



มหาวิทยาลัยราชภัฏนครปฐม
Nakhon Pathom Rajabhat University

บทที่ 3 วงจรสะท้อนกระแส และ โหลดแบบแอคทีฟ (Current mirror and active load)

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Outline

- Introduction
- Current mirror
- Active load
- Small signal equivalent circuit

Current mirror

- วงจรสะท้อนกระแส (current mirror) คือการสะท้อนกระแสอ้างอิง และกระแส
อินพุตไปที่เอาต์พุตของวงจร

$$I_B = I_D = K_N \left(V_{GS1} - V_{TH} \right)^2 \left(1 + \lambda V_{DS1} \right)$$

$$I_{out} = K_N \left(V_{GS2} - V_{TH} \right)^2 \left(1 + \lambda V_{DS2} \right)$$

$$I_{REF} = K_{N1} \left(V_{GS1} - V_{TH} \right)^2$$

$$I_{out} = K_{N2} \left(V_{GS2} - V_{TH} \right)^2$$

$$\frac{I_{out}}{I_{REF}} = \frac{K_{n2} (V_{GS2} - V_{TH2})^2}{K_{n1} (V_{GS1} - V_{TH1})^2}$$

$$I_{out} = \left[K_{N2} / K_{N1} \right] I_{REF}$$

Ex. 1 จงหา i_{out} กำหนดให้ $K_{N1} = K_{N2} = 0.1\text{mA/V}^2$ และ $I_{REF} = 1\text{ mA}$

$$I_{out} = \left[K_{N2} / K_{N1} \right] I_{REF}$$

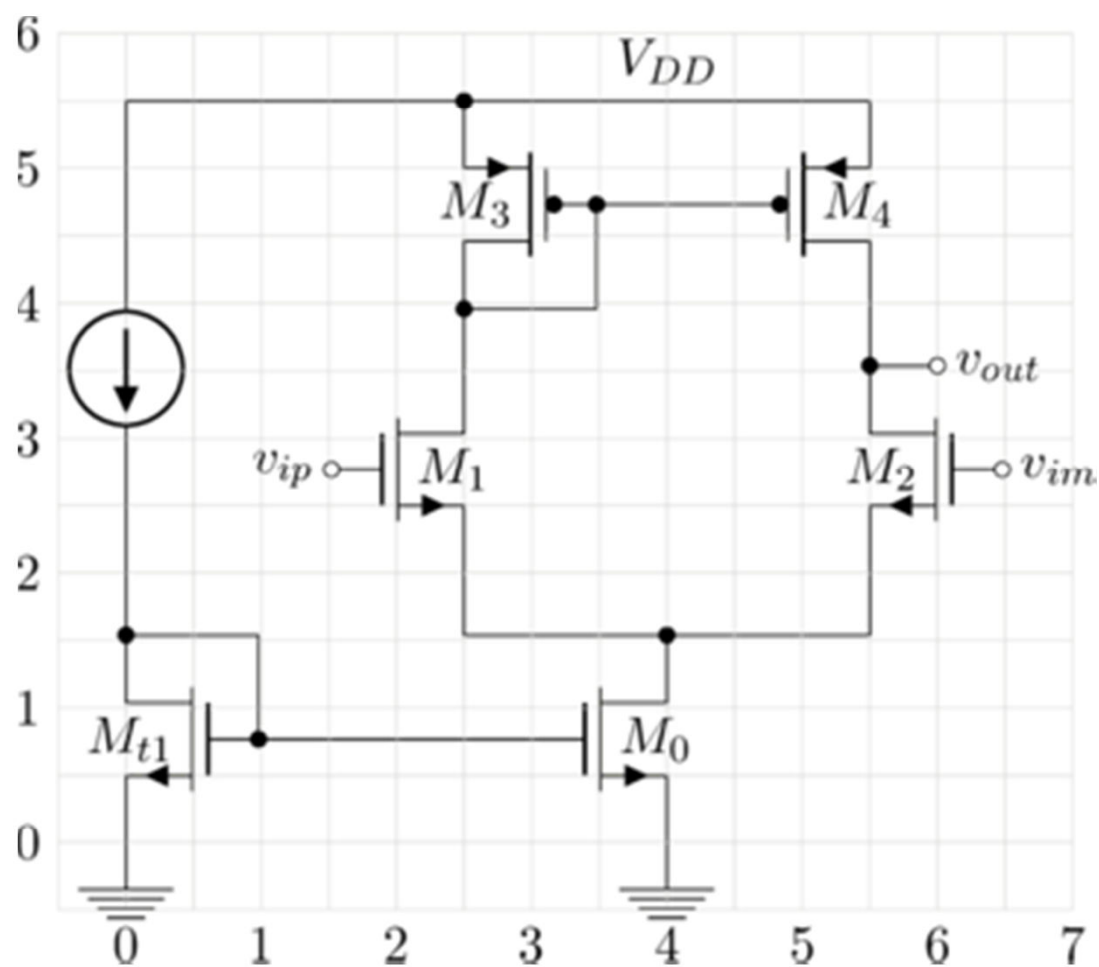
$$I_{out} = I_{REF} = 1\text{mA}$$

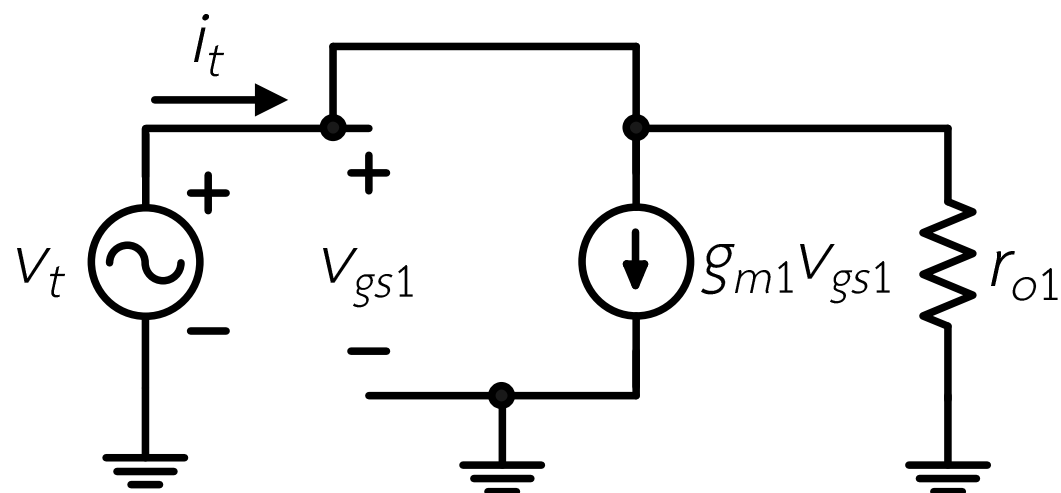
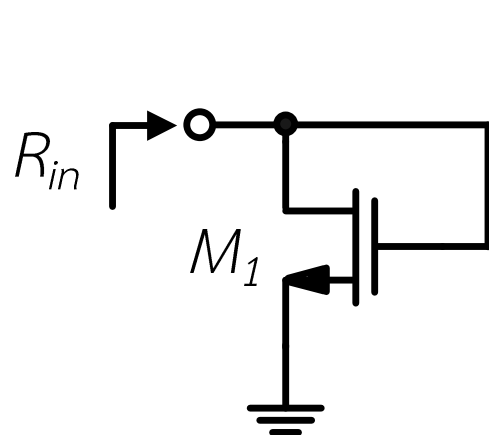
Ex. 2 จงหา i_{out} กำหนดให้ $K_{N2} = 2K_{N1}$ 0.1mA/V^2 และ $I_{REF} = 1\text{ mA}$

$$I_{out} = \left[K_{N2} / K_{N1} \right] I_{REF}$$

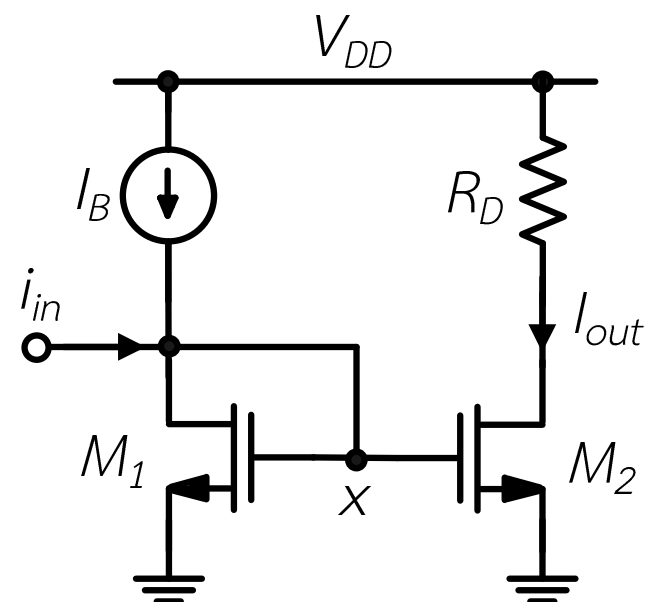
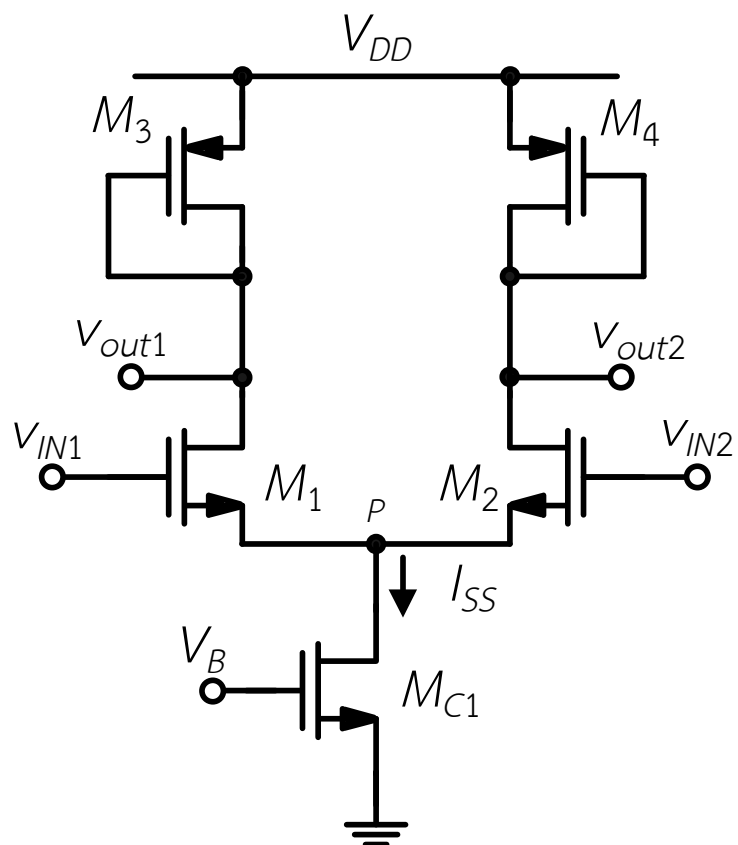
$$I_{out} = \left[2K_{N1} / K_{N1} \right] I_{REF}$$

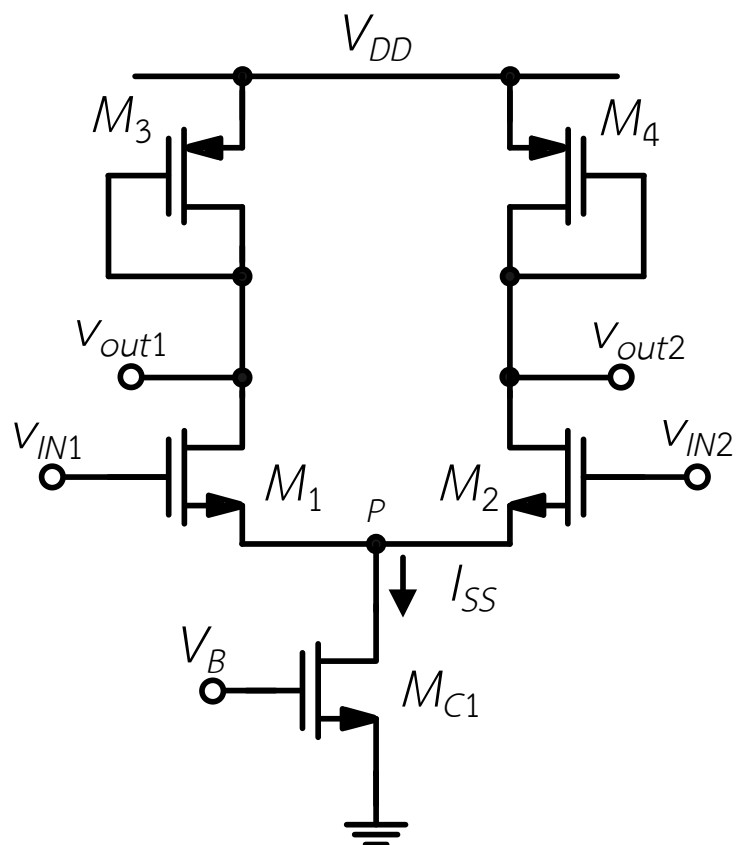
$$I_{out} = 2I_{REF} = 2\text{mA}$$



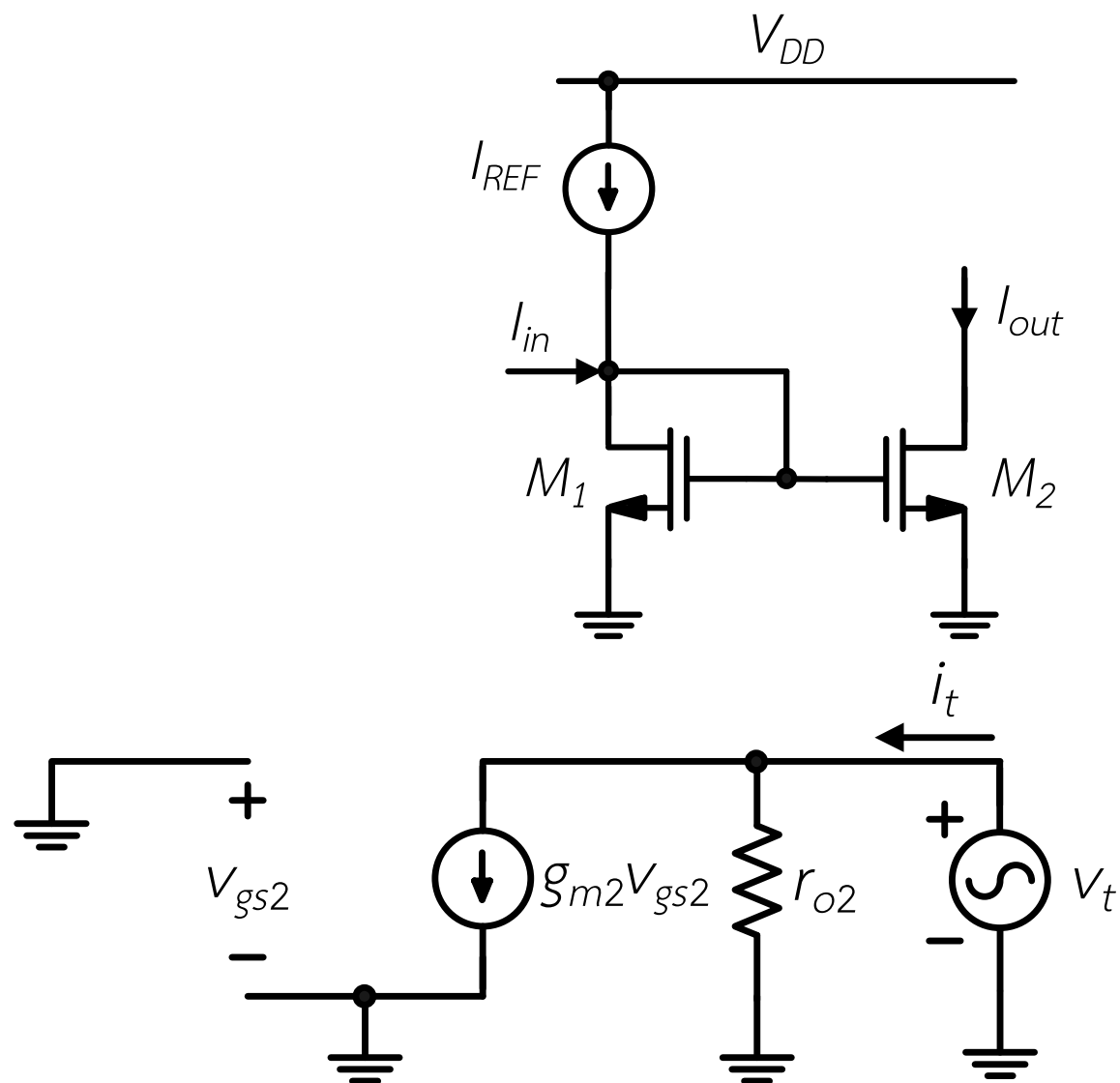


$$R_{in} = \frac{V_t}{i_t} = \frac{1}{g_{m1}}$$

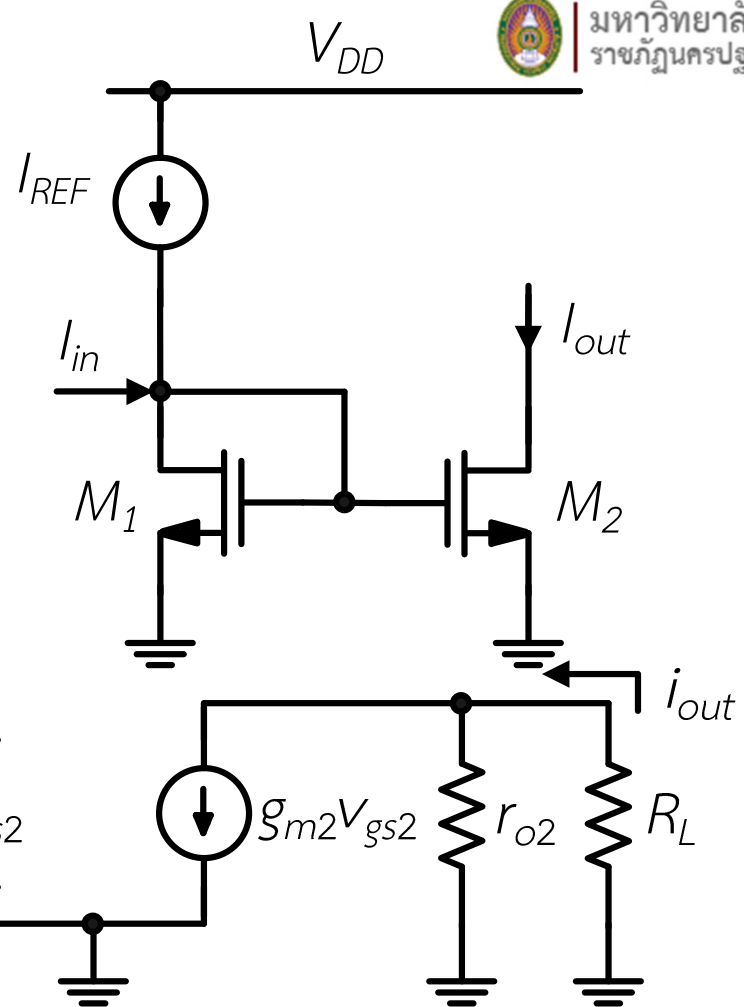
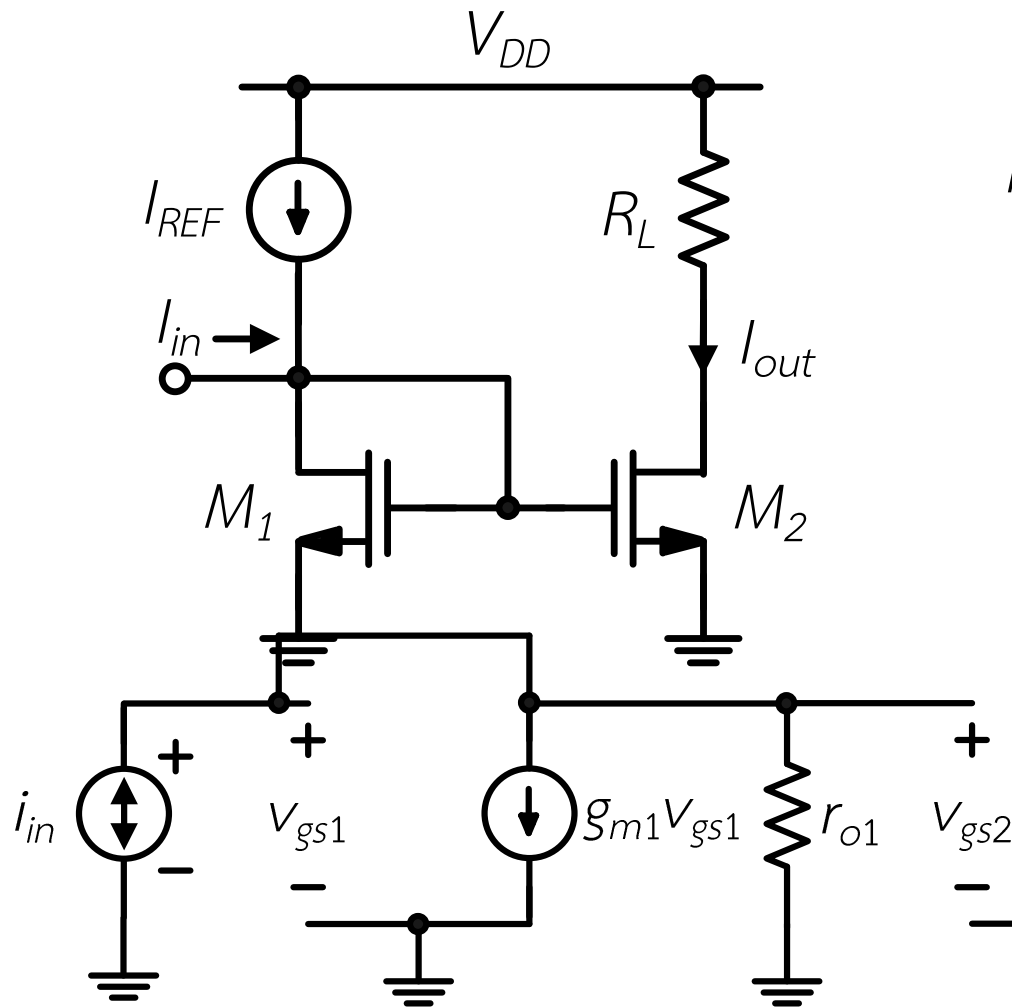




$$A_v = \frac{V_{outd}}{V_{ind}} = -g_{m1,2} \left(\frac{1}{g_{m3,4}} \parallel r_{O1,2} \right)$$



$$R_{out} = r_{o2}$$



$$\frac{i_{out}}{i_{in}} = \left[g_{m2} / g_{m1} \right] = \left[K_{N2} / K_{N1} \right]$$

Thank you