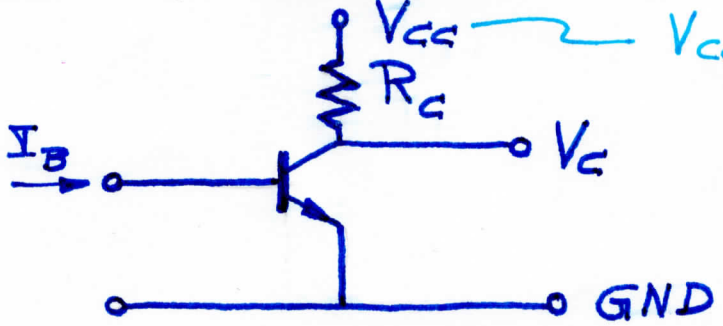
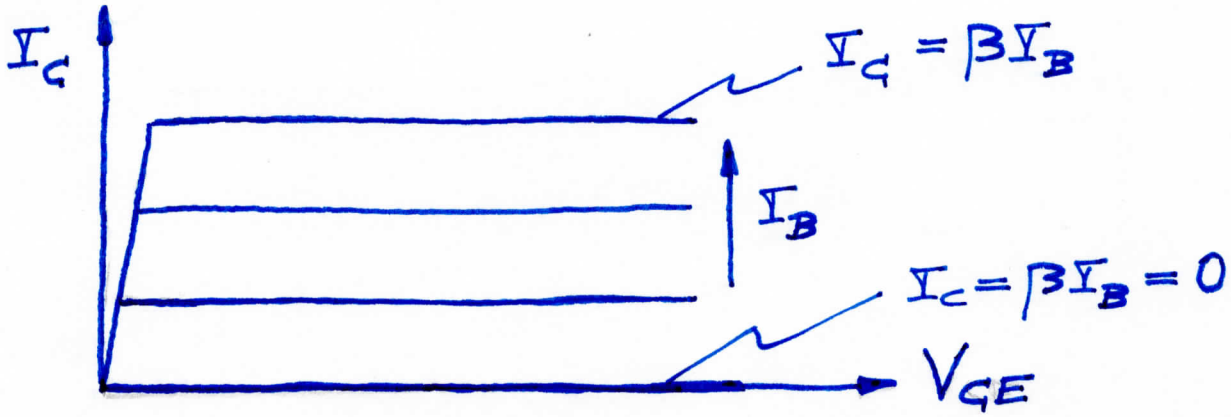
BJT output characteristic

Consider a common-E circuit



V_{CC} = Supply voltage = Common collector voltage

Transistor output characteristic



KVL $\quad V_{CC} = I_C R_C + V_{CE}$

Solve for I_C $\Rightarrow$

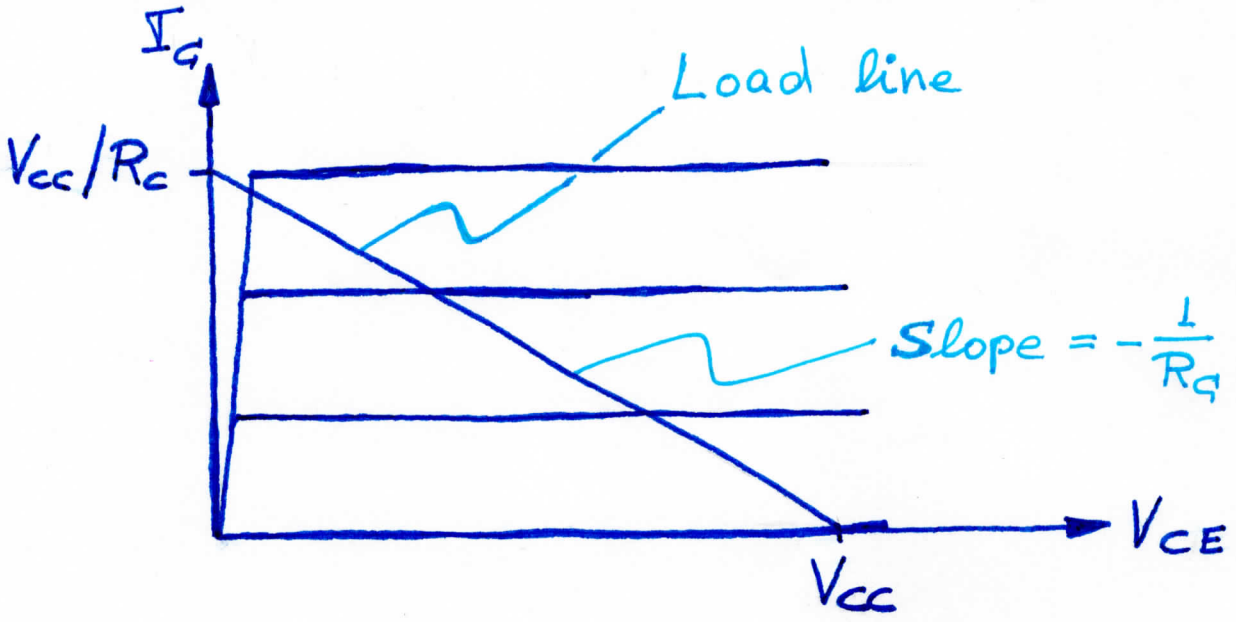
Load line

$$I_C = -\frac{1}{R_C} V_{CE} + \frac{V_{CC}}{R_C}$$

Slope (Variable) (Constant)

Recall: Straight line $\quad y = mx + c$

$\Rightarrow$ Load line



Q: What is output resistance of transistor?

Q: What is output resistance of the transistor circuit ?

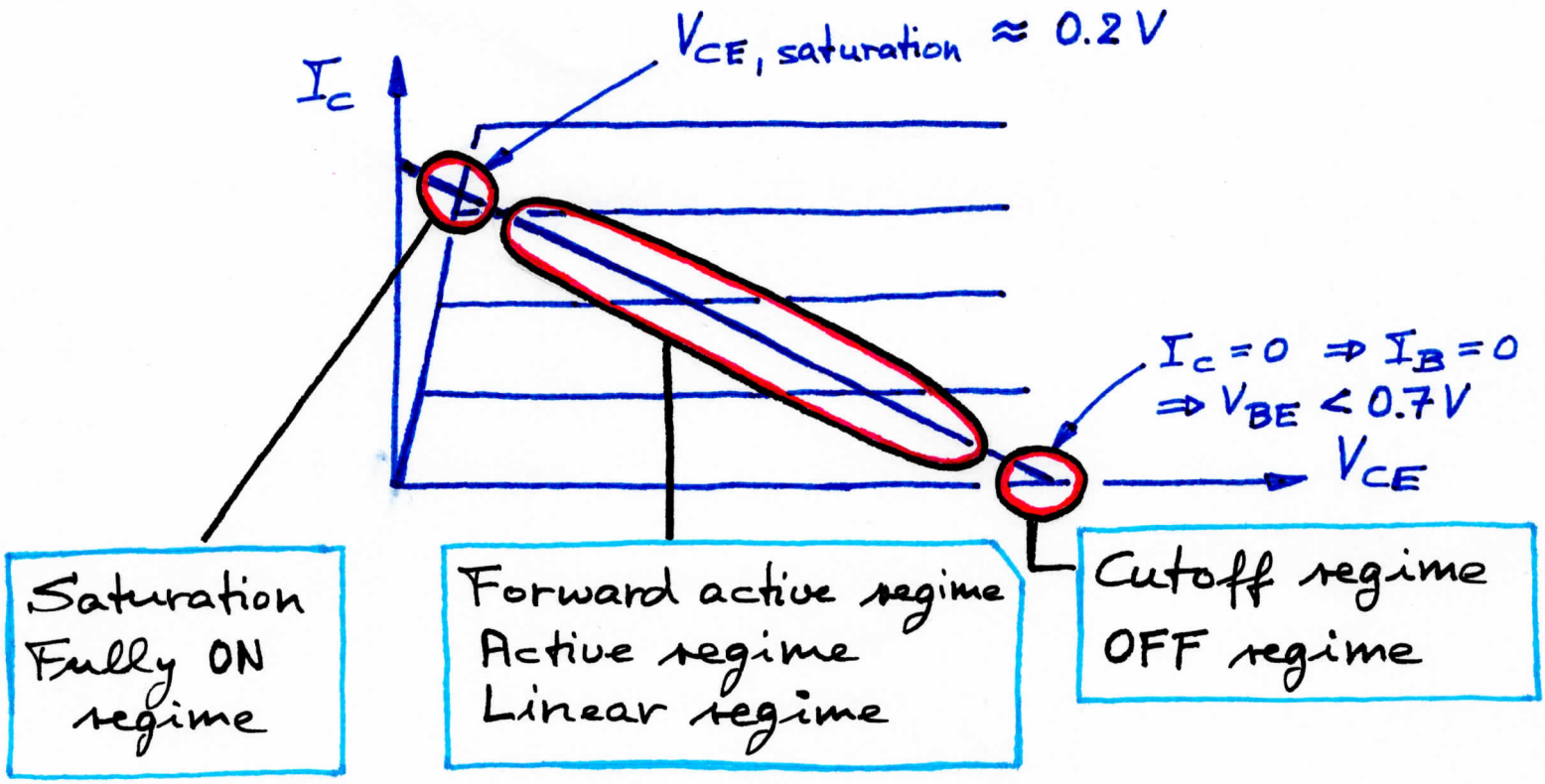
Q: Is a transistor a voltage source or current source ?

Q: Can you write $V_c = f(I_B)$?

$$\Rightarrow \quad V_c = V_{cc} - I_c R_c$$

$$= V_{cc} - \beta I_B R_c$$

Operating regimes of BJT



Cutoff: $V_{BE} < 0.7\,V \Rightarrow I_B = I_C = 0 \Rightarrow$ **OFF**

CE "resistance" $= \infty \Rightarrow$ Transistor blocks

Forward active: $I_C = \beta I_B \Rightarrow$ Linear regime

$V_{BE} = 0.7\,V \Rightarrow$ Linear operating regime

$\Rightarrow$ Used in amplifiers

Saturation: Transistor is fully **ON**

$V_{CE} \approx 0.1 \sim 0.2\,V$