UNIVERSIDAD
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Preinforme 9: Amplificación MOSFET

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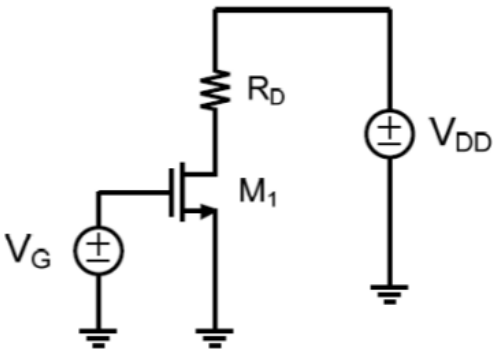
Simulación y análisis del circuito Fig 1.



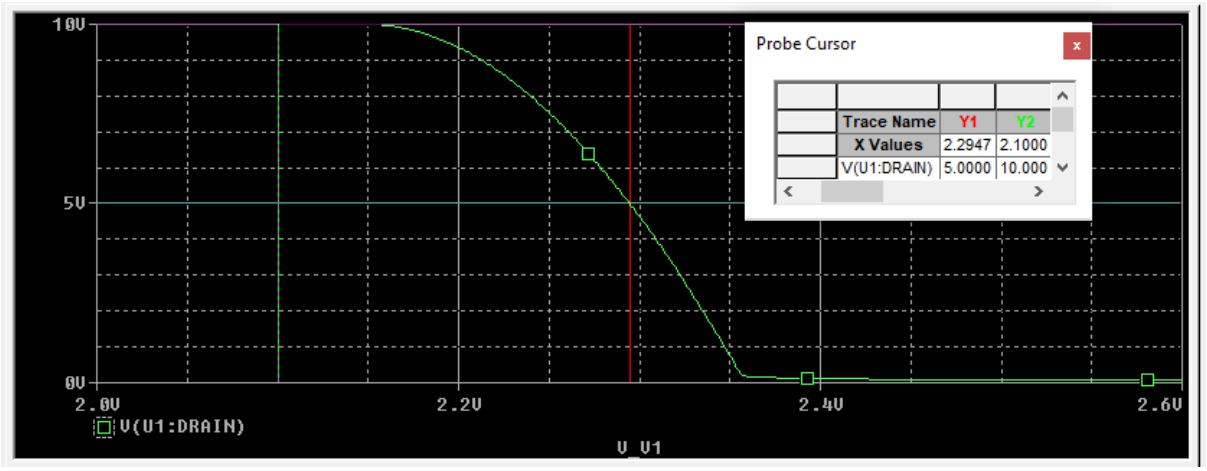
Determinar el valor de V_G para el cual $V_{DS} = V_{DD}/2$:

$$I_D = \frac{V_{DD} - V_{DS}}{R_D} = \frac{V_{DD}}{2R_D}$$

$$I_D = \frac{1}{2}k'(V_{GS} - V_{th})^2 \rightarrow V_{GS} = \sqrt{\frac{2I_D}{k'}} + V_{th}$$

$$V_{GS} = \sqrt{\frac{V_{DD}}{k'R_D}} + V_{th};\ k' = 0.51,\ V_{th} = 2.15V$$

$$V_{GS} = 2.29V$$



$$V_{GS_S} = 2.2947$$

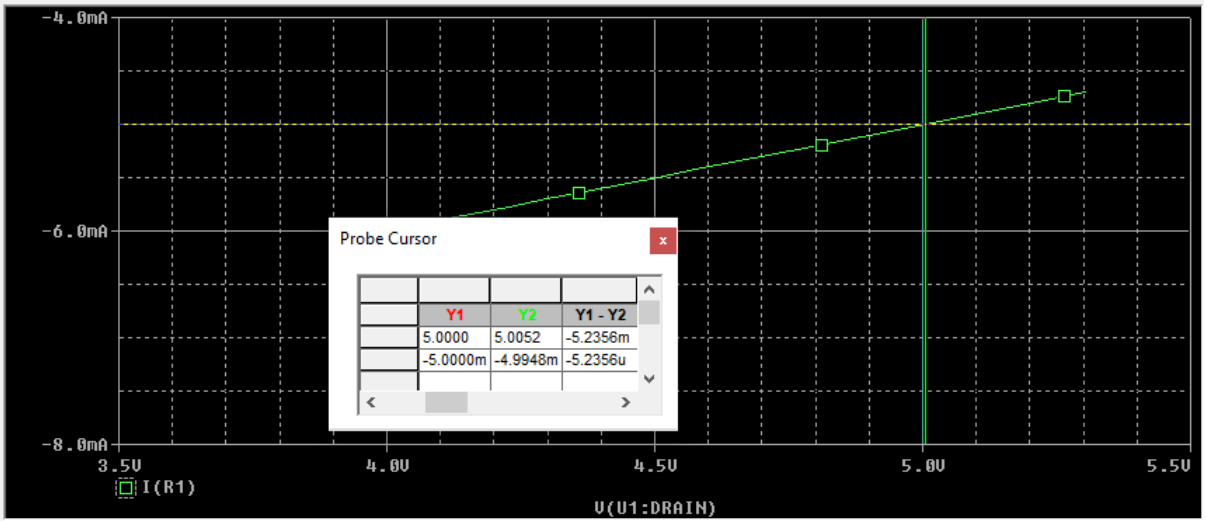
Determinar $I_D,\ g_m,\ r_o$

$$g_m = k_n'(V_{GS} - V_{th}) = 0.0714mA/V$$

$$I_D = 5mA,\ r_o = 14\Omega$$

$$I_D = 5.002mA,\ g_m = 66mS,\ r_o = 1k\Omega?$$

=



Función de transferencia AC

$v_D(v_G) = -g_m R_D v_G$

ganancia AC para pequeña señal

$A_V = -g_m R_D = -71.4$

2.14.

Determinar el valor de V_G para que $V_D = V_{DD}/2$

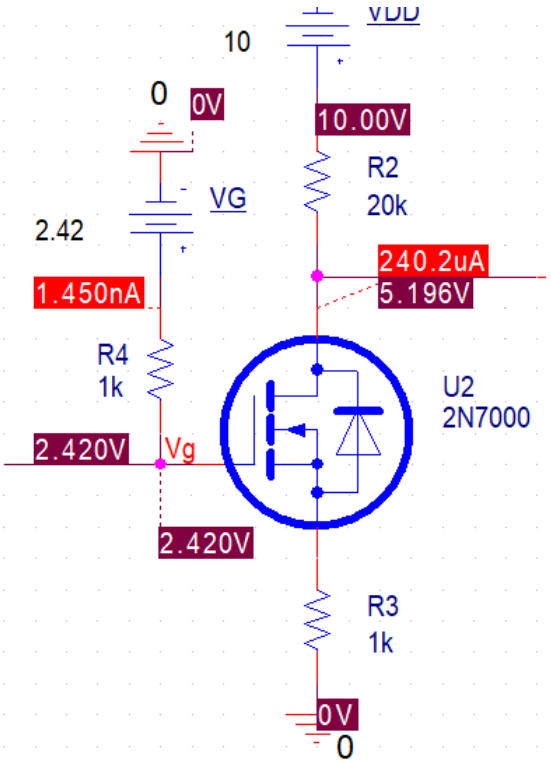
$V_{DD} = V_{RD} + V_{RS} = I_D R_D + V_{DD}/2$

$\frac{V_{DD}}{2R_D} = \frac{1}{2}k'(V_{GS} - V_{th})^2$

$V_{GS} = V_{th} + \sqrt{\frac{V_{DD}}{k'R_D}} = 2.18$

$V_G = V_{GS} + V_{RS} = V_{GS} + I_D R_D$

$V_G = V_{GS} + \frac{1}{2}k'(V_{GS} - V_{th})^2 = 2.42$



Determinar I_D, g_m, r_o

$I_D = \frac{1}{2}k'(V_{GS} - V_{th})^2 = 0.25mA$

$g_m = k'(V_{GS} - V_{th}) = 15.9mA/V$

$r_o = 62.8\Omega$

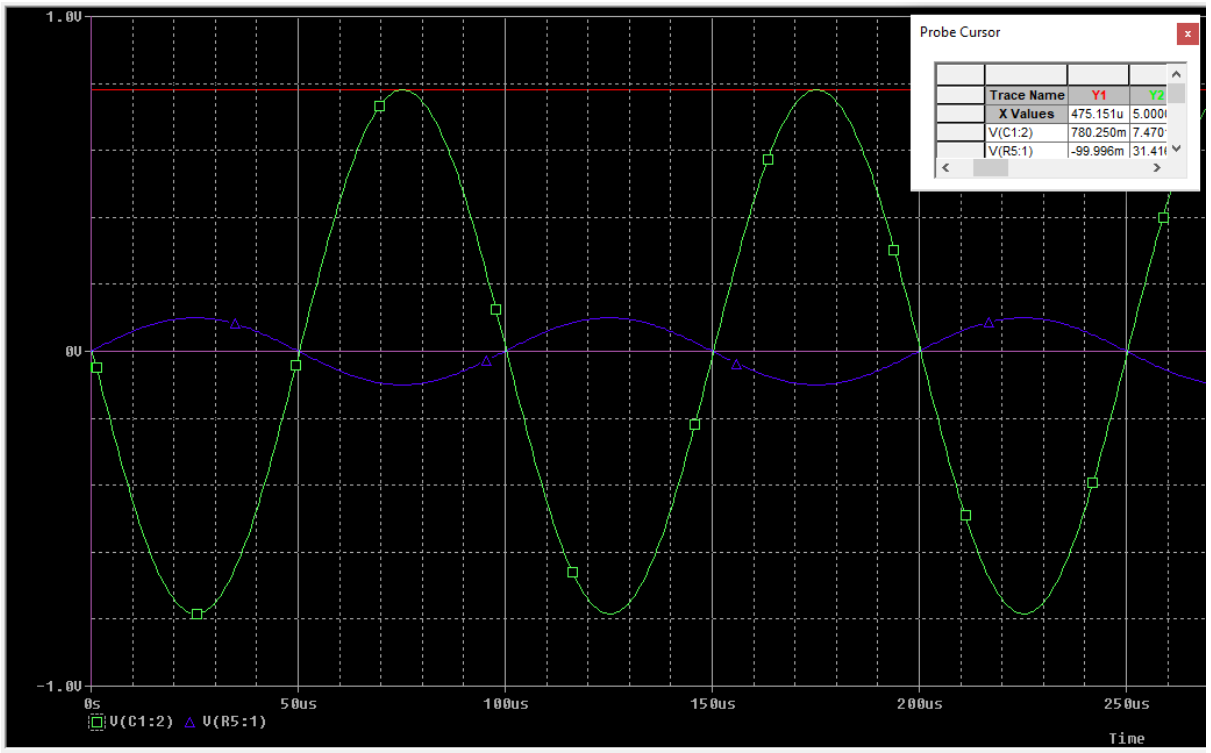
Función de transferencia

$v_o(v_i) = -\left(\frac{R_G}{R_{in}+R_G}\right)\left(\frac{g_m}{g_m R_S+1}\right)(R_D||RL)v_i$

$v_o(v_i) = -7.84v_i$

Determinar ganancia AC

$$A_V = -\left(\frac{R_G}{R_{in}+R_G}\right)\left(\frac{g_m}{g_m R_S+1}\right)\left(R_D||RL\right) = -\ 7.84V/V$$



$$A_V = \frac{780.25}{-99.99} = -\ 7.803V/V$$