Introduction To Electronics

# MOSFET Parameters

# MOSFET Selections & Applications

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# What Is MOSFET?

Field effect transistor (MOSFET) is a commonly used electronic component and a transistor widely used in digital and analog circuits. The function of the MOSFET is to control the current, and by adjusting the gate voltage, the current between the source and drain can be controlled. The MOSFET consists of three parts: the gate, the source and the drain. The gate is used to control the current, the source is used to introduce current, and the drain is used to output current.

MOSFET can also be divided into two types: NMOSFET and PMOSFET. The circuit symbol is shown in the figure below:

A diagram of a circuit

Description automatically generated with medium confidence

# Key Parameters Of MOSFET.

## 1-Saturation Drain-Source Current (IDSS):

The saturated drain-source current is the maximum current at the drain of the FET when the gate-source voltage VGS is zero. IDSS is a basic parameter, which is very important for the use of equipment, because it indicates the limiting current capacity of the equipment. If the current exceeds this value, the performance of the FET will be severely affected and may cause damage to the device.

## 2-Transfer Guide (GM):

The transfer conductance is the conduction slope of the circuit on the output pole of the FET, which is measured by the ratio of the current change to the gate-source voltage change.

## 3-Negative Temperature Coefficient Of Gain (TCGA):

Negative gain temperature coefficient is a FET parameter that is the proportional change in negative gain as temperature changes. This parameter is important because at high temperatures, the performance of the FET is easily compromised. At low temperatures, however, the negative gain coefficient of the FET is greatly reduced, which can be detrimental for some applications.

## 4-Forward Capacitance (Cgs):

The forward capacitance is the capacitance between the gate and source of the FET, and it is an important indicator in the FET parameters. The smaller the forward capacitance, the better the frequency response of the FET.

## 5-Blocking Capacitance (Cgd):

The blocking capacitance is the capacitance between the drain and gate of the field effect transistor, and it is also an important FET parameter. The blocking capacitance can affect the switching speed of the FET because it affects the rate at which the FET is discharged.

# MOSFET Selections & Applications.

## 1-Switches

One of the most common applications of MOSFETs is as switches in power electronics circuits. A MOSFET can switch on and off very fast, which allows it to handle high frequencies and reduce power losses. A MOSFET can also handle high currents and voltages, which makes it suitable for high-power applications.

### EX:

-DC-DC converters are circuits that change one DC voltage level to another. Using a MOSFET as a switch, it controls the charging and discharging of an inductor or capacitor, managing energy in cycles. The output voltage is regulated by the switch’s duty cycle—the ratio of on-time to off-time.

A diagram of a circuit

Description automatically generated

-Motor control: These are circuits that control the speed and direction of electric motors. A MOSFET can be used as a switch to control the current flow through the motor windings, which create magnetic fields that rotate the motor shaft. The speed and direction of the motor can be controlled by varying the frequency and polarity of the switch.

## 2-Amplifier

Another common application of MOSFETs is as amplifiers in analog circuits. A MOSFET can amplify a small input signal by controlling a large output current with a small input voltage. A MOSFET can also operate in different regions, such as linear, saturation, or cut-off, depending on the input and output voltages.

EX:  
-Radio-frequency amplifiers boost signals in the radio-frequency spectrum, including radio and microwaves. MOSFETs amplify these signals, enhancing their power for better transmission and reception. Their fast switching speed allows operation at high frequencies.

A diagram of a circuit

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