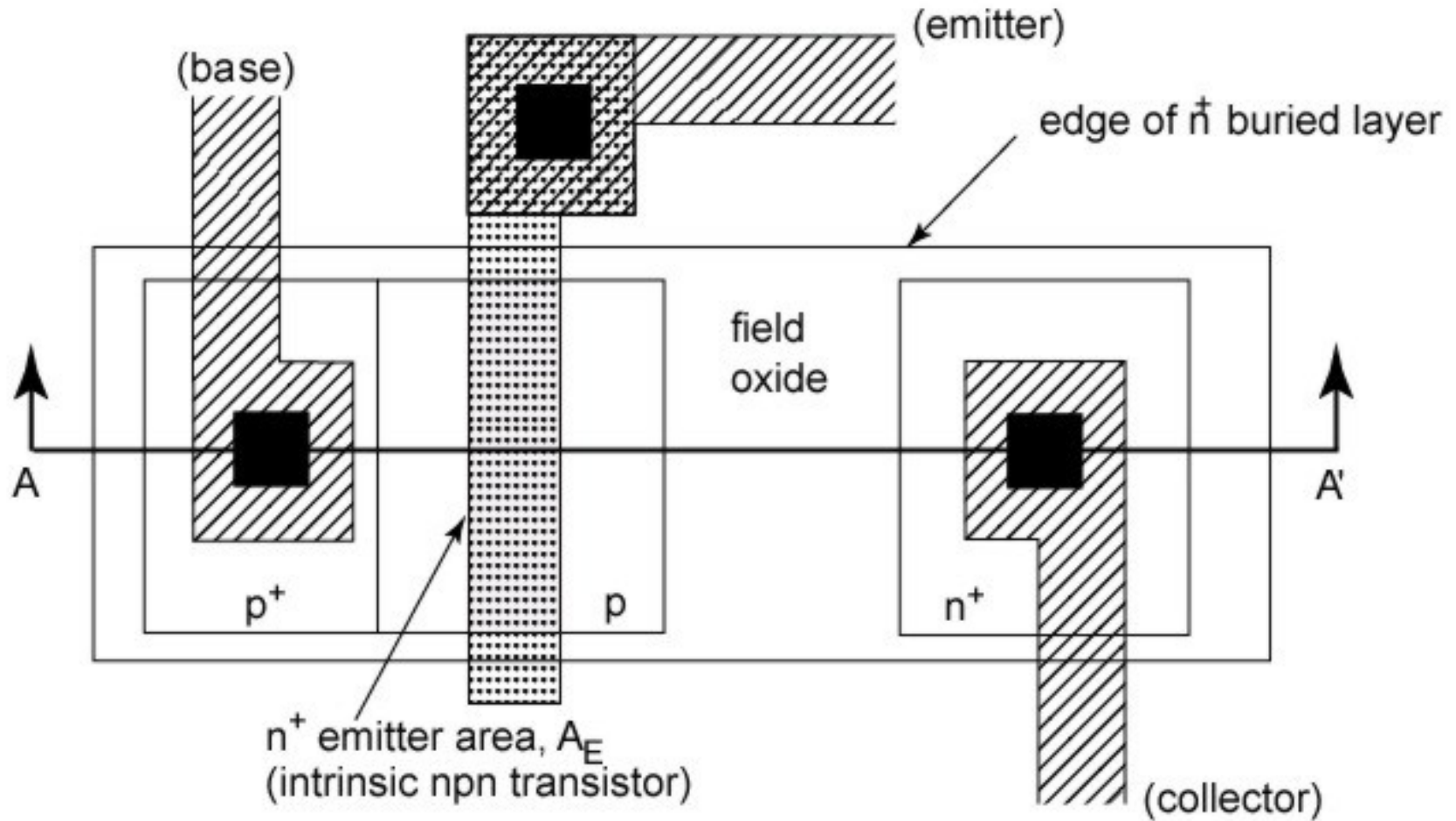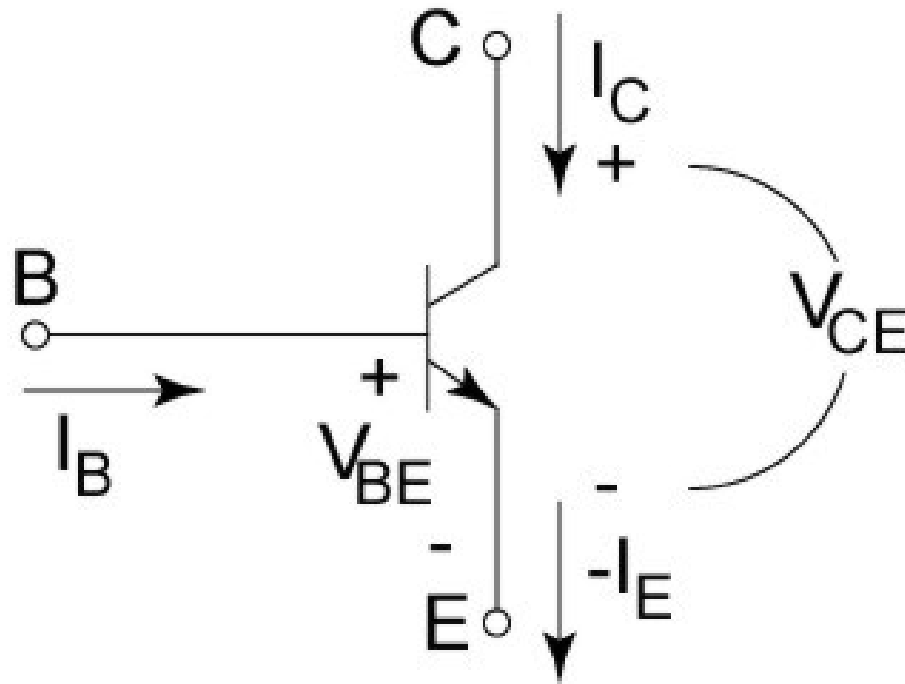# Lecture 19

- Last time:

  – DC and small-signal model of the forward-biased diode

- Today :

  – the npn bipolar junction transistor (BJT): large-signal characteristics
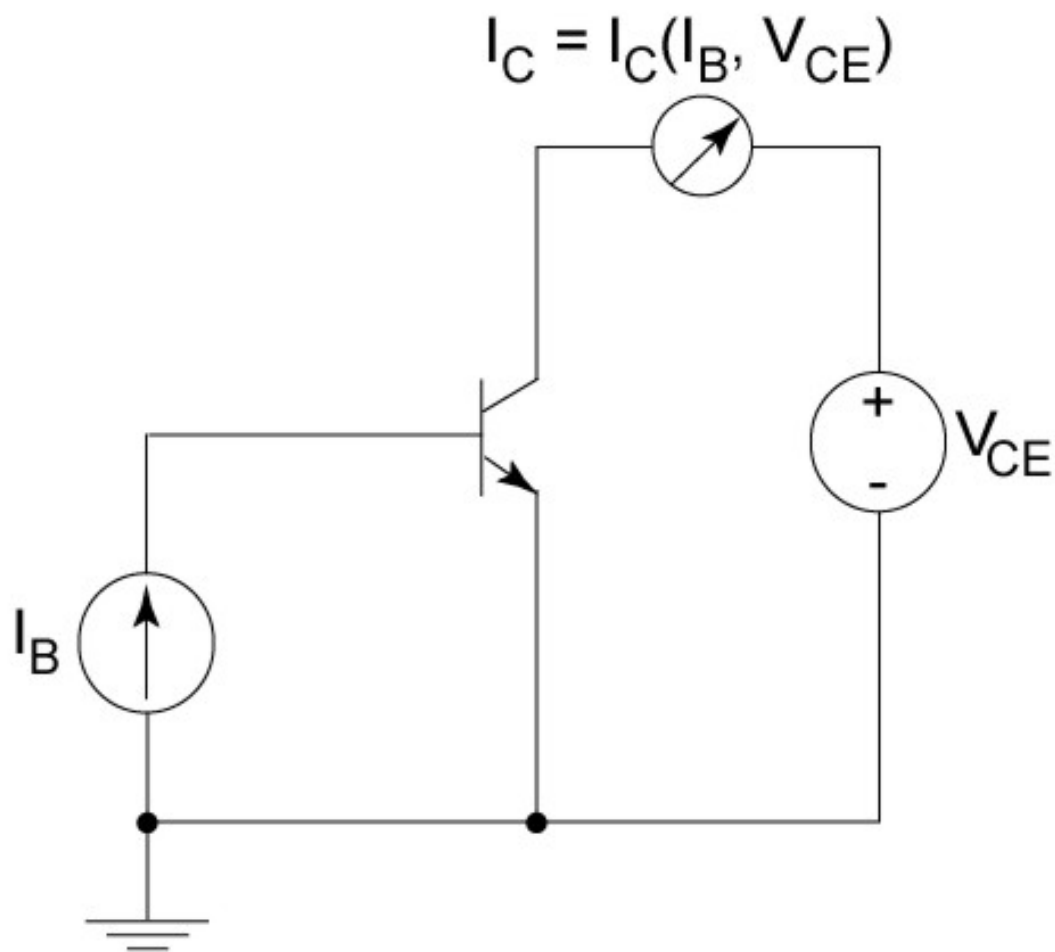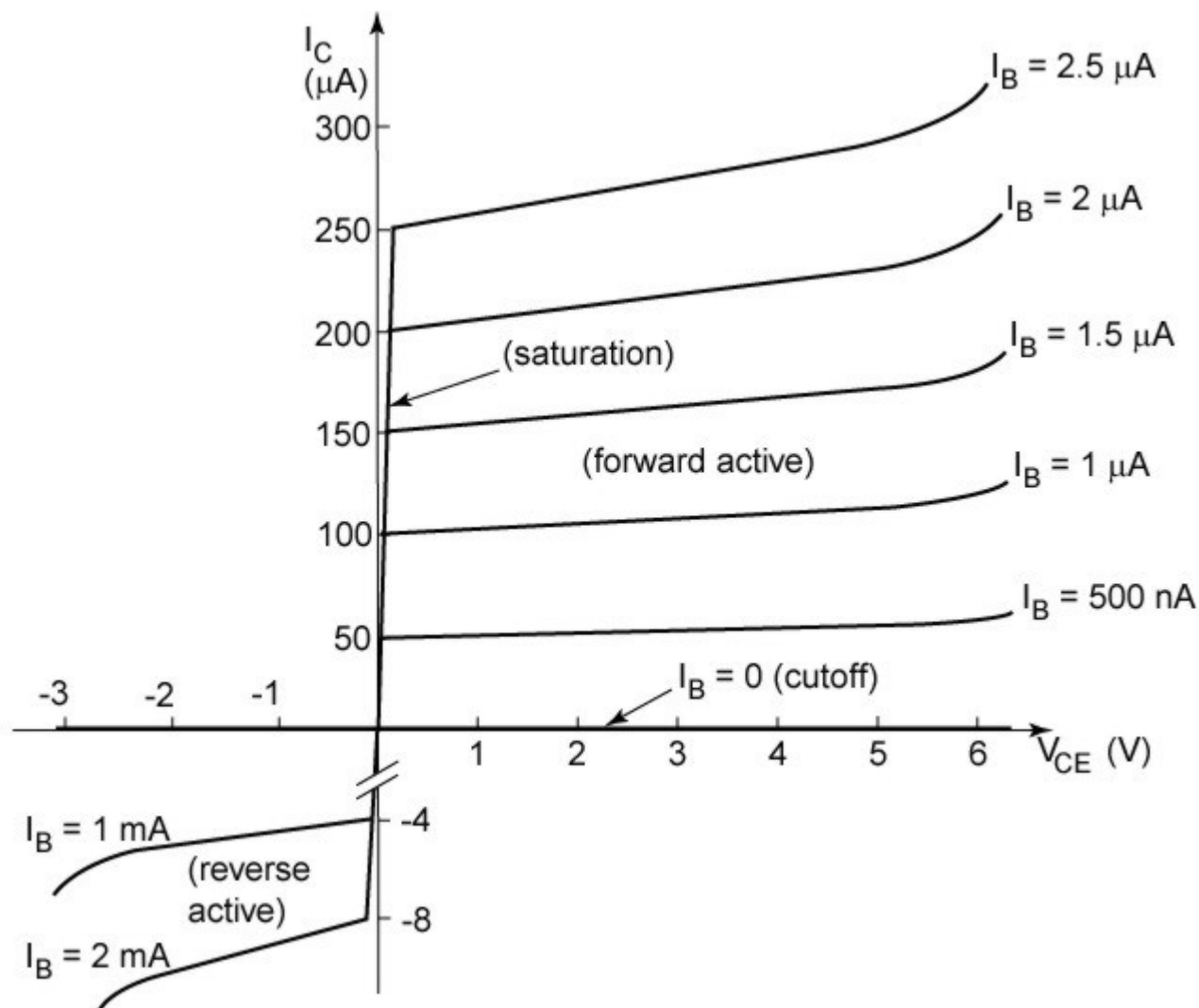
npn Bipolar Transistor Structure

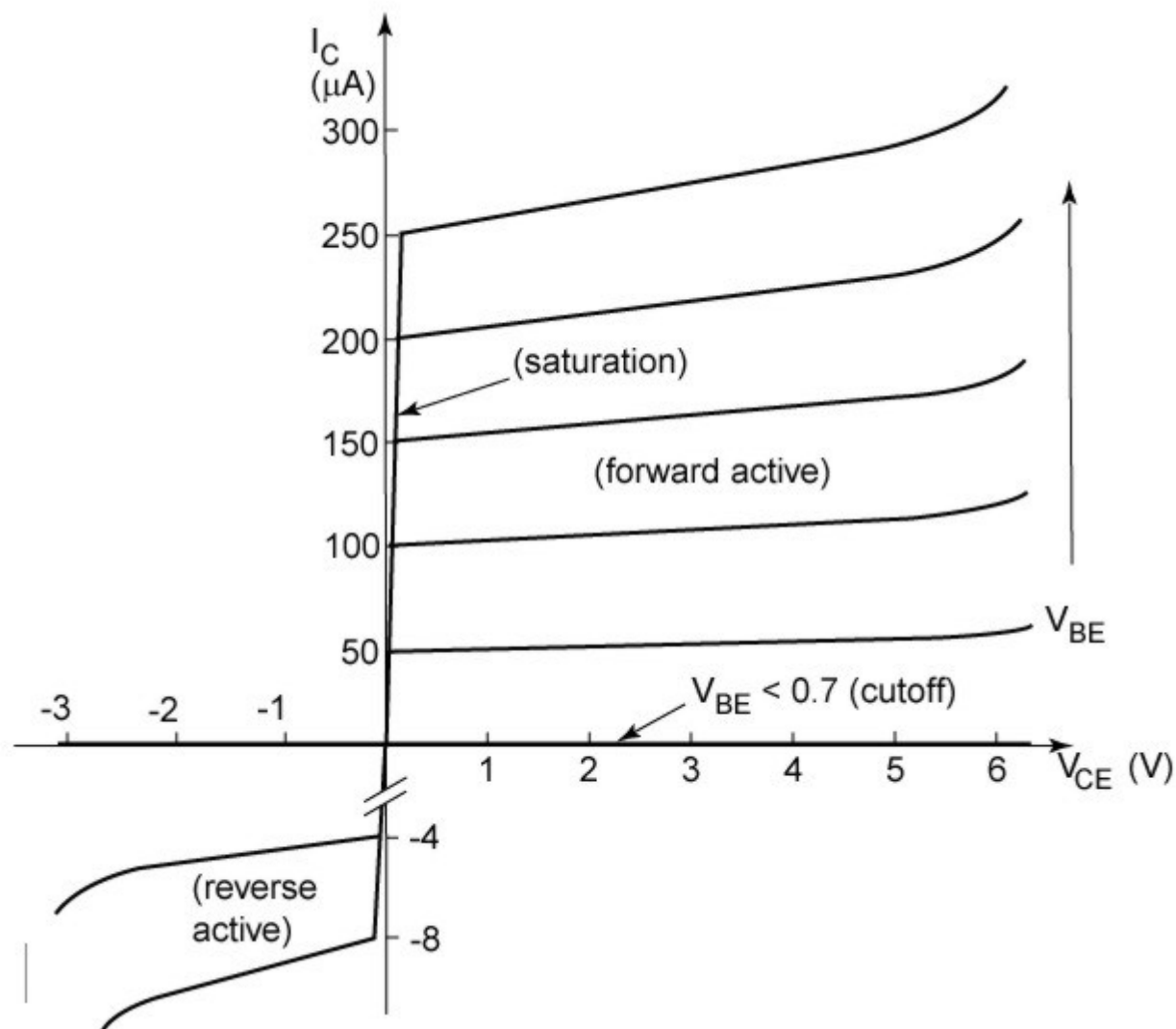# npn Bipolar Transistor Layout

(base)

(emitter)

edge of n^+ buried layer

field
oxide

A

A'

p^+

p

n^+

n^+ emitter area, A_E
(intrinsic npn transistor)

(collector)

BJT Symbol

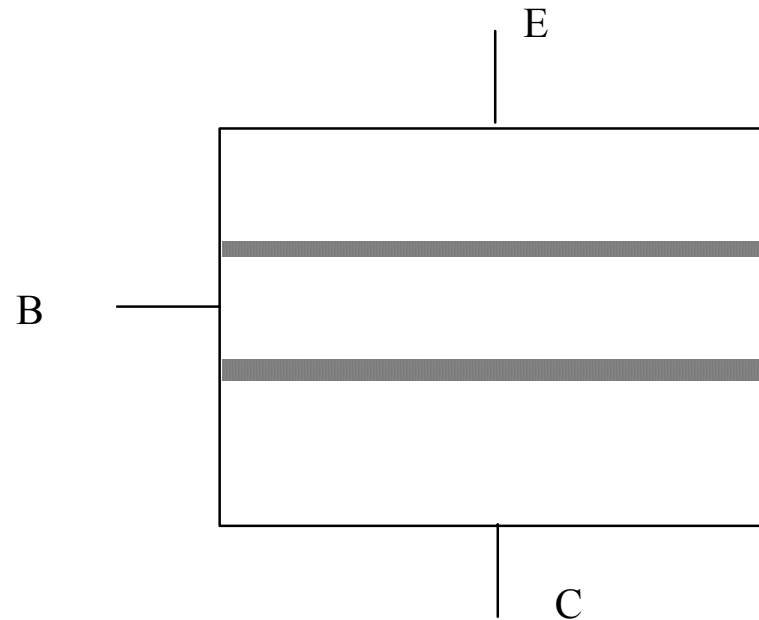# Measuring the BJT's Collector Characteristics
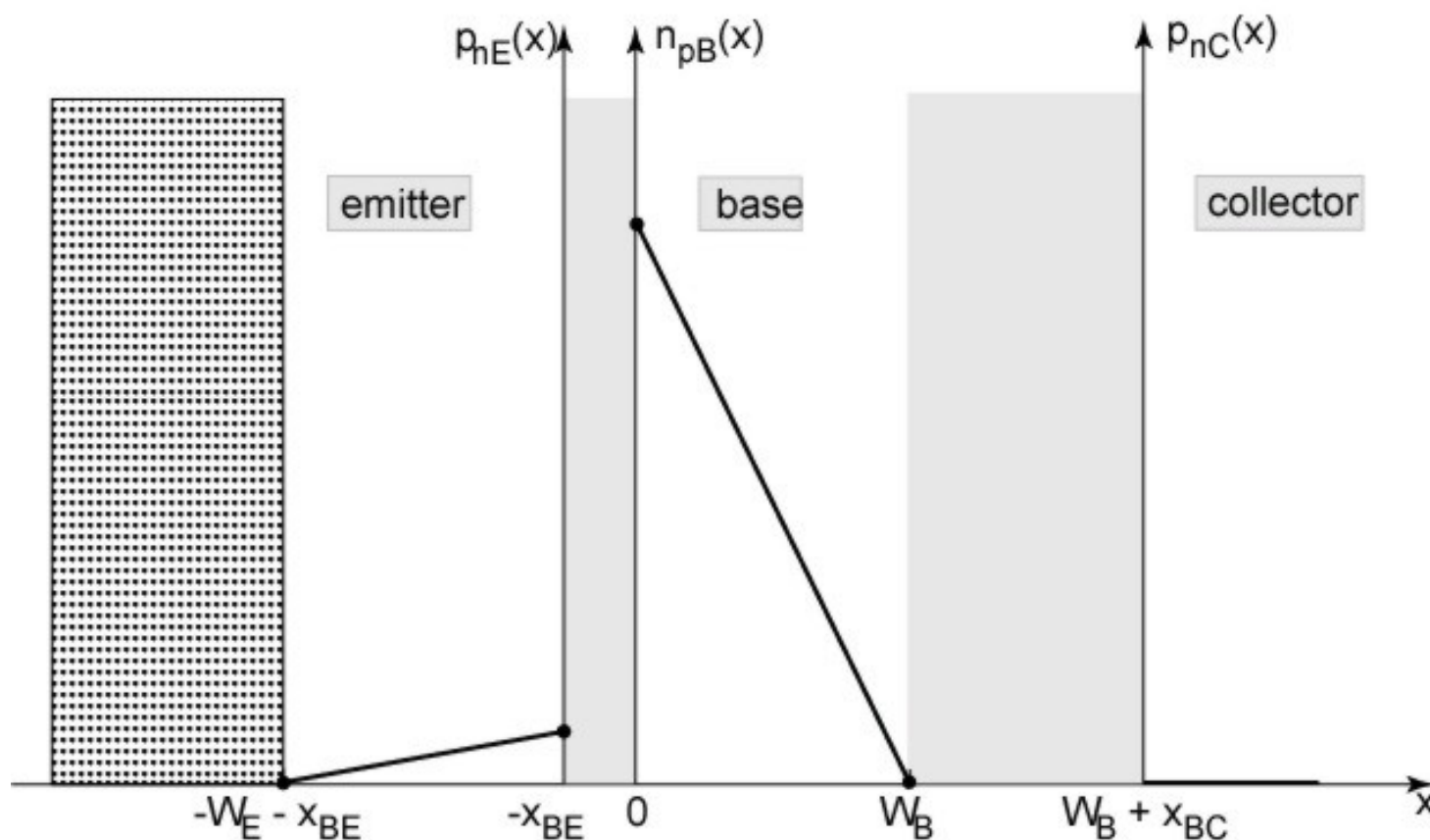
Collector Characteristics

Base-Emitter Voltage Control

"Transistor Action"

E

B

C

Diffusion Currents

BJT Currents

Collector current is nearly identical to the (magnitude) of the emitter current … define
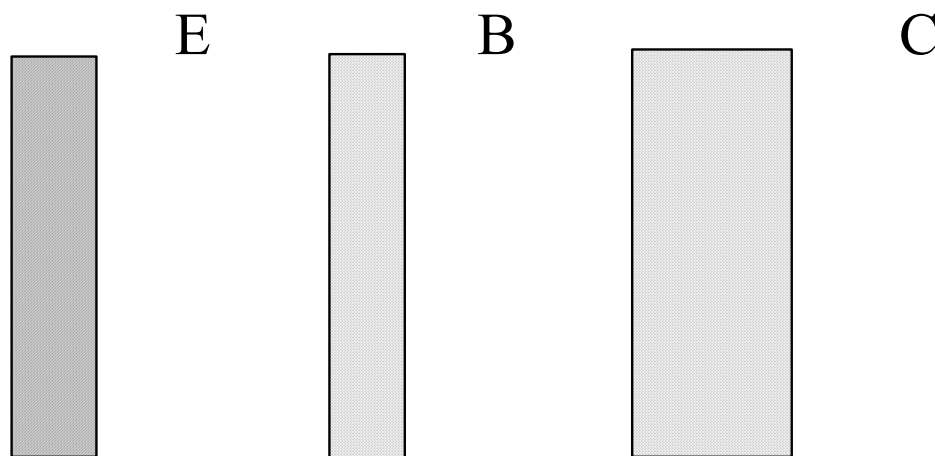
$$I_C = -\alpha_F I_E$$

Kirchhoff:

$$-I_E = I_C + I_B$$

DC Current Gain:

Origin of α_F

Base-emitter junction: some reverse injection of holes into the emitter $\rightarrow$ base current isn't zero

Typical α_F