



SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

Approved by AICTE & Affiliated to Anna University
Accredited by NBA & Accredited by NAAC with 'A+' Grade,
Recognized by UGC saravanampatti (post), Coimbatore-641035.



Department of Biomedical Engineering

Course Name: **23BMB101-Electron Devices and Circuits**

I Year : II Semester

Unit II -Transistors

Topic : Metal Oxide Semiconductor Field Effect Transistor¹



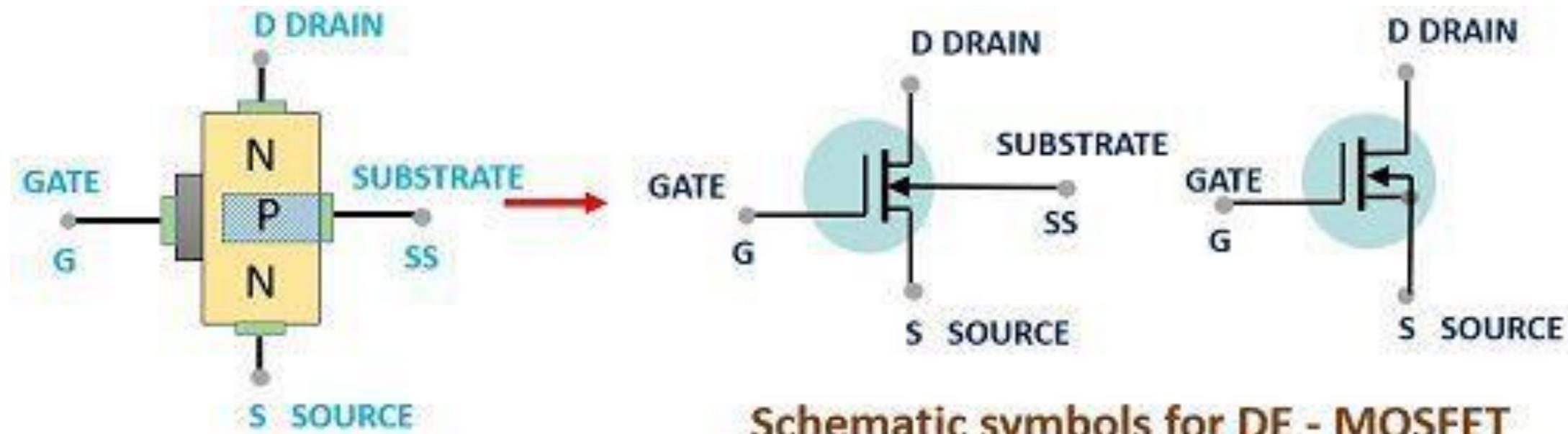
INTRODUCTION



- MOSFET is an acronym for **Metal Oxide Semi-Conductor Field Effect Transistor**. It is a device in which the variation in the voltage determines the conductivity of the device. It is a three terminal device which has a source, a drain and a gate terminal.
- These are **voltage controlled devices**, in which the current flowing between source and drain is proportional to the provided input voltage.
- MOSFET has a smaller value of capacitance and its input impedance is much more than that of FET due to small leakage current².
- It finds application widely **in switching and amplification of electronic signals** because of its ability to change conductivity with the applied voltage.



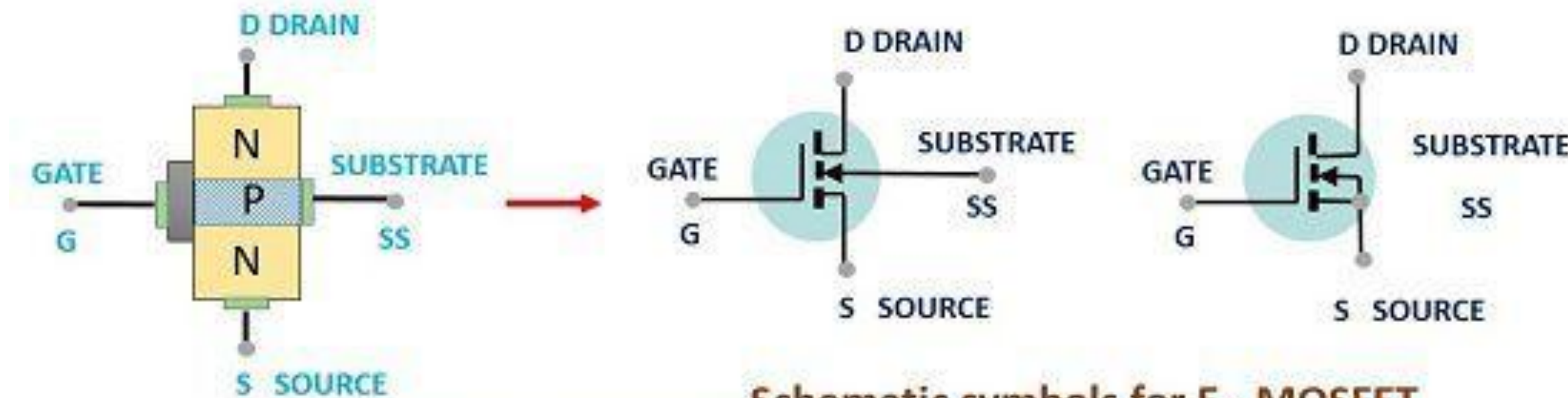
MOSFET



File 3

Schematic symbols for DE - MOSFET

N – Channel DE- MOSFET



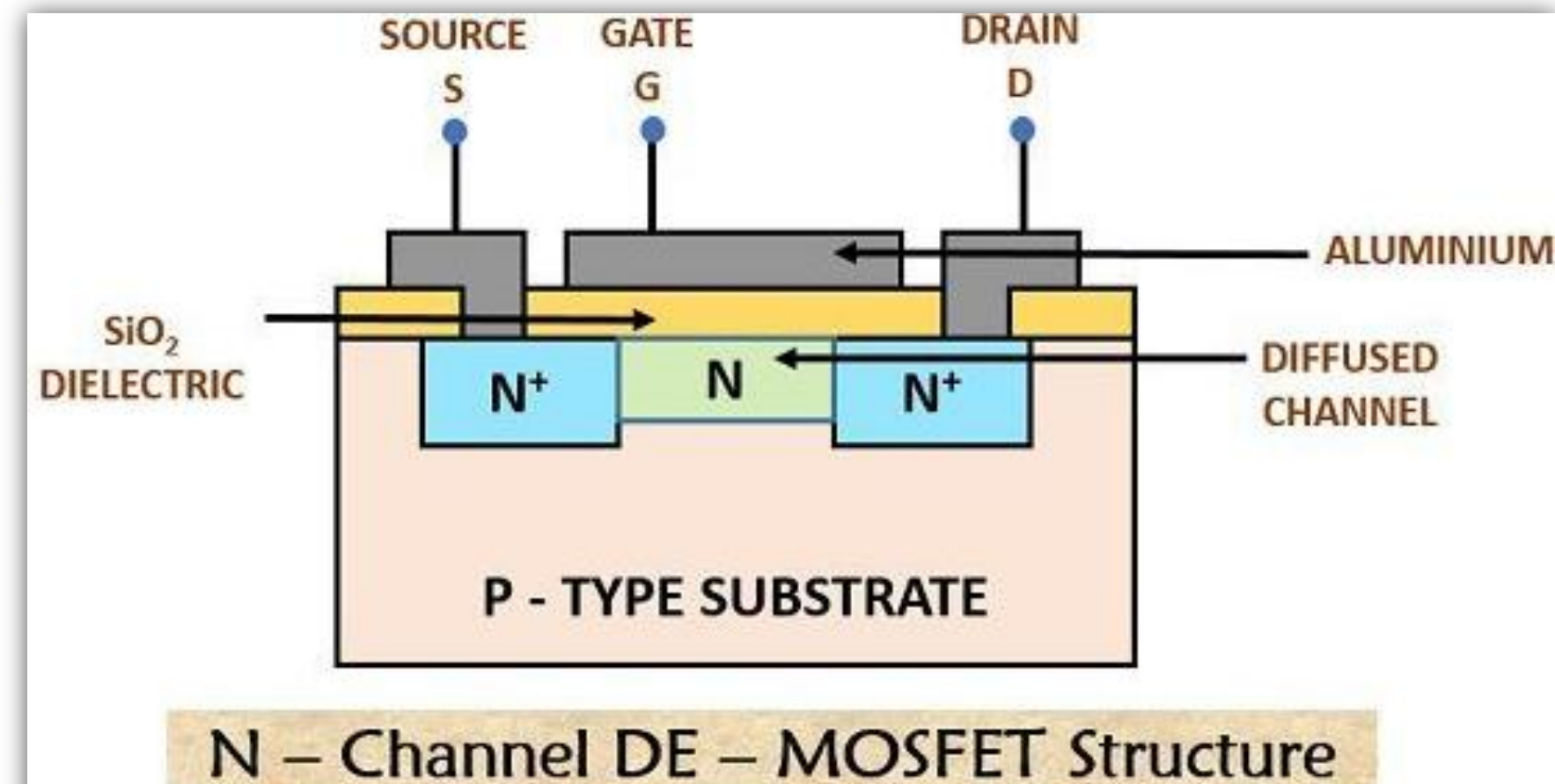
Schematic symbols for E - MOSFET

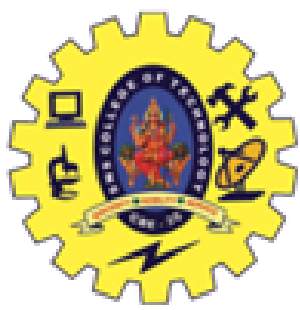
N – Channel E- MOSFET



Construction of a depletion type MOSFET

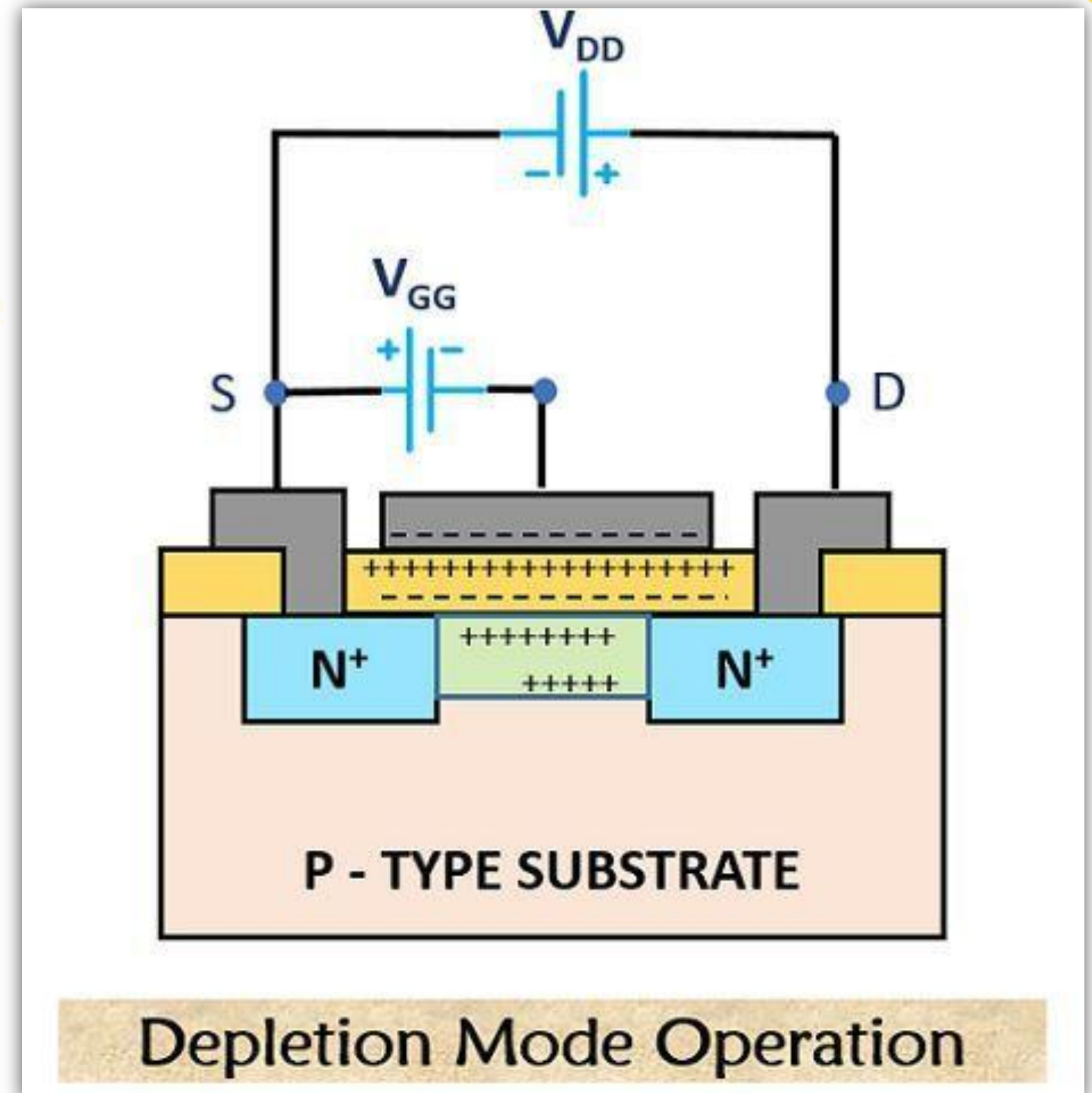
- Lightly doped P-type substrate contains two heavily doped N-type material thus forming source and drain.
- A thin layer of SiO₂ is deposited over the surface and holes are then cut through SiO₂.
- A metal plate is also deposited in between the source and drain terminal which acts as gate terminal for the device.
- The layer of SiO₂ provides an extremely high input impedance of the order of 10¹⁰ to 10¹⁵ ohms.





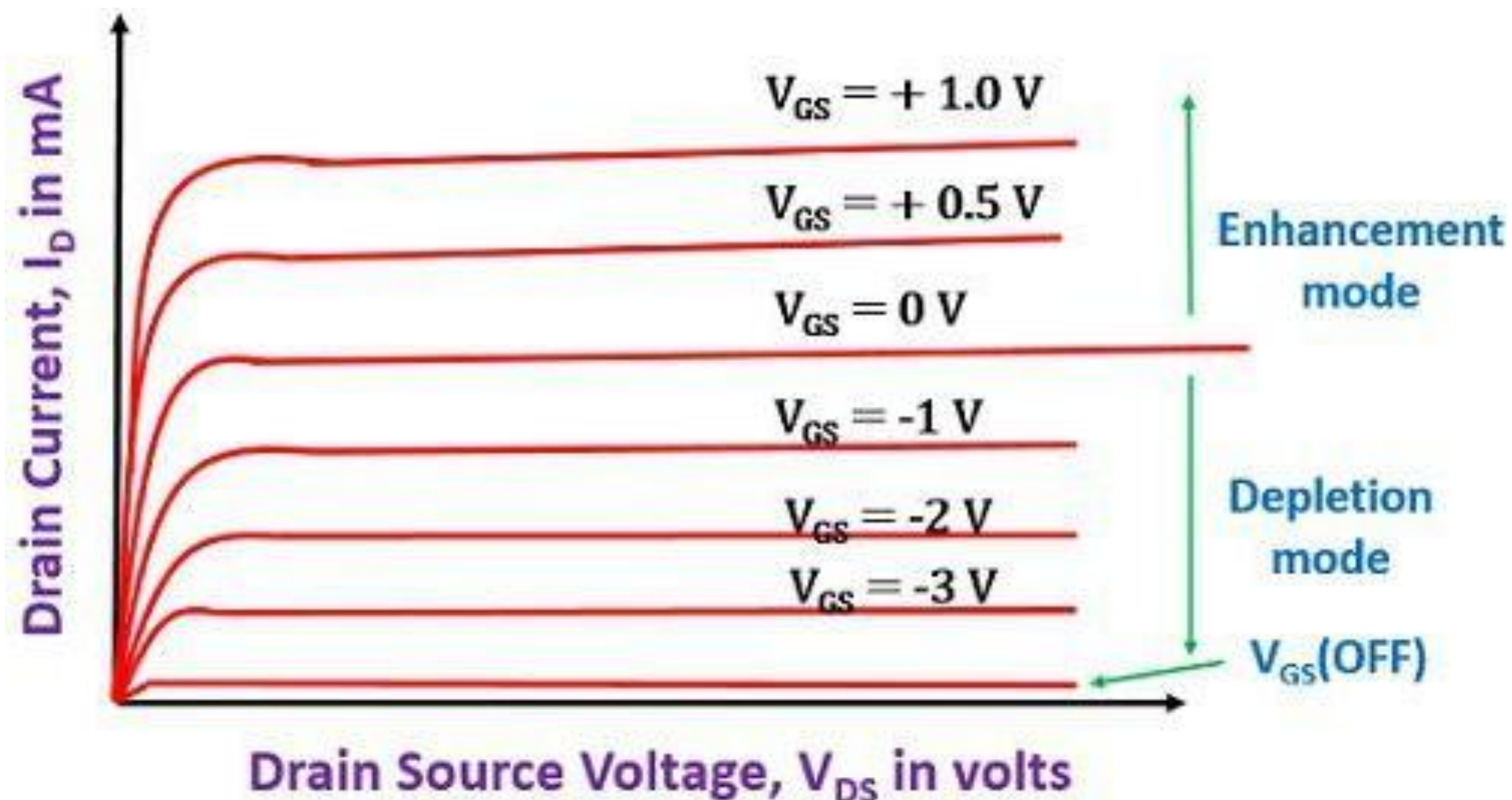
Working of a Depletion-type MOSFET

- In a DE-MOSFET when the gate potential is made negative with respect to the substrate, it causes repulsion of negative charge carriers out of the initially formed channel.
- This increases the channel resistance which resultantly reduces the drain current.
- In the case when the gate terminal is made positive with respect to the substrate, more number of electrons gets attracted towards the channel. Thus, causing more current to flow through the channel.
- A pinch-off condition also arises in DE-MOS when a much negative gate voltage is applied.





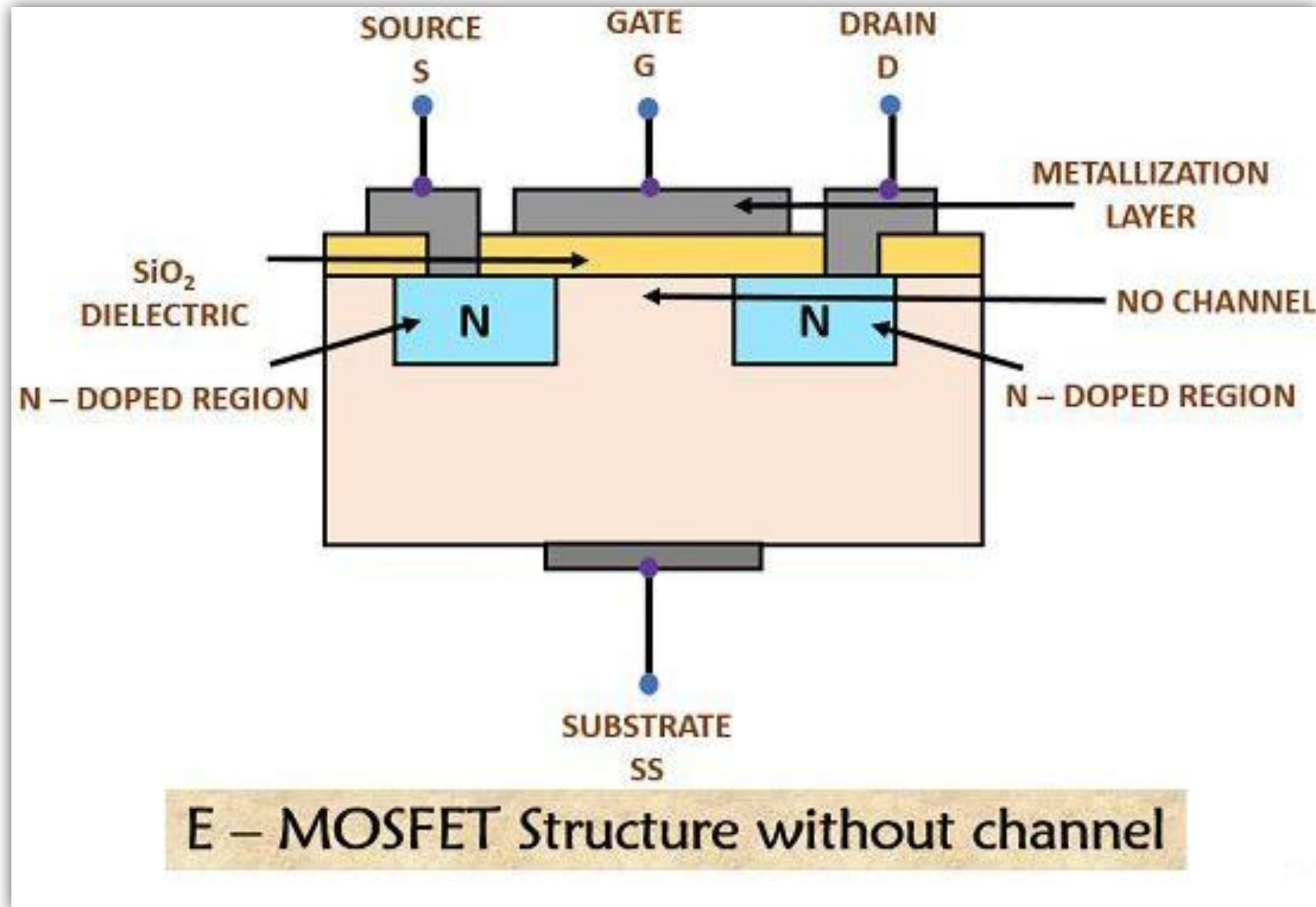
Characteristic Curve of Depletion MOSFET



DRAIN CHARACTERISTICS

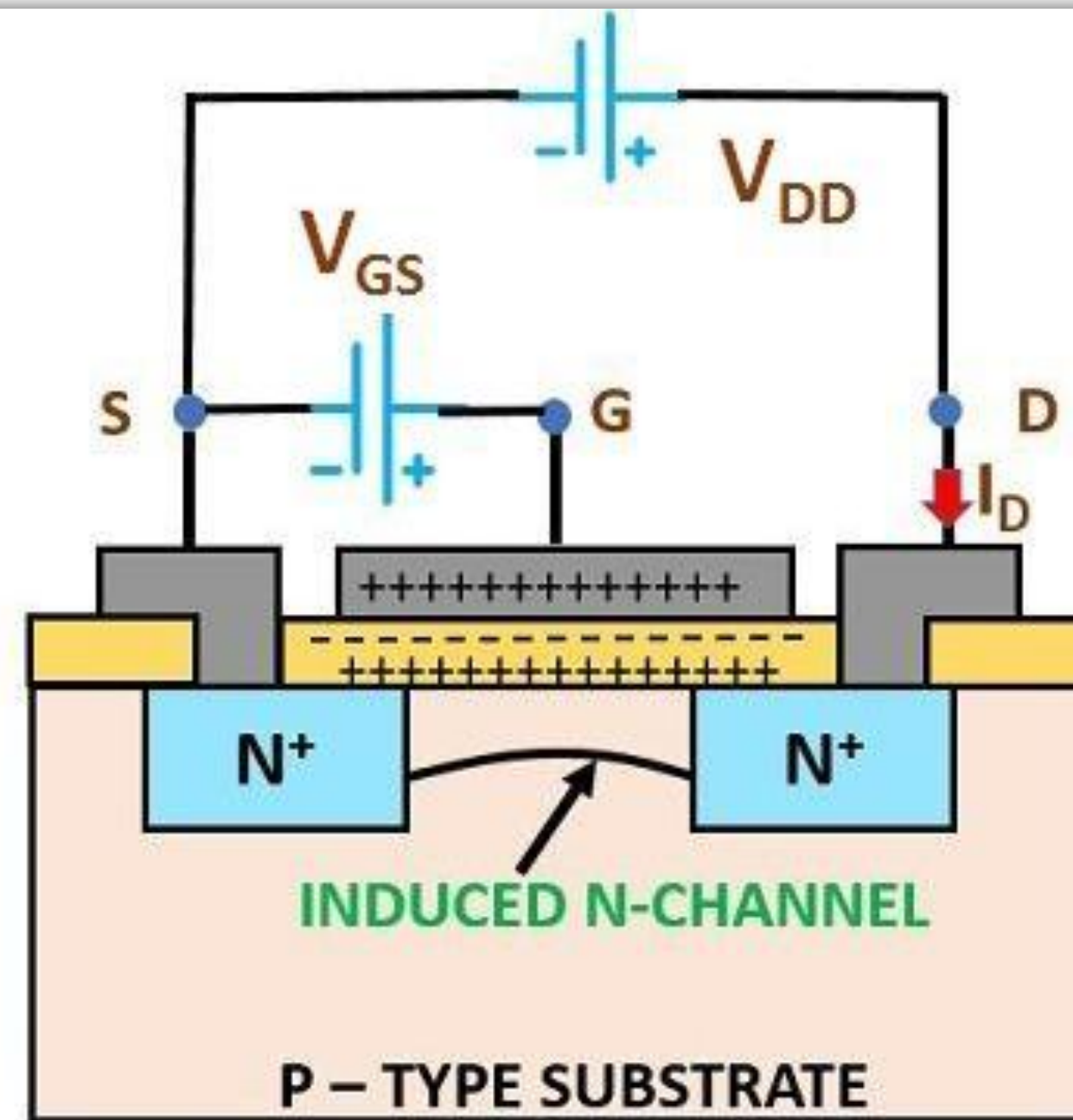


Construction of Enhancement type MOSFET





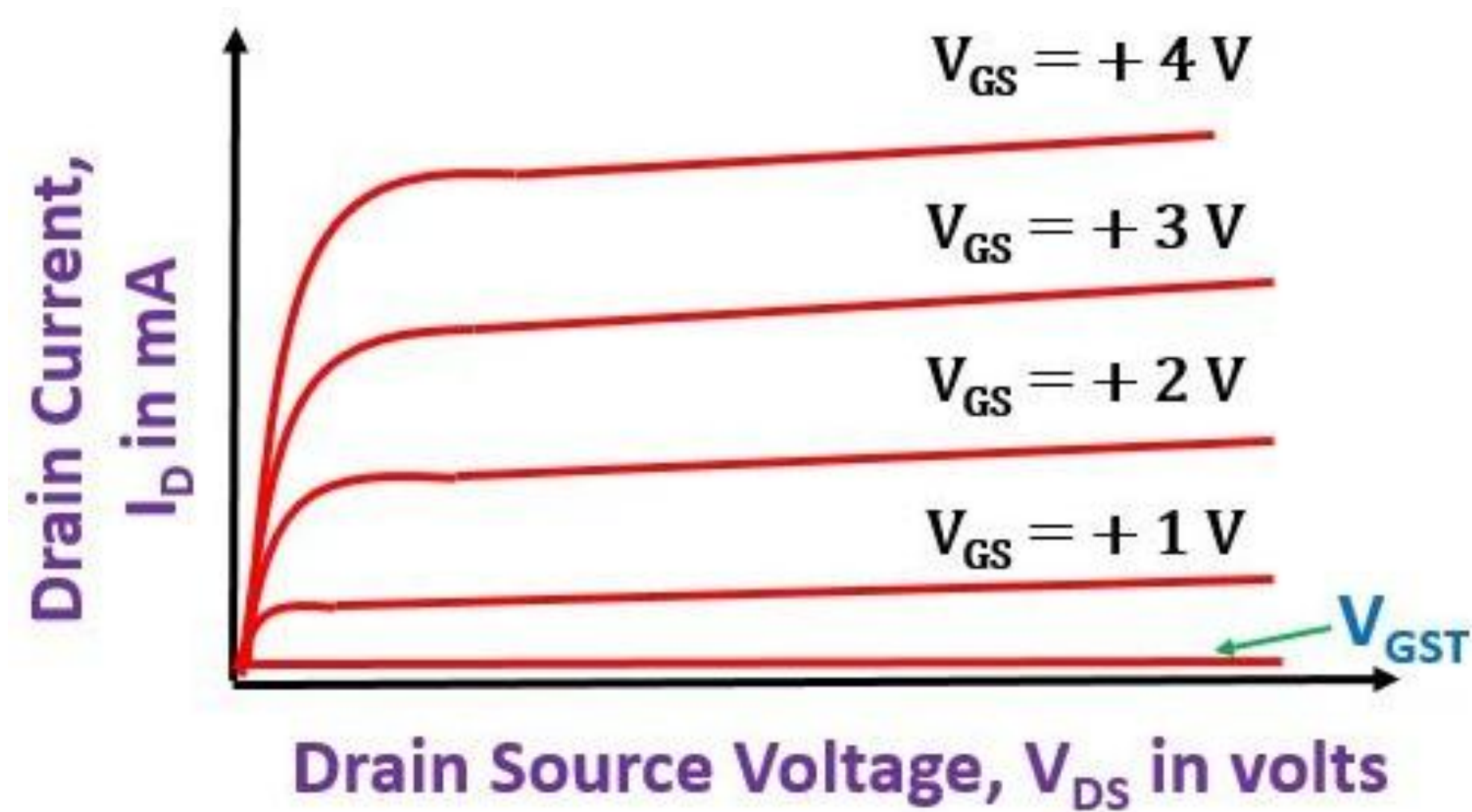
Working of a Enhancement-type MOSFET



Operation of N-Channel E – MOSFET



Characteristic Curve of Enhancement MOSFET



Drain Characteristics



Comparison between BJT, FET and MOSFET



| TERMS | BJT | FET | MOSFET |
|-------------------|---------------------|---------------------|--------------------------------------|
| Device type | Current controlled | Voltage controlled | Voltage Controlled |
| Current flow | Bipolar | Unipolar | Unipolar |
| Terminals | Not interchangeable | Interchangeable | Interchangeable |
| Operational modes | No modes | Depletion mode only | Both Enhancement and Depletion modes |
| Input impedance | Low | High | Very high |
| Output resistance | Moderate | Moderate | Low |
| Operational speed | Low | Moderate | High |
| Noise | High | Low | Low |
| Thermal stability | Low | Better | High |