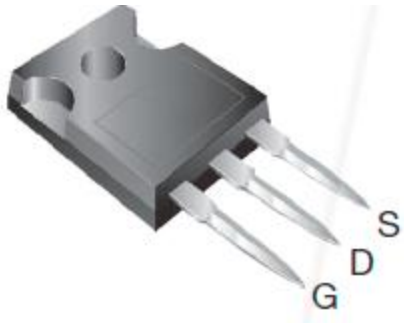
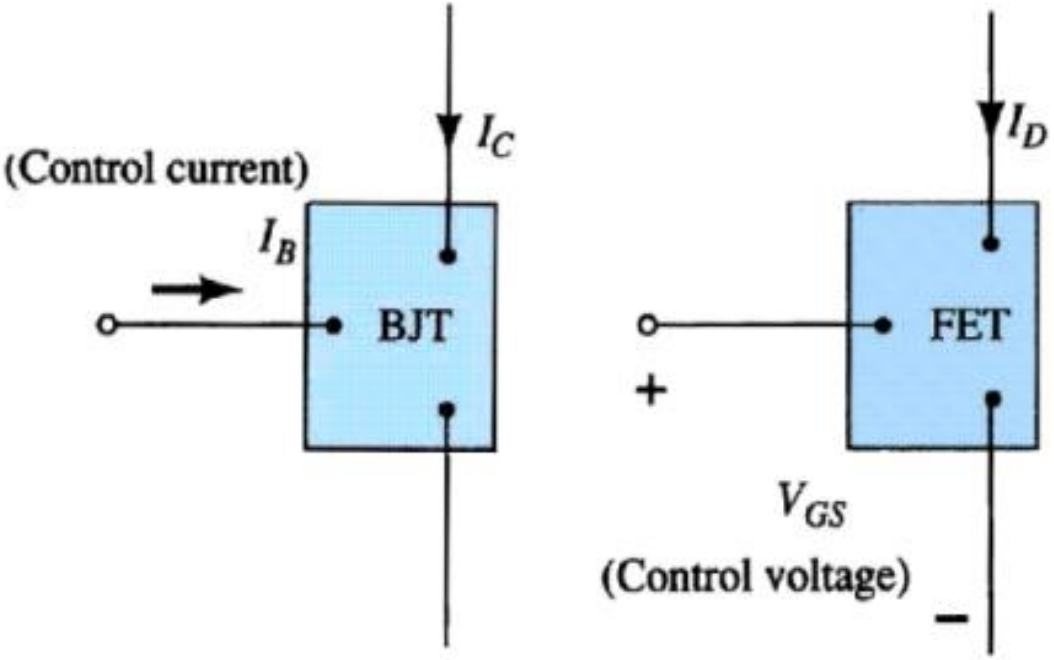
MOSFET’s
(metal–oxide–semiconductor field-effect transistor)



Current Controlled vs Voltage Controlled Devices

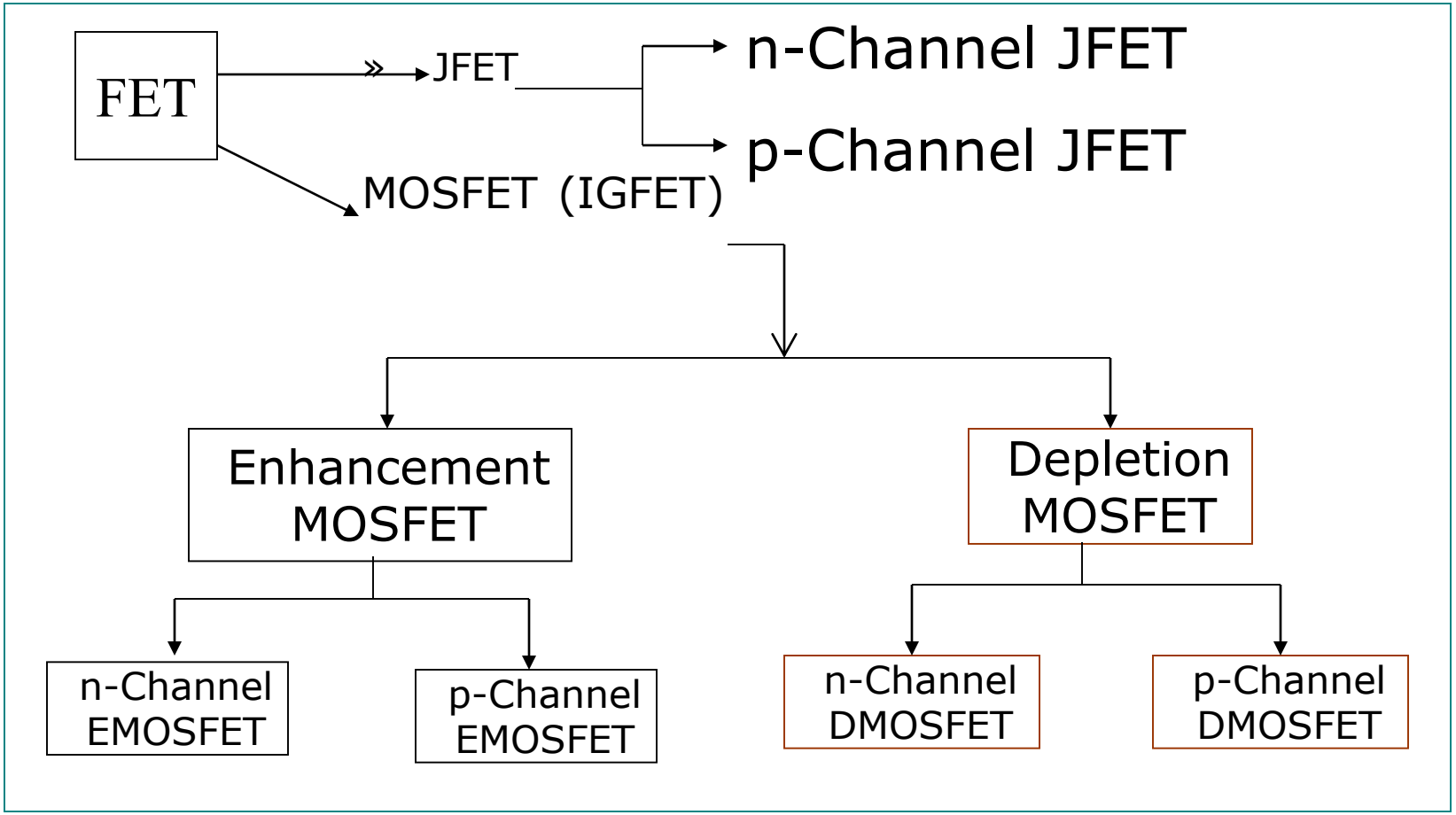


FET (Field Effect Transistor)

Few important advantages of FET over conventional Transistors

1. Unipolar device i. e. operation depends on only one type of charge carriers (*h* or *e)*
2. Voltage controlled Device (gate voltage controls drain current)
3. Very high input impedance ($\approx 10^{9}$-$10^{12}\ \Omega$)
4. Low Voltage Low Current Operation is possible (Low-power consumption)
5. Less Noisy as Compared to BJT
6. Very small in size, occupies very small space in Ics
7. Low voltage low current operation is possible in MOSFETS

Types of Field Effect Transistors
(The Classification)

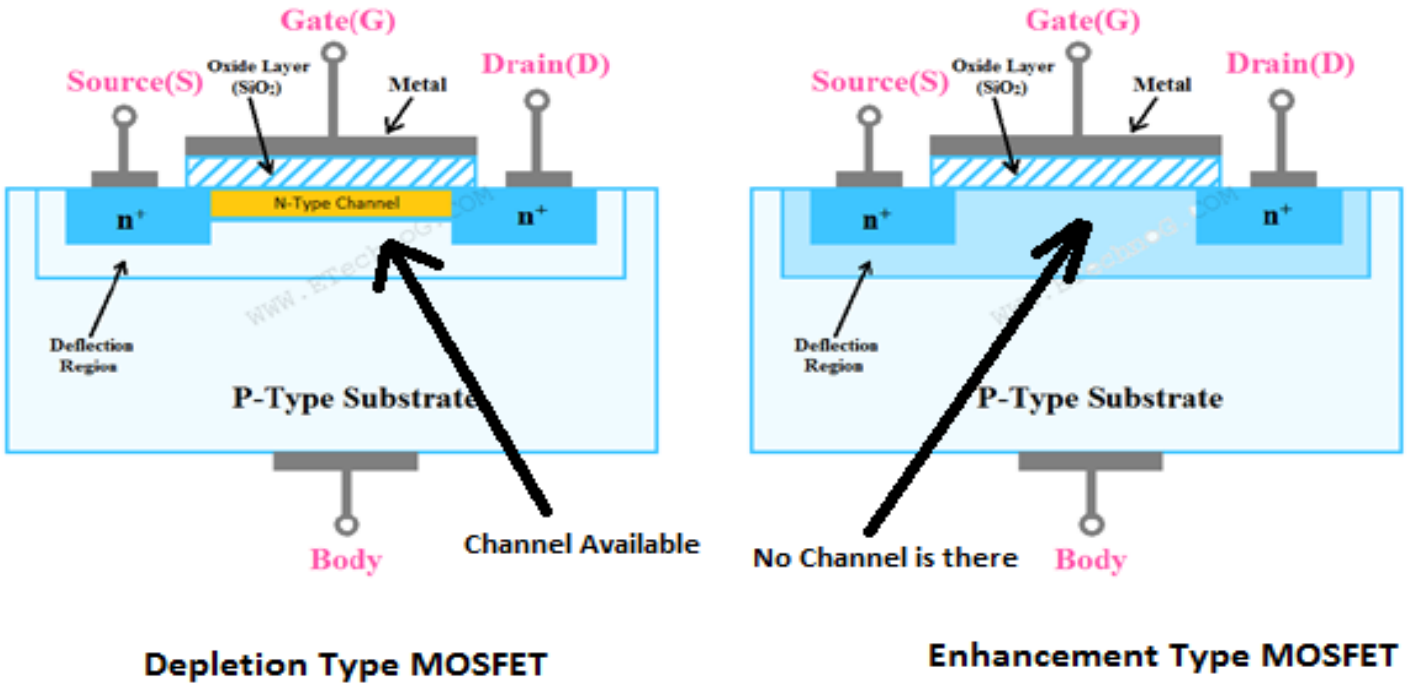


MOSFETs

MOSFETs have characteristics similar to JFETs and additional characteristics that make them very useful.

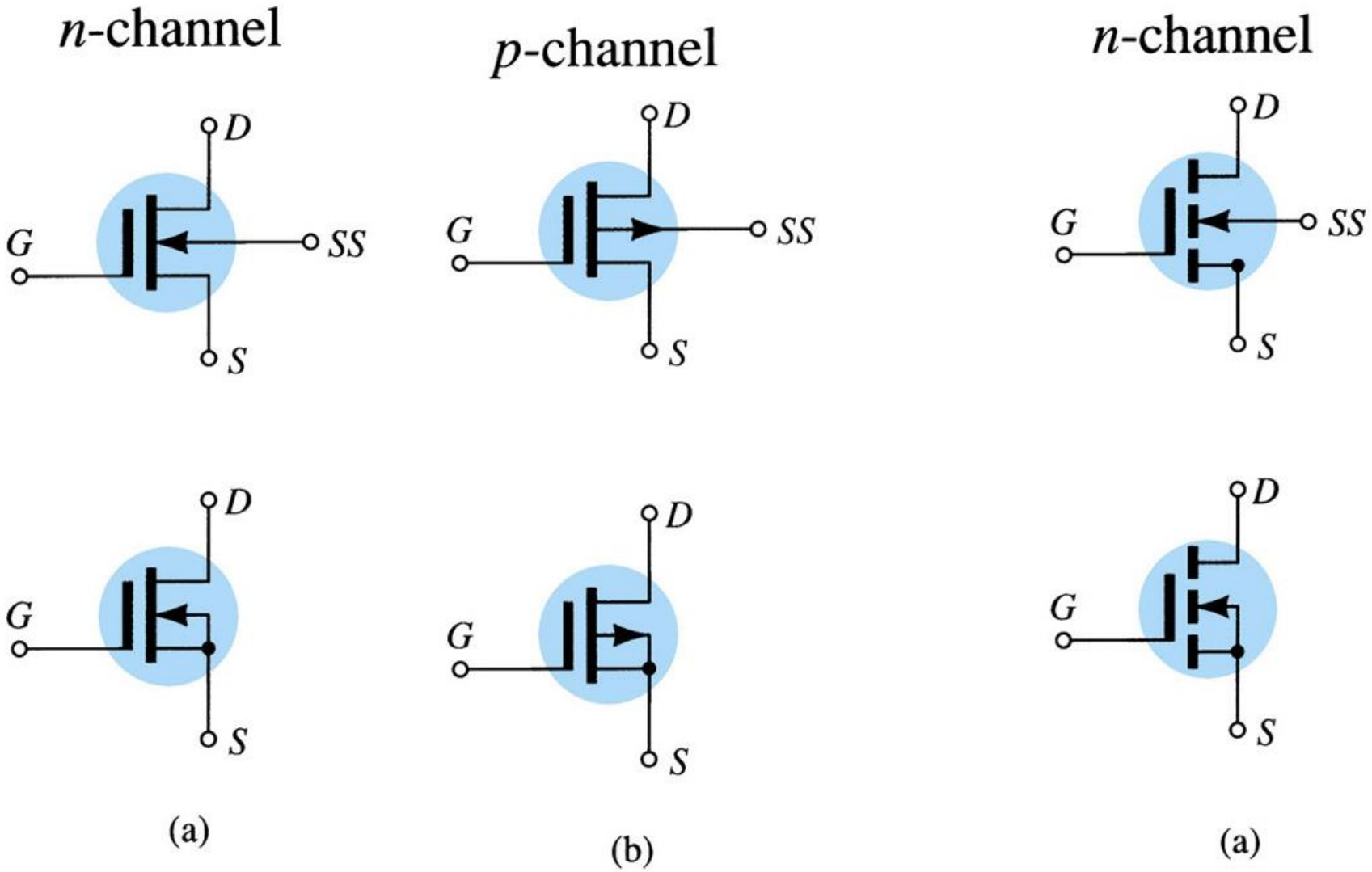
There are 2 types of MOSFET's:

- Depletion mode MOSFET (D-MOSFET)
- Enhancement Mode MOSFET (E-MOSFET)

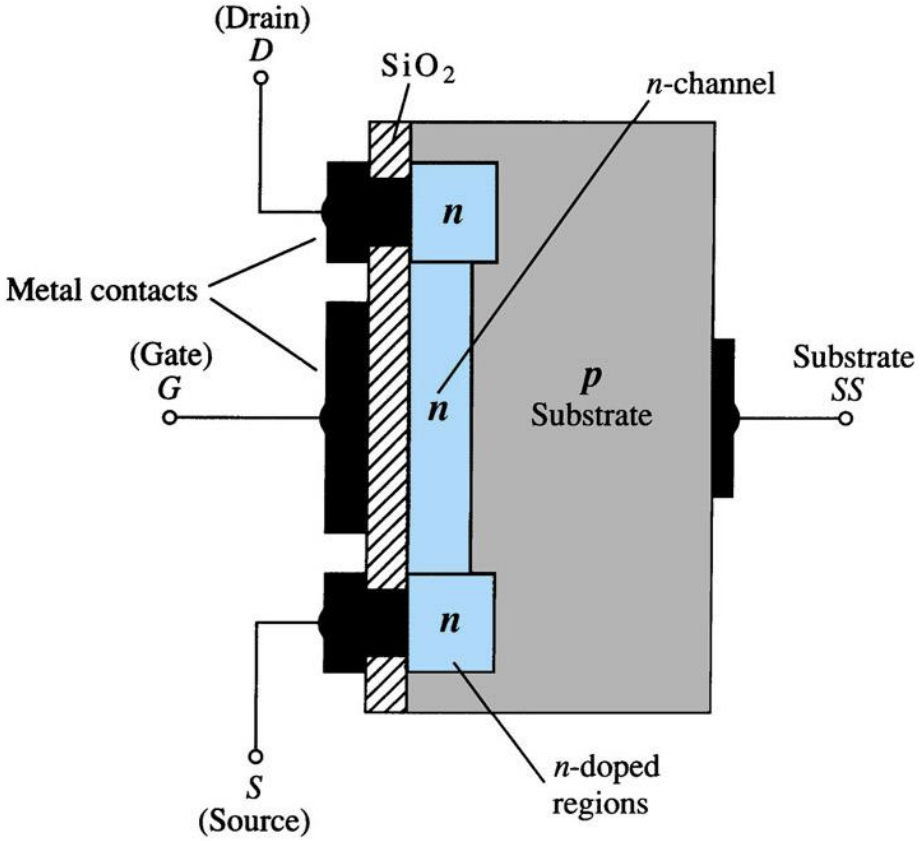


D-MOSFET Symbols

E-MOSFET Symbols

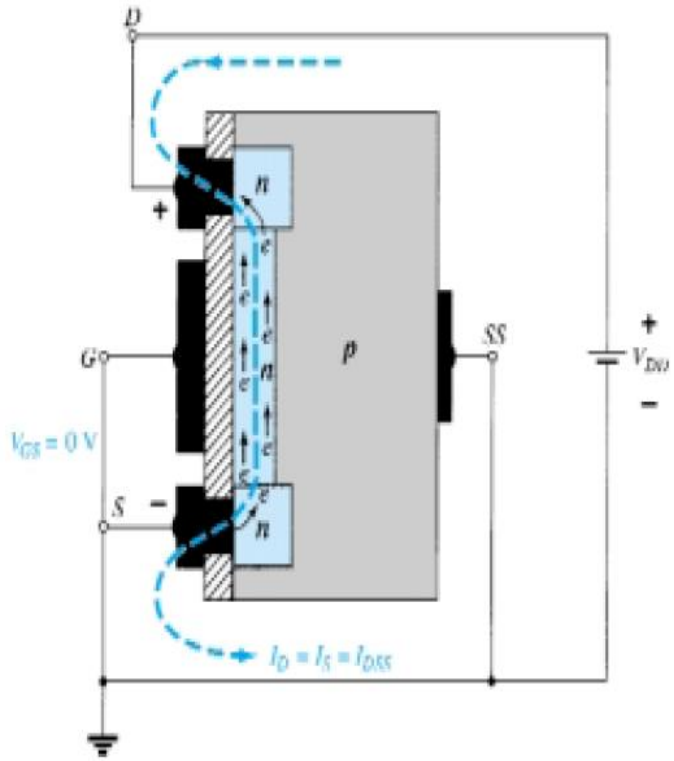


Depletion Mode MOSFET Construction

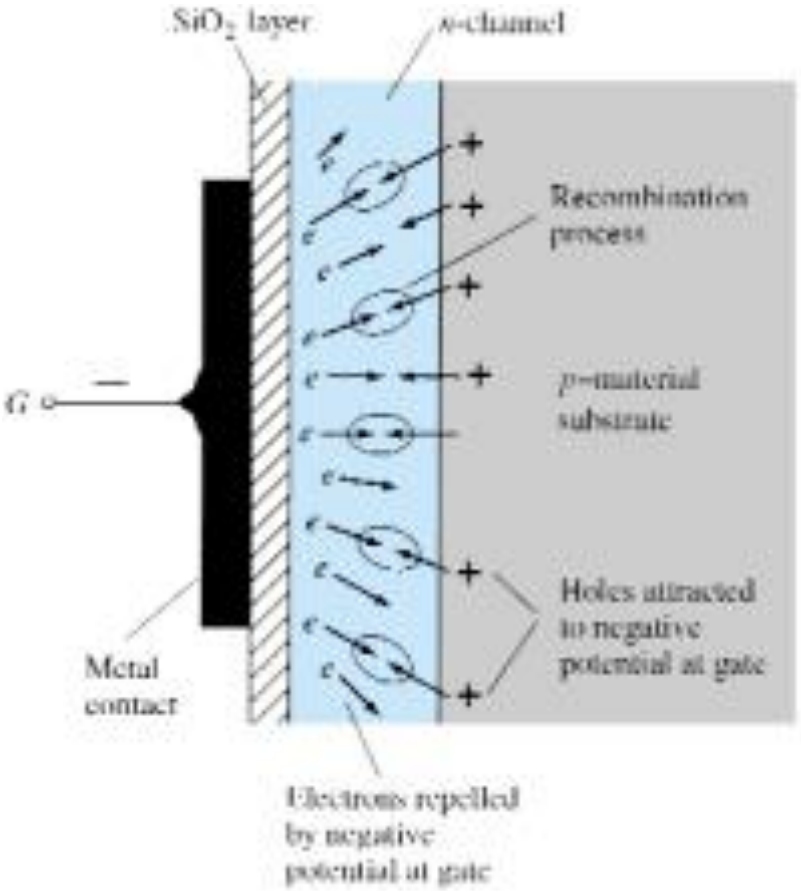


The Drain (D) and Source (S) leads connect to the to n-doped regions
These N-doped regions are connected via an n-channel
This n-channel is connected to the Gate (G) via a thin insulating layer of SiO_2
The n-doped material lies on a p-doped substrate that may have an additional terminal connection called SS

Basics Operation

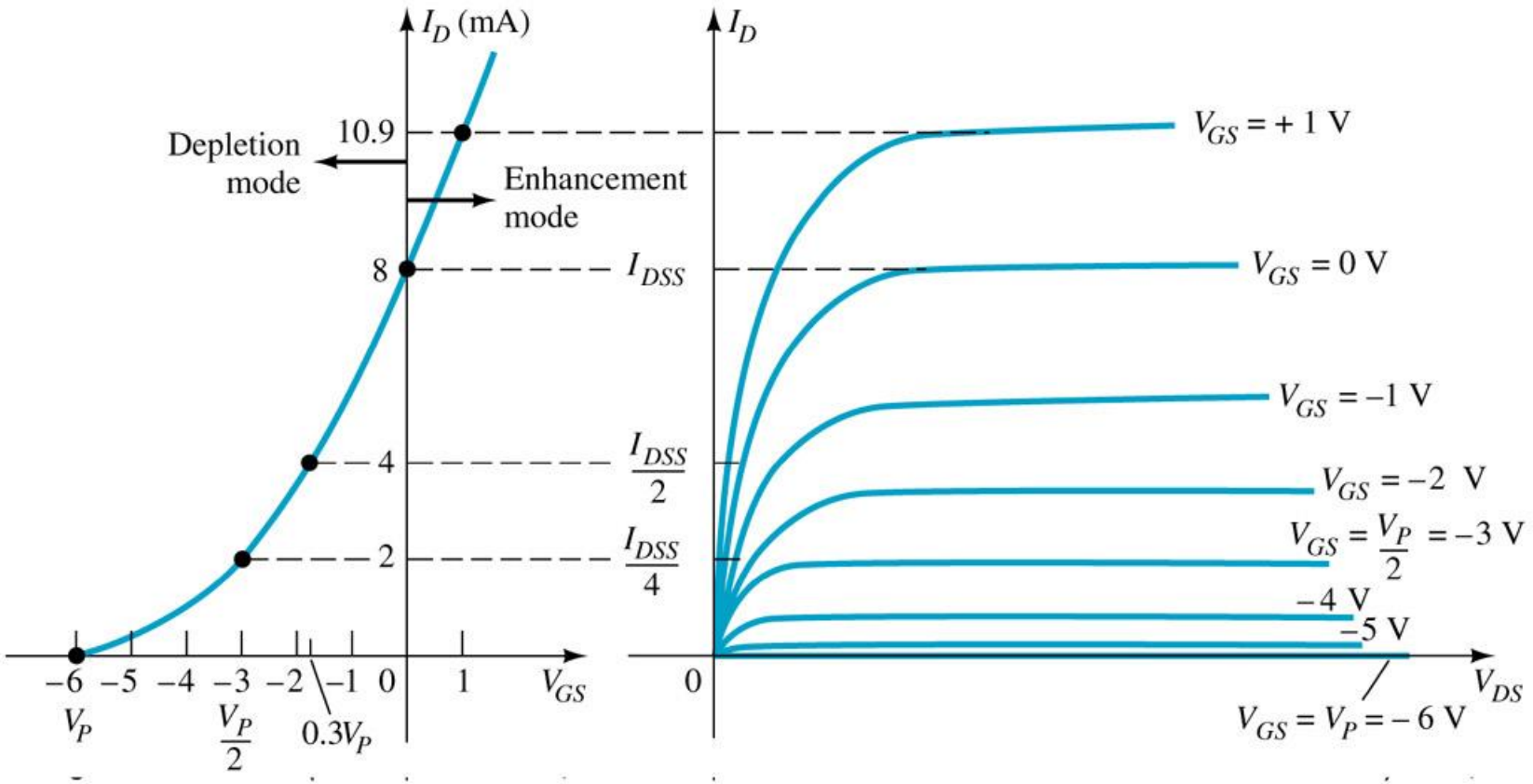


n-Channel depletion-type MOSFET with V_{GS} = 0 V and an applied



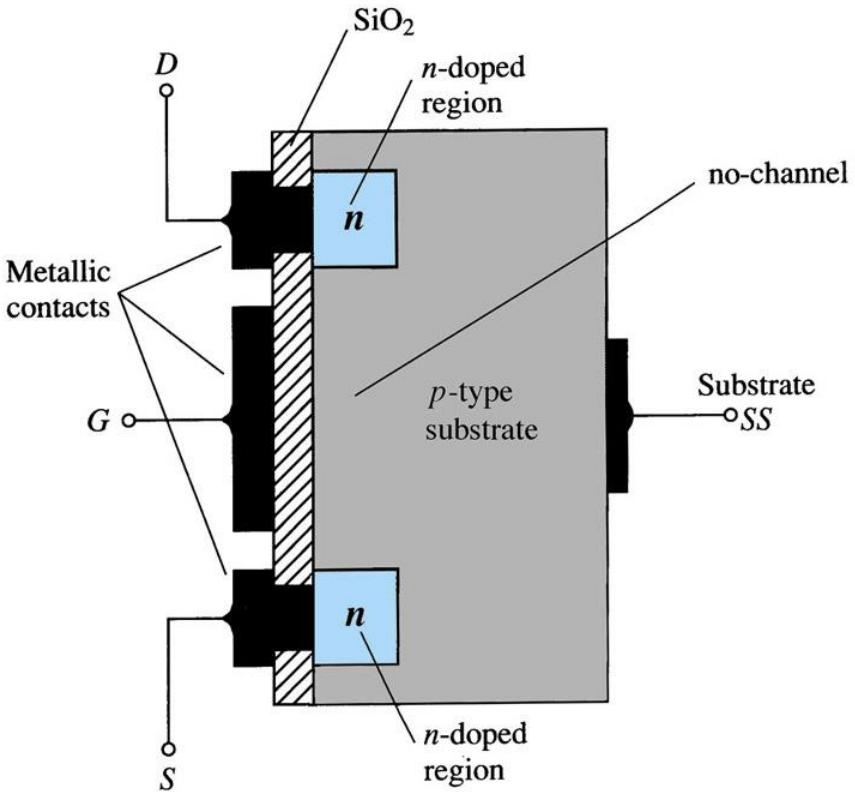
Basic Operation

A D-MOSFET may be biased to operate in two modes:
the **Depletion** mode or the **Enhancement** mode



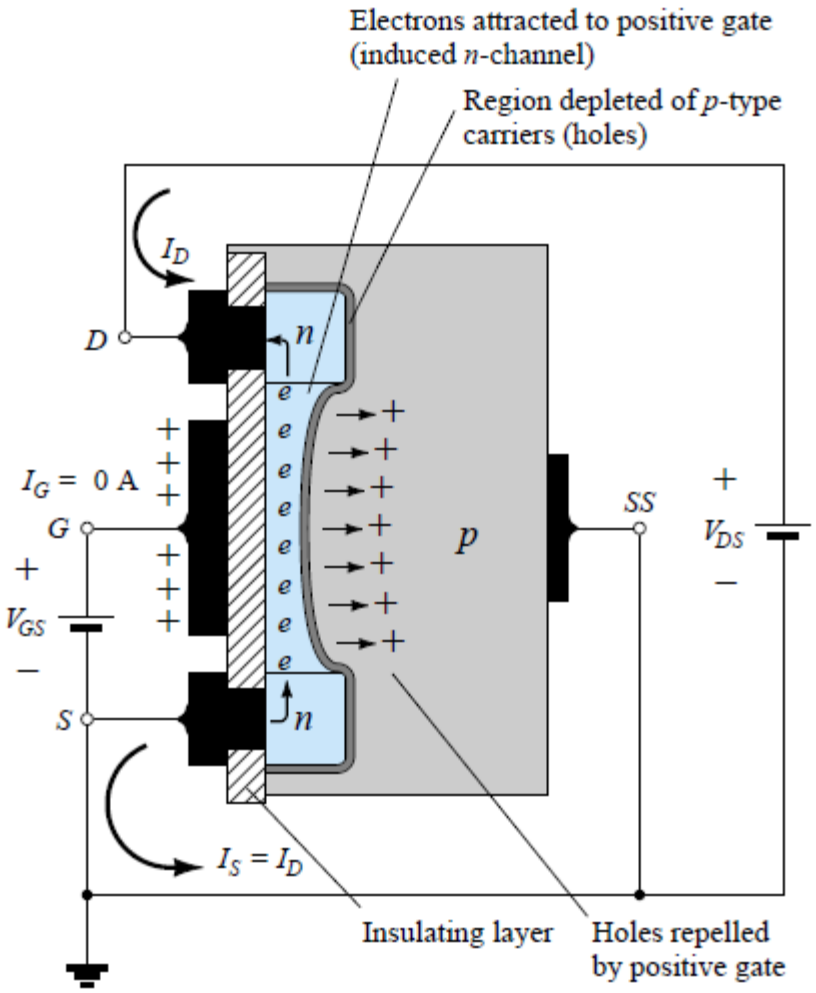
Enhancement Mode MOSFET's

Enhancement Mode MOSFET Construction



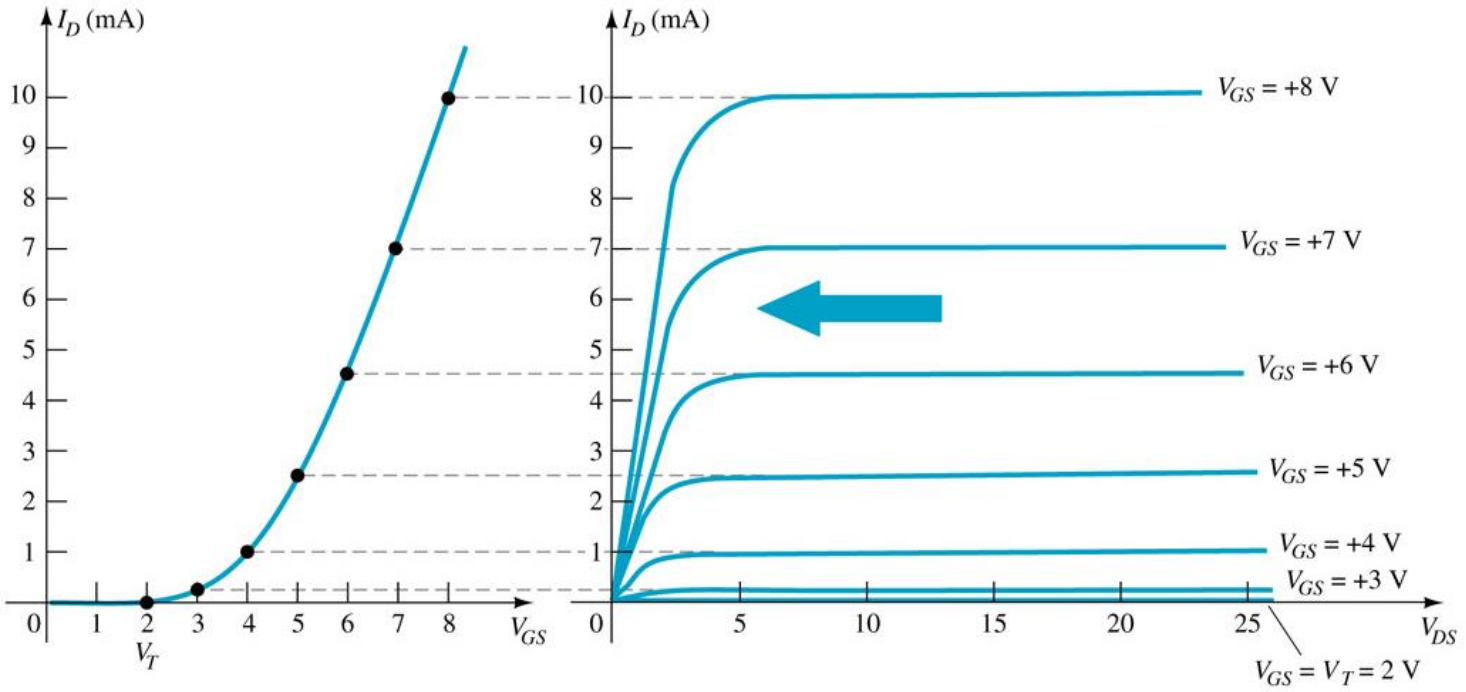
The Drain (D) and Source (S) connect to the to n-doped regions
These n-doped regions are not connected via an n-channel without an external voltage
The Gate (G) connects to the p-doped substrate via a thin insulating layer of SiO_2
The n-doped material lies on a p-doped substrate that may have an additional terminal connection called SS

Basics opeartion



Basic Operation

The Enhancement mode MOSFET only operates in the enhancement mode.



V_{GS} is always positive

$I_{DSS} = 0$ when $V_{GS} < V_T$

As V_{GS} increases above V_T, I_D increases

If V_{GS} is kept constant and V_{DS} is increased, then I_D saturates (I_{DSS})

The saturation level, V_{DSsat} is reached.

MCQ

A JFET has three terminals, namely ……

(A) cathode, anode, grid
(B) emitter, base, collector
(C) source, gate, drain
(D) none of the above

MCQ

A MOSFET is a …… driven device

(A) current

(B) voltage

(C) both current and voltage

(D) none of the above

MCQ

A MOSFET can be operated with ……..

(A) negative gate voltage only
(B) positive gate voltage only
(C) positive as well as negative gate voltage
(C) none of the above

MCQ

The input control parameter of a MOSFET is ……

(A) gate voltage
(B) source voltage
(c) drain voltage
(D) gate current

MCQ

The input impedance of a MOSFET is of the order of ……..

(A) 1 Ω

(B) a few hundred Ω

(C) kΩ

(D) several MΩ