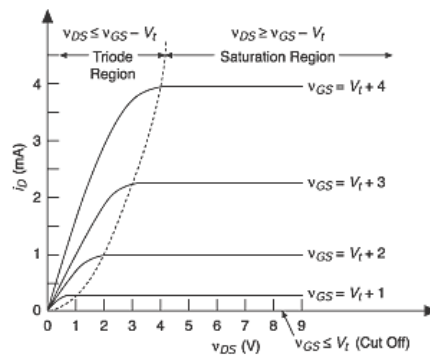


- **Threshold Voltage ( $v_{th}$ ):** This is the minimum required gate-source voltage ( $v_{gs}$ ) to enable the MOSFET.
- **Gate-Source Voltage ( $v_{gs}$ ):** The gate-source voltage is used to describe the voltage difference between the gate, and the source terminals.
- **Drain-Source Voltage ( $v_{ds}$ ):** The drain-source voltage is used to describe the voltage difference between the gate, and the drain terminals. It is also used to define the operating region of the MOSFET.
- **Drain-Source Current ( $i_{ds}$ ):** This is the current flowing from the drain terminal to the source terminal. Its value is dependent on the gate-source voltage, and the drain-source voltage.
- **On-Resistance ( $r_{ds}$ ):** It is the resistance between the drain, and the source terminals when the MOSFET is fully on. It can also be used as an indicator for the power efficiency of the MOSFET.

## Operating Regions



- **Cutoff Region:** A MOSFET is said to be in the cutoff region when it acts as an open switch. This happens when the gate-source voltage is less than the threshold voltage  $v_{gs} < v_t$ , which results in no current flow between the drain and source terminals.
- **Triode Region:** In this region the MOSFET is on and operates like a variable resistor. This happens when the drain-source voltage is less than or equal to the difference between the gate-source voltage and the threshold voltage i.e.  $v_{ds} \leq v_{gs} - v_t$
- **Saturation Region:** This region is used to operate the MOSFET as an amplifier. This happens when the drain-source voltage is greater than or equal to the difference between the gate-source voltage and the threshold voltage  $v_{ds} \geq v_{gs} - v_t$ . In this region the drain-source current is no longer dependent on the drain-source voltage, that's why amplifiers make use of this region.

## Guidelines For Selecting The Right MOSFET

MOSFETs are used in a lot of different applications, and selecting the right MOSFET for the right application is an essential thing. A lot of important factors like the maximum drain-source current  $i_{ds_{max}}$ , drain-source voltage  $v_{ds}$ , and the threshold voltage  $v_t$  play a crucial role in different applications. For example, for low-power applications, the MOSFET should have a low threshold voltage ( $v_t$ ) and low on-resistance ( $r_{ds}$ ) to ensure efficient switching with minimal power loss. However for high-voltage applications, a high drain-source voltage  $v_{ds}$  is recommended, to ensure that the MOSFET can handle the required current without overheating.