Syllabus

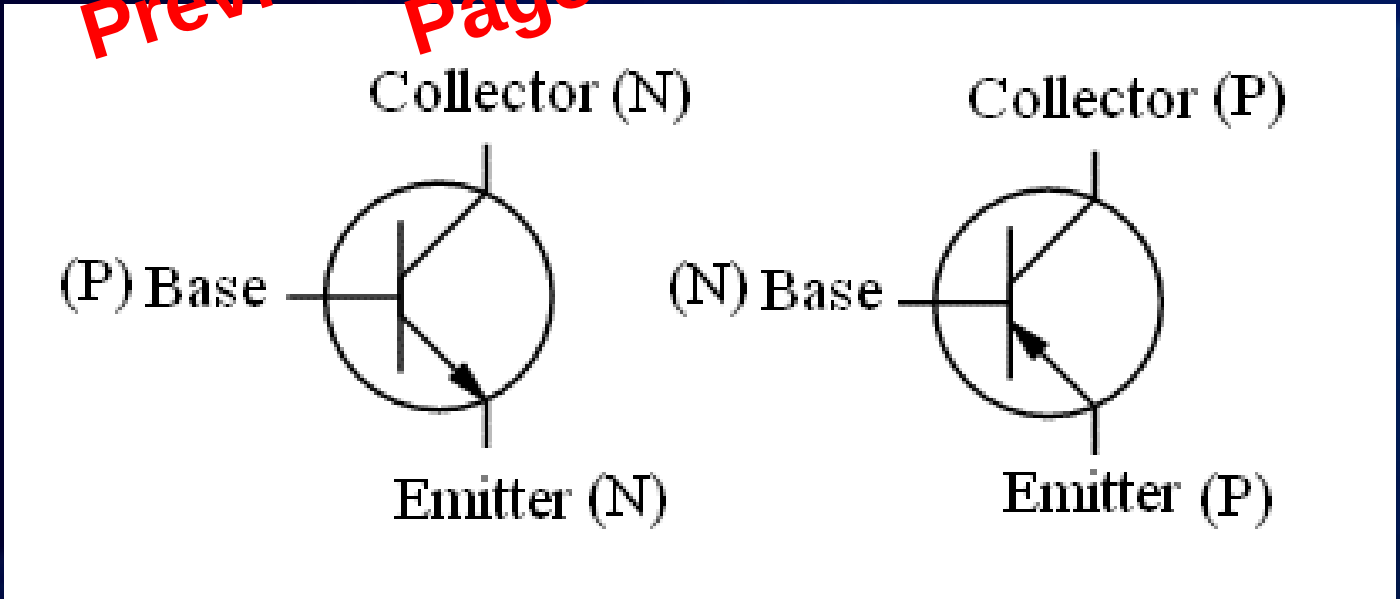
- Introduction to Bipolar Junction Transistor
- BJT Operation
- BJT Configurations
- Tutorials
- BJT Biasing
- Tutorials
- BJT Amplifier
- Tutorials

Reference Books

1. "Electronic Devices and Circuit Theory" by Boylestad & Nashelsky,
2. "Integrated Electronics" by Millman & Halkias,

Introduction

- Transistor symbols:



Note: Arrow direction from P to N (like diode)

Introduction

- BJT has two junctions – Emitter-Base (EB) Junction and Collector-Base (CB) Junction
- Analogous to two diodes connected back-to-back:
  - EB diode and CB diode
- The device is called "bipolar junction transistor" because current is due to motion of two types of charge carriers – free electrons & holes

Transistor Operation

- As noted earlier, collector current has two components:
  - One due to injected charge carriers from emitter
  - Another due to thermally generated minority carriers
- Both results in current in the same direction. Hence

$$I_C = \alpha_{dc} I_E + I_{CBO} \qquad \text{--- (2)}$$

α_{dc} is the fraction of charge carriers emitted from emitter, that enter into the collector region

I_{CBO} is the reverse saturation current in CB diode

$$\alpha_{dc} = \frac{I_C - I_{CBO}}{I_E} \qquad \text{--- (3)}$$

Transistor Configurations

- Output resistance r_o

$$r_O = \left.\frac{\Delta V_{CB}}{\Delta I_C}\right| \text{with } I_E \text{ const}$$

- Current amplification factor A_I or α_{ac}

$$\alpha_{ac} = \left.\frac{\Delta I_C}{\Delta I_E}\right| \text{with } V_{CB} \text{ const}$$

- Both can be measured from output characteristics

Transistor Configurations

CE input characteristics

- Plot of I_B versus V_{BE} for various values of V_{CE}
- Similar to diode characteristics
- As V_{CE} is increased, I_B decreases only slightly
- This is due to base-width modulation
- Note that second suffix is *E* (for emitter)