Differential Signals:

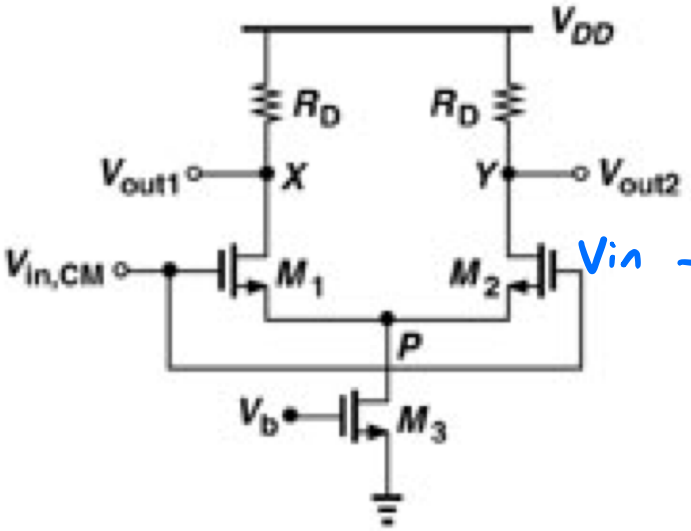
- Measured between two nodes as opposed to node to ground

V_a, V_b:

$$V_A = \frac{V_A+V_B}{2} + \frac{V_A-V_B}{2}, \quad V_B = \frac{V_A+V_B}{2} + \frac{V_A-V_B}{2}$$

- CM: Common Mode DC Level
- DM: Differential Mode Signal

Common Mode Response:



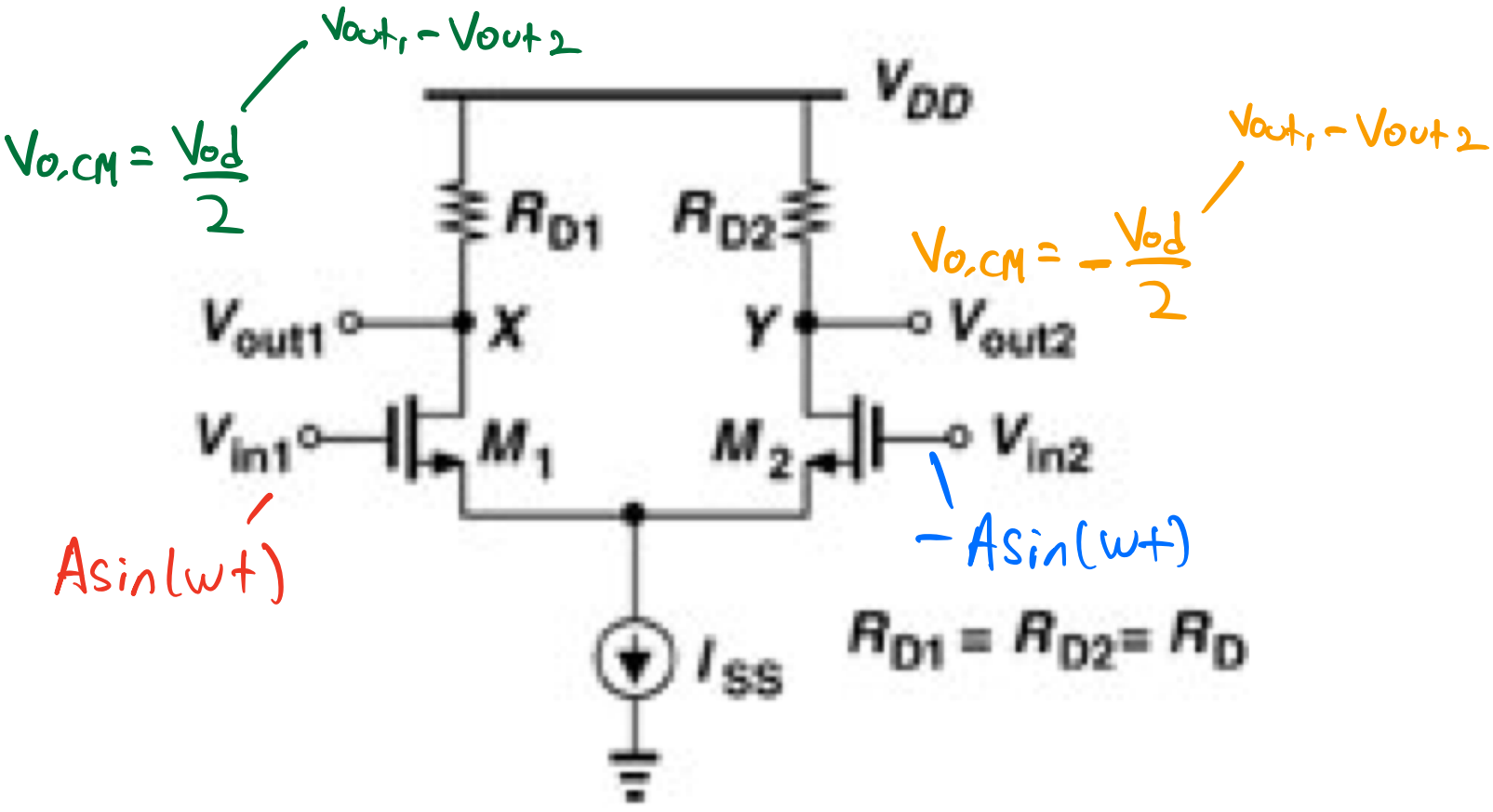
Range

$V_{in} \rightarrow 0 < V_{in} < V_{DD}$

if: $V_{in}=0$; $V_G=0$, transistors are off. No current

$V_{GS_1}+(V_b-V_{th_3})$ → minimum voltage needed to operate

Half-Circuit Model:



Case 1: (Small signal Gain $\lambda = 0$)

$$V_{in1} = \frac{V_{in1}+V_{in2}}{2} + \frac{V_{in1}-V_{in2}}{2} : V_{CM} = \frac{V_{id}}{2} = V_{DC} + A\sin(\omega t)$$

$$V_{in2} = \frac{V_{in1}+V_{in2}}{2} + \frac{V_{in1}-V_{in2}}{2} : V_{CM} = \frac{V_{id}}{2} = V_{DC} - A\sin(\omega t)$$