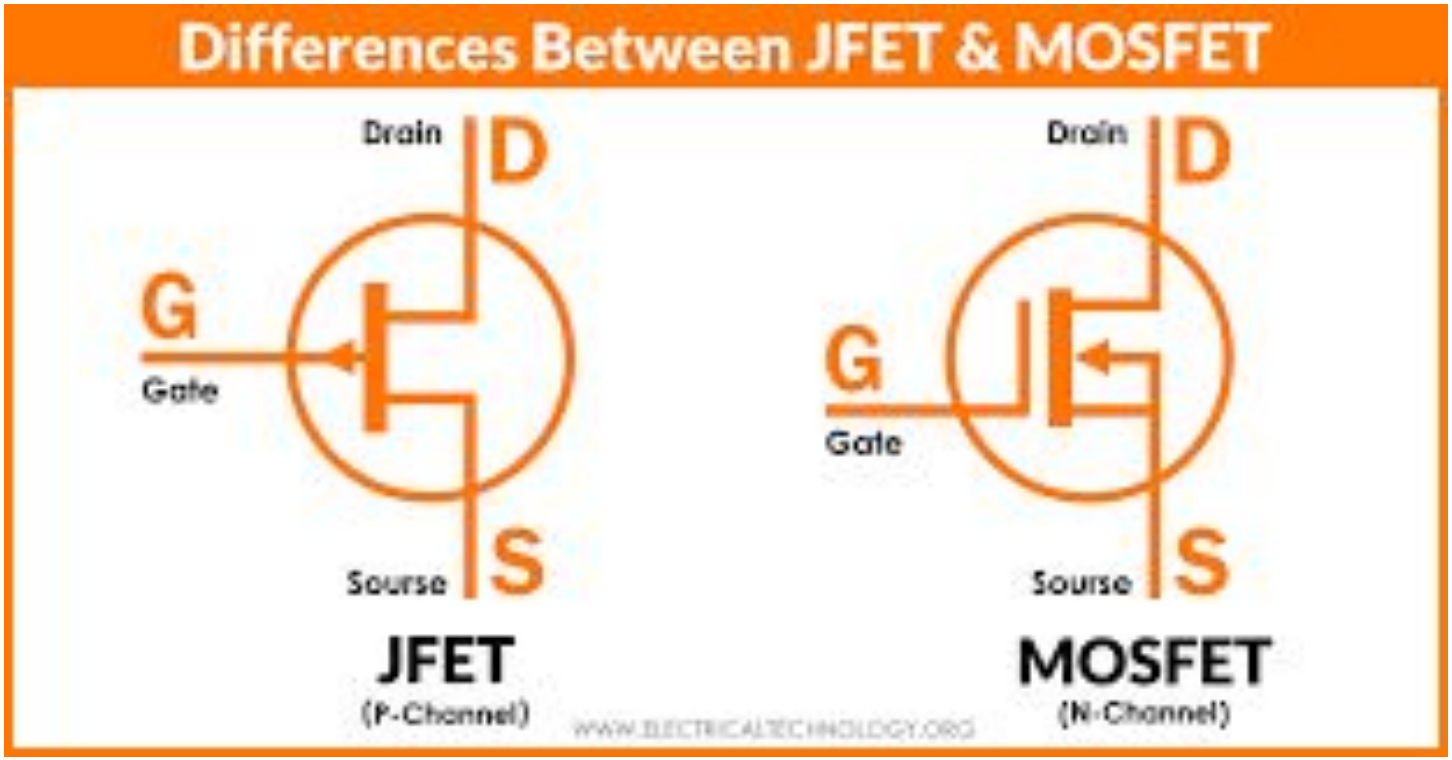
Summary of FET vs. MOSFET

JFET and MOSFET are the two most popular field effect transistors commonly used in electronic circuits. Both JFET and MOSFET are voltage-controlled semiconductor devices used to amplify weak signals using an electric field effect. The name itself hints at the attributes of the device. While they share common attributes corresponding to amplifying and switching, they have their fair share of differences. JFET is operated only in depletion mode, whereas MOSFET is operated in both depletion mode and enhancement mode. MOSFETs are used in VLSI circuits owing to their expensive manufacturing process, against the less expensive JFETs which are mainly used in small signal applications.

JFET VERSUS MOSFET

JFET	MOSFET
JFET stands for Junction Field Effect Transistor.	MOSFET stands for Metal Oxide Semiconductor Field Effect Transistor.
It only operates in the depletion mode.	It operates in both depletion mode and enhancement mode.
It has less input impedance than a MOSFET (about 10^9 Ω).	It offers higher input impedance than JFETs (about 10^14 Ω).
Manufacturing process is simple and less sophisticated which makes them cheaper.	Manufacturing process is complex plus the additional metal oxide layer adds to the high cost.
It is less susceptible to damage because of the high input capacitance.	The metal oxide insulator reduces the input capacitance making it more susceptible to damage.
It is mainly used in low noise applications.	It is mostly used in high noise applications.

Differences Between JFET & MOSFET



JFET

Working of JEFT

The working of JFET can be explained as follows:

Case-i:

When a voltage VDS is applied between drain and source terminals and voltage on the gate is zero as shown in fig.3(i), the two pn junctions at the sides of the bar establish depletion layers.

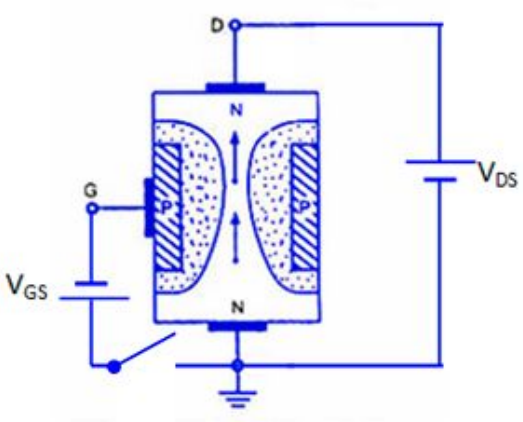


Fig.3 (i)

The electrons will flow from source to drain through a channel between the depletion layers.

Case-ii:

When a reverse voltage VGS is applied between gate and source terminals, as shown in fig.3(ii), the width of depletion layer is increased.

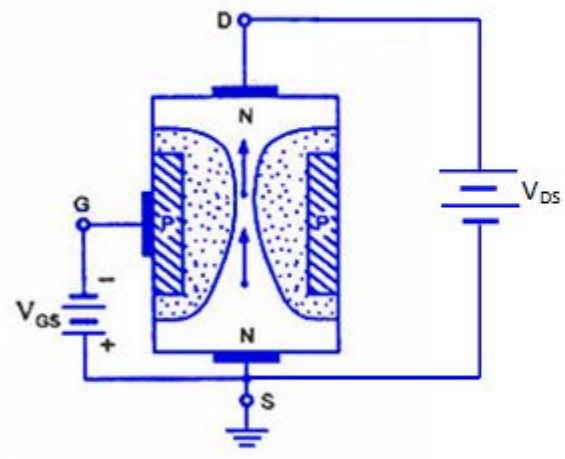


Fig.3 (ii)

This reduces the width of conducting channel, thereby increasing the resistance of n-type bar.

This reduces the width of conducting channel, thereby increasing the resistance of n-type bar.

Consequently, the current from source to drain is decreased.

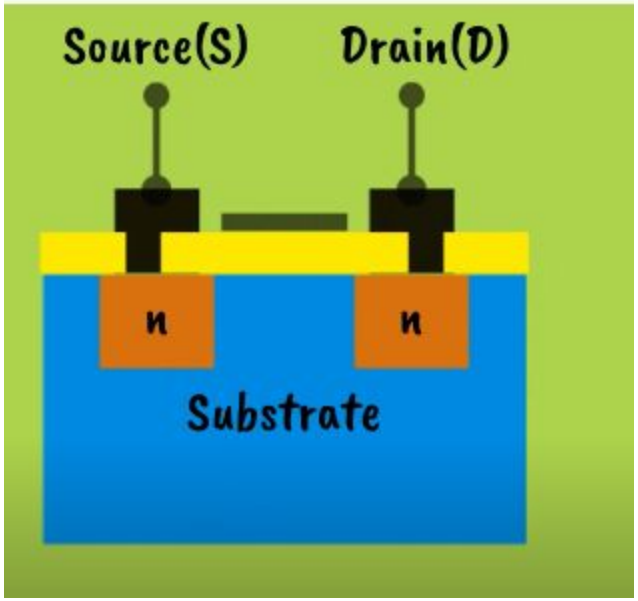
On the other hand, when the reverse bias on the gate is decreased, the width of the depletion layer also decreases.

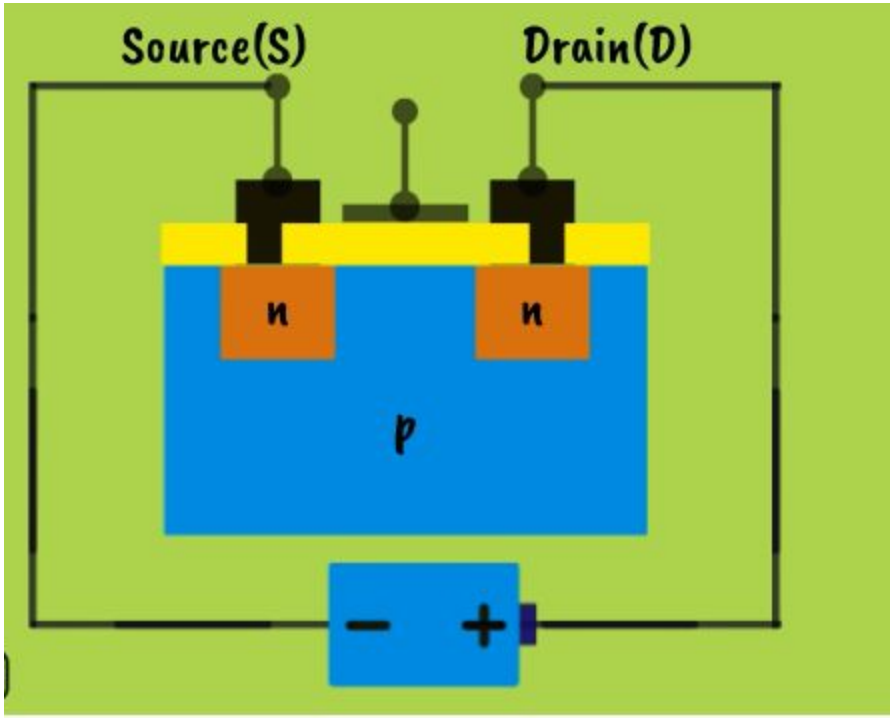
This increases the width of the conducting channel and hence source to drain current.

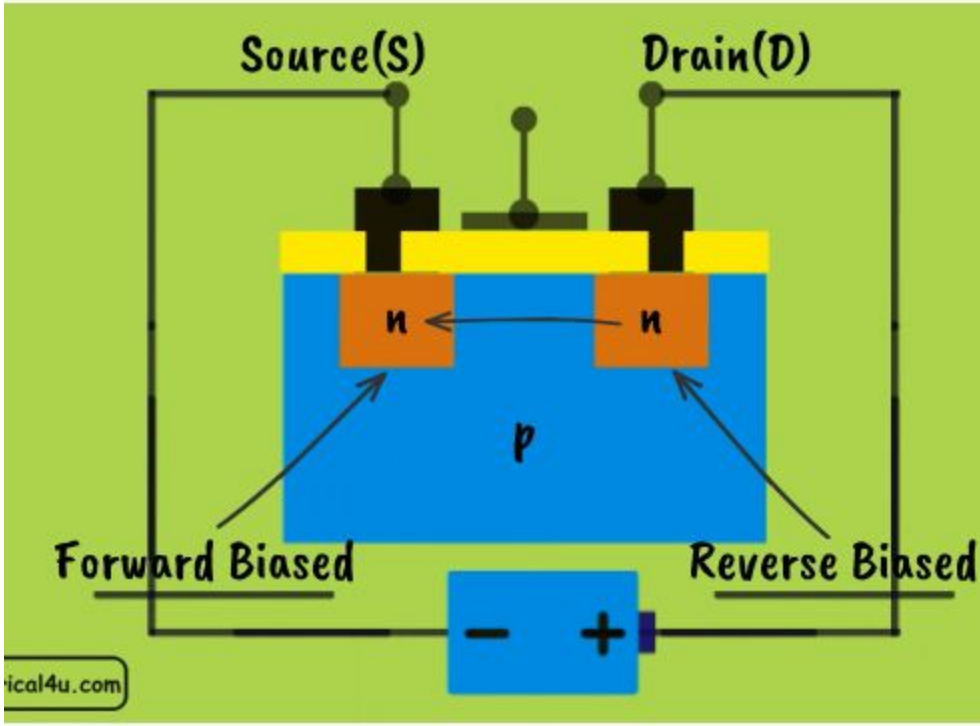
A p-channel JFET operates in the same manner as an n-channel JFET except that channel current carriers will be the holes instead of electrons and polarities of VGS and VDS are reversed.

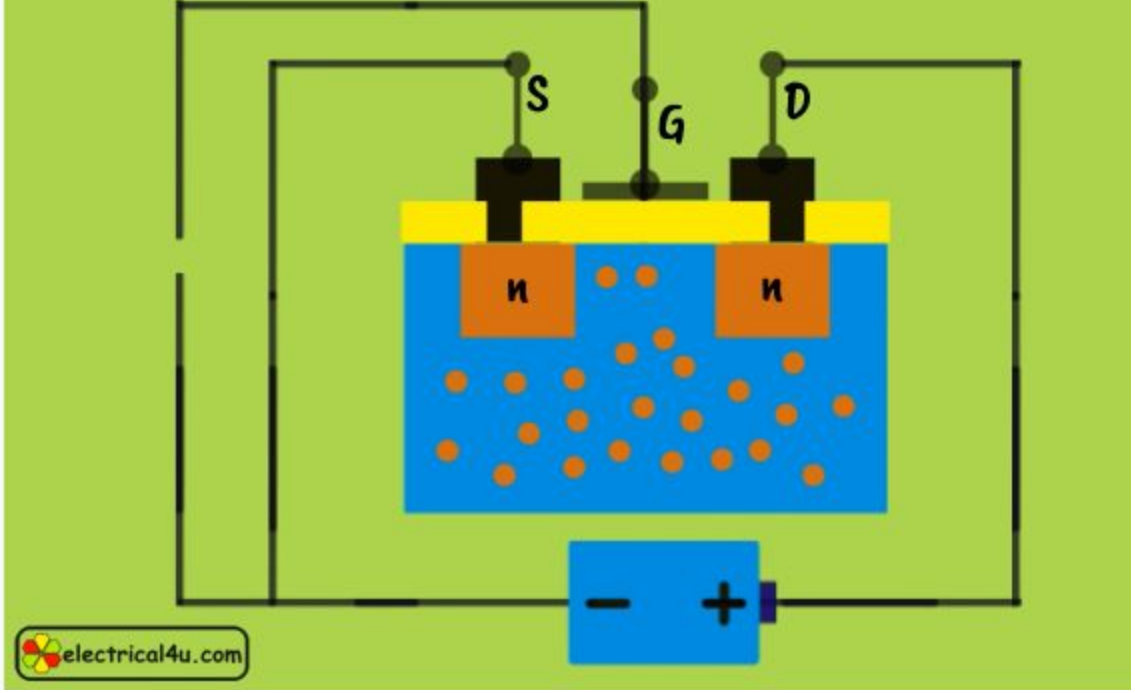
MOSFET

A metal–oxide–semiconductor field-effect transistor (MOSFET) is a field-effect transistor (FET with an insulated gate) where the voltage determines the conductivity of the device. It is used for switching or amplifying signals. The ability to change conductivity with the amount of applied voltage can be used for amplifying or switching electronic signals. MOSFETs are now even more common than BJTs (bipolar junction transistors) in digital and analog circuit



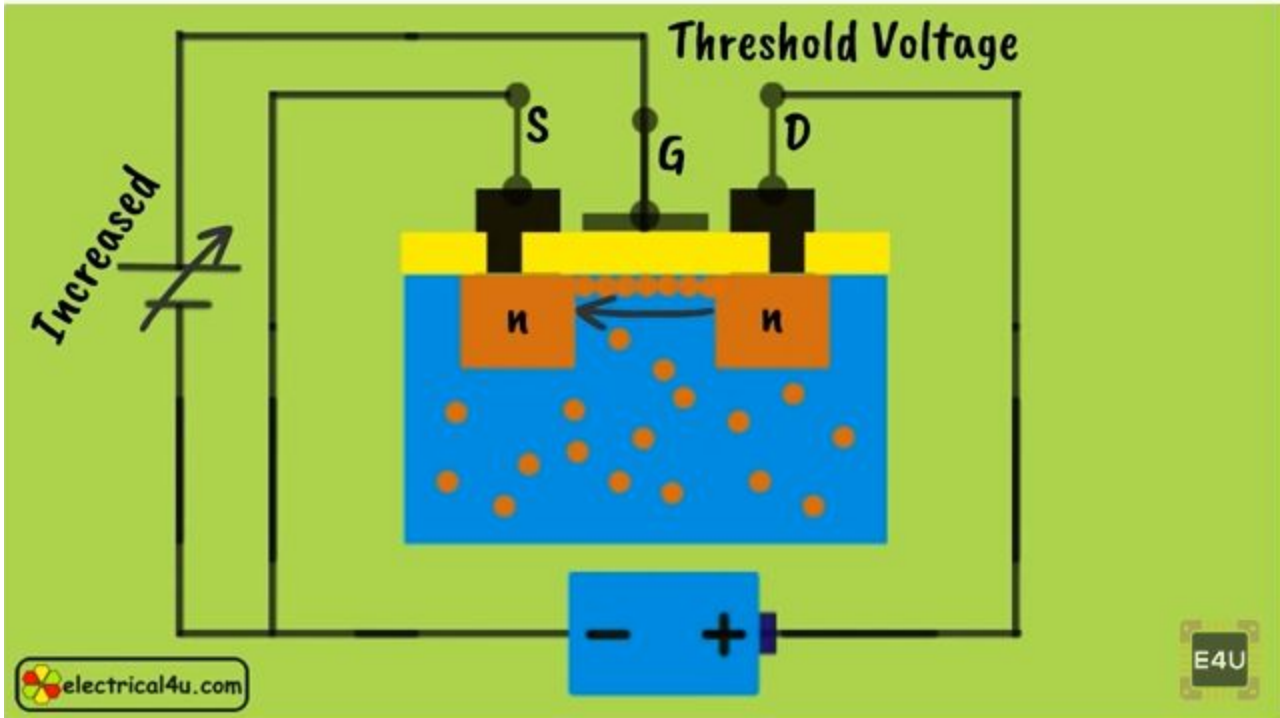

Source(S)
Drain(D)
n
n
p
−
+

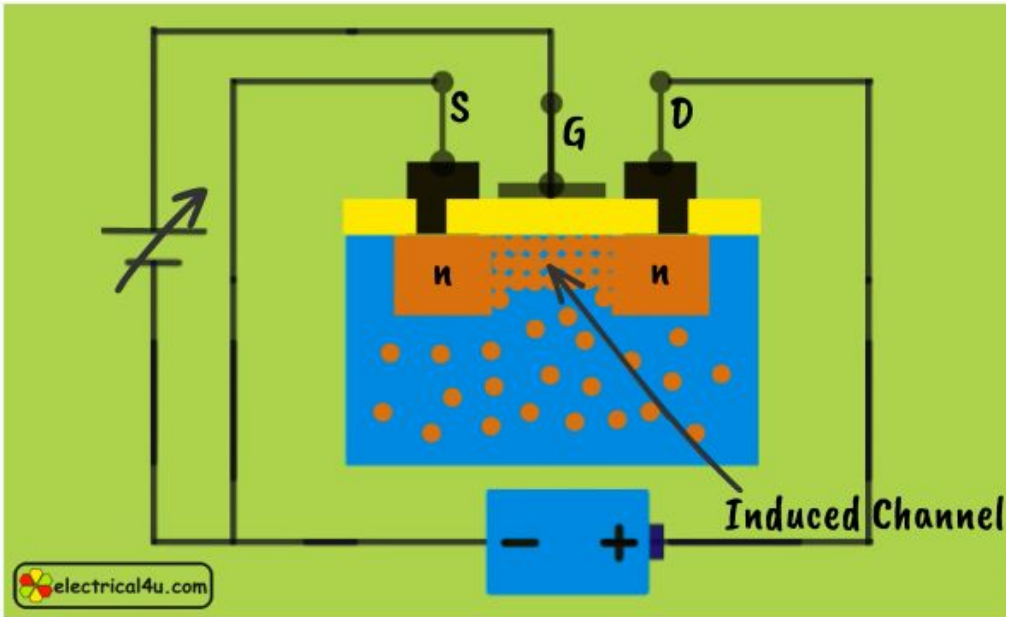

Source(S)
Drain(D)
n
n
p
Forward Biased
Reverse Biased
−
+



No voltage applied across gate and source

When voltage applied across gate and source

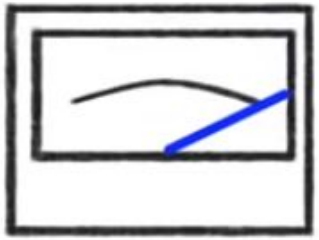




Gate Voltage < Threshold Voltage --> OFF Mode

Gate Voltage > Threshold Voltage --> ON Mode

FQP30N06L

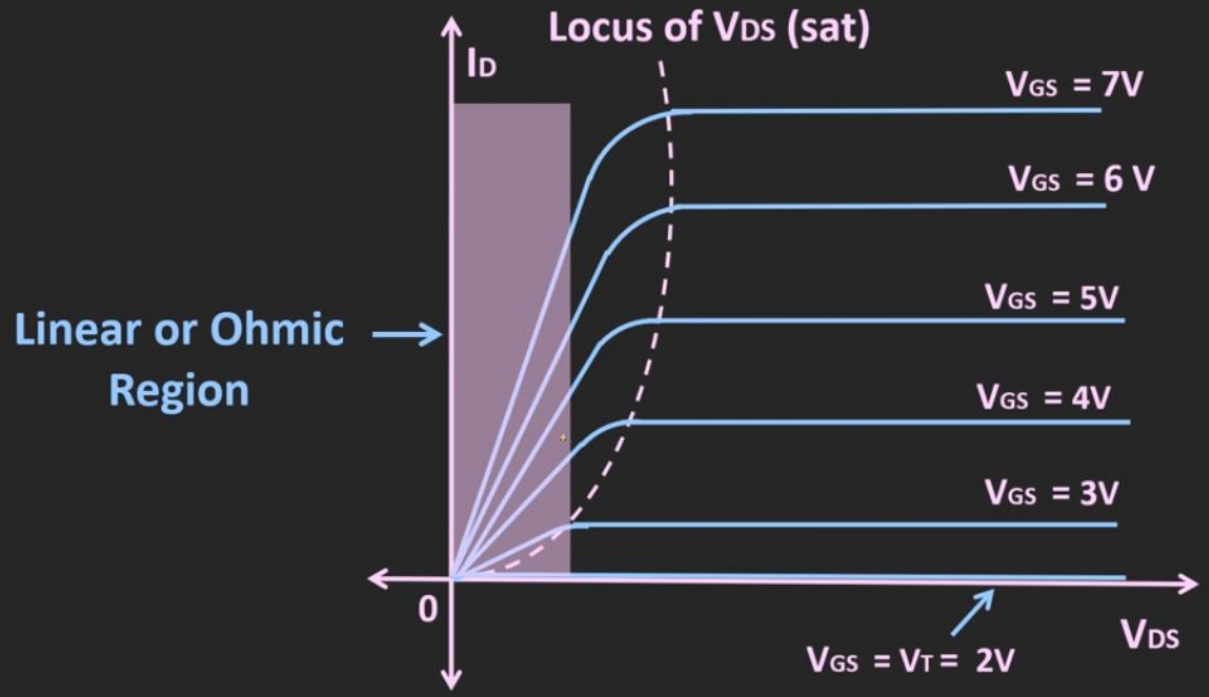


$R_{DS}ON$

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu A$	1.0	--
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\ V$, $I_D = 16\ A$	--	0.027
		$V_{GS} = 5\ V$, $I_D = 16\ A$	--	0.035

Enhancement Type MOSFET (Drain Characteristics)



$V_{ds} < V_{gs} - V_T$

$V_{gs} > V_T$

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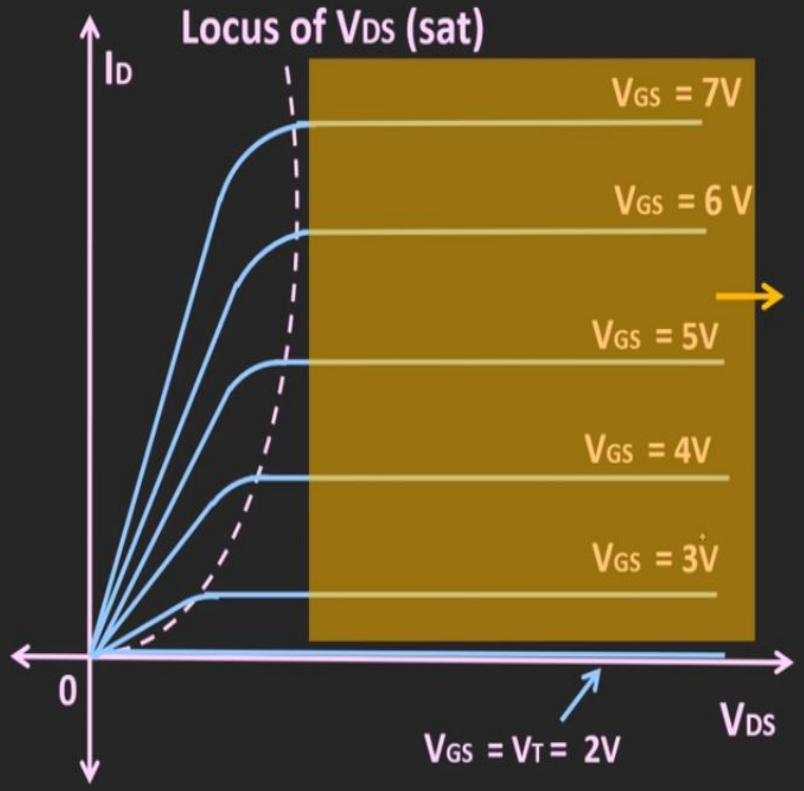
Enhancement Type MOSFET (Drain Characteristics)

$V_{DS} \geq V_{GS} - V_T$



Saturation Region

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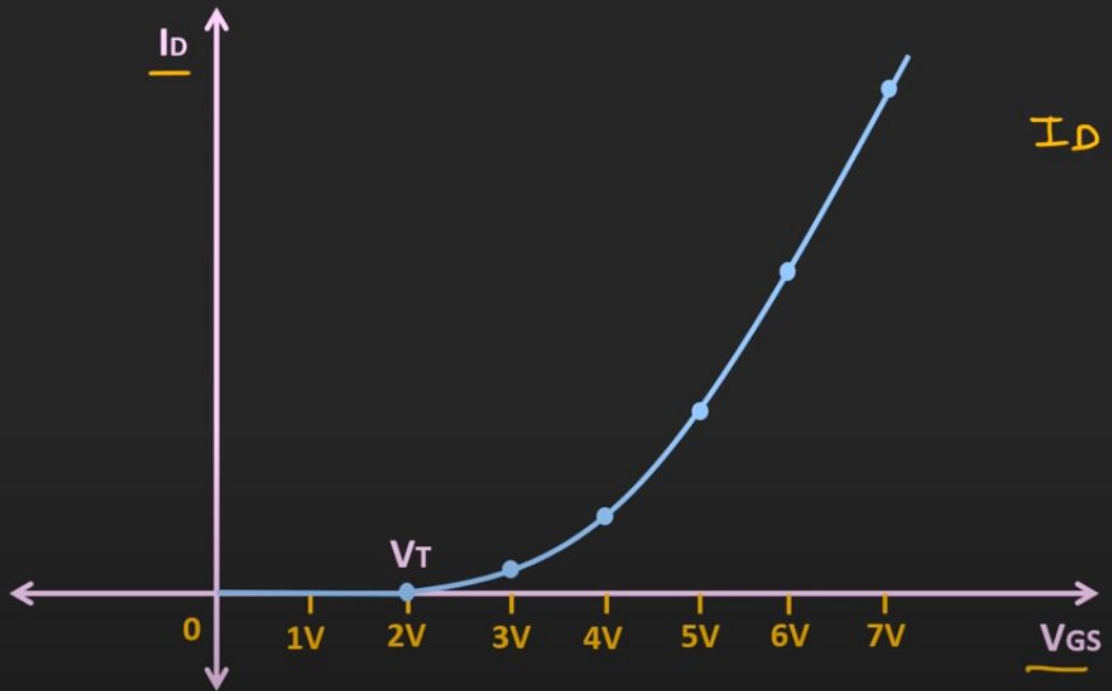
Enhancement Type MOSFET (Transfer Characteristics)



$$I_D = K \times (V_{GS} - V_T)^2$$