Metal Insulator Semiconductor Field Effect Transistors (MISFETs):

The Metal Insulator Semiconductor Field Effect Transistors (MISFETs) is one of the most widely used electronic devices, particularly in digital circuits, because of relatively small size-thousands of devices can be fabricated in a single integrated circuit (IC). Since it is constructed with the gate terminal insulated from the channel, it may be referred to generally as an **insulated-gate field-effect transistor (IGFET)**.

However, since most of such devices are made using silicon for the semiconductor, SiO_2 for the insulator, and metal or heavily doped polysilicon for the gate electrode, the term **metal-oxide-semiconductor field-effect transistor (MOSFET)** or simply MOS is commonly used. MISFET is the more general term, where the insulator is not necessarily silicon dioxide (SiO_2) and the semiconductor is not necessarily silicon (Si). Here discussion will be about MOSFETs although the same physics applies to the Metal Insulator Semiconductor Field Effect Transistors.

Like, a JFET, a MOSFET is also a three terminal (source, gate and drain) device and drain current in it is also controlled by gate bias. The operation of MOSFET is similar to that of JFET. It can be employed in any of the circuits covered for the JFET and, therefore, all the equations apply equally well to the MOSFET and JFET in amplifier connections. However, MOSFET has lower capacitance and input impedance much more than that of a JFET owing to small leakage current. In case of a MOSFET the positive voltage may be applied to the gate and still the gate current remains zero.

MOSFETs are of two types namely (i) **enhancement type MOSFET or E-MOSFET** and (ii) **depletion type MOSFET or DE-MOSFET**. In the depletion-mode construction a channel is physically constructed and a current between drain and source is due to voltage applied across the drain-source terminals. The enhancement MOSFET structure has no channel formed during its construction. Voltage is applied to the gate, in this case, to develop a channel of charge carriers so that a current results when a voltage is applied across the drain-source terminals.

The enhancement type MOSFET (E-MOSFET) is widely used in both discrete and integrated circuits. In discrete circuits, the main use is in power switching, which means turning largest currents on and off. In ICs, the main use is in digital switching, the basic process behind modern computers. Although their use is declined, depletion-mode MOSFETs (DE-MOSFETs) are still found in high-frequency front-end communication circuits as RF amplifiers.

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