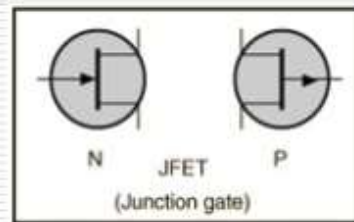


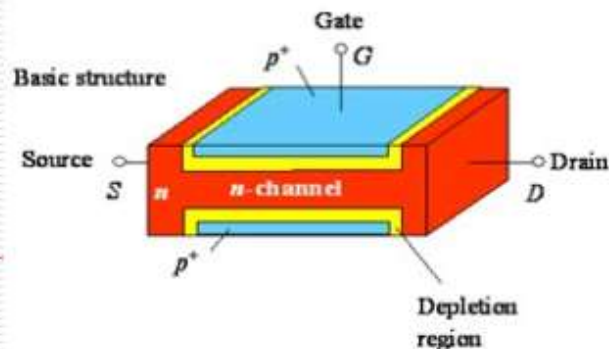
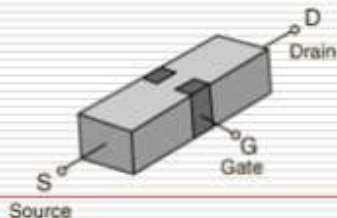
Introduction (FET)

- ❑ Field-effect transistor (FET) are important devices such as BJTs
- ❑ Also used as amplifier and logic switches
- ❑ Types of FET:
 - MOSFET (metal-oxide-semiconductor field-effect transistor)
 - Depletion-mode MOSFET
 - JFET (junction field-effect transistor)

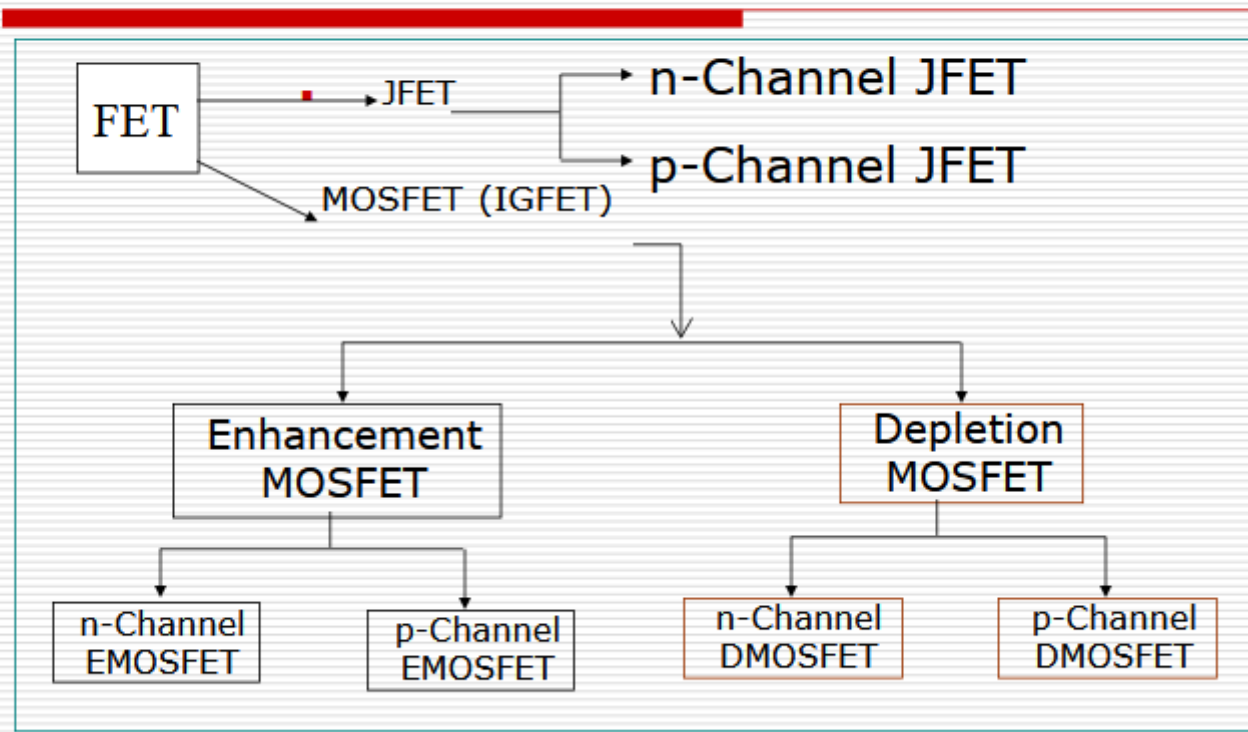
Junction FETs (JFETs)



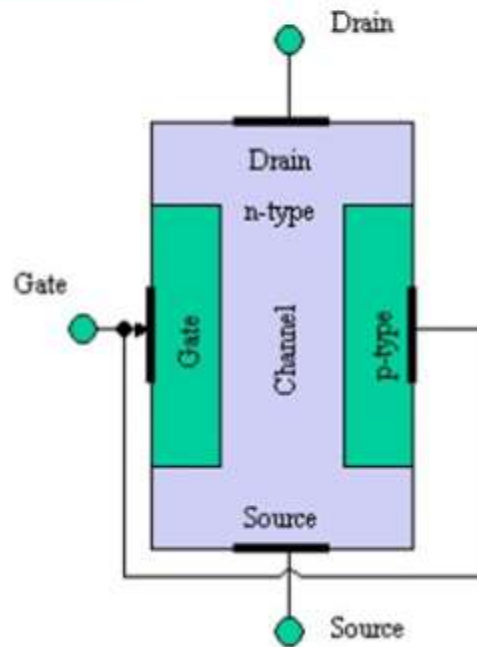
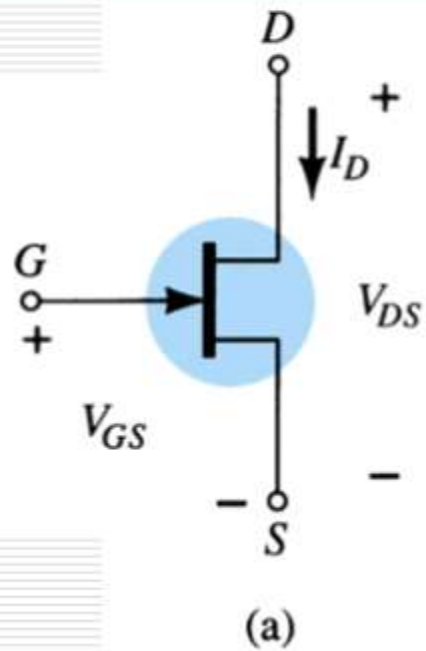
- JFETs consists of a piece of high-resistivity semiconductor material (usually Si) which constitutes a **channel** for the majority carrier flow.
- Conducting semiconductor channel between two ohmic contacts – **source & drain**



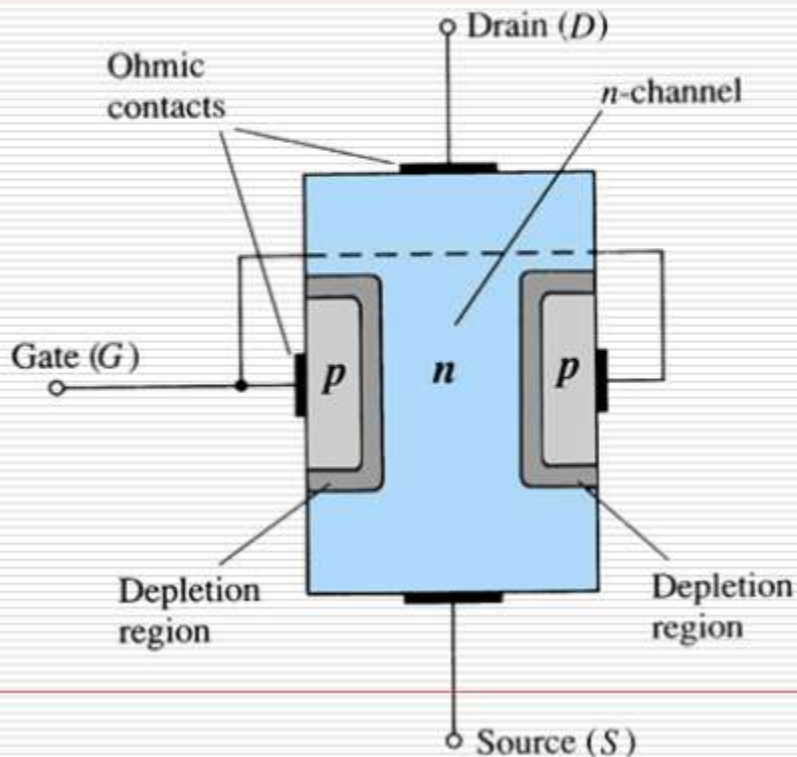
Types of Field Effect Transistors (The Classification)

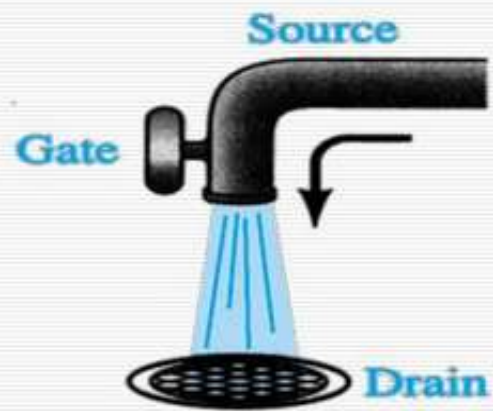


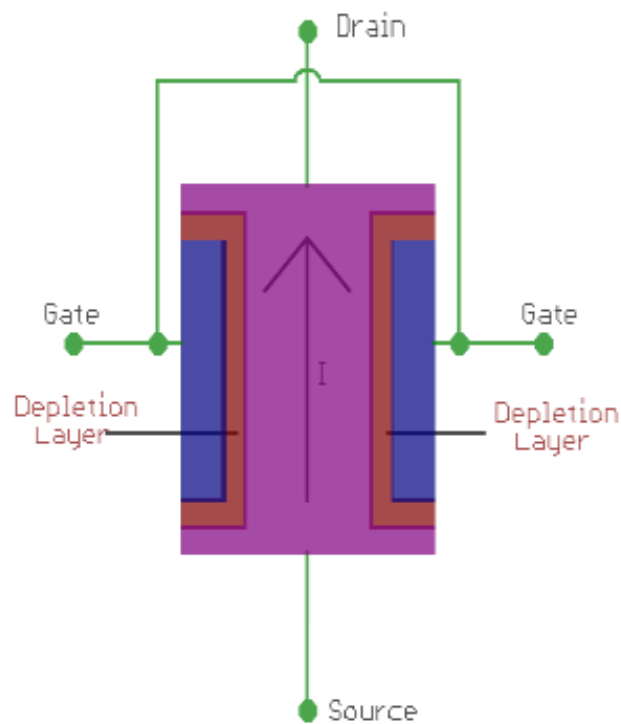
N-channel JFET..



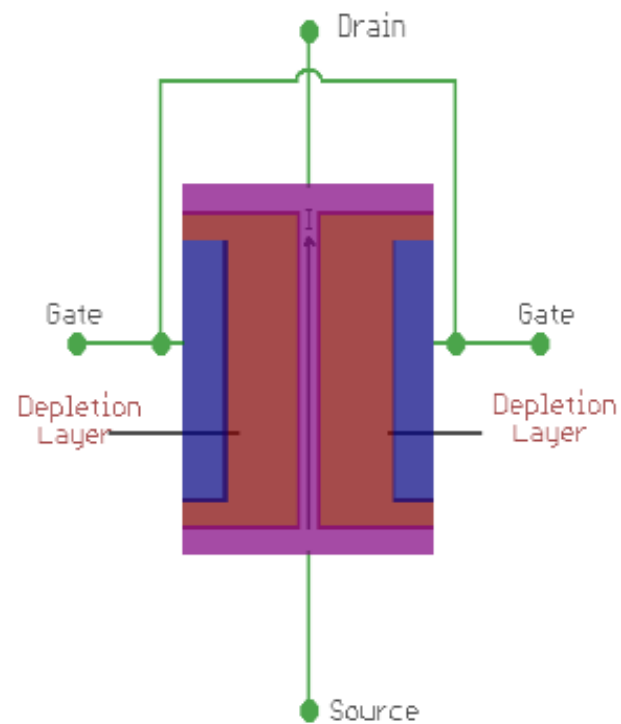
Junction field-effect transistor (JFET)







Saturation mode



Pinch-off mode

□ There are 2 types of JFET

- n-channel JFET

- p-channel JFET

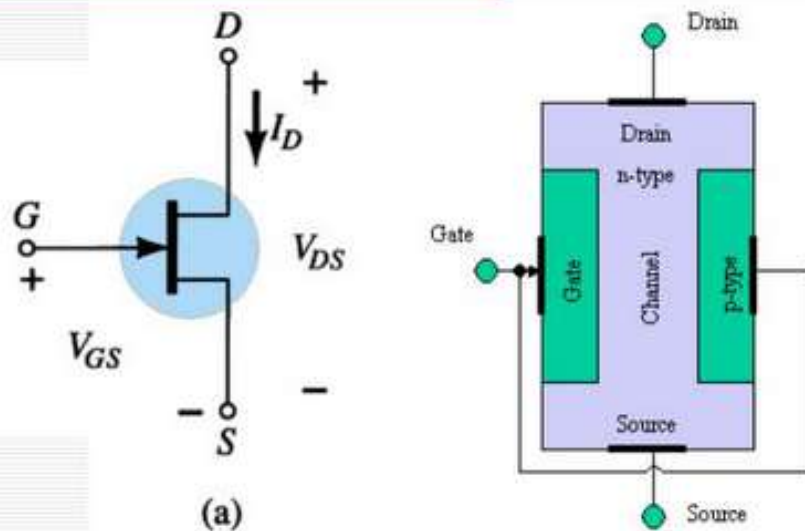
□ Three Terminal

- Drain – D (*Saliran*)

- Gate -G (*Get*)

- Source – S (*Punca*)

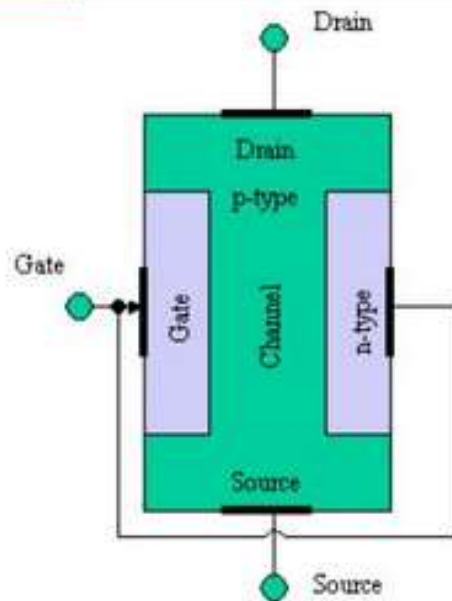
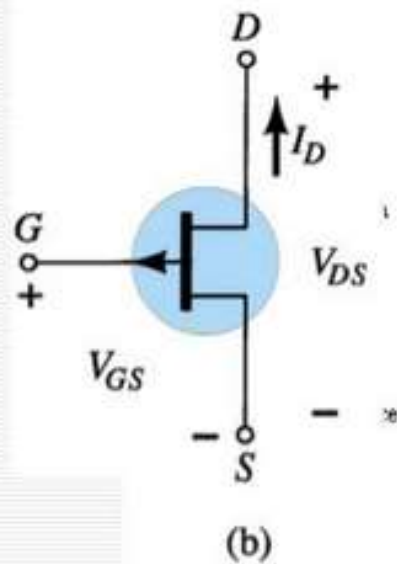
N-channel JFET..



□ N channel JFET:

- Major structure is n-type material (channel) between embedded p-type material to form 2 p-n junction.
- In the normal operation of an n-channel device, the Drain (D) is positive with respect to the Source (S). Current flows into the Drain (D), through the channel, and out of the Source (S)
- Because the resistance of the channel depends on the gate-to-source voltage (V_{GS}), the drain current (I_D) is controlled by that voltage

P-channel JFET..



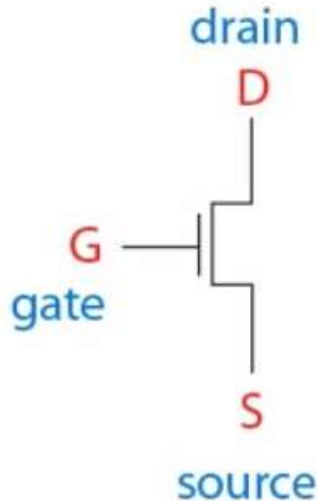
□ P channel JFET:

- Major structure is p-type material (channel) between embedded n-type material to form 2 p-n junction.
- Current flow : from Source (S) to Drain (D)
- Holes injected to Source (S) through p-type channel and flowed to Drain (D)

MOSFET Review

MOSFET (Metal–Oxide–Semiconductor Field–Effect–Transistor)

- A three terminal semiconducting device
- Current through two terminals (Drain and Source) can be controlled by voltage in third terminal (Gate)
- One can make an amplifier with MOSFET
- MOSFET is also used as switch in modern micro processors



Working principle of MOSFET

- The working principle of MOSFET depends up on the MOS capacitor.
- The MOS capacitor is the main part.
- The semiconductor surface at below the oxide layer and between the drain and source terminal can be inverted from p-type to n-type by applying a positive or negative gate voltages respectively.
- When we apply positive gate voltage the holes present beneath the oxide layer experience repulsive force and the holes are pushed downward with the substrate

Working principle of MOSFET

The depletion region is populated by the bound negative charges, which are associated with the acceptor atoms.

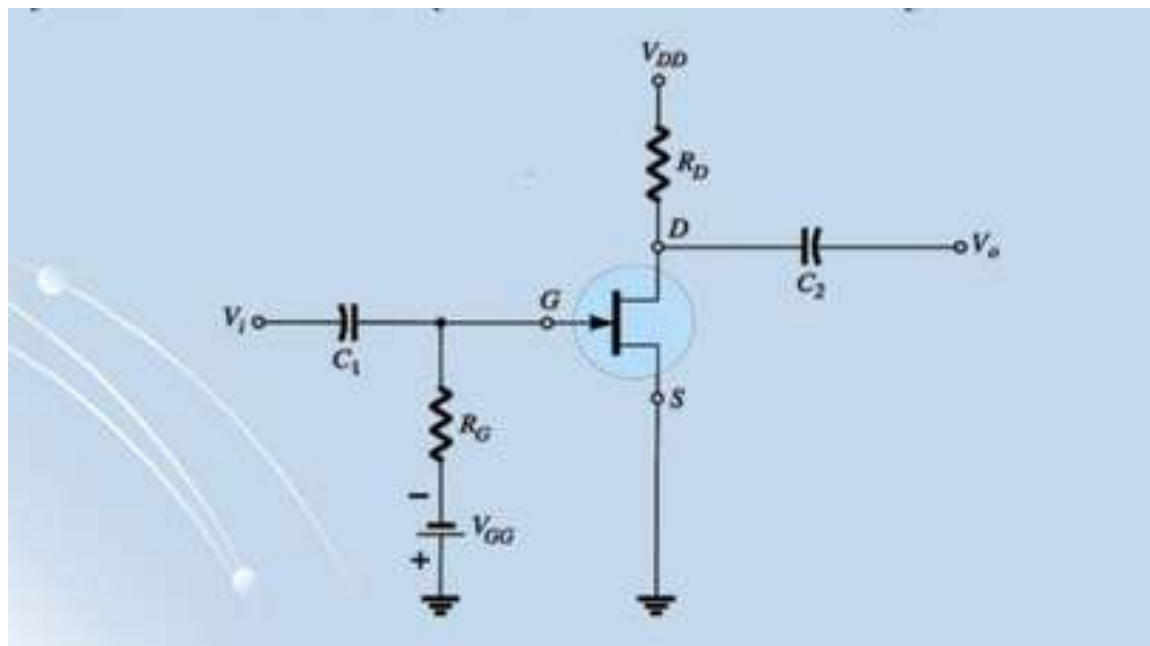
The **positive voltage** also **attracts electrons** from the n^+ source and drain regions in to the channel.

The electron reach channel is formed. Now, if a voltage is applied between the source and the drain, current flows freely between the source and drain gate voltage controls the electrons concentration the channel.

Instead of positive if apply negative voltage a hole channel will be formed beneath the oxide layer.

Common FET Biasing Circuits

- JFET
 - Fixed – Bias
 - Self-Bias
 - Voltage-Divider Bias
- Depletion-Type MOSFET
 - Self-Bias
 - Voltage-Divider Bias
- Enhancement-Type MOSFET
 - Feedback Configuration
 - Voltage-Divider Bias



S.No	JFET	MOSFET
1	Operated in depletion mode	Operated in depletion mode and enhancement mode
2	High input impedance($>10\text{M}\Omega$)	Very High input impedance($>10000\text{M}\Omega$)
3	Gate is not insulated from channel	Gate is insulated from channel by a layer of SiO_2
4	Channel exists permanently	Channel exists permanently in depletion type but not in enhancement type.
5	Difficult to fabricate than MOSFET	Easier to fabricate
6	Drain resistance is high	Drain resistance is less
7	Gate is formed as a diode	Gate is formed as a capacitor