



SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution
Coimbatore-35



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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

16EC402- MICROWAVE AND OPTICAL ENGINEERING

IV YEAR/ VII SEMESTER

UNIT I-MICROWAVE ACTIVE DEVICES

TOPIC 7-Parametric Amplifier



CONTENTS



- Introduction
- Structure
- Principle Of Operation
- Advantages & Disadvantage
- Typical Parameters
- Application
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Parametric Amplifier

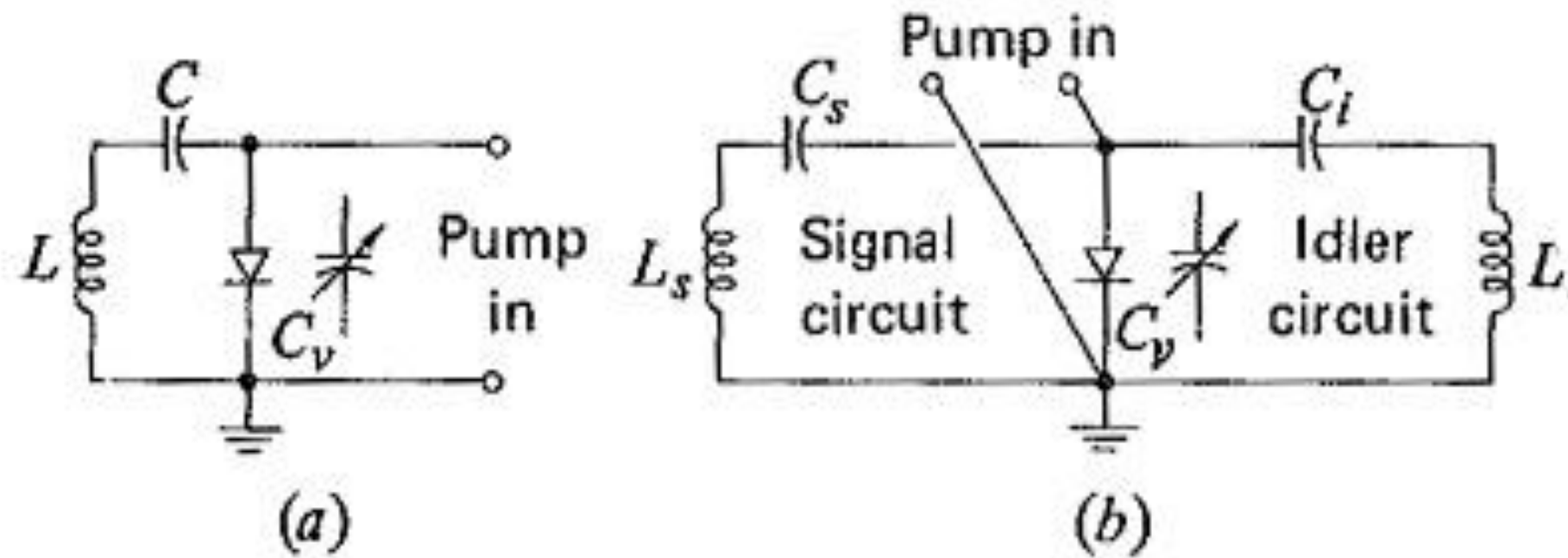


FIGURE 12-14 Basic parametric amplifiers. (a) Degenerate; (b) nondegenerative, showing idler circuit.



Parametric Amplifier

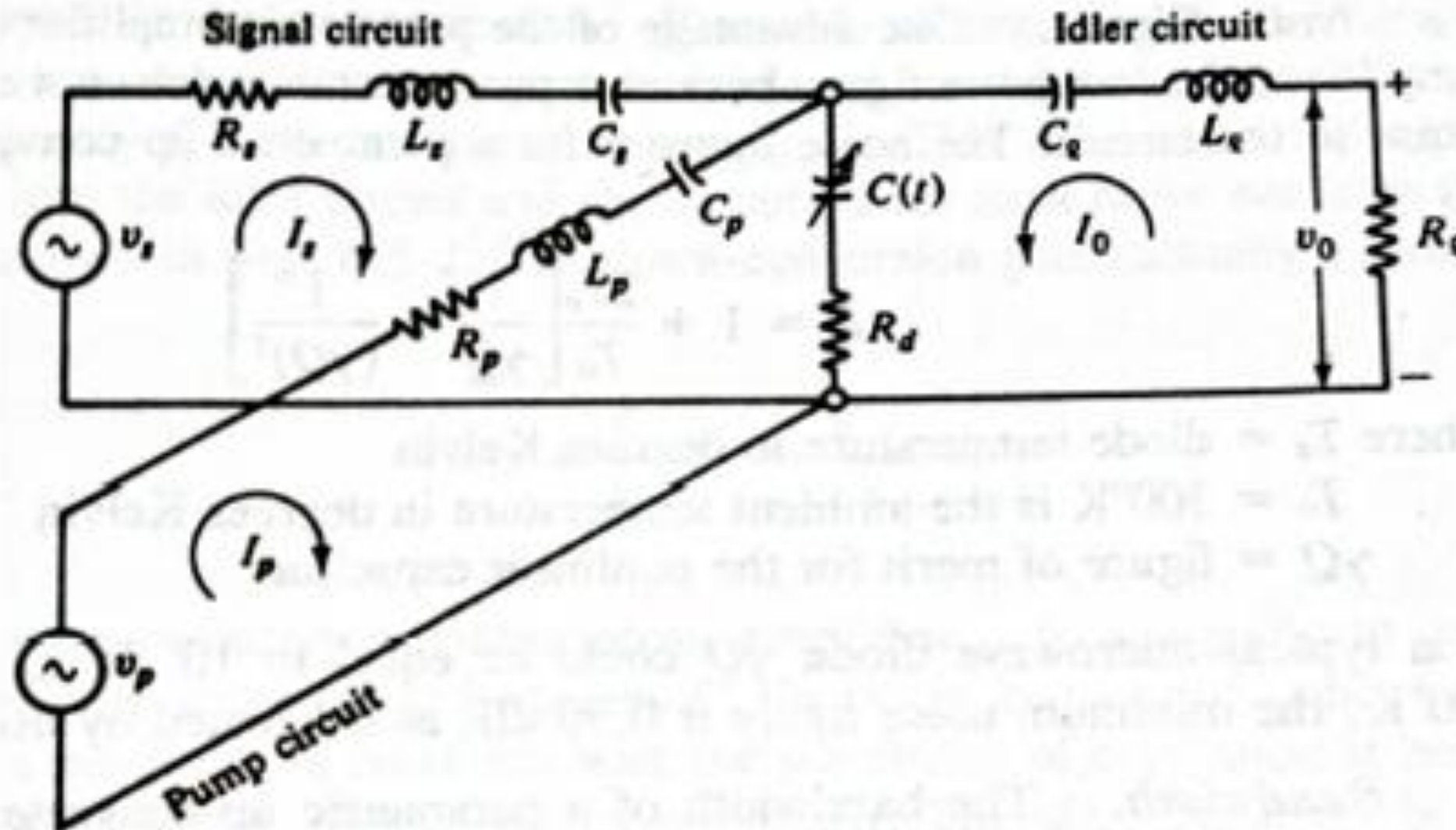


Figure: Circuit for parametric Amplifier.



Bipolar Junction Transistors

- The transistor is a three-layer semiconductor device consisting of either two n- and one p-type layers of material or two p- and one n-type layers of material.
- The former is called an npn transistor, while the latter is called a pnp transistor
- So, there are two types of BJT-
 - i) pnp transistor
 - ii) npn transistor



Bipolar Junction Transistors

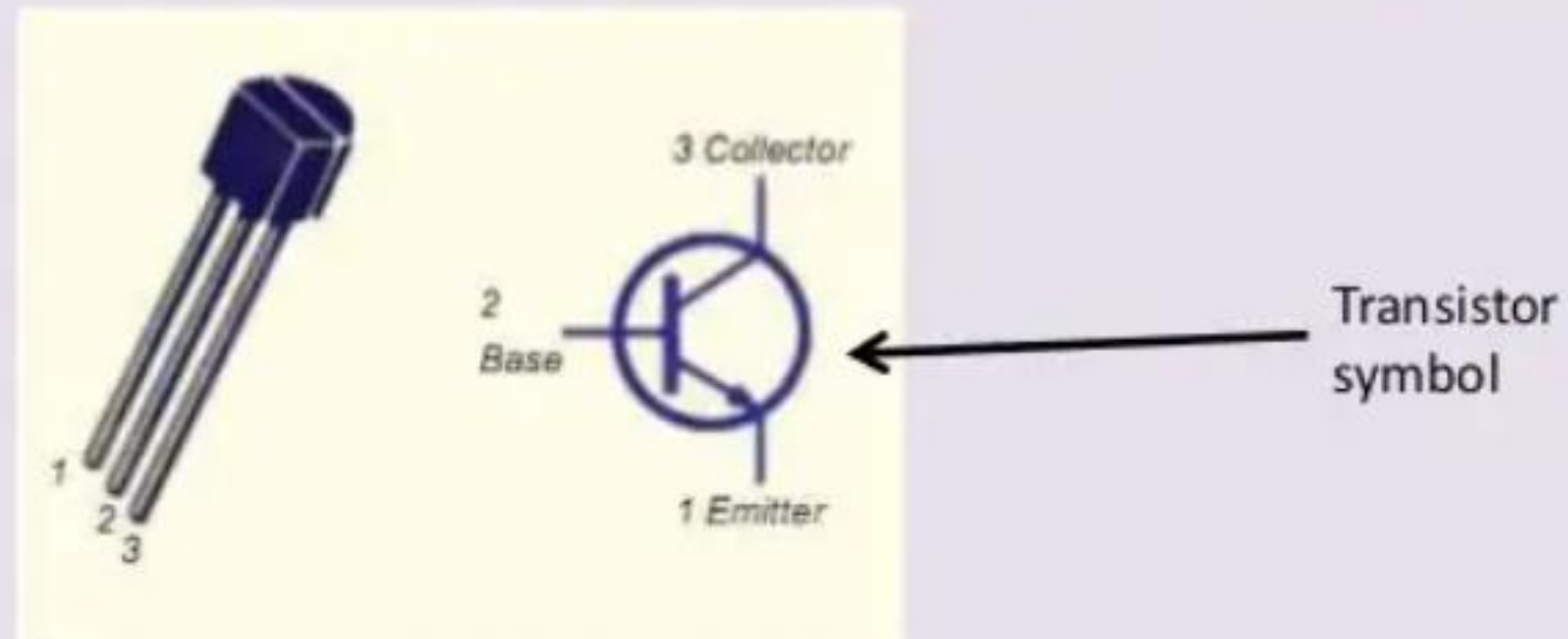


- In each transistor following points to be noted-
- i) There are two junction, so transistor can be considered as two diode connected back to back.
 - ii) There are three terminals.
 - iii) The middle section is thin than other.



Naming of Transistor Terminals

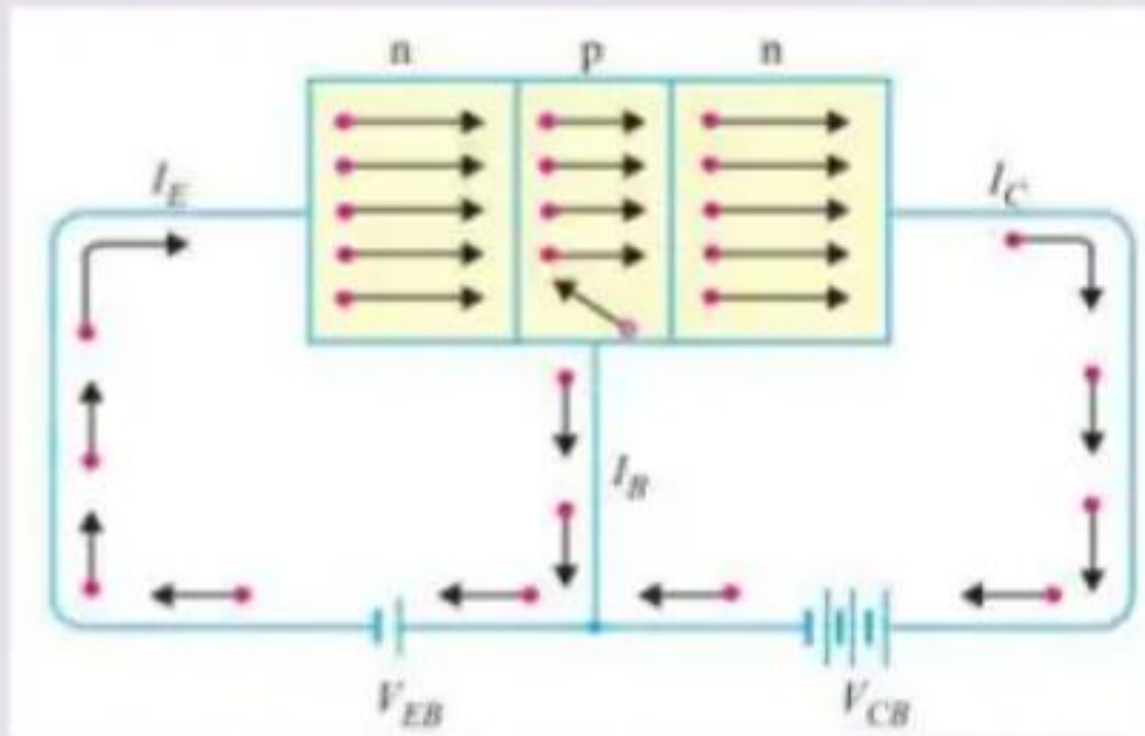
- Transistor has three section of doped semiconductor.
- The section one side is called “emitter” and the opposite side is called “collector”.
- The middle section is called “base”.





Transistor Operation

1) Working of npn transistor:



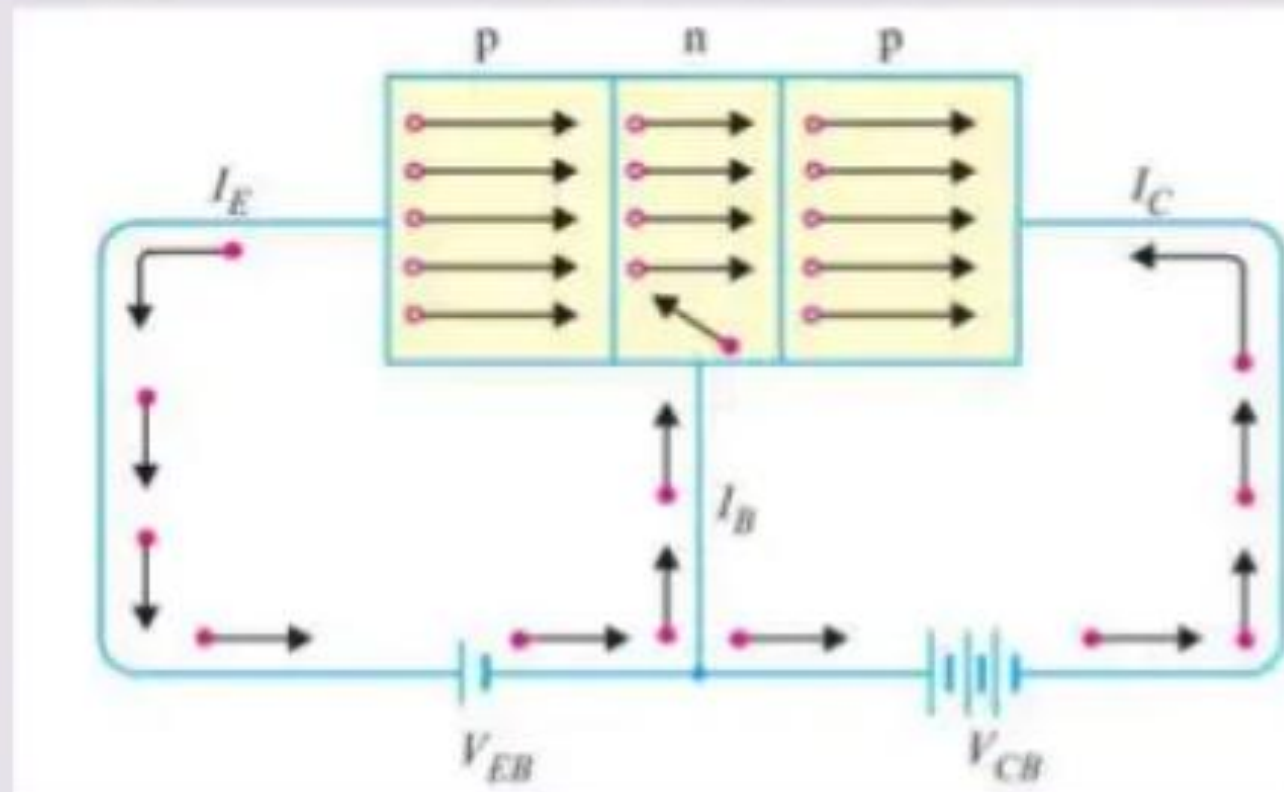
✓ Forward bias is applied to emitter-base junction and reverse bias is applied to collector-base junction.

✓ The forward bias in the emitter-base junction causes electrons to move toward base. This constitutes emitter current, I_E



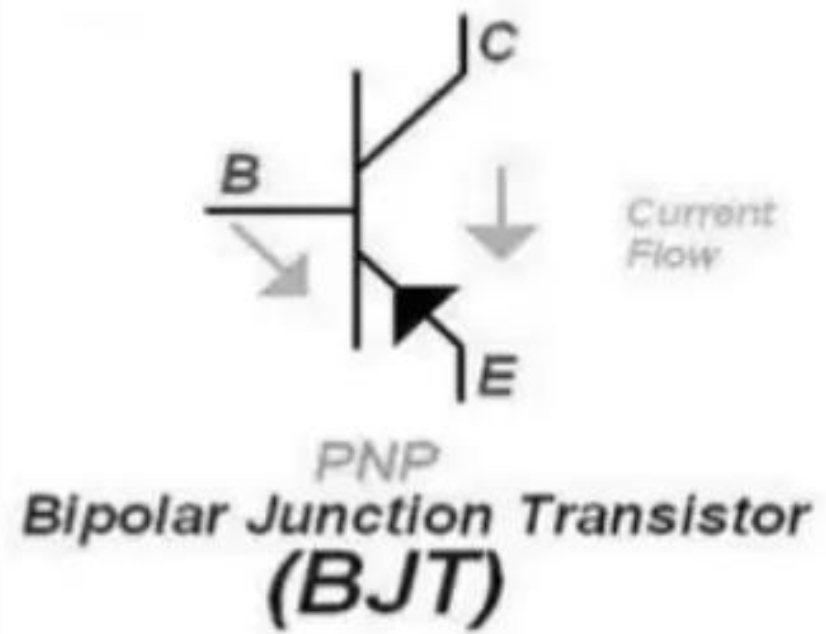
Transistor Operation

2) Working of pnp transistor:

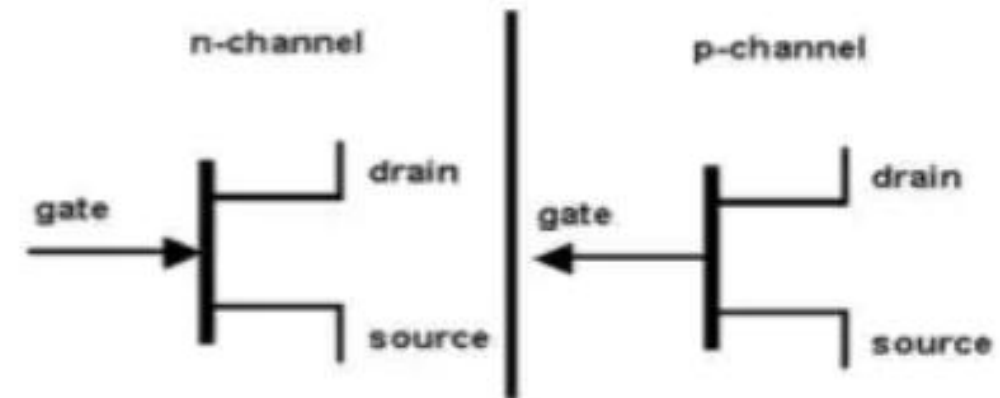


✓ Forward bias is applied to emitter-base junction and reverse bias is applied to collector-base junction.

✓ The forward bias in the emitter-base junction causes holes to move toward base. This constitute emitter current, I_E



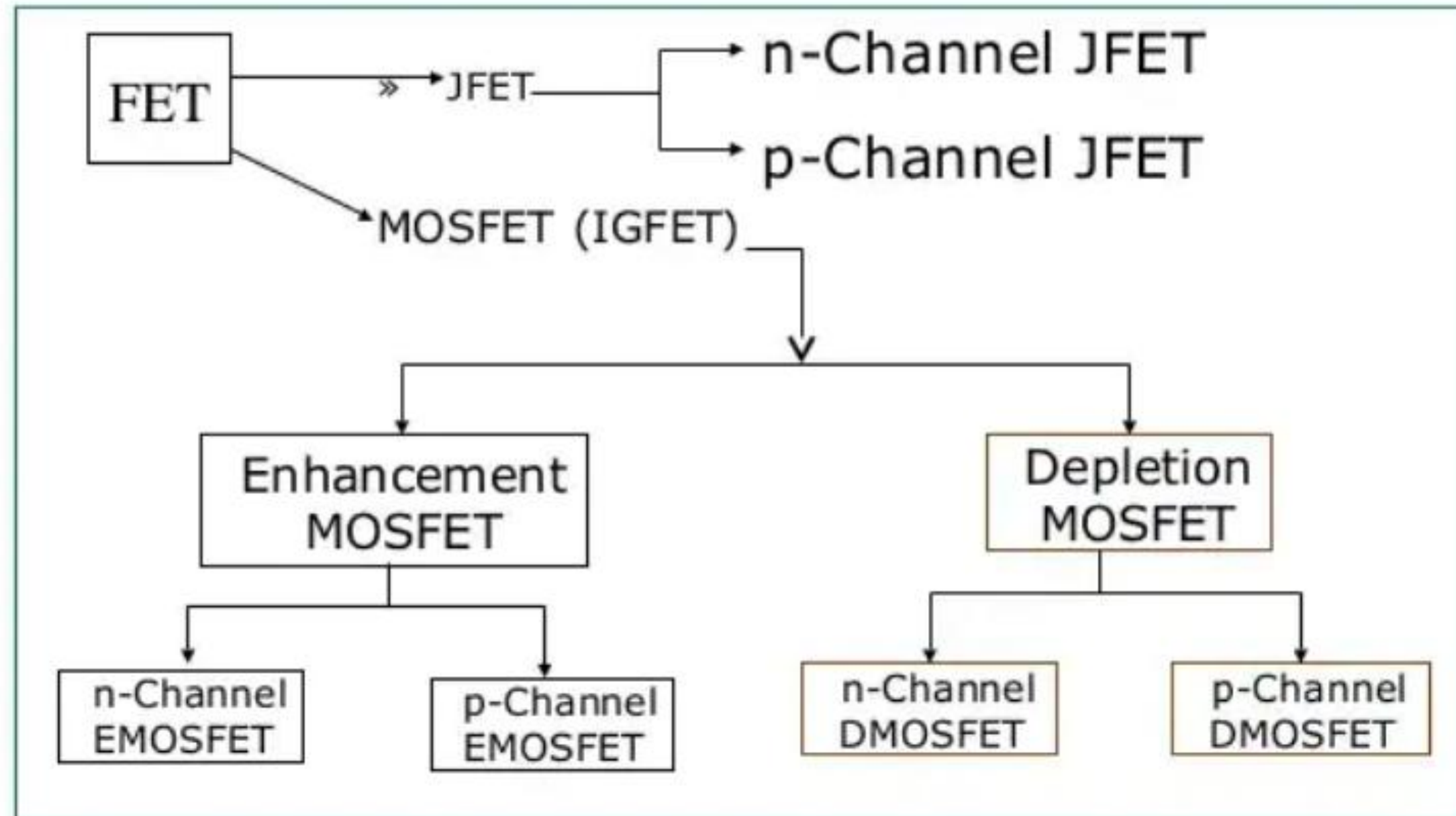
PNP
Bipolar Junction Transistor
(BJT)

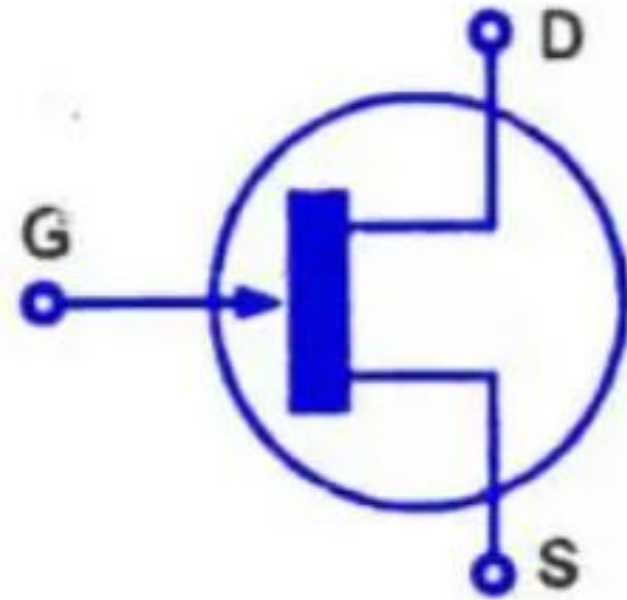


FET
Field-Effect Transistor

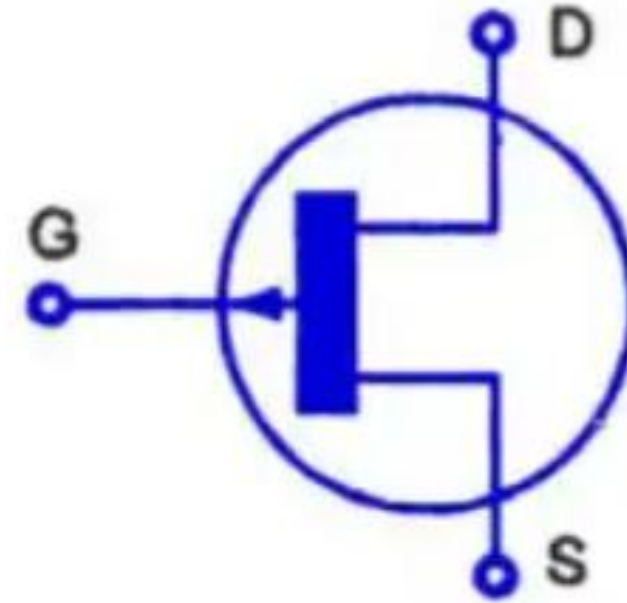


Types of Field Effect Transistors (The Classification)





N-Channel JFET

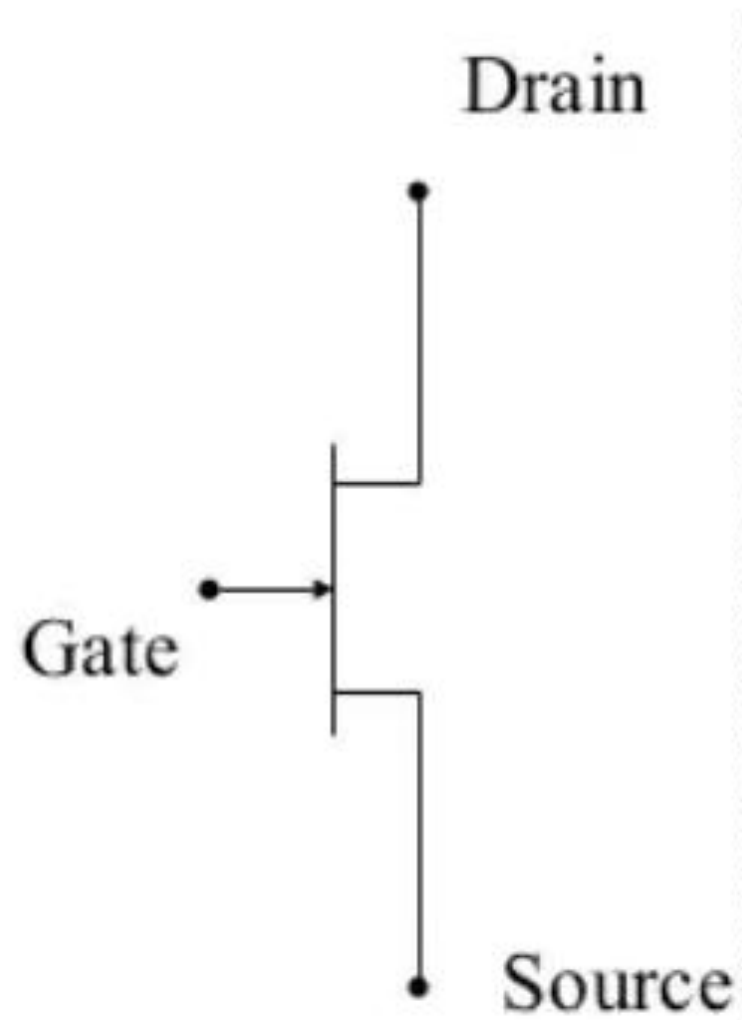


P-Channel JFET

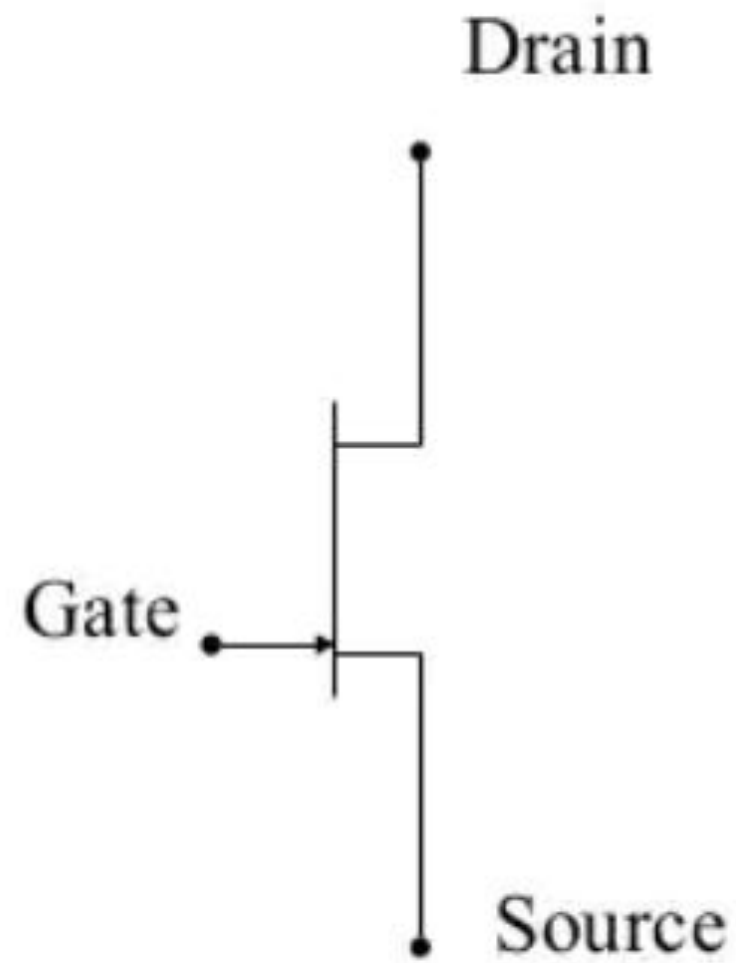
Schematic Symbols For JFETs



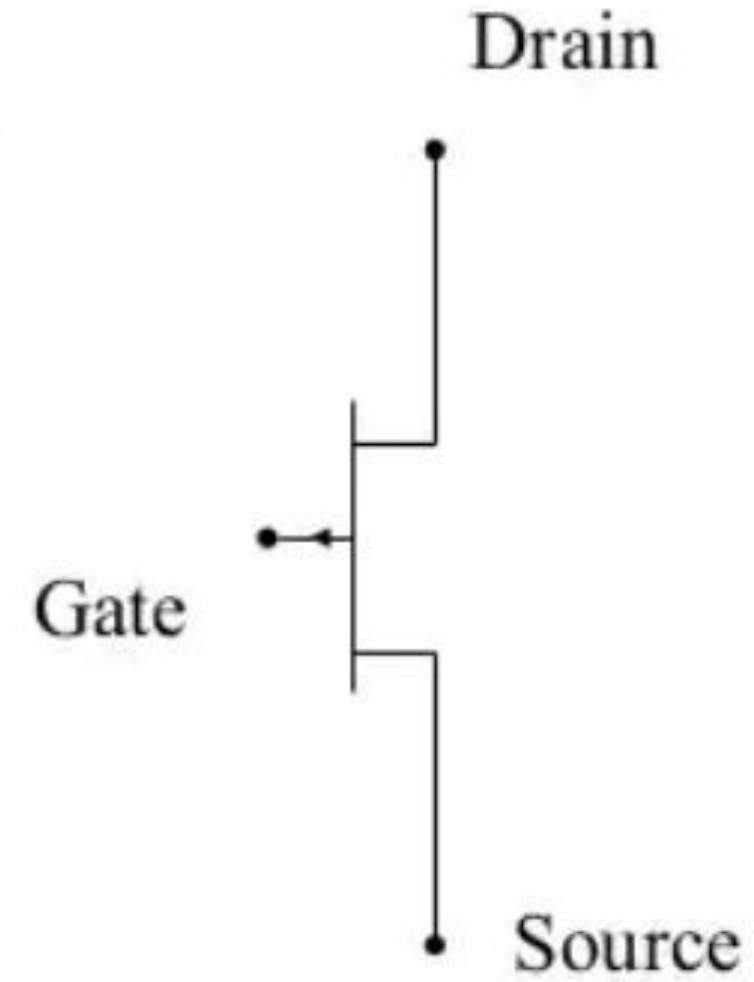
SYMBOLS



n-channel JFET



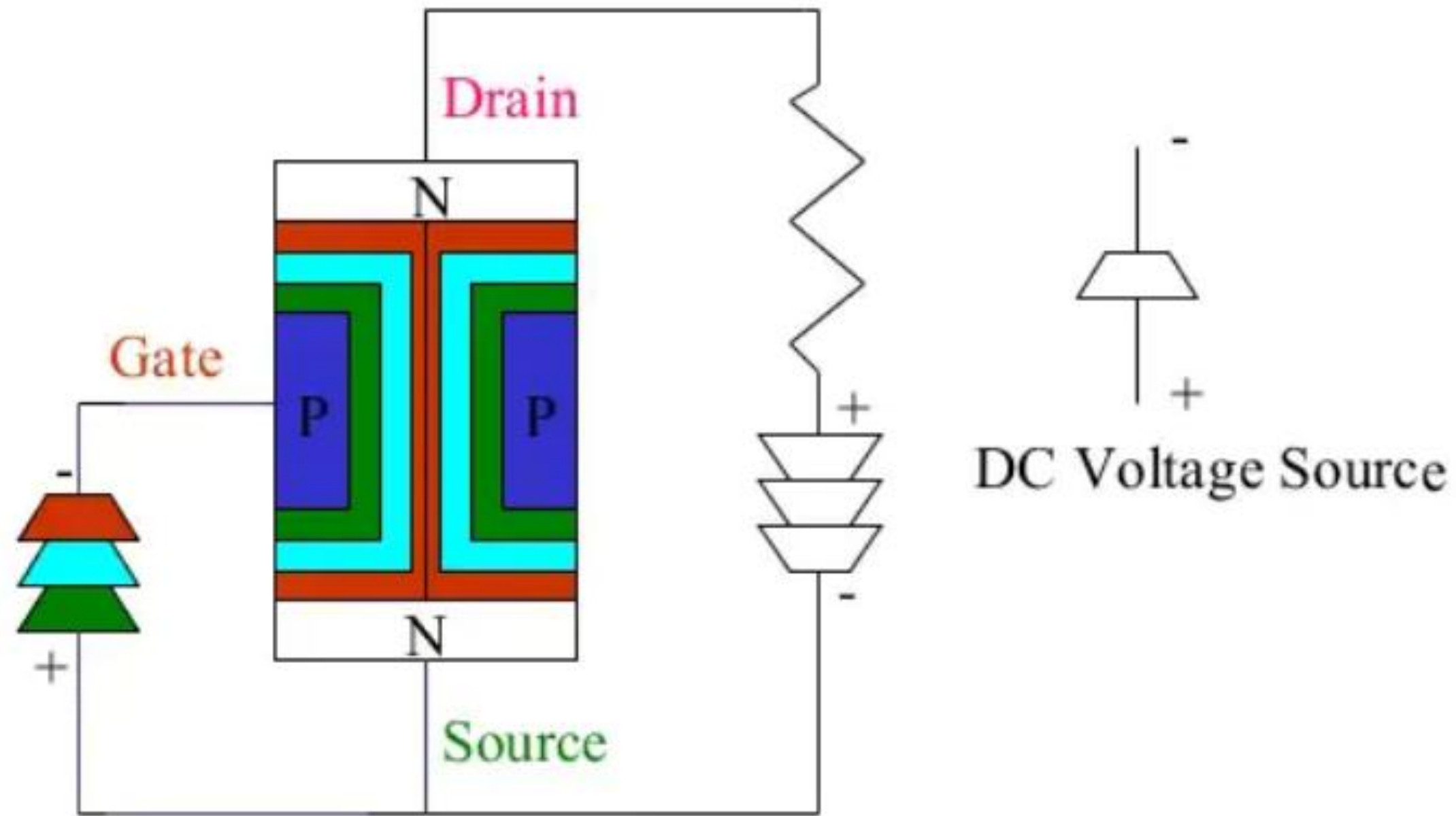
n-channel JFET
Offset-gate symbol



p-channel JFET



Operation of a JFET





Few important advantages of FET over conventional Transistor

- Unipolar device i.e. operation depends on only one type of charge carriers (h or e)
- Voltage controlled Device (gate voltage controls drain current)
- Very high input impedance ($\approx 10^9 - 10^{12} \Omega$)
- Source and drain are interchangeable in most
- Low-frequency applications



Disadvantages of FET

- It has a relatively low gain-bandwidth product compared to a BJT. The MOSFET has a drawback of being very susceptible to overload voltages, thus requiring special handling during installation.
- The fragile insulating layer of the MOSFET between the gate and channel makes it vulnerable to electrostatic damage during handling. This is not usually a problem after the device has been installed in a properly designed circuit.



Uses of FET

- The most commonly used FET is the MOSFET. The CMOS (complementary metal oxide semiconductor) process technology is the basis for modern digital integrated circuits. This process technology uses an arrangement where the (usually "enhancement-mode") p-channel MOSFET and n-channel MOSFET are connected in series such that when one is on, the other is off.
- In FETs, electrons can flow in either direction through the channel when operated in the linear mode. The naming convention of drain terminal and source terminal is somewhat arbitrary, as the devices are typically (but not always) built symmetrically from source to drain. This makes FETs suitable for switching analog signals between paths (multiplexing). With this concept, one can construct a solid-state mixing board, for example.



THANK YOU