Lecture Study Guideline

You need to follow three steps to study

Step 1: Watch the topic related video uploaded on LMS.

Step 2: Read the lecture notes attached.

Step 3: Read the topic from course book.

Topic: MOSFET Biasing

Step 1

Watch the topic related video uploaded on LMS.

Step 2

MOSFET Biasing

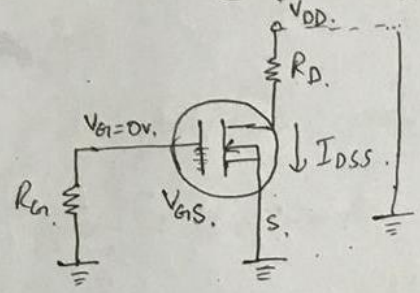
Three ways to bias a MOSFET.

(1) Zero bias.

(2) Voltage-divider bias.

(3) Drain feedback bias.

D-MOSFET bias (zero bias):-

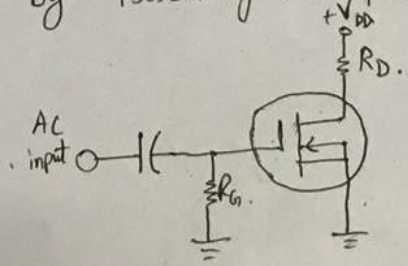


As we know that $V_{GS}=0V$. $I_D = I_{DSS}$ (~~near~~ Repeal very few electrons from channel).

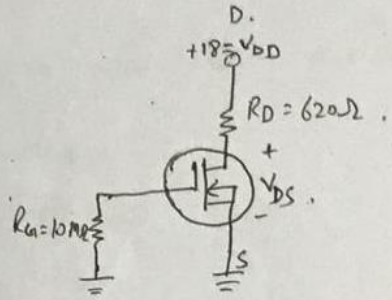
Apply KVL on above circuit.

$$V_{DS} = V_{DD} - I_{DSS}R_D.$$

Purpose of R_G is to accomodate an ac signal input by isolating it from ground.



Example 7-15. Determine the drain-to-source voltage in the circuit of fig. The MOSFET data sheet gives $V_{GS(off)} = -8V$ and $I_{DSS} = 12mA$



As its zero bias circuit.

$I_D = I_{DSS} = 12mA$

drain to source voltage is.

$V_{DS} = V_{DD} - I_D R_D$.

$V_{DS} = V_{DD} - I_{DSS} R_D$.

$V_{DS} = 18V - (12mA)(620\Omega)$

$V_{DS} = 10.6V$.

class work when $V_{GS(off)} = -10V$ $I_{DSS} = 20mA$.

$V_{DS} = ?$

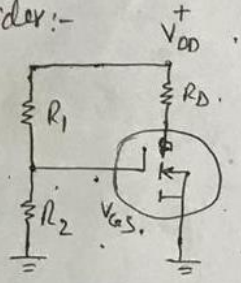
E-MOSFET bias :-

In E-MOSFET V_{GS} greater than the threshold value, $V_{GS(th)}$ so zero bias can not be used.

Two ways to bias an E-MOSFET.

→ Voltage divider.
→ Drain-feedback bias.

Voltage-divider :-



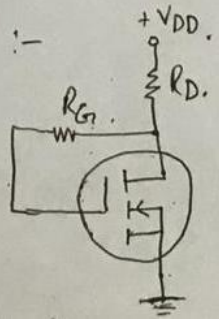
Voltag-divider bias.

$$V_{GS} = \left(\frac{R_2}{R_1 + R_2}\right) V_{DD}.$$

$$V_{DS} = V_{DD} - I_D R_D.$$

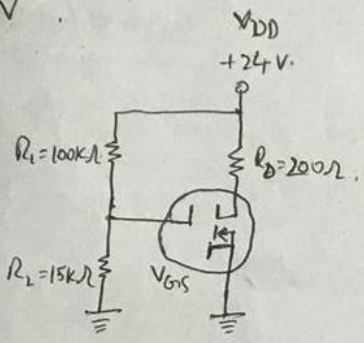
where $I_D = K(V_{GS} - V_{GS(th)})^2$

Drain-Feedback bias :-



In drain feedback bias circuit, there is negligible gate current and therefore no voltage drop across R_G. This makes $V_{GS} = V_{DS}$.

Example 7-16 :- Determine V_{GS} and V_{DS} for the E-MOSFET circuit in Fig. Assume this particular MOSFET has minimum values of $I_{D(on)} = 200\,mA$ at $V_{GS} = 4V$ and $V_{GS(th)} = 2V$.



$$V_{GS} = \left(\frac{R_2}{R_1 + R_2}\right) V_{DD} = \left(\frac{15K\Omega}{115K\Omega}\right) 24 = 3.13V$$

for $V_{DS} = V_{DD} - I_D R_D$ —— (1)

we need to find I_D for $V_{GS} = 3.13V$.

$$I_D = K\left(V_{GS} - V_{GS(th)}\right)^2 \text{ .} \quad \text{——(2)}$$

Now first we will find K.

2(b)

using assumption to find K.

$I_{D(on)} = 200mA$

at $V_{GS} = 4V$ $V_{GS(th)} = 2V$.

$$I_{D(on)} = K\left(V_{GS} - V_{GS(th)}\right)^2.$$

$$200mA = K\left(4-2\right)^2.$$

$$K = \frac{200mA}{4V^2} = 50mA/V^2.$$

$$\boxed{K = 50mA/V^2}$$

put this value of K in equ (2) to find I_D for $V_{GS} = 3.13V$.

$$I_D = 50m\left(3.13 - 2\right)^2$$

$$\boxed{I_D = 63.8mA}$$

using this value of I_D in equ (1)

$$V_{DS} = V_{DD} - I_D R_D$$

$$V_{DS} = 24 - (63.8mA)(200\Omega)$$

$$\boxed{V_{DS} = 11.2V.} \qquad \boxed{V_{GS} = 3.13V.}$$

Step3: Read topic 7.5, 7.6 from text book (Thomas L Floyd 7th edition)