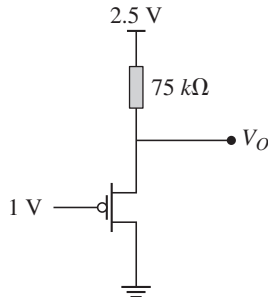
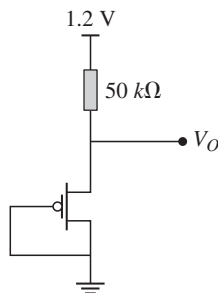


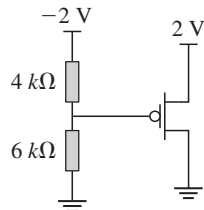
3-20. Given that $W/L = 20$, $V_{tp} = -0.6$ V, and $K_p = 30 \mu\text{A}/\text{V}^2$, calculate V_O and I_D .



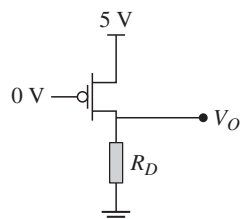
3-21. Given that $W/L = 6$, $V_{tp} = -0.3$ V, and $K_p = 40 \mu\text{A}/\text{V}^2$, calculate V_O and I_D .



3-22. Given that $V_{tp} = -0.4$ V, $W/L = 4$, and $K_p = 100 \mu\text{A}/\text{V}^2$, (a) Give the transistor bias state, (b) Calculate I_D .



3-23. Given $V_{tp} = -0.8$ V and $K_p = 75 \mu\text{A}/\text{V}^2$, what is the required W/L ratio and what is R_D if M1 is to pass 0.25 A and keep $V_{SD} < 0.2$ V.

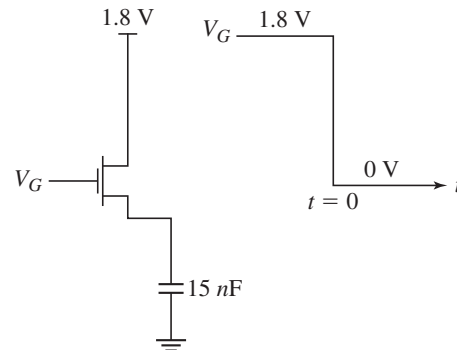


3-24. Given

$$K_p = 40 \mu\text{A}/\text{V}^2$$

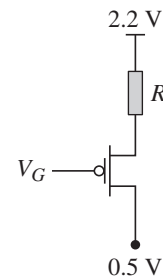
$$V_{tp} = -0.4 \text{ V}$$

$$W/L = 5$$



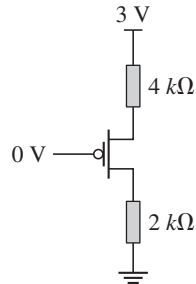
- (a) The capacitor is initially uncharged at $t = 0$. At $t = 0^+$ the gate voltage has changed state from 1.8 V to 0 V. What is the initial surge of current at $t = 0^+$.
- (b) At $t = \infty$ what is the bias state on the transistor?
- (c) How much energy is dissipated in the charge movement, and where does the heat loss occur?

3-25. Given $V_{tp} = -0.4$, $K_p = 50 \mu\text{A}/\text{V}^2$, and $W/L = 8$, the transistor is biased at the saturated/nonsaturated boundary. The power in the resistor is $10 \mu\text{W}$. What is the value of the resistor R ?

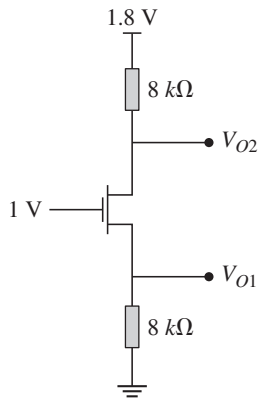


Two Resistor MOSFET Circuits

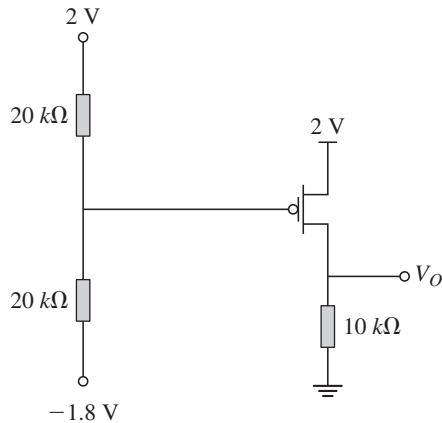
3-26. Given $V_{tp} = -0.6$ V and $K_p = 75 \mu\text{A}/\text{V}^2$, and $W/L = 5$, (a) Solve for source voltage V_s , (b) Solve for drain voltage.



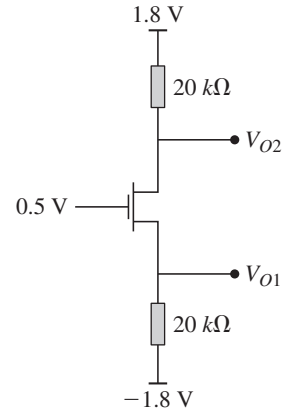
3-27. Given that $W/L = 4$, $V_m = 0.4$ V, and $K_n = 95 \mu\text{A}/\text{V}^2$, calculate V_{o1} , V_{o2} , and I_D .



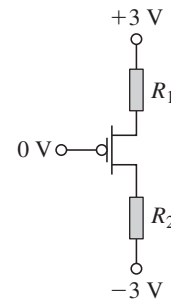
3-28. Given that $W/L = 8$, $V_{tp} = -0.5$ V, and $K_p = 43 \mu\text{A}/\text{V}^2$, calculate V_O and I_D .



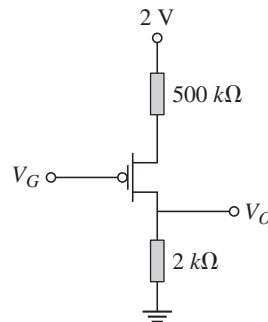
3-29. Given that $W/L = 4$, $V_m = 0.4$ V, and $K_p = 95 \mu\text{A}/\text{V}^2$, calculate V_{o1} , V_{o2} , and I_D for
 (a) $V_G = +0.5$ V
 (b) $V_G = -0.3$ V



3-30. Given that $R_1 = R_2$, $W/L = 3$, $V_m = 0.6$ V, and $K_n = 200 \mu\text{A}/\text{V}^2$, determine the resistance values so that $V_D = 1$ V and $V_S = -1$ V.

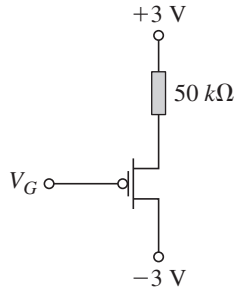


3-31. $V_{tp} = -0.5$ V, $W/L = 5$, and $K_p = 50 \mu\text{A}/\text{V}^2$, design a value for V_G such that $V_O = 0.3$ V.

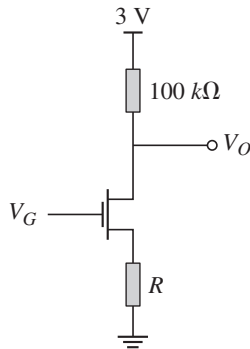


3-32. Given that $V_{tp} = -0.6$ V, $K_p = 75 \mu\text{A}/\text{V}^2$, and $W/L = 4$,
 (a) What gate voltage will put the transistor at the saturated/nonsaturated bias state boundary? Calculate V_S .

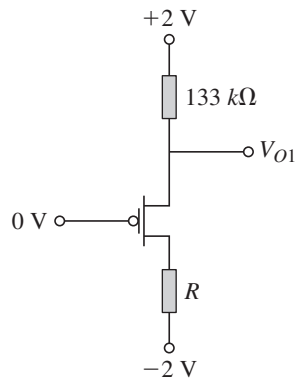
(b) Calculate the drain current.



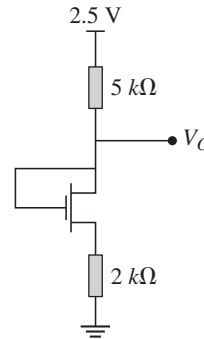
3-33. Given $V_{tp} = -0.6$ V, $K_p = 50 \mu\text{A}/\text{V}^2$, $W/L = 3$, and $V_D = 0.8$ V, if $V_o = 1.2$ V, what are R and V_G ?



3-34. Given $V_{tp} = -0.6$ V, $K_p = 50 \mu\text{A}/\text{V}^2$, $W/L = 3$, and $V_D = 0.8$ V, if $V_o = 1.2$ V, what is R ?

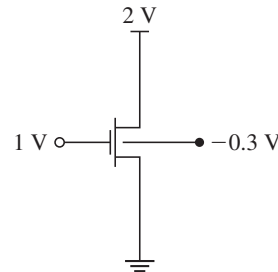


3-35. If $K_n = 90 \mu\text{A}/\text{V}^2$, $V_{tn} = 0.5$ V, and $W/L = 10$, calculate I_D and V_O .



Body Effect and Threshold Voltage

3-36. The n MOSFET has: $V_{tn0} = 0.5$ V, $K_n = 200 \mu\text{A}/\text{V}^2$, $\phi_F = -0.35$ V, $W/L = 3$, and the body effect constant $\gamma = 0.1 \text{ V}^{1/2}$. The bulk voltage is at -0.3 V with respect to the source. Calculate I_D .



3-37. An n MOSFET threshold voltage is measured as 0.62 V when it should be 0.60 V. A parasitic source to substrate voltage is suspected of raising V_m . If $\gamma = 0.4 \text{ V}^{1/2}$ and $\phi_F = 0.35$ V, what would be the V_{BS} of this suspected mechanism?

3-38. $V_{t0} = 0.6$ V, $\gamma = 0.25 \text{ V}^{1/2}$, and $\phi_F = 0.35$ V. Calculate V_O .

