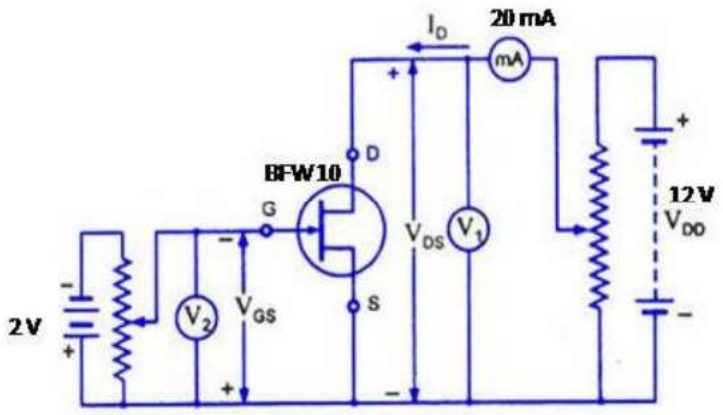

I_D
20 mA
mA
D
BFW10
G
S
V_{DS}
V_1
12 V
V_{DD}
2 V
V_2
V_{GS}

EXPERIMENT-10

Objective: To verify V-I characteristics of MOSFET.

Apparatus required

Power supply

Lab trainer kit

Jumper wires

Oscilloscope

Waveform generator

Multimeter

Theory

MOSFET is a field effect transistor whose drain current (I_D) is controlled by the voltage on the gate. MOSFET has a much higher input impedance because of the very small gate leakage current. It has wide applications in the field of modern-era digital circuits. It is used in the amplification of the signal and switching action. Its major advantage over BJT in switching is that it is much more power efficient at high-frequency switching. It has a +ve temperature coefficient, so it is thermally stable.

MOSFET is of 2 types: a) enhancement type - n & p type b) depletion type - n & p type

The experiment will be done with n-enhancement type MOSFET.

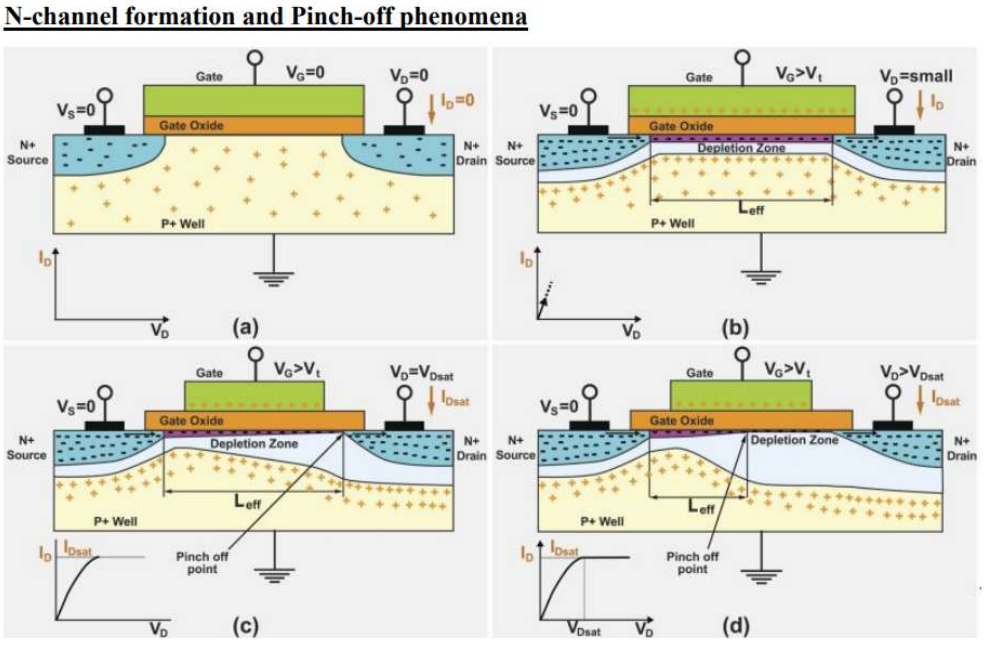


Figure 1

Figure 1 (a) $V_G = 0$, no biasing between Gate & Source,

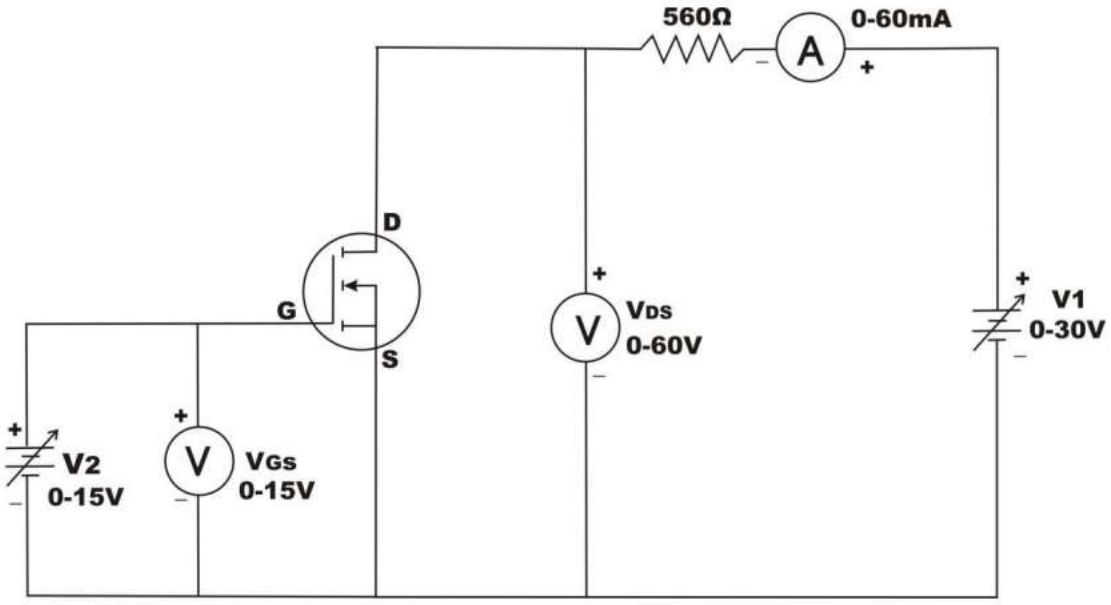
Figure 1(b) $V_G > V_T$, forward bias to Gate

w.r.t to Source. The -ve charge is pulled towards Gate. Thus, at a particular point number of electrons > number of holes within the depletion region. So, there is a creation of a region where n-type conductivity opposed to p-type is formed. This is called the inversion region. Hence n-channel is formed through which electrons can flow.

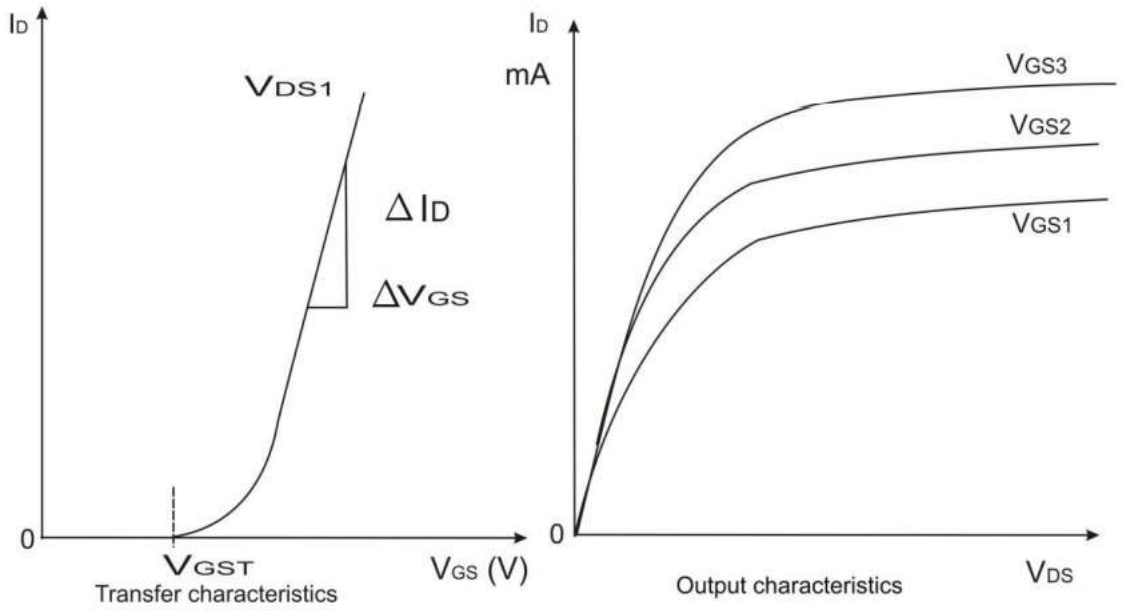
Figure 1(c) $V_D = V_{DSat} = V_{GS} - V_T$, transition from ohmic region to saturation region,

Figure 1(d) $V_D > V_{DSat}$, pinch-off point moves towards the Source thus reducing the channel length. Under these conditions, the area between the pinch-off point and the drain is fully depleted with no inversion layer. Since this region has no positive free carriers, there is no possibility for electron-hole recombination if an electron enters the region from the electron-rich source and, if there is an electric field across the depletion zone, the electron can freely transit to the drain. The current through the device becomes controlled solely by the gate voltage under drain saturation conditions.

Circuit diagram



Nature of Graph



PROCEDURE:

Transfer Characteristics:

1. Make the connections as per the circuit diagram.
2. Initially keep V_1 and V_2 at 0 V.
3. Switch ON the regulated power supplies. By varying V_1, set V_{DS} to some constant voltage say 5V.
4. Vary V in steps of 0.5V, and at each step note down the corresponding values of V_{GS} and I_D. (Note: note down the value of V_{GS} at which I_D starts increasing as the threshold voltage).
5. Reduce V_1 and V_2 to zero.
6. By varying V_1, set V_{DS} to some other value say 10V.
7. Repeat step 4.
8. Plot a graph of V_{GS} versus I_D for different values of V_{DS}.

Drain or Output Characteristics:

1. Make the connections as per the circuit diagram.
2. Initially keep V_1 and V_2 at zero volts.
3. By varying V_2, set V_{GS} to some constant voltage (must be more than Threshold voltage).
4. By gradually increasing V_1, note down the corresponding value of V_{DS} and I_D. (Note: Till the MOSFET jumps to conducting state, the voltmeter which is connected across device as VDS reads approximately zero voltage. Further increase in voltage by V1 source cannot be read by VDS, so connect multimeter to measure the voltage and tabulate the readings in the tabular column).
5. Set V_{GS} to some other value (more than threshold voltage) and repeat step 4.
6. Plot a graph of V_{DS} versus I_D for different values of V_{GS}.