Electronics II

Lecture 04
re Equivalent Model for
Common Base & Common Emitter

Muhammad Tilal
Department of Electrical Engineering
CIIT Attock Campus

Previous Lecture

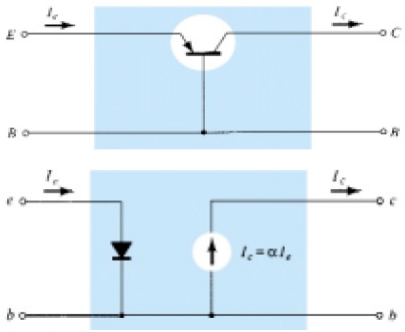
- Important Amplifier Parameters using Two Port System
  - Voltage Gain.
  - Current Gain.
- r_e Equivalent Model for
  - Common Base Configuration.

Session Overview

Topic	re Model for Common Base, Common Emitter & Common Collector configurations.
Concepts	r_e model for Common Base & Common Emitter
Recommended Reading	Section 7.5 of [1]
Keywords	re Model, Common Base, Common Emitter.

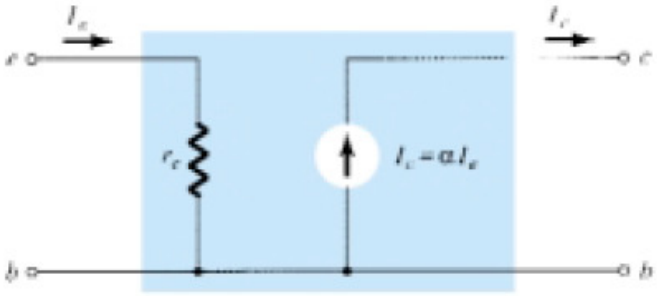
Common Base Configuration

- A pnp transistor is employed to derive the re model for common base configuration.
- It is depicted in a way to replicate the two port network.
- The forward biased pn junction is replaced by a diode.
- A current source is connected in order to represent the collector current I_C.
- AC resistance of diode can be determined by
- $r_{ac} = 26mV/I_D$. $r_e = 26mV/I_E$



Robert L. Boylestad, *Electronic Devices and Circuit Theory*, 8th Edition, Pearson Education Inc, ISBN: 81-7808-590-9.

Common Base Configuration



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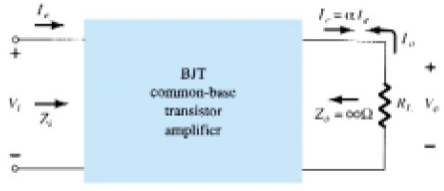
Common Base Configuration

- Input Impedance, $Z_i = r_e$.
  - Typical Values are 1 - 50Ω.
- Output Impedance, $Z_o \cong \infty\Omega$.
  - Set input to zero
  - $I_e = 0A$, $I_c = \alpha I_e = 0A$.
  - Typical value: Mega Ohms.
- For common base configuration
  - Input Impedance= Small.
  - Output Impedance= Large.
- Current Gain, $A_i = I_o/I_i = -I_c/I_e$
  $= -\alpha I_e/I_e = -\alpha \cong -1$
- Voltage Gain, $A_v = R_L/r_e$



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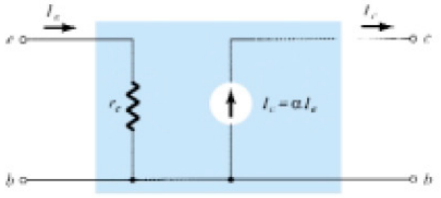
Common Base Configuration

- Example 7.4(Boylestad): For the given common base configuration with IE=4mA, α= 0.98, ac signal of 2 mV applied between base and emitter terminals, determine

- Input Impedance.
- Voltage Gain with R_L= 0.56kΩ.
- Output Impedance.
- Current Gain.



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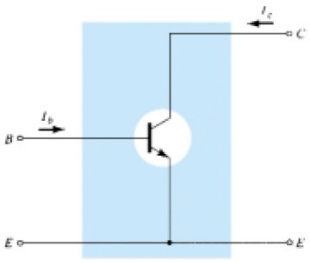
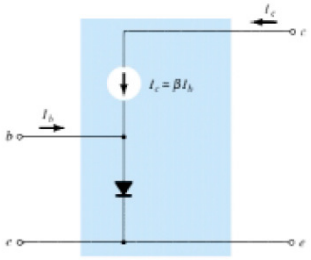
Common Emitter Configuration

- ***Input Terminals:*** Base and Emitter.
- ***Output Terminals:*** Collector and Emitter.
- Emitter is common to both the input and the output.
- According to the re equivalent model, a diode is connected between the base and emitter while a current source is connected between the collector and base terminals.
- I_b is the input current and I_c is the output current.





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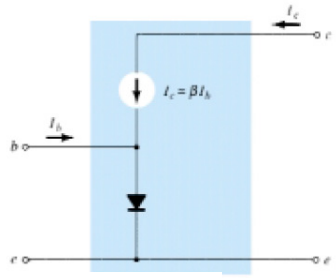
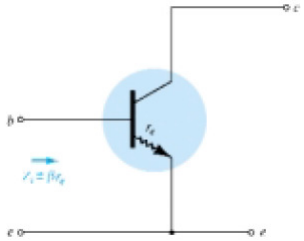
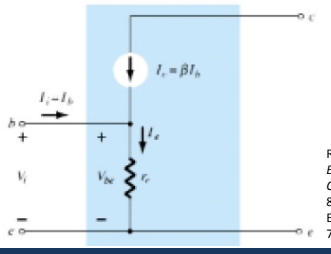
Common Emitter Configuration

- I_b, $I_c = \beta I_b$, $I_e \cong \beta I_b$.
- Input Impedance
  - $Z_i \cong \beta r_e$
- Typical Values ?







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References

[1] Robert L. Boylestad, *Electronic Devices and Circuit Theory,* 8th Edition, Pearson Education Inc, ISBN: 81-7808-590-9.