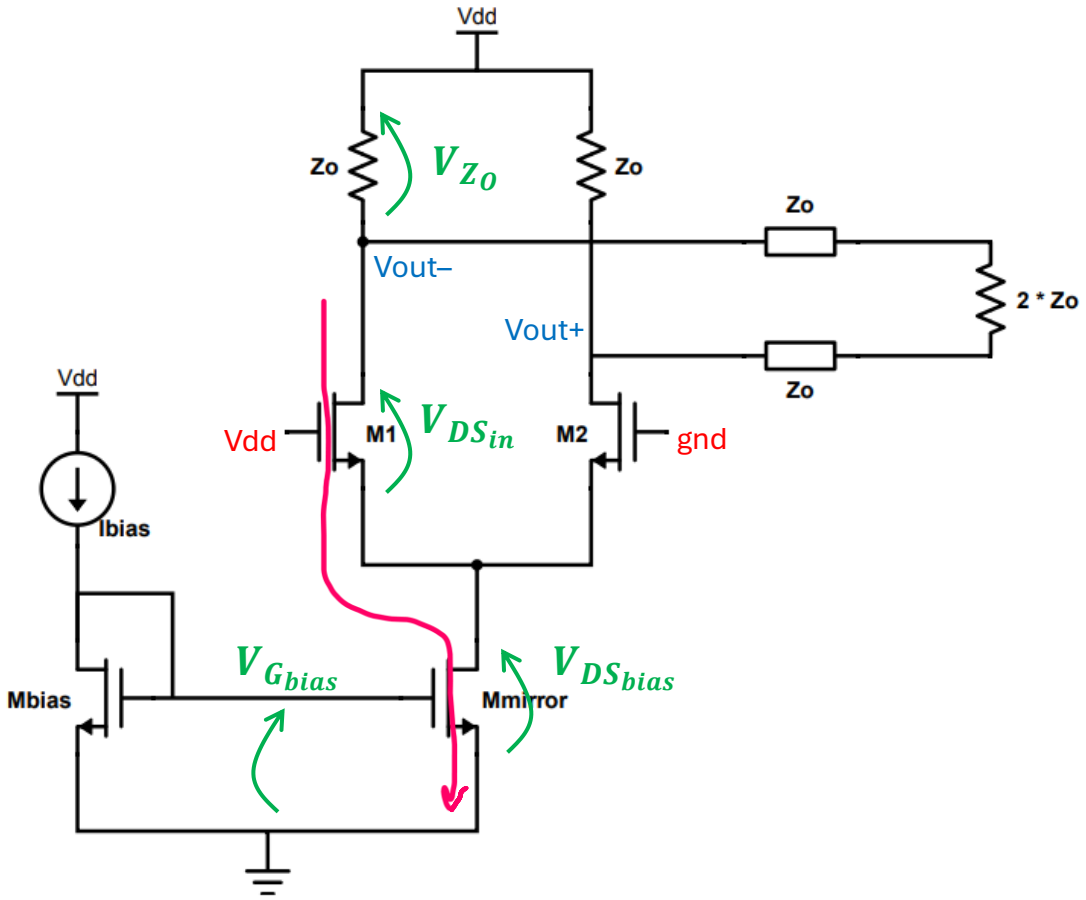
$$Z_O = 50\ \Omega$$

$$V_{Swing_{(pk2pk)}} = 500\ mV$$

$$I_{BIAS} = \frac{500\ mV}{50\ \Omega} = \mathbf{10\ mA}$$

Notes

- Start with DC Analysis.
  a) Set $V_{IN+} = V_{dd}$ & $V_{IN-} = \text{GND}$.
  b) Ensure that $I_{MIRROR} = I_{BIAS}$.
  c) Ensure there's no headroom issue.



We want M_{mirror} to be in SAT:

- $V_{DS_{bias(MIN)}} = V_{G_{bias}} - V_{th}$
- $V_{DS_{bias}} = V_{DD} - (I_{BIAS} * Z_O) - V_{DS_{in}}$
  - $\boxed{V_{DS_{in}} < V_{DD} - (I_{BIAS} * Z_O) - V_{DS_{bias(MIN)}}}$

Notes

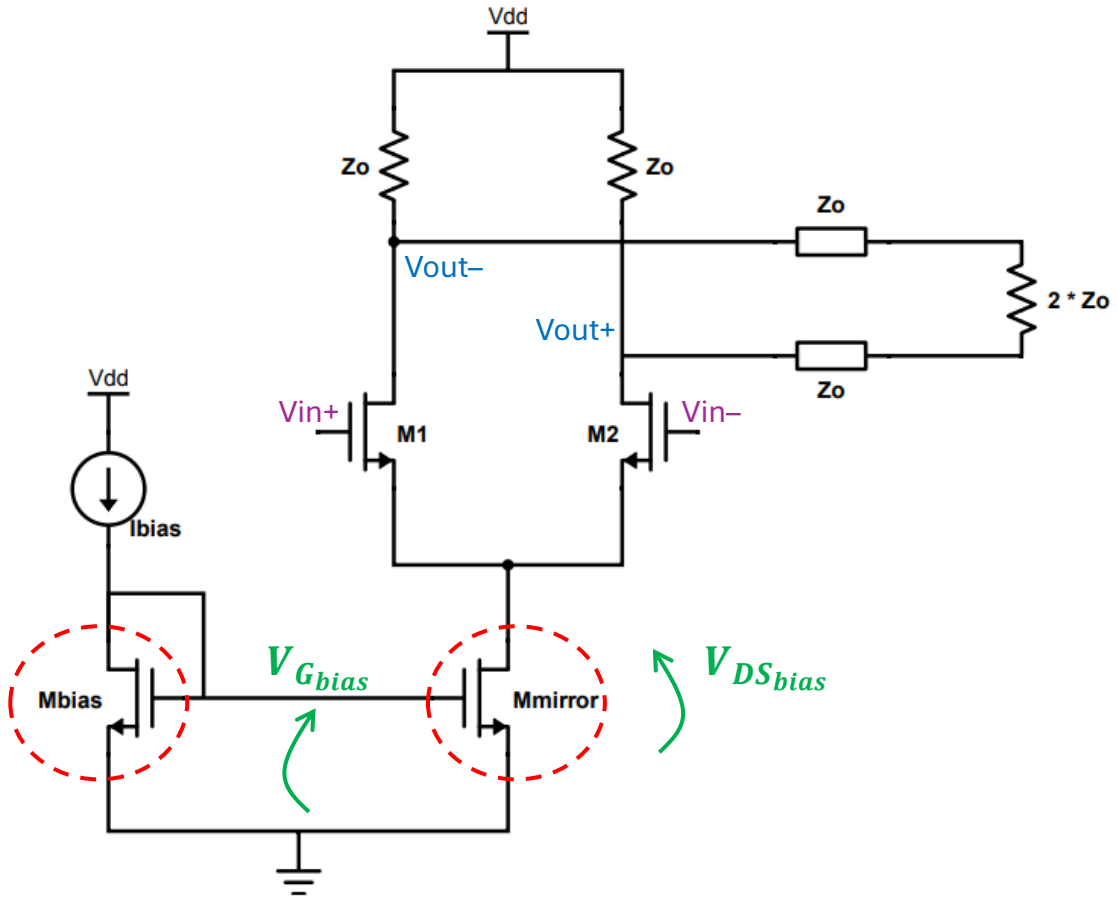
1. Current Mirror Devices:

   ➔Must be in Saturation

   a) Set L > L_{MIN} ,
   to reduce channel-length modulation effect.

   b) Increase W to reduce $V_{G_{bias}}$,
   making mirror device closer to SAT.

$$V_{DS_{bias}} > V_{G_{bias}} - V_{th}$$



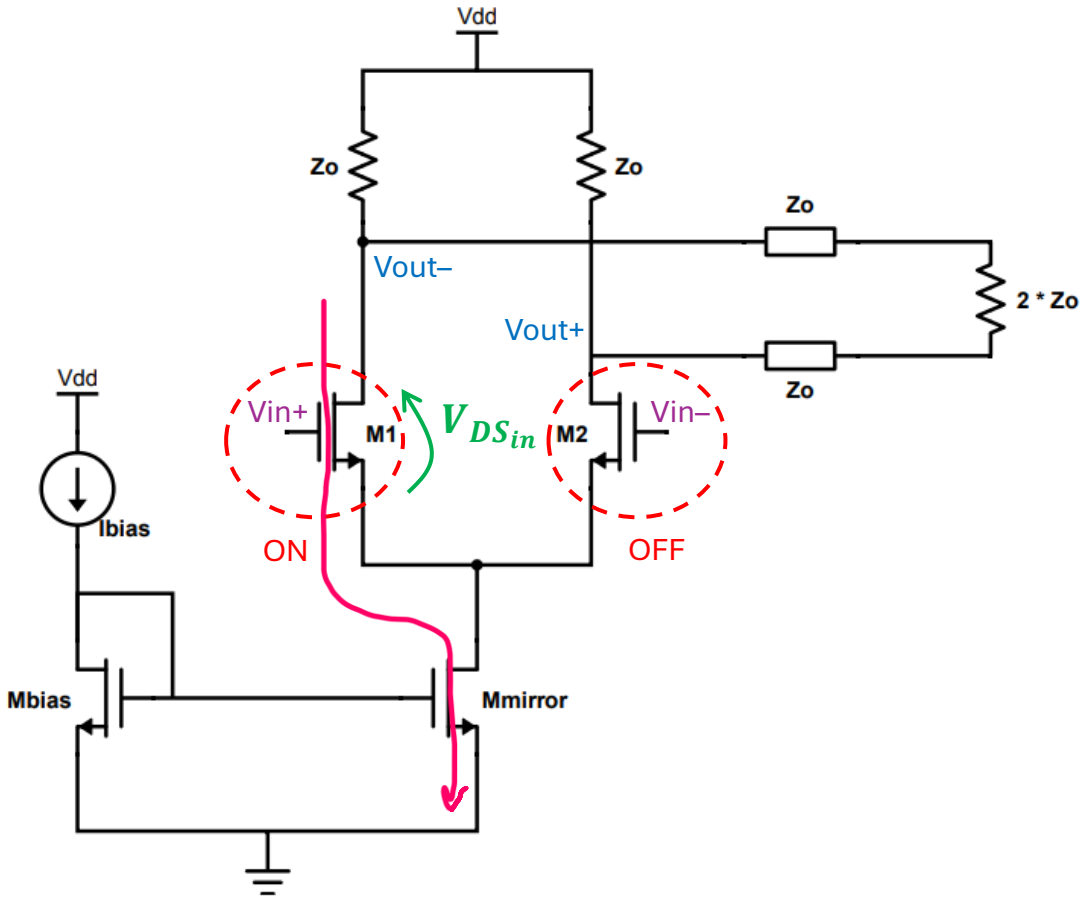
Notes

2. Input Devices:

➔Will either be in Triode (ON) or OFF

a) Set L = L_{MIN} ,
because these devices act as switches.

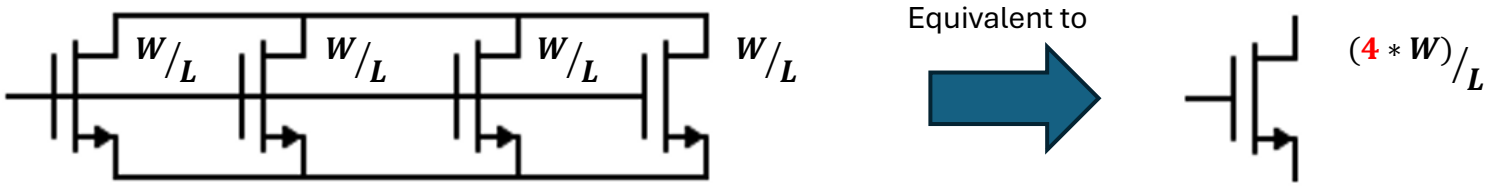
b) Increase W to reduce $V_{DS_{in}}$,
by reducing the R_{ON} of the input devices.



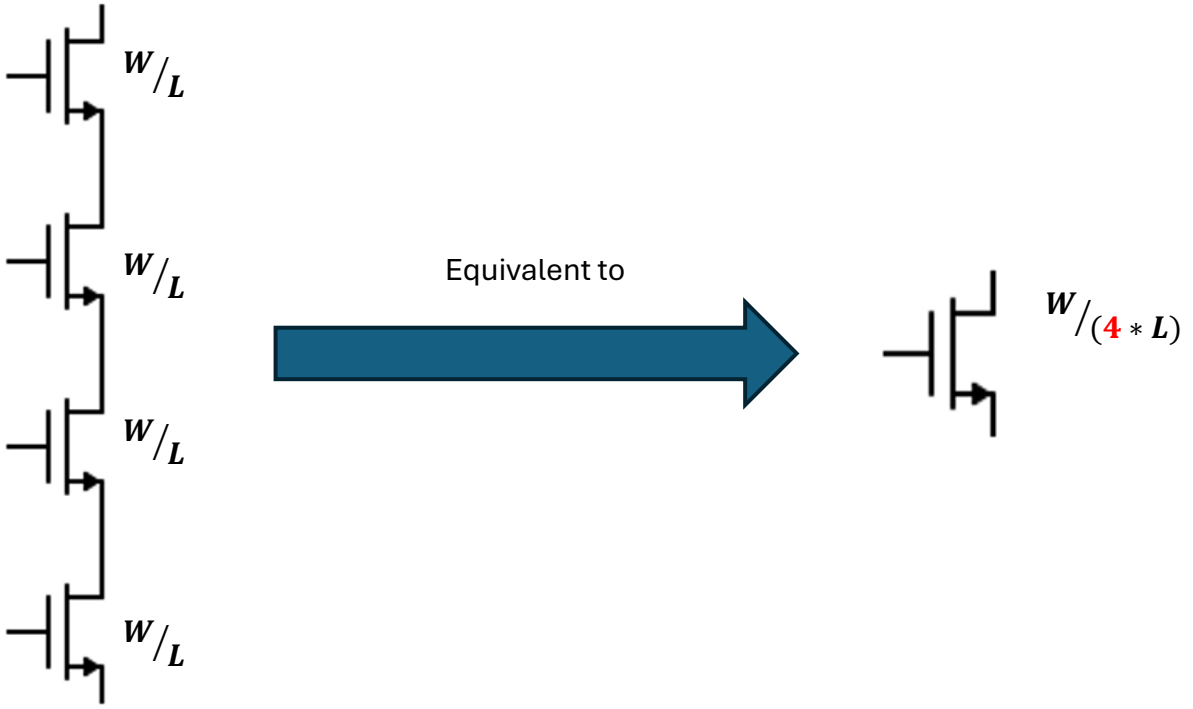
Notes

- We can increase the W or the L of a device by stacking them in either parallel or series.

➢ Parallel (increasing W):

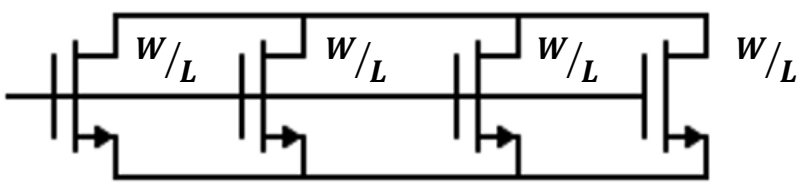


➢ Series (increasing L):

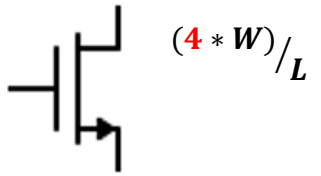
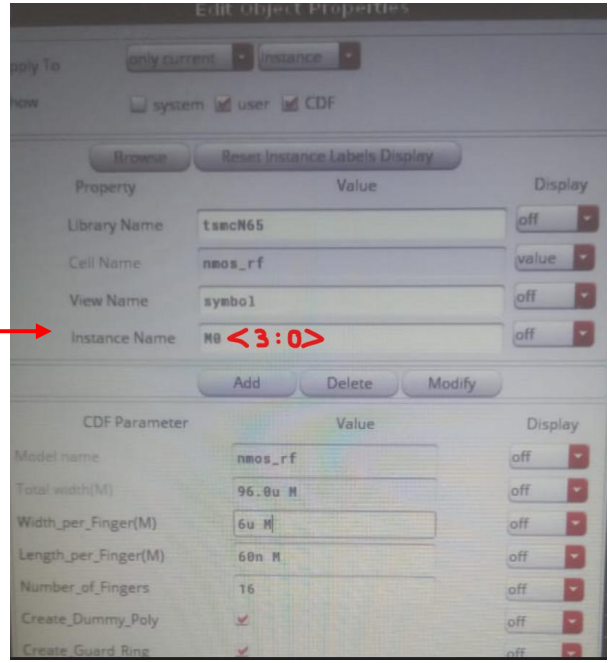


Notes

- How to implement 4 instances of a transistor in parallel ?



Equivalent to



M0<3:0>