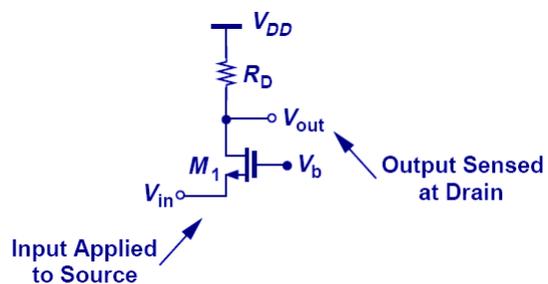


EE 530 Eletrônica Básica I

AMPLIFICADORES CMOS

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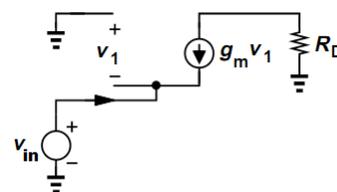
Porta comum



$$\lambda = 0$$

$$A_v = g_m R_D$$

$$|A_i| = 1$$



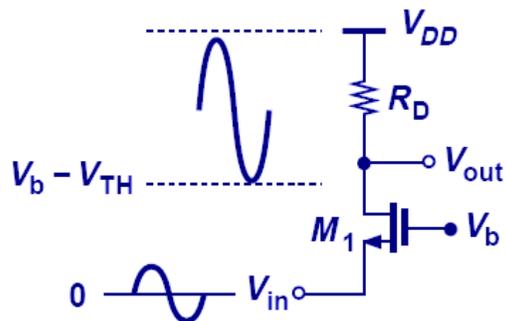
$$R_{in} = \frac{1}{g_m}$$

$$R_{out} = R_D$$

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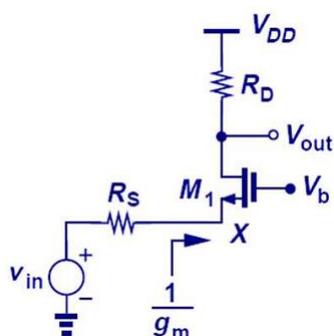
Porta comum

- Excursão do Sinal dentro da região de saturação



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Porta comum com resistência de fonte



$$\lambda = 0$$

$$A_v = \frac{R_D}{\frac{1}{g_m} + R_S}$$

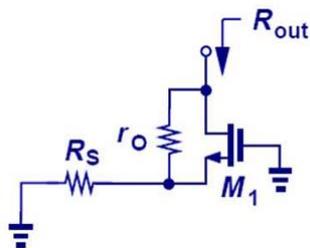
$$R_{in} = \frac{1}{g_m} + R_S$$

$$R_{out} = R_D$$

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Porta comum com resistência de fonte ($\lambda > 0$)

- Impedância de Saída

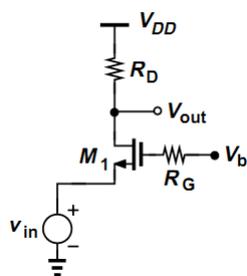


$$R_{out} = (1 + g_m r_o) R_s + r_o$$

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Porta comum com resistência de gate

- Não passa corrente em R_G , portanto o ganho e as impedâncias são os mesmos.



$$\lambda = 0$$

$$A_v = g_m R_D$$

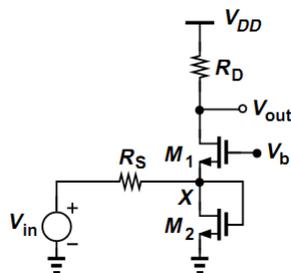
$$|A_i| = 1$$

$$R_{in} = \frac{1}{g_m}$$

$$R_{out} = R_D$$

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Exemplo 7.13 RAZAVI

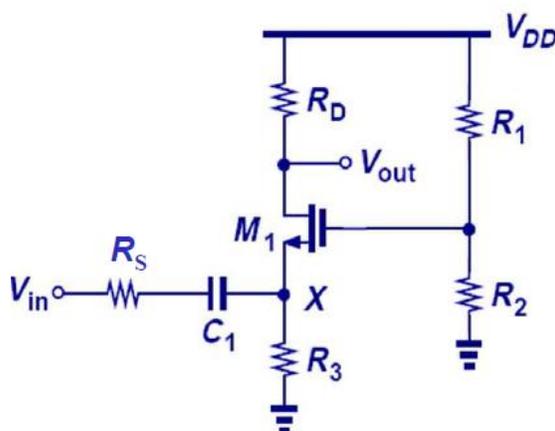


$$A_v ?, \lambda = 0$$

$$Z_{out} ?, \lambda > 0$$

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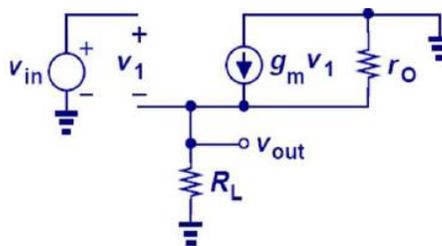
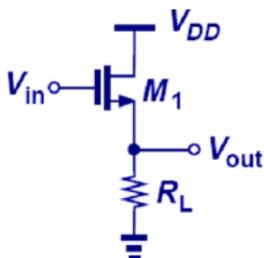
Porta Comum com polarização



$$\frac{v_{out}}{v_{in}} = \frac{R_3 \parallel (1/g_m)}{R_3 \parallel (1/g_m) + R_S} g_m R_D$$

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Seguidor de Fonte (Dreno comum)



$$\lambda > 0$$

$$A_v = \frac{r_o // R_L}{\frac{1}{g_m} + r_o // R_L}$$

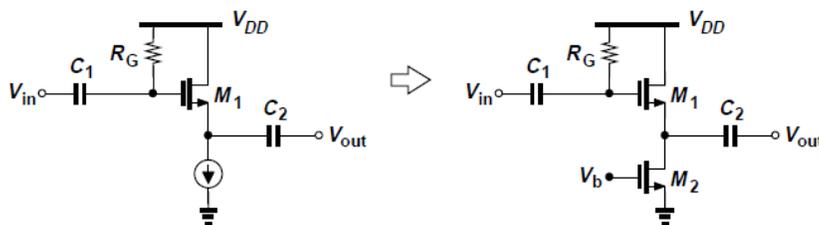
$$R_{in} = \infty$$

$$R_{out} = R_L // r_o // \frac{1}{g_m}$$

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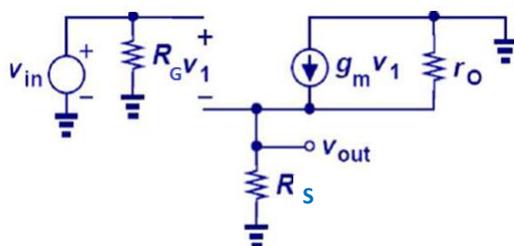
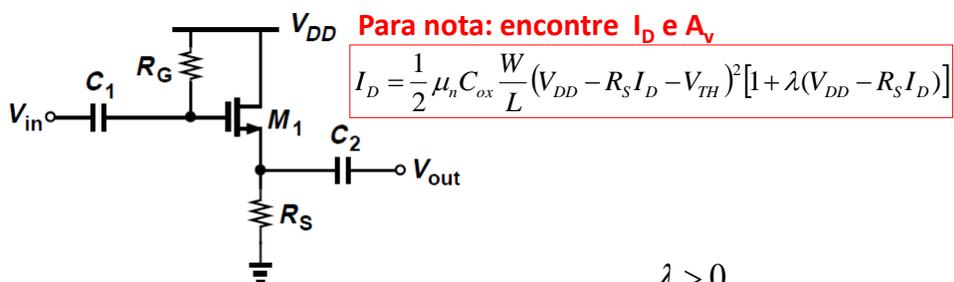
Seguidor de Fonte com Carga Ativa

- Como I_D varia com V_{DD} , em CIs o transistor é polarizado com fonte de corrente.



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Seguidor de Fonte com Polarização



$$\lambda > 0$$

$$A_v = \frac{r_o // R_S}{\frac{1}{g_m} + r_o // R_S}$$

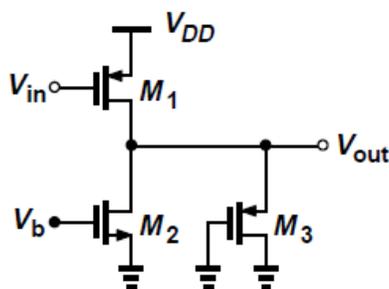
$$R_{in} = R_G$$

$$R_{out} = R_S // r_o // \frac{1}{g_m}$$

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Exemplo 7.19 RAZAVI

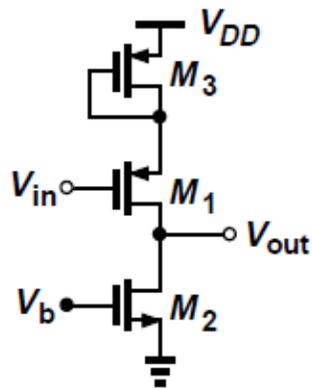
- R_{out} e A_v ? ($\lambda > 0$)



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Exemplo 7.20 RAZAVI

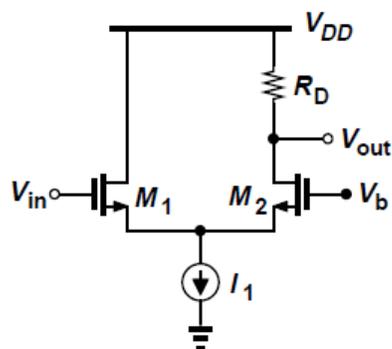
- $A_v?$ ($\lambda_1=0$)



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Exemplo 7.22 RAZAVI

- $A_v?$ ($\lambda=0$)



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Sugestão de estudo

- Razavi, cap. 7
- Sedra/Smith cap. 5 seções 5.4 até 5.6
 - Exemplos, exercícios e problemas correspondentes

Para saber mais:

Paul R. Gray e Robert G. Meyer, Analysis and Design of Analog integrated Circuits, John Wiley & Sons

T. Tsvividis, Design considerations in single-channel MOS analog integrated circuits – A tutorial”, IEEE JSSC SC 13, pp 383-391, junho de 1978