

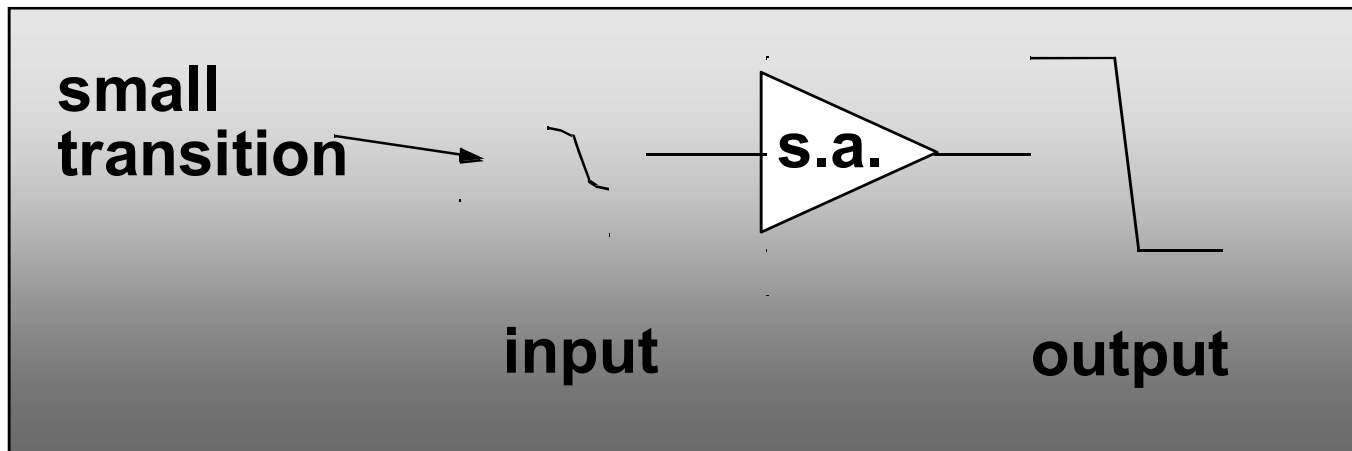
# Sense Amplifiers

$$t_p = \frac{C \cdot \Delta V}{I_{av}}$$

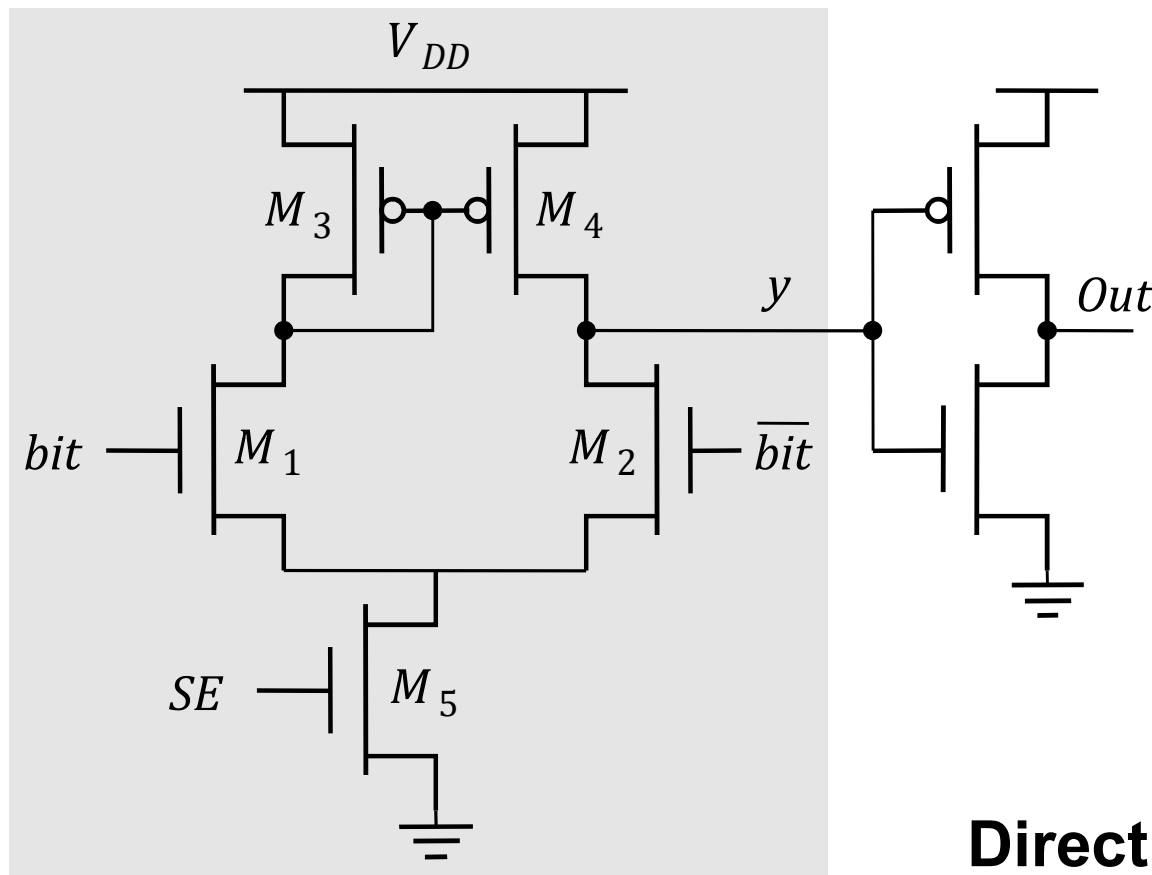
make  $\Delta V$  as small as possible

large      small

**Idea: Use Sense Amplifier**

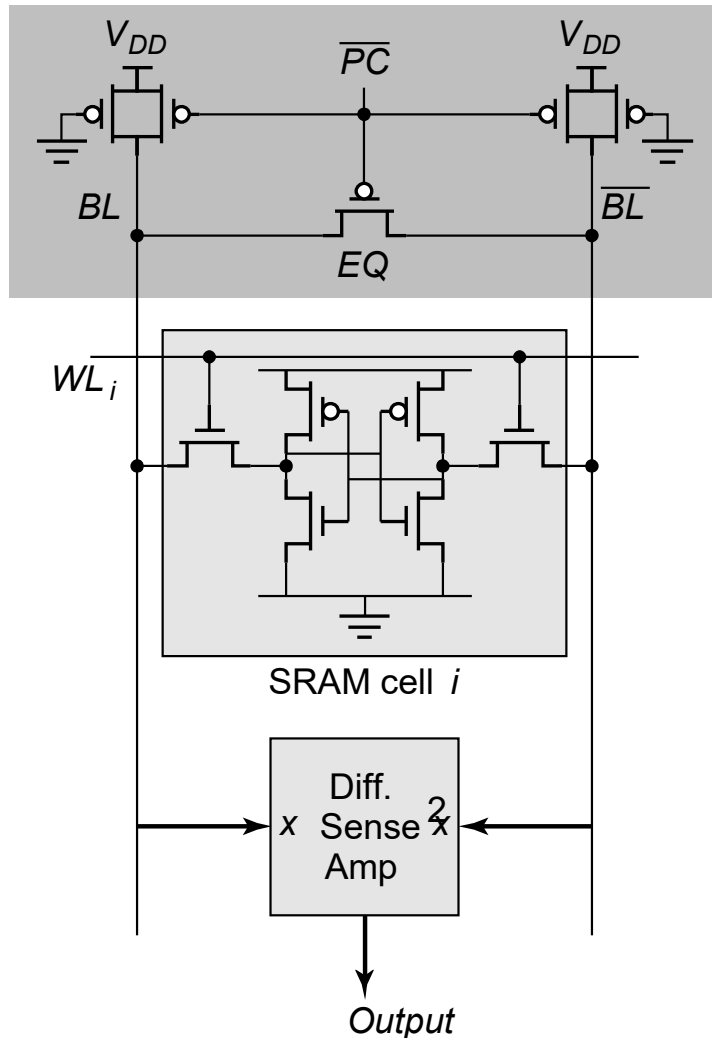


# Differential Sense Amplifier

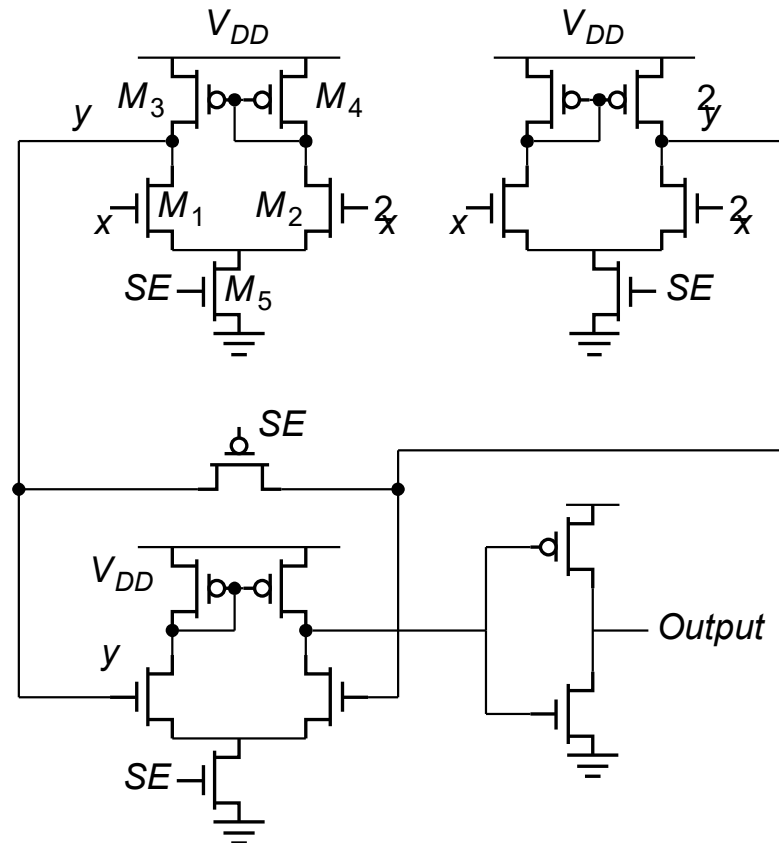


**Directly applicable to  
SRAMs**

# Differential Sensing – SRAM

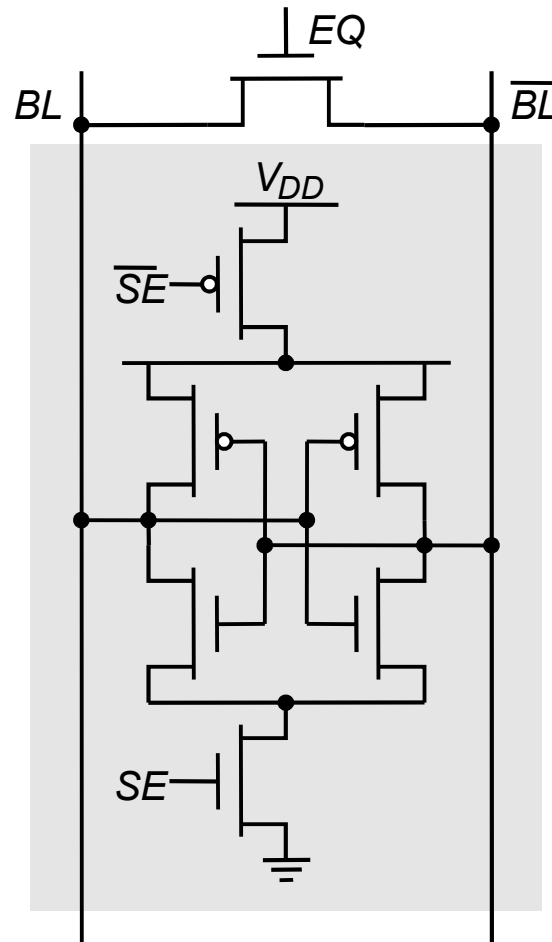


(a) SRAM sensing scheme



(b) two stage differential amplifier

# Latch-Based Sense Amplifier (DRAM)

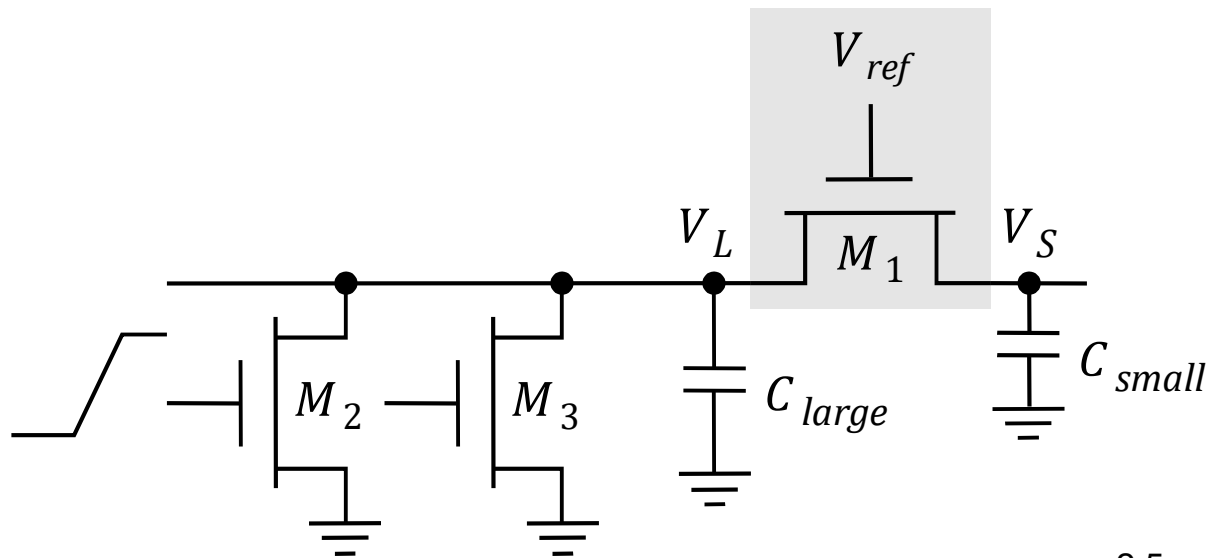


Initialized in its meta-stable point with EQ

Once adequate voltage gap created, sense amp enabled with SE

Positive feedback quickly forces output to a stable operating point.

# Charge-Redistribution Amplifier



Concept

Transient Response

