

Dr. MD. Aslam, Dept. Of physics,  
B.Sc. part-2 physics (Hons) paper-iv  
Lecture no-51

## Topic: Field Effect transistor

An FET is a three-terminal unipolar semiconductor device. It is a **voltage controlled device** unlike a bipolar junction transistor. The main advantage of FET is that it has a very high input impedance, which is in the order of Mega Ohms. It has many advantages like low power consumption, low heat dissipation and FETs are highly efficient devices.

# Features of FET

The following are the varied features of a Field Effect Transistor.

- ▣ **Unipolar** – It is unipolar as either holes or electrons are responsible for conduction.
- ▣ **High input impedance** – The input current in a FET flows due to the reverse bias. Hence it has high input impedance.
- ▣ **Voltage controlled device** – As the output voltage of a FET is controlled by the gate input voltage, FET is called as the voltage controlled device.
- ▣ **Noise is low** – There are no junctions present in the conduction path. Hence noise is lower than in BJTs.
- ▣ **Gain is characterized as transconductance.**  
Transconductance is the ratio of change in output current to the change in input voltage.

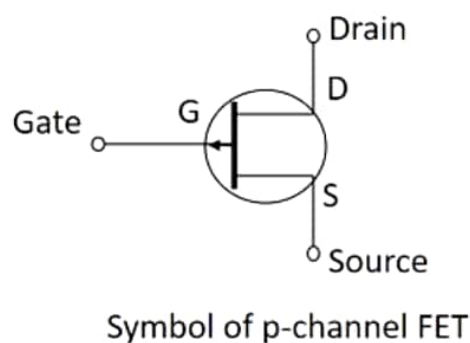
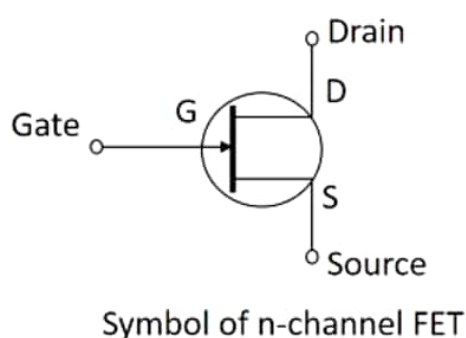
## Applications of FET

- FET is used in circuits to reduce the loading effect.
- FETs are used in many circuits such as Buffer Amplifier, Phase shift Oscillators and Voltmeters.

## FET Terminals

Though FET is a three terminal device, they are not the same as BJT terminals. The three terminals of FET are Gate, Source and Drain. The **Source** terminal in FET is analogous to the Emitter in BJT, while **Gate** is analogous to Base and **Drain** to Collector.

The symbols of a FET for both NPN and PNP types are as shown below



## Source

- ▣ The Source terminal in a Field Effect Transistor is the one through which the carriers enter the channel.
- ▣ This is analogous to the emitter terminal in a Bipolar Junction Transistor.
- ▣ The Source terminal can be designated as **S**.
- ▣ The current entering the channel at Source terminal is indicated as  $I_S$ .

## Gate

- ▣ The Gate terminal in a Field Effect Transistor plays a key role in the function of FET by controlling the current through the channel.
- ▣ By applying an external voltage at Gate terminal, the current through it can be controlled.

- ▣ Gate is a combination of two terminals connected internally that are heavily doped.
- ▣ The channel conductivity is said to be modulated by the Gate terminal.
- ▣ This is analogous to the base terminal in a Bipolar Junction Transistor.
- ▣ The Gate terminal can be designated as **G**.
- ▣ The current entering the channel at Gate terminal is indicated as  $I_G$ .

## Drain

- ▣ The Drain terminal in a Field Effect Transistor is the one through which the carriers leave the channel.
- ▣ This is analogous to the collector terminal in a Bipolar Junction Transistor.

- The Drain to Source voltage is designated as  $V_{DS}$ .
- The Drain terminal can be designated as **D**.
- The current leaving the channel at Drain terminal is indicated as  $I_D$ .