# Bipolar Junction Transistor (BJT)

## Construction & Operation

- **BJT**: A three-layer semiconductor device with **Emitter (E), Base (B), and Collector (C)**.
- **Types**:
- **NPN**: Current flows from collector to emitter.
- **PNP**: Current flows from emitter to collector.
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- **Operation**: Works by controlling a small base current to regulate a larger collector current.

## BJT Configurations & Characteristics

1st **Common Base (CB)**:
- Low input impedance, high output impedance.
- Voltage gain is high, but current gain is less than 1.
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2nd**Common Emitter (CE)**:
- Most used configuration.
- High voltage and current gain.
- Provides phase inversion.
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3rd**Common Collector (CC)**:
- Also called an **emitter follower**.
- High input impedance, low output impedance.
- Voltage gain ≈ 1, but high current gain.
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## Biasing of BJT

- Ensures **stable operation** of the transistor in amplification mode.
- Types of Biasing:
- **Fixed Bias**
- **Collector-to-Base Bias**
- **Voltage Divider Bias** (most stable method).
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# Junction Field Effect Transistor (JFET)

## Construction & Operation

- **JFET**: A unipolar device controlled by voltage, with terminals **Drain (D), Source (S), and Gate (G)**.
- **Types**:
- **N-channel JFET**: Majority carriers are electrons.
- **P-channel JFET**: Majority carriers are holes.
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- **Operation**:
- When voltage at the **Gate** is negative (for N-channel), the conduction channel narrows, reducing current.
- No gate current flows, making it **highly efficient**.
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# Metal Oxide Semiconductor Field Effect Transistor (MOSFET)

## Types of MOSFET

1st **Enhancement MOSFET (EMOSFET)**

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- No conduction at zero gate voltage.
- Needs a **positive voltage** (N-channel) or **negative voltage** (P-channel) to conduct.
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2nd**Depletion MOSFET (DMOSFET)**

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- Conducts even at zero gate voltage.
- Can operate in both enhancement and depletion modes.
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## MOSFET Operation Characteristics

- High input impedance (ideal for signal amplification).
- Faster switching speed than BJTs (used in digital circuits).
- Less power consumption, making it suitable for low-power applications.