



BAŞKENT UNIVERSITY
ELECTRIC & ELECTRONICS ENGINEERING

EEM 214 ~ ELECTRONICS–I
LABORATORY
REPORT

Experiment Name : MOSFET Transistor Basics

Experiment Number : 9

Student Name : XXXXXXXXXX
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Student Number XXXXXXXXXX
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Experiment Date/Day: 12 / 5 / 2006

Laboratory Number:

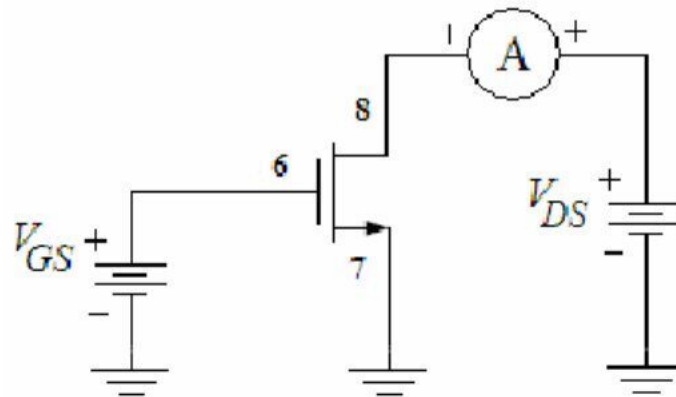
Honor Pledge:

I did this preliminary work or lab report by myself and I have neither cheat from anybody nor let anybody cheat from me at the any part of this work.

Student Signature:

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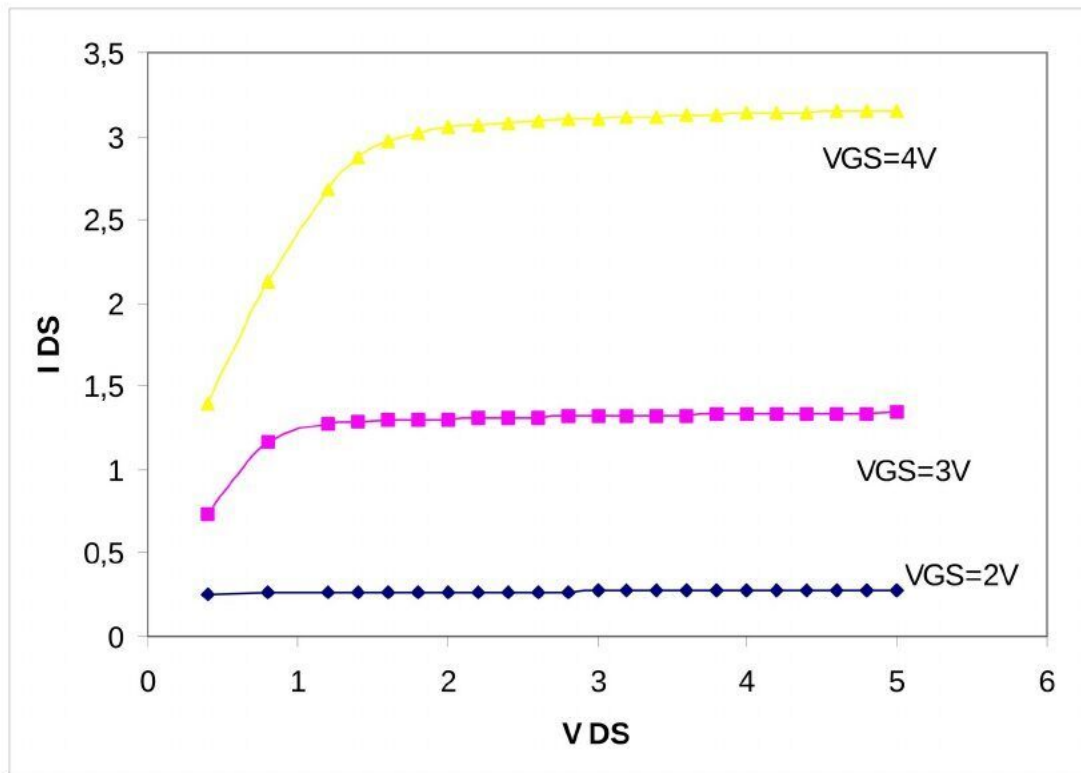
1-)



c-)

V_{DS}	I_{DS}		
	$V_{GS} = 2V$	$V_{GS} = 3V$	$V_{GS} = 4V$
0,4 V	0,250	0,738	1,393
0,8V	0,262	1,170	2,129
1,2V	0,265	1,270	2,680
1,4V	0,266	1,284	2,880
1,6V	0,267	1,294	2,969
1,8V	0,268	1,301	3,014
2V	0,268	1,304	3,049
2,2V	0,269	1,309	3,068
2,4V	0,270	1,312	3,082
2,6V	0,270	1,315	3,090
2,8V	0,270	1,319	3,099
3V	0,271	1,321	3,108
3,2V	0,272	1,324	3,115
3,4V	0,272	1,326	3,120
3,6V	0,272	1,328	3,126
3,8V	0,273	1,330	3,132
4V	0,273	1,332	3,136
4,2V	0,273	1,334	3,139
4,4V	0,274	1,336	3,143
4,6V	0,274	1,338	3,148
4,8V	0,275	1,340	3,151
5V	0,276	1,342	3,154

All I_{DS} values are measured as mA

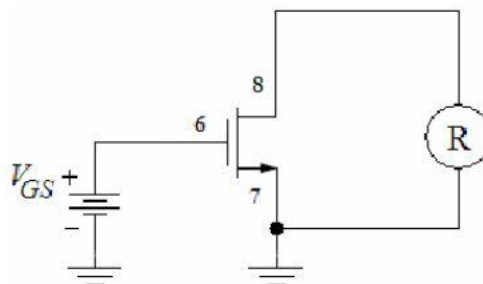


Using the data collected in Part.1 we plotted a family of curves (using Excel) for the three values of V_{GS} overlaid on the same graph.

2-) With $V_{DS} = 5V$, we determine the value of V_{GS} at which the current I_{DS} becomes negligible; assume for the purposes here that this means $5\ \mu A$.

$$V_{GS} = 1.2\ V$$

3-)



b-)

V_{GS}	r_{ohmic}
1.5 V	2,634 K
2 V	960 Ω
3 V	447 Ω
4 V	302 Ω

5 V	241 Ω
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For the following conditions given, we calculated the drain-source r_{ohmic} . We saw that the measured and calculated values were nearly the same values.

a.) $V_{GS} = 1.5V$;

$$\mu_o C_{OX} \left(\frac{W}{L} \right) [V_{GS} - V_T - V_{DS}] = \frac{1}{r_{ohmic}} \rightarrow$$

$$166.67 \mu A/V^2 \times (3) \times [1.5 - 1.45] = \frac{1}{r_{ohmic}} \rightarrow r_{ohmic} = \underline{4.000} \text{ k}\Omega$$

b.) $V_{GS} = 2V$;

$$\mu_o C_{OX} \left(\frac{W}{L} \right) [V_{GS} - V_T - V_{DS}] = \frac{1}{r_{ohmic}} \rightarrow$$

$$166.67 \mu A/V^2 \times (3) \times [2 - 1.45] = \frac{1}{r_{ohmic}} \rightarrow r_{ohmic} = \underline{3.636} \text{ k}\Omega$$

c.) $V_{GS} = 3V$;

$$\mu_o C_{OX} \left(\frac{W}{L} \right) [V_{GS} - V_T - V_{DS}] = \frac{1}{r_{ohmic}} \rightarrow$$

-2-

$$166.67 \mu A/V^2 \times (3) \times [3 - 1.45] = \frac{1}{r_{ohmic}} \rightarrow r_{ohmic} = \underline{1.290} \text{ k}\Omega$$

d.) $V_{GS} = 4V$;

$$\mu_o C_{OX} \left(\frac{W}{L} \right) [V_{GS} - V_T - V_{DS}] = \frac{1}{r_{ohmic}} \rightarrow$$

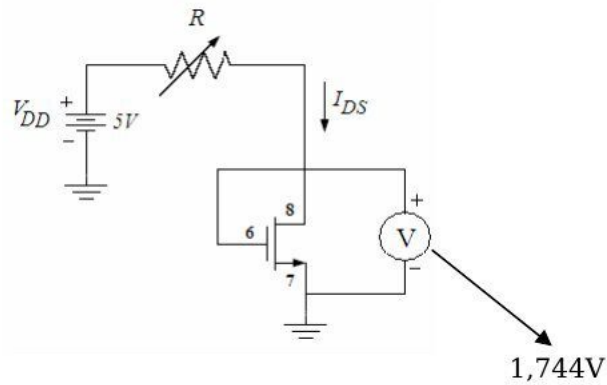
$$166.67 \mu A/V^2 \times (3) \times [4 - 1.45] = \frac{1}{r_{ohmic}} \rightarrow r_{ohmic} = \underline{0.784} \text{ k}\Omega$$

e.) $V_{GS} = 5V$;

$$\mu_o C_{OX} \left(\frac{W}{L} \right) [V_{GS} - V_T - V_{DS}] = \frac{1}{r_{ohmic}} \rightarrow$$

$$166.67 \mu A/V^2 \times (3) \times [5 - 1.45] = \frac{1}{r_{ohmic}} \rightarrow r_{ohmic} = \underline{0.563} \text{ k}\Omega$$

4-)



c-)

R _{POT}	I _{DS}	V _{DS}
29,18 K	100μA	1,744 V
40,92 K	75μA	1,658 V
70,5 K	50μA	1,556 V

Using Equation 4 for the voltage of a diode-connected MOSFET, we calculated the voltages for the following conditions given: We again saw that the measured and calculated values were nearly the same.

I_{DS}=100μA

$$V_{MOSDIODE} = V_T + \sqrt{\frac{I_{DS}}{\frac{1}{2}\mu_o C_{OX} \left(\frac{W}{L}\right)}} \Rightarrow V_{MOSDIODE} = 1.45 + \sqrt{\frac{100}{\frac{1}{2}166.67 \times (3)}}$$

$$\Rightarrow V_{DS} \equiv \underline{2.08 \text{ V}}$$

I_{DS}=75μA

$$V_{MOSDIODE} = V_T + \sqrt{\frac{I_{DS}}{\frac{1}{2}\mu_o C_{OX} \left(\frac{W}{L}\right)}} \Rightarrow V_{MOSDIODE} = 1.45 + \sqrt{\frac{75}{\frac{1}{2}166.67 \times (3)}}$$

$$\Rightarrow V_{DS} \equiv \underline{2.00 \text{ V}}$$

I_{DS}=50μA

$$V_{MOSDIODE} = V_T + \sqrt{\frac{I_{DS}}{\frac{1}{2}\mu_o C_{OX} \left(\frac{W}{L}\right)}} \Rightarrow V_{MOSDIODE} = 1.45 + \sqrt{\frac{50}{\frac{1}{2}166.67 \times (3)}}$$

$$\Rightarrow V_{DS} \equiv \underline{1.90 \text{ V}}$$

I_{DS}	V_{DS} (Calculated)
100μA	2.08 V
75μA	2.00 V
50μA	1.90 V