

Circuit Simulation Project

<https://esim.fossee.in/circuit-simulation-project>

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Title of the circuit: Analysis of MOSFET characteristics

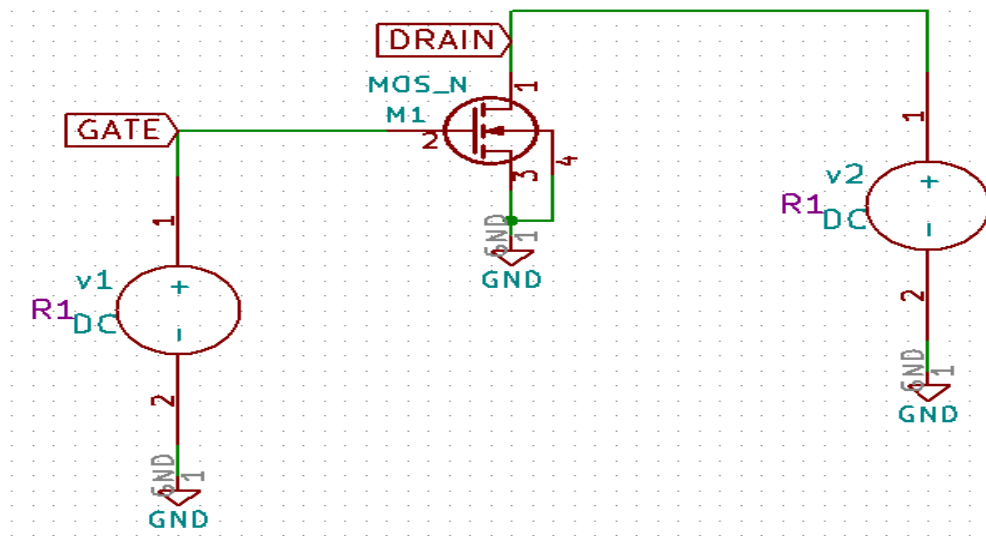
Theory/Description:

In this project, **MOSFET model NMOS-180um Drain characteristics and Transfer characteristics** is analysed. The metal–oxide–semiconductor field-effect transistor (MOSFET) is a field-effect transistor where the voltage determines the conductivity of the device. It is a four-terminal device with source(S), gate (G), drain (D) and body (B) terminals. These devices can be classified into two types viz., depletion-type and enhancement-type, depending on whether they possess a channel in their default state or no, respectively. Further, each of them can be either p-channel or n-channel devices. The N-Channel MOSFET has an N- channel region located in between the source and drain terminals. In this type of Field Effect Transistor, the drain and source are heavily doped n+ region and the substrate or body are of P-type.

The **drain characteristics** of a MOSFET are drawn between the drain current I_D and the drain source voltage V_{DS} . Actually when V_{DS} is increased, the drain current I_D should increase, but due to the applied V_{GS} , the drain current is controlled at certain level. Hence the gate current controls the output drain current.

Transfer characteristics define the change in the value of V_{DS} with the change in I_D and V_{GS} in both depletion and enhancement modes.

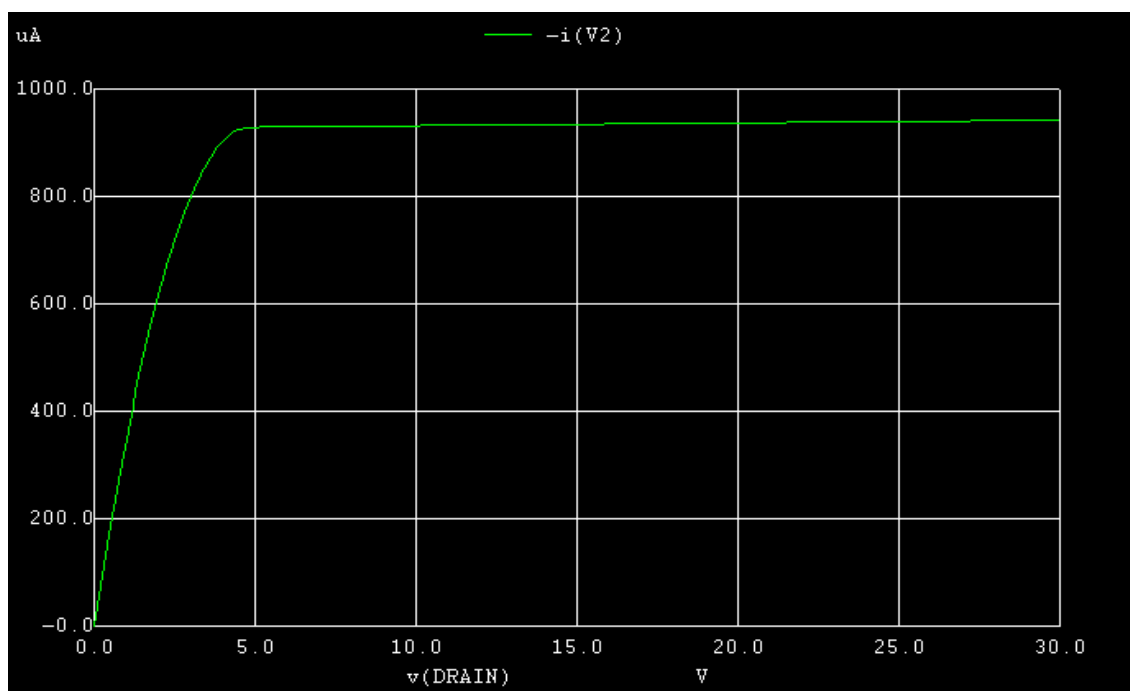
Circuit Diagram(s):



Results :

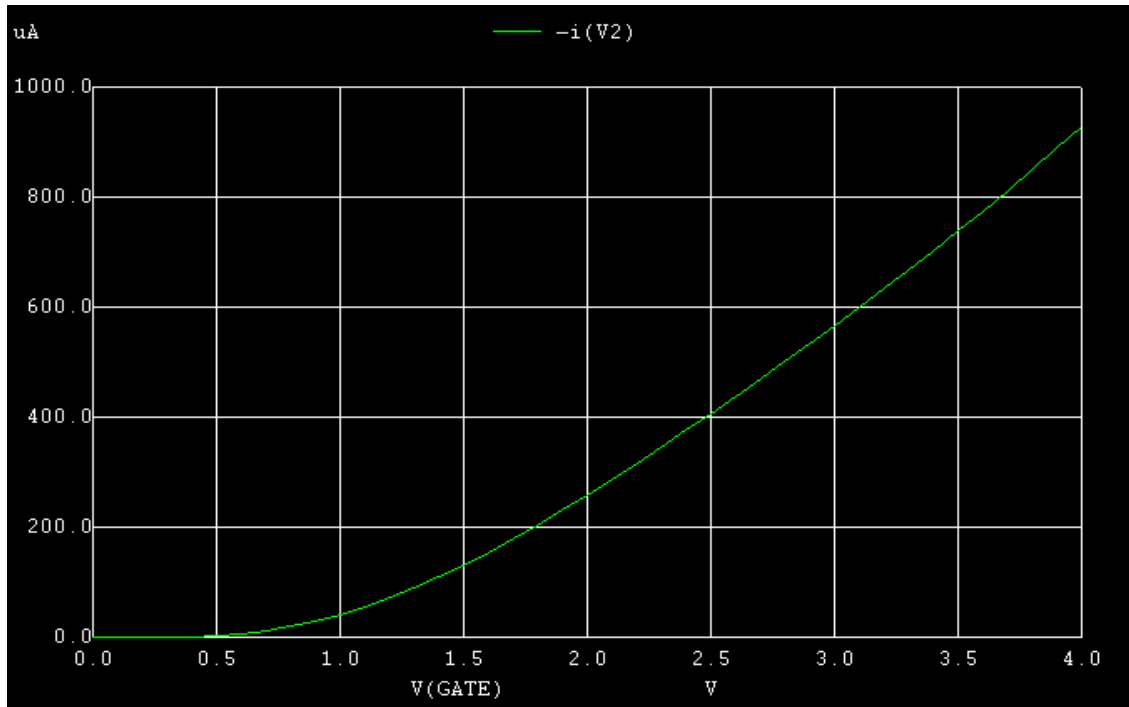
Ngspice Plots:

i) Plot $i(v2)$ vs $V(\text{DRAIN})$



The drain characteristics of NMOS with gate voltage=4v

ii) Plot $i(V_2)$ vs $V(\text{GATE})$



The transfer characteristics of NMOS with drain voltage=5v

Conclusion:

Thus, we have studied the drain and transfer characteristics of NMOS using eSim and we got the appropriate waveform.

Source/Reference(s):

<https://en.wikipedia.org/wiki/MOSFET>

https://vlsi-iitg.vlabs.ac.in/MOSFET_theory.html