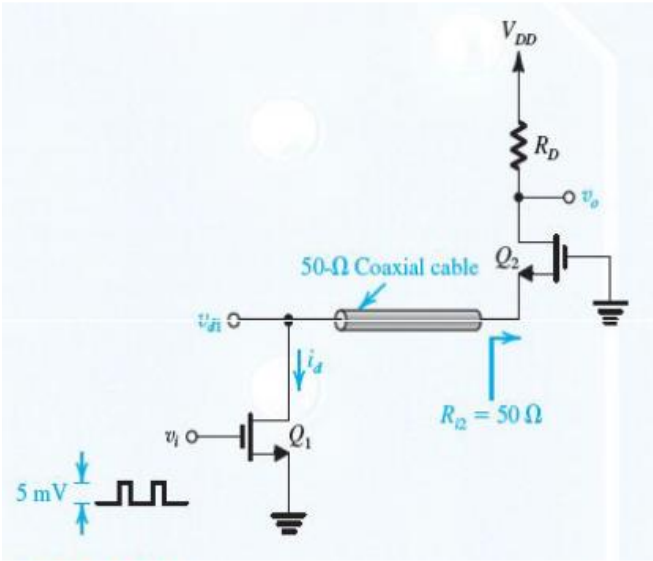
Problem 5.114

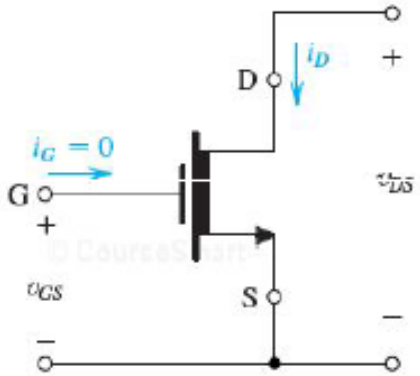
The figure below shows a scheme for coupling and amplifying a high-frequency pulse signal. The circuit utilizes two MOSFETs whose bias details are not shown and a 50-Ω coaxial cable. For proper operation, transistor Q_2 is required to present a 50-Ω resistance to the cable. This situation is known as "proper termination" of the cable and ensures that there will be no signal reflection comping back on the cable. When the cable is properly terminated, input resistance is 50-Ω.

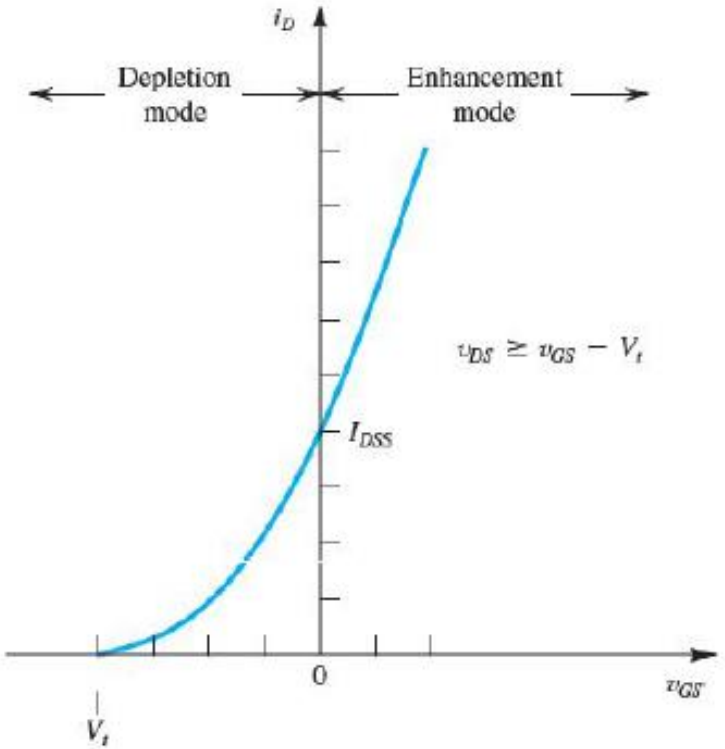
1) **What must g_{m2} be?**
2) **If Q_1 is biased at the same point as Q_2, what is the amplitude of the current pulses in the drain of Q_1?**
3) **What is the amplitude of the voltage pulses at the drain of Q_1?**
4) **What value of R_D is required to provide 1-V pulses at the drain of Q_2?**



Depletion-Type MOSFET

- **Has a physically implanted channel**
  → there is no need to induce a channel to conduct current!
- **The channel depth and hence its conductivity can be controlled by v_{GS} in exactly the same manner as in the enhancement-type device**
- **The threshold voltage is negative!!!!**





Problem 5.109

The figure below shows a variation of the feedback bias circuit of Fig. 5.54. Using a 5-V supply with an NMOS transistor for which V_t = 1V, k_n = 6.25 mA/V^2 and λ = 0, provide a design that biases the transistor at I_D = 2mA, with V_{DS} large enough to allow saturation operation for a 2-V negative signal swing at the drain. Use 22 MΩ as the largest resistor in the feedback-bias network. What values of R_D, R_{G1}, and R_{G2} have you chosen? Specify all resistor to two significant digits.

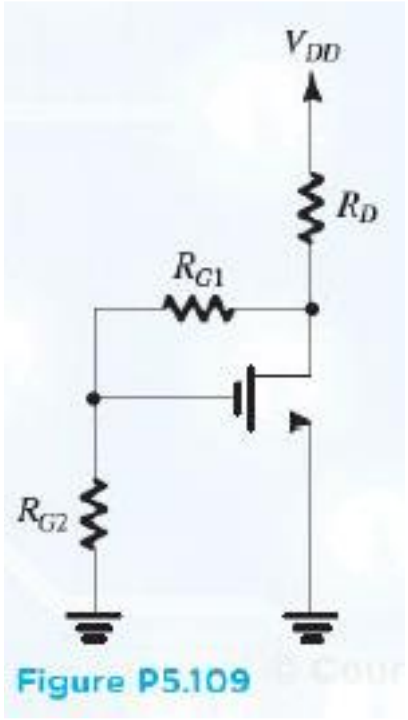


Figure P5.109

Problem 5.124

For the given circuit, assuming that the transistor is sized an biased so that g_m = 1mA/V, r_0 = 100kΩ, R_L = 10kΩ, R_1 = 500kΩ, and R_2 = 1kΩ, find the overall voltage gain v_o/v_{sig} and the input resistance R_{in}.