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MOSFET AND TRANSISTOR PERFORMANCE ANALYSIS

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Abstract:-
In this article, we are going to learn about MOSFET, it's the definition Application of MOSFET as a switch, advantages, and disadvantages, etc. MOSFET is known as the metal–oxide–silicon field-effect transistor. The MOSFET is a form of insulated-gate field-effect transistor that is created by the controlled oxidation of a semiconductor, often silicon. Because the device is available in very small sizes, a MOSFET can be either a core or an integrated circuit, in which case it is developed and produced on a single silicon chip. Because of the development of the MOSFET device, the field of switching in electronics has undergone a significant transformation. Let us now proceed to a more in-depth examination of this topic.

Define MOSFET
A MOSFET is a four-terminal device with four terminals: the source (S), the gate (G), the drain (D), and the body (B). MOSFETs are three-terminal devices, and the body of a MOSFET is connected to the source terminal, creating a device similar to a field-effect transistor in appearance. MOSFET is commonly regarded as a type of transistor and is used in both analog and digital circuits, depending on the application.

Applications of MOSFET as a switch
One of the most notable applications of this device is a switch in automatic brightness control in street lights, which is one of the most common examples. Nowadays, high-intensity discharge lamps (HIDs) are used in a large number of traffic lights, particularly on highways. Utilizing HID bulbs, on the other hand, results in greater energy consumption. Because the brightness cannot be adjusted based on the requirements, a switch for the alternative lighting technology, which is LED, must be provided for convenience. The use of an LED system will eliminate the drawbacks associated with high-intensity bulbs. The basic notion behind its development was to employ a microprocessor to directly control the lights on highways, which was the primary motivation behind its construction.

Structure of MOSFET
It is a four-terminal device with terminals for the source (S), drain (D), and gate Terminal (G), as well as the body (B). Because the body is commonly attached to the source terminal, the number of available terminals is reduced to three. A channel through which charge carriers pass is made wider or narrower depending on the situation (electrons or holes).
The charge carriers enter the channel at the source and exit the channel at the drain, in that order. The width of the channel is controlled by the voltage applied to an electrode known as the gate, which is placed between the source and drain of the transistor. It is protected from the channel by a very thin coating of metal oxide in the vicinity of it. A metal-insulator-semiconductor field-effect transistor, sometimes known as a MISFET, is a phrase that is almost synonymous with the term metal-oxide-semiconductor field-effect transistor. Another name for the insulated-gate field-effect transistor is the IGFET (insulated-gate field-effect transistor).

Power MOSFETs are a type of semiconductor device that emerged from the MOS integrated circuit. Initial attempts to build high voltage MOSFETs were made by modifying lateral MOSFETs in order to boost their voltage blocking capacity. The resulting technology was dubbed lateral double diffused MOS (lateral double diffused MOS) (DMOS). However, it was quickly discovered that using a vertically oriented construction might result in far higher breakdown voltage and current ratings than using a horizontally oriented structure. Almost all Power MOSFET manufacturers have since adopted the vertical DMOS (VDMOS) structure as a result of this development. VDMOS technology is used to create a power MOSFET with a vertically oriented three-layer structure that alternates between p type and n type semiconductors. A vast number of cells are connected in parallel in order to produce a full piece of equipment or apparatus.

Advantages of MOSFET
1.MOSFETs have a much faster-switching speed than other types of transistors, such as BJTs.
1. MOSFETs are capable of handling a considerable amount of current, but not as much as SCRs and IGBTs.
2. MOSFETs can handle higher temperatures.

3. Because of the extremely minimal voltage drop that occurs in MOSFETs, they have extremely high switching efficiency.
4. The input impedance of a MOSFET is extremely high, which helps to boost its efficiency.
5. Another significant advantage of MOSFETs is that they are voltage-regulated devices, which aid in the reduction of loss and the enhancement of efficiency.
6. Because it can withstand more heat, the MOSFET has a very low likelihood of experiencing thermal runaway.
7. Due to the fact that the MOSFET is a unipolar device, it produces no noise.
8. Compared to other transistors, the MOSFET has an extremely low power loss.

Types of MOSFET

As a result of their almost infinite input impedance, MOSFETs are particularly helpful in amplifiers because they allow the amplifier to capture nearly all of the incoming signal. When compared to bipolar transistors, the fundamental advantage of this type of transistor is that it takes almost no input current to control the load current. The following are the numerous varieties of MOSFETs available:

Transistor with Depletion Type: To turn the device “OFF,” the transistor requires the Gate-Source voltage (VGS). The depletion-mode MOSFET is analogous to a “Normally Closed” switch in its operation.

The transistor requires a Gate-Source voltage (VGS) to be applied in order to turn the device “ON.” The enhancement-mode MOSFET is analogous to a “Normally Open” switch in its operation. introduced in the low resistance circuit and output is taken from the high resistance circuit. Therefore, a transistor transfers a signal from a low resistance to high resistance. The prefix ‘trans’ means the signal

transfer property of the device while ‘resistor classifies

Reference

1. Zinoviev, G. *Fundamentals of Power Electronics—Part II*; Novosibirsk State University: Novosibirsk, Russia, 2004. (In Russian) [**Google Scholar**]
2. Rashid, M.H. *Power Electronics Handbook: Devices, Circuits, and Applications*; Academic Press: Cambridge, MA, USA, 2007.
3. Ned Mohan, U.; Tore, M.; Robbins; William, P. *Power Electronics—Converters, Applications, and Design*, 3rd ed.; John Wiley & Sons: Hoboken, NJ, USA, 2003. [**Google Scholar**]
4. Mauricio, J.M.; Torres, M.; Baier, C.; Silva, J. Enhanced average model for current source converter hybrid simulations. In Proceedings of the IEEE International Conference on Industrial Technology (ICIT), Seville, Spain, 17–19 March 2015; pp. 2520–2525. [**Google Scholar**] [**CrossRef**]
5. Dokić, B.L.; Blanuša, B. *Power Electronics Converters and Regulators*, 3rd ed.; Springer International Publishing: Cham, Switzerland, 2015; ISBN 978-3-319-09401-4. [**Google Scholar**]
6. Khluabwannarat, P.; Thammarat, C.; Tadsuan, S.; Bunjongjit, S. An analysis of iron loss supplied by sinusoidal, square wave, bipolar PWM inverter and unipolar PWM inverter. In Proceedings of the 2007 International Power Engineering Conference (IPEC 2007), Singapore, 3–6 December 2007; pp. 1185–1190. [**Google Scholar**]
7. Kharjule, S. Voltage source inverter. In Proceedings of the 2015 International Conference on Energy Systems and Applications, Pune, India, 30 October–1 November 2015; pp. 537–542. [**Google Scholar**] [**CrossRef**]
8. Popov, E. *Analysis, Modeling and Design of Converter Units (Computer—Aided Design of Power Electronic Circuits)*; Technical University Printing House: Sofia, Bulgaria, 2005. (In Bulgaria) [**Google Scholar**]
9. Penev, D.; Arnaudov, D.; Hinov, N. Formalization, Equivalence and Generalization of Basic Resonance Electrical Circuits. In Proceedings of the AIP Conference Proceedings, Sozopol, Bulgaria, 8–13 June 2017; Volume 1910, ISBN 978-0-7354-1602-4. [**Google Scholar**] [**CrossRef**] [**Green Version**]
10. Kazimierczuk, M.K.; Czarkowski, D. *Resonant Power Converters*, 2nd ed.; IEEE Press and John Wiley & Sons: New York, NY, USA, 2011; pp. 1–595. ISBN 978-0-470-90538-8. [**Google Scholar**]
11. Gradinarov, N.P. Analysis and Development of Autonomous Resonant Inverters with Electrical Application. Ph.D. Thesis, Technical University of Sofia, Sofia, Bulgaria, 2002. (In Bulgarian). [**Google Scholar**]