

BJT Topologies – DC Characteristics

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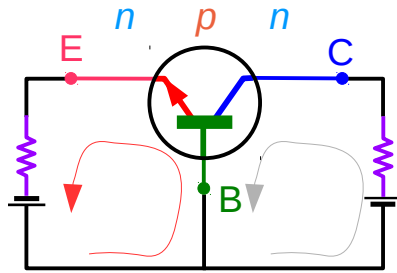
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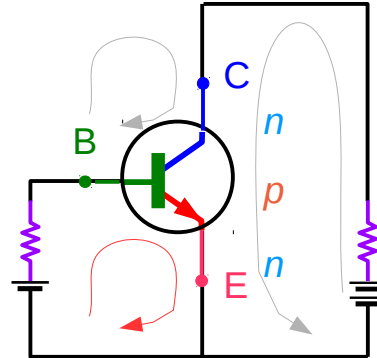
Active and Saturation Regions (1)

Common Base



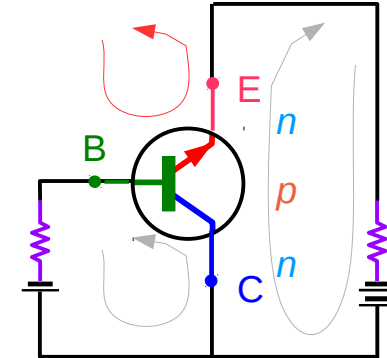
active

Common Emitter

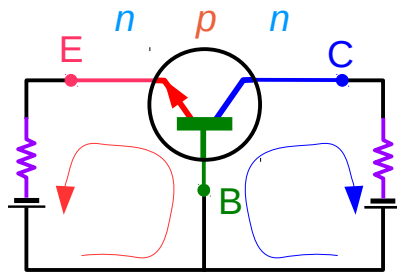


active

Common Collector

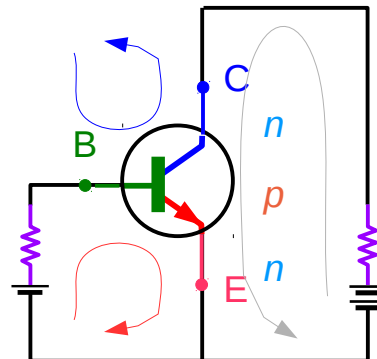


active



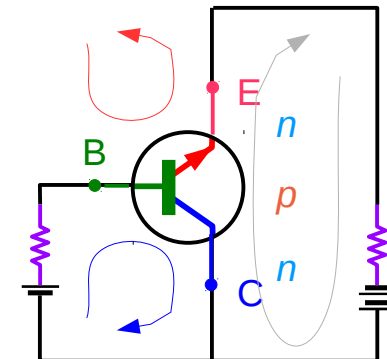
Large V_{BB} , Small V_{CE}

saturation



Large V_{BB} , Small V_{CE}

saturation

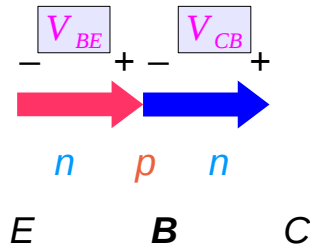


Large V_{BB} , Small V_{CE}

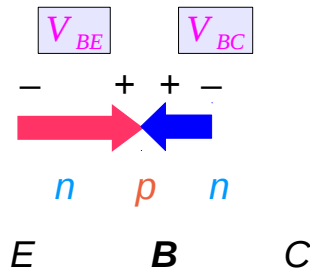
saturation

Active and Saturation Regions (2)

Common Base

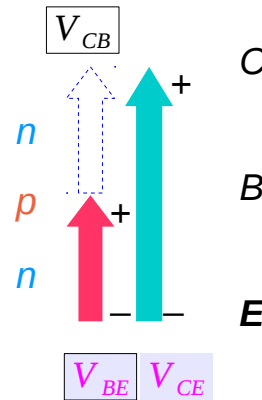


active

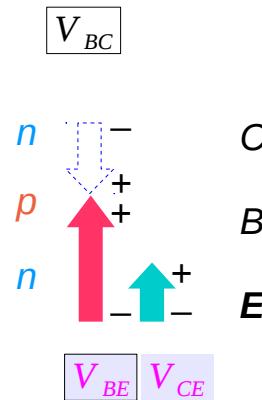


saturation

Common Emitter

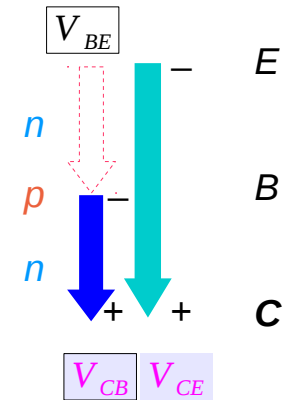


active

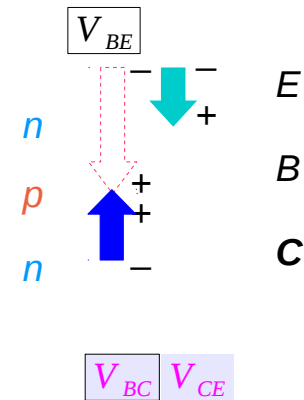


saturation

Common Collector



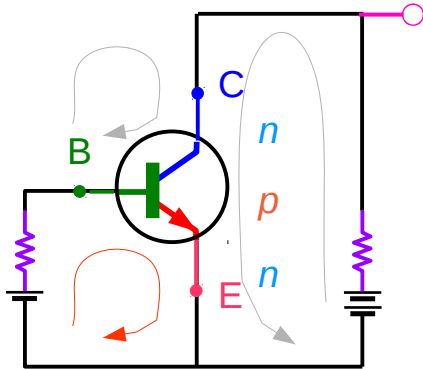
active



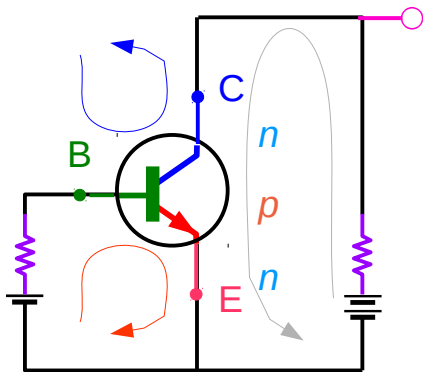
saturation

Active and Saturation Regions (3)

Common Emitter

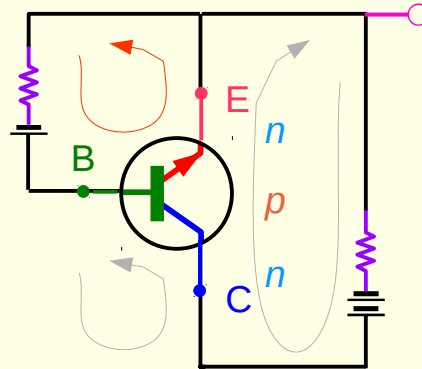


active

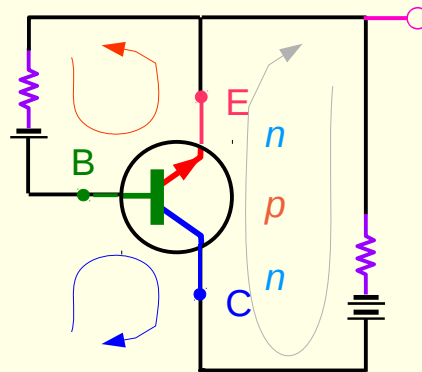


saturation

Common Collector 2

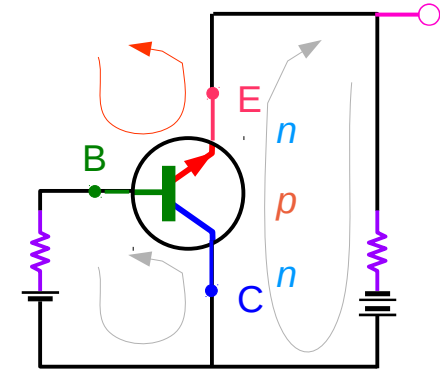


active

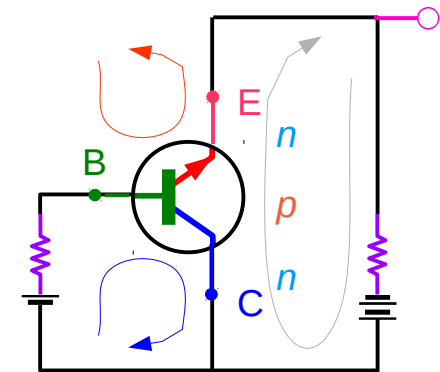


saturation

Common Collector



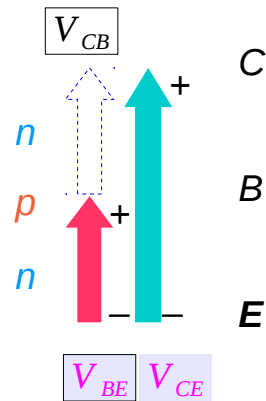
active



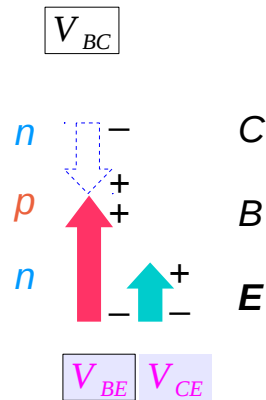
saturation

Active and Saturation Regions (4)

Common Emitter

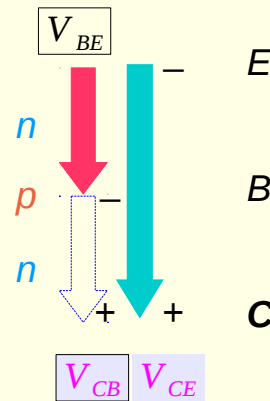


active

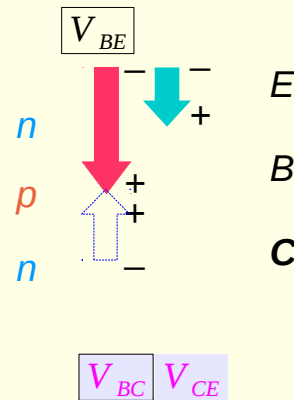


saturation

Common Collector 2

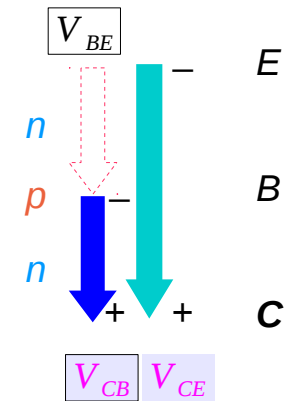


active

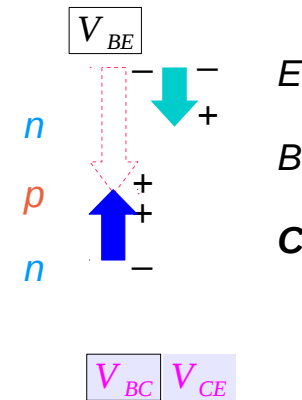


saturation

Common Collector



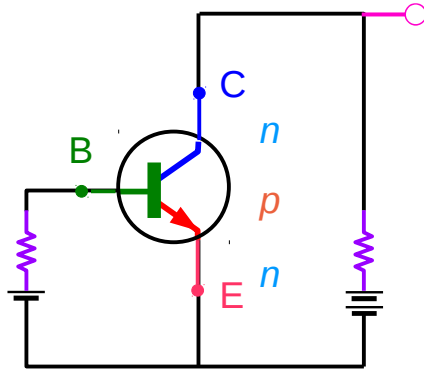
active



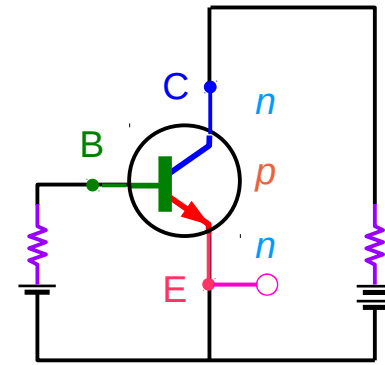
saturation

CC & CB from CE

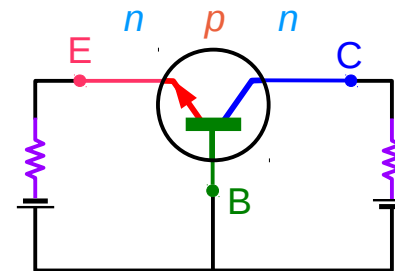
Common Emitter



Common Collector 3

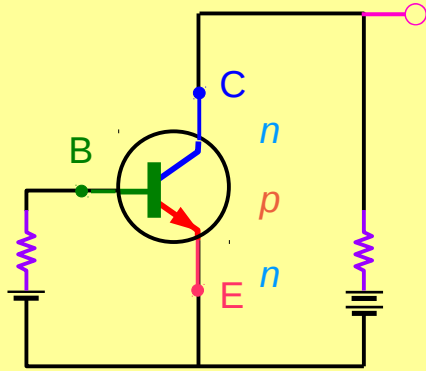


Common Base

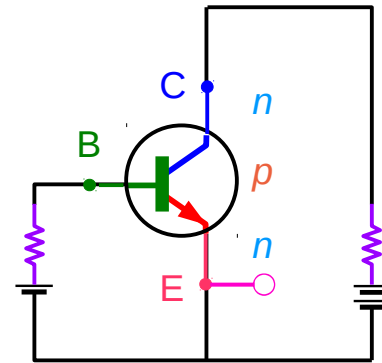


1. DC Characteristics of CE Amplifiers

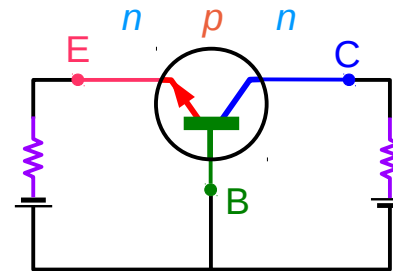
Common Emitter



Common Collector 3

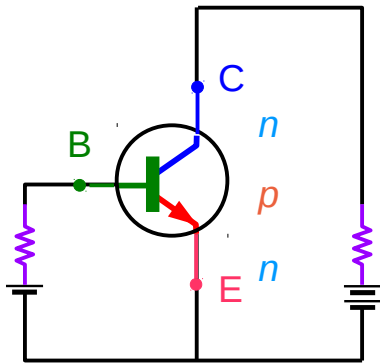


Common Base

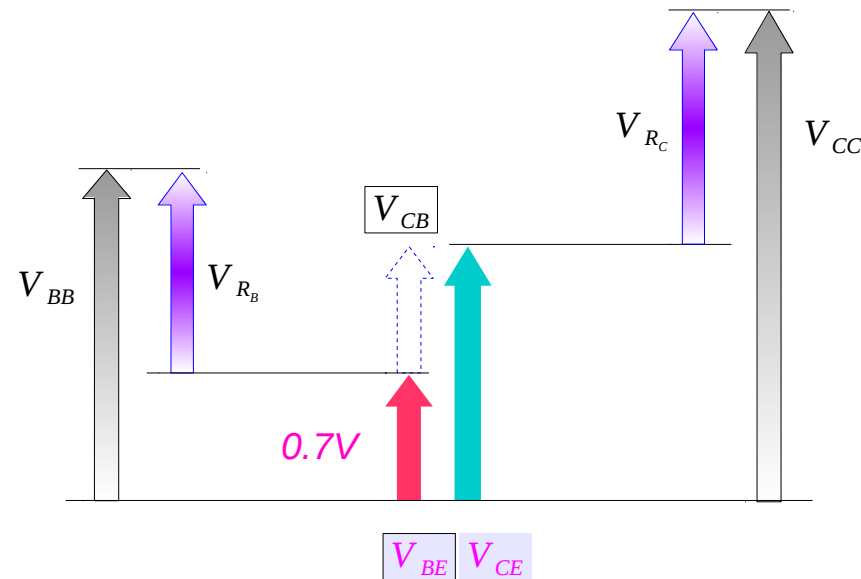
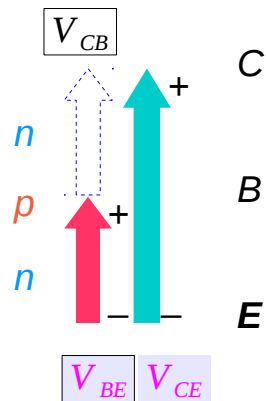


CE Amplifier : Voltage drops across resistors

Common Emitter

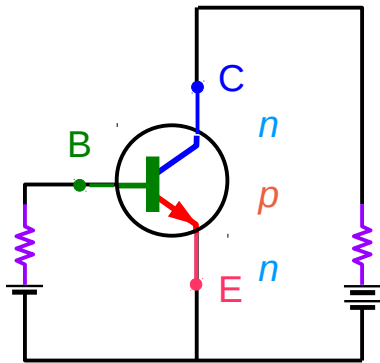


Active region

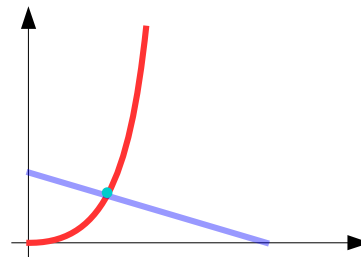


CE Amplifier : Load lines

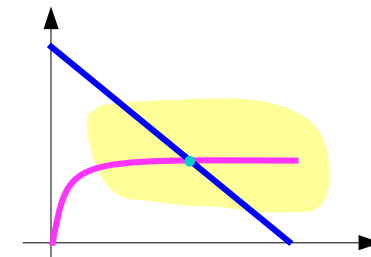
Common Emitter



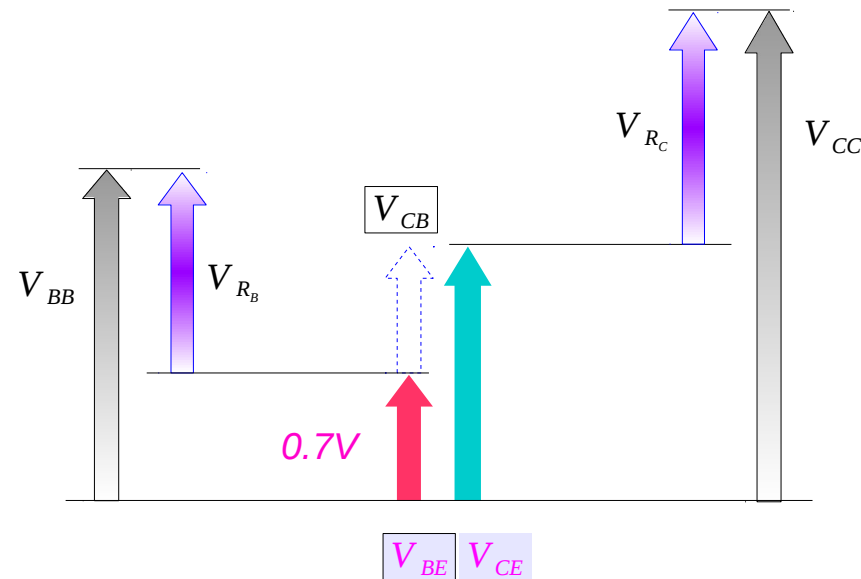
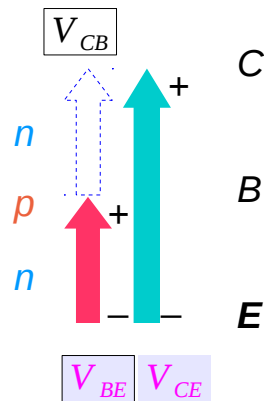
Input Characteristics



Output Characteristics

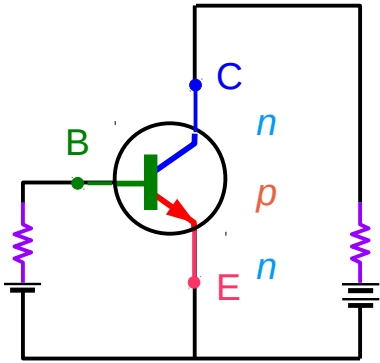


Active region

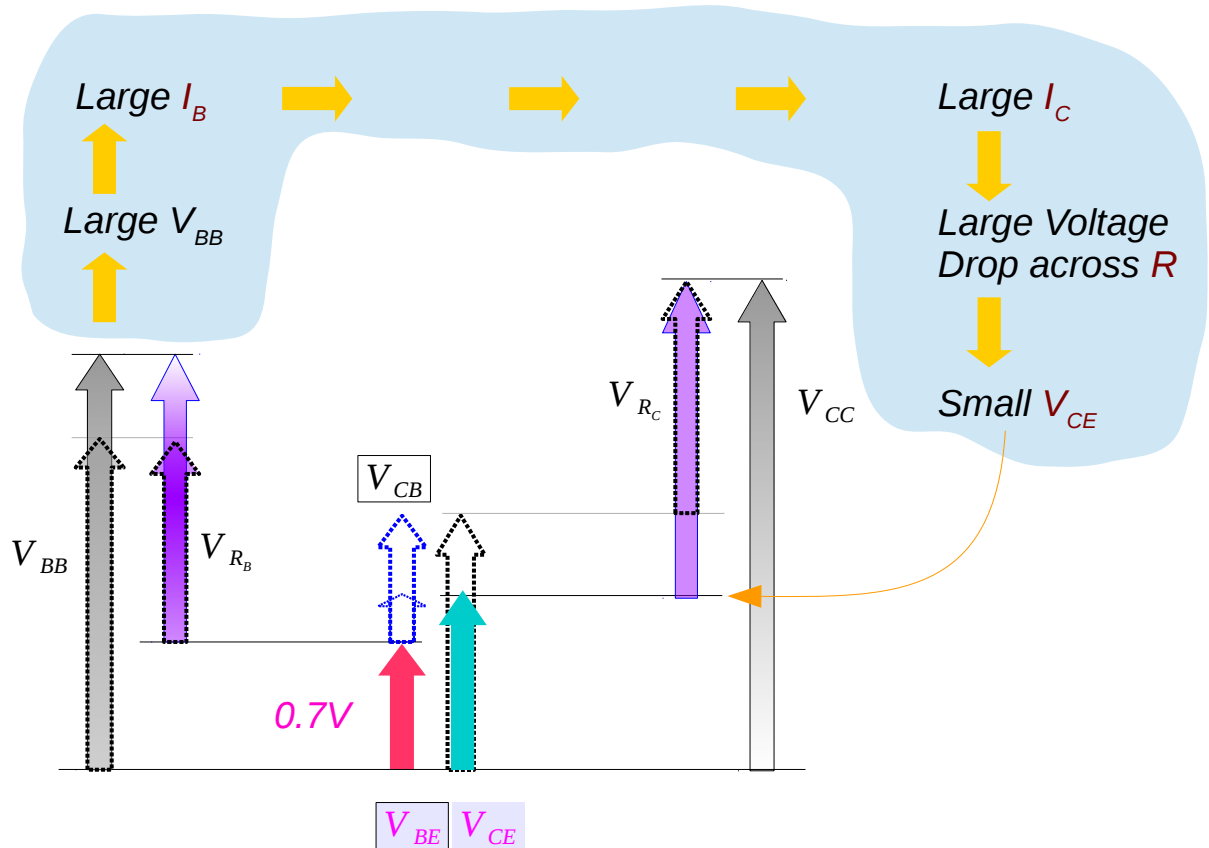
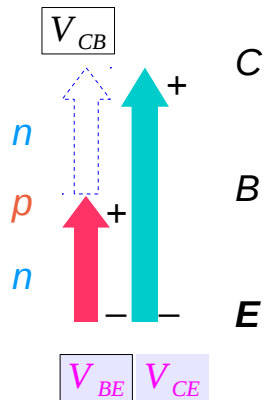


CE Amplifier : increasing $V_{BB} \rightarrow$ increasing V_R

Common Emitter

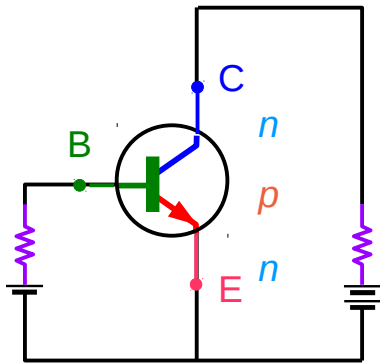


Active region

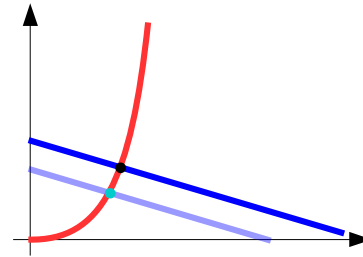


CE Amplifier : increasing $I_B \rightarrow$ decreasing V_{CE}

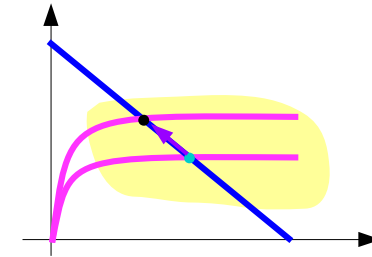
Common Emitter



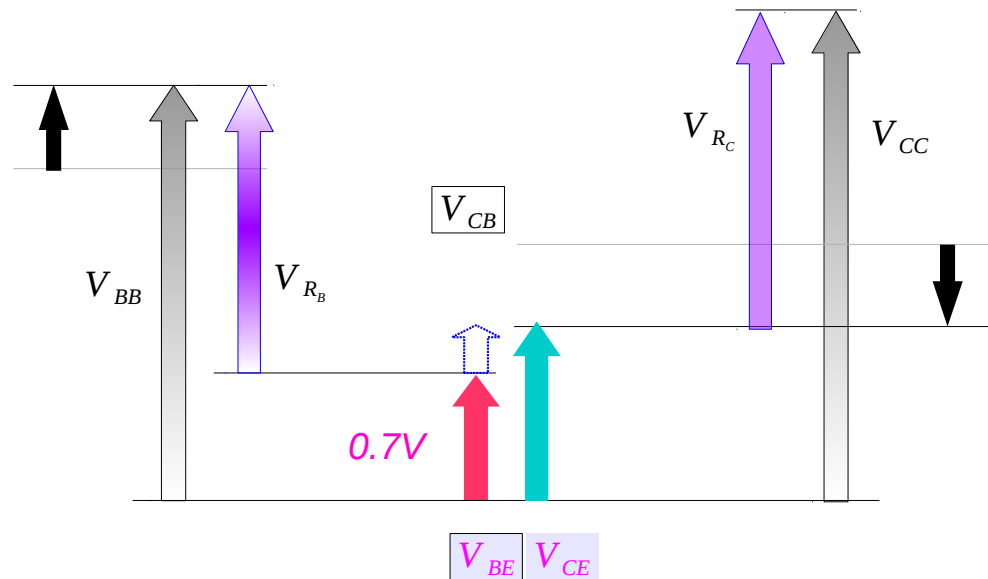
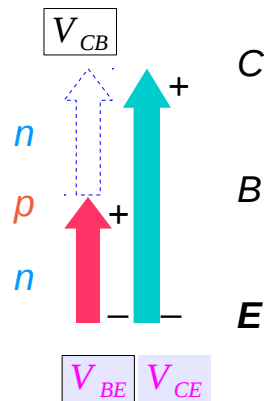
Input Characteristics



Output Characteristics

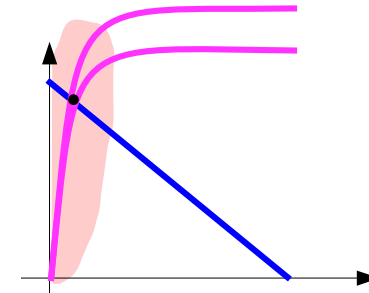
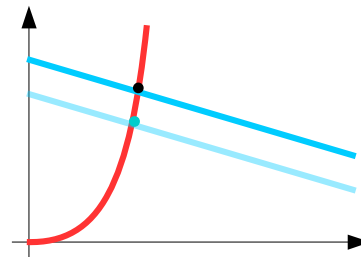
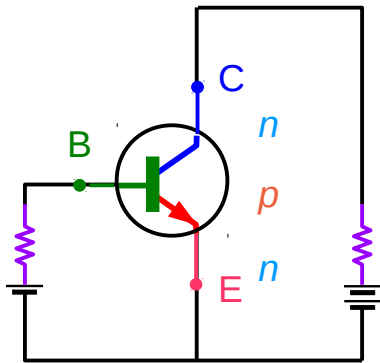


Active region

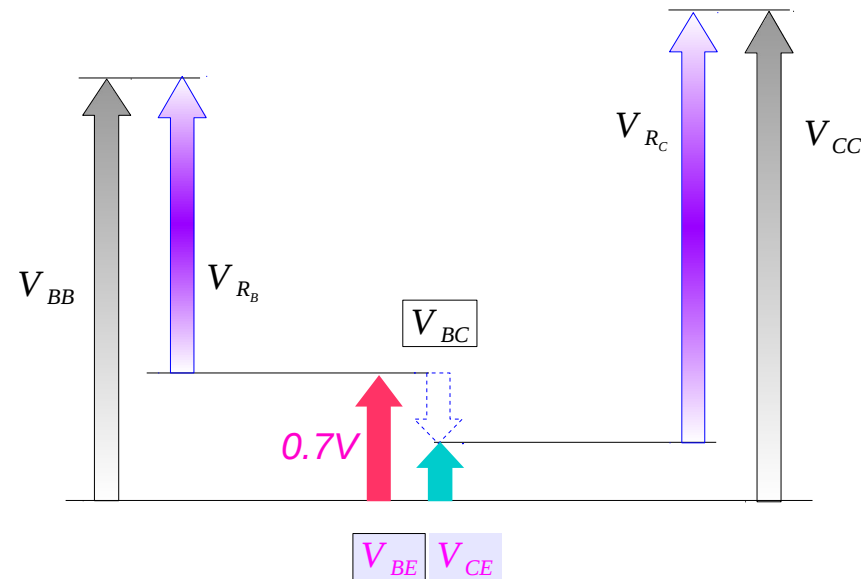
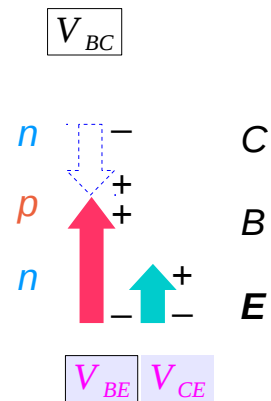


CE Amplifier : Saturation when $V_{RC} \approx V_{CC}$

Common Emitter

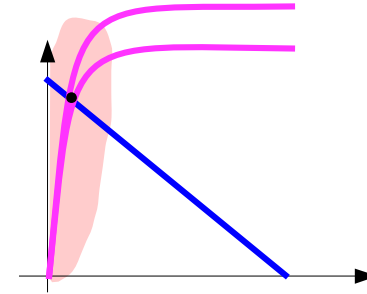
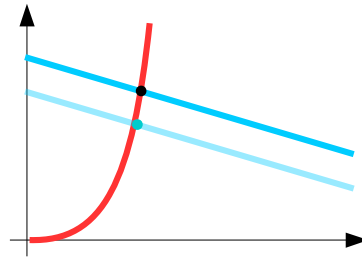
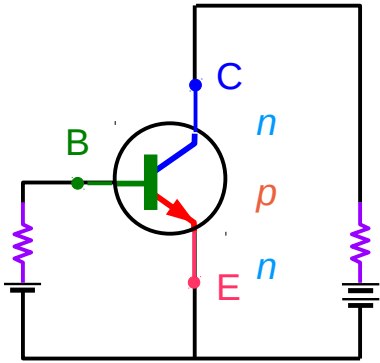


saturation

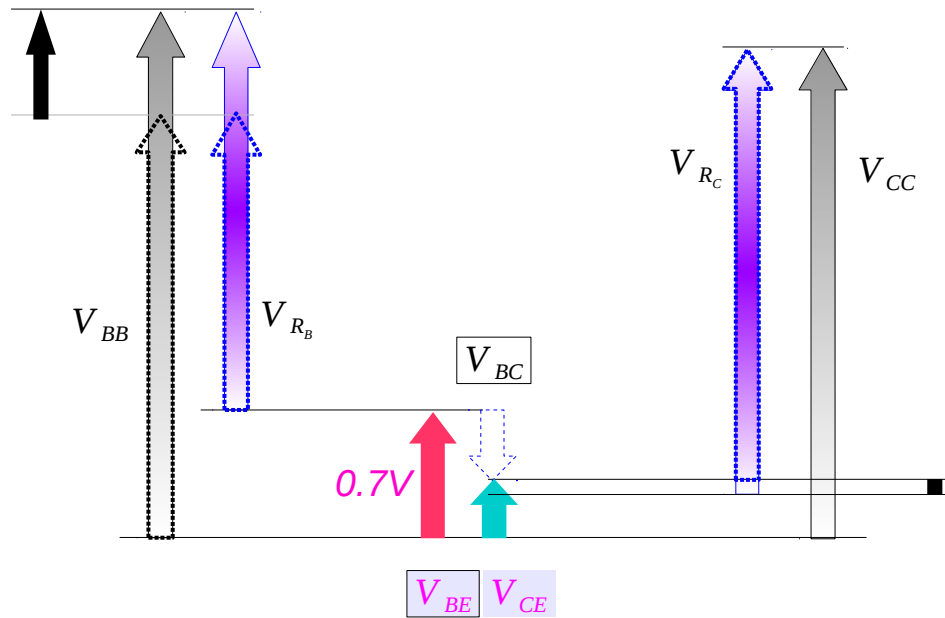
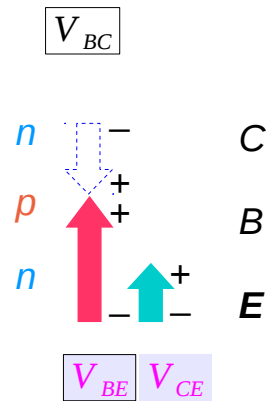


CE Amplifier : increasing $I_B \rightarrow$ decreasing V_{CE} : Saturation

Common Emitter



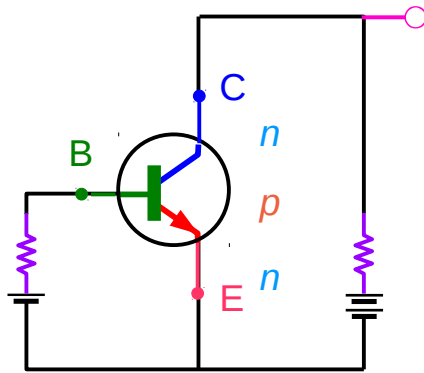
saturation



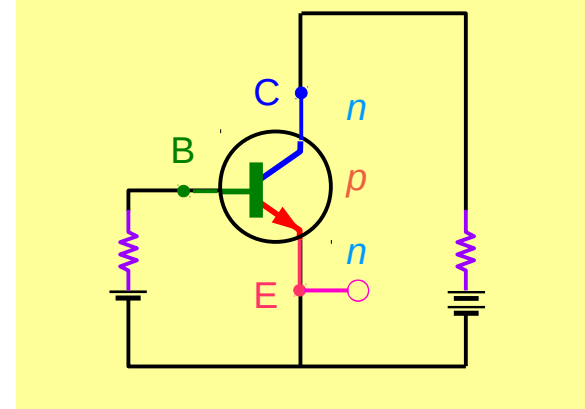
AC Equivalent Circuits

2. DC Characteristics of CC Amplifiers

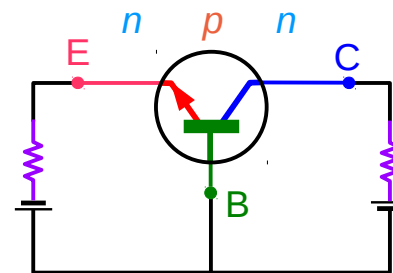
Common Emitter



Common Collector 3

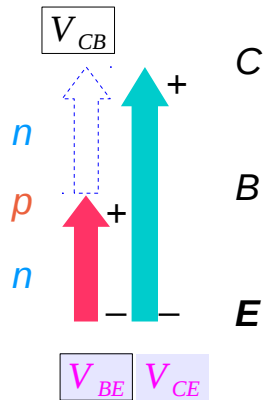
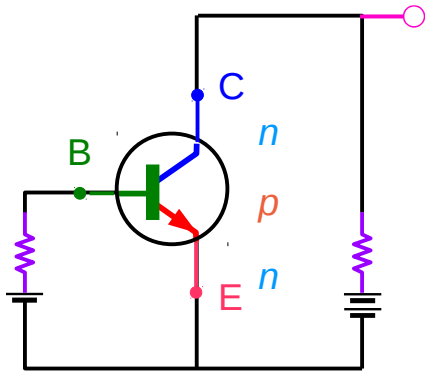


Common Base



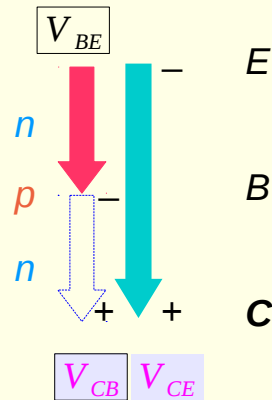
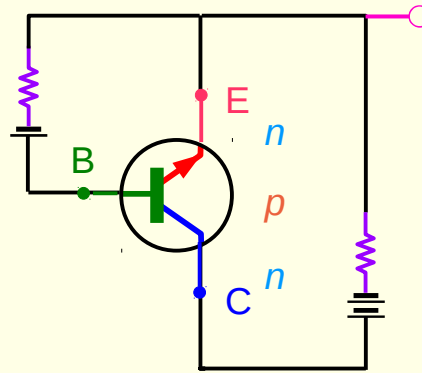
CE & CC Comparison

Common Emitter



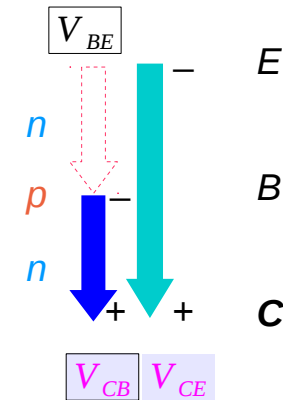
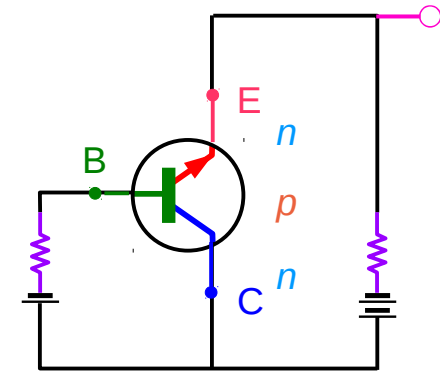
Active region

Common Collector 2



Active region

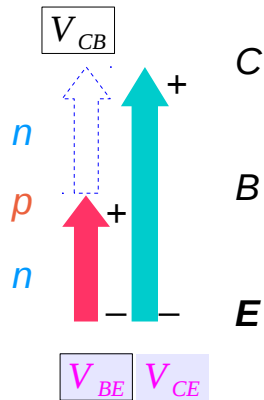
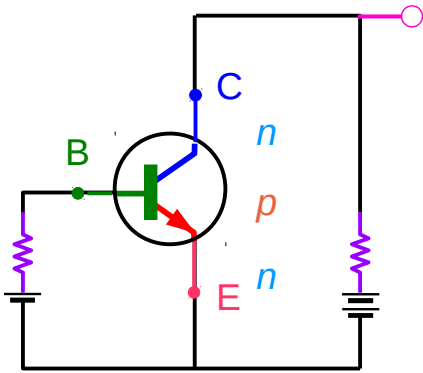
Common Collector



Active region

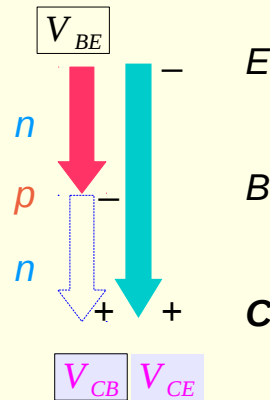
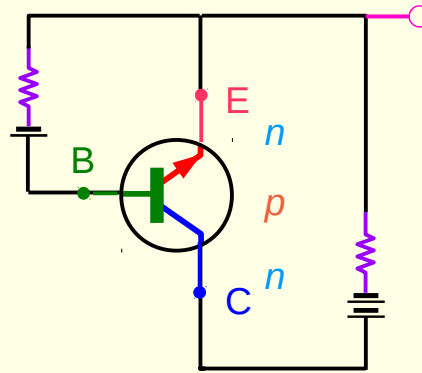
CE & CC Comparison

Common Emitter



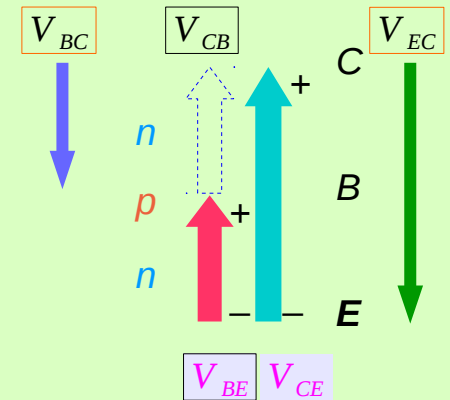
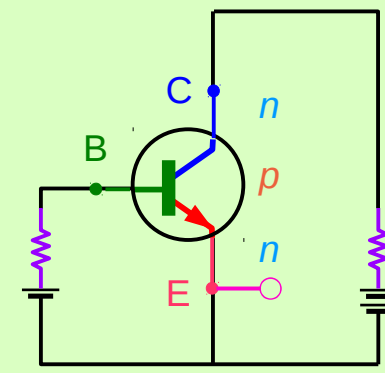
Active region

Common Collector 2



Active region

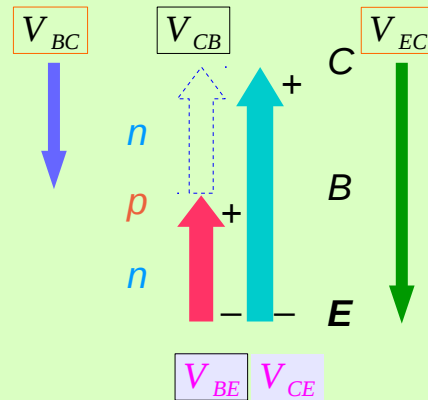
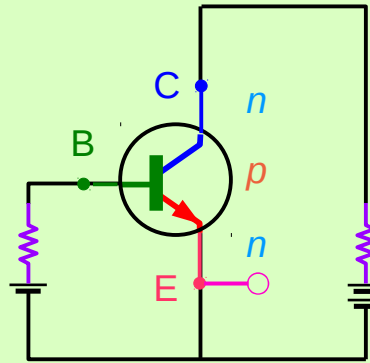
Common Collector 3



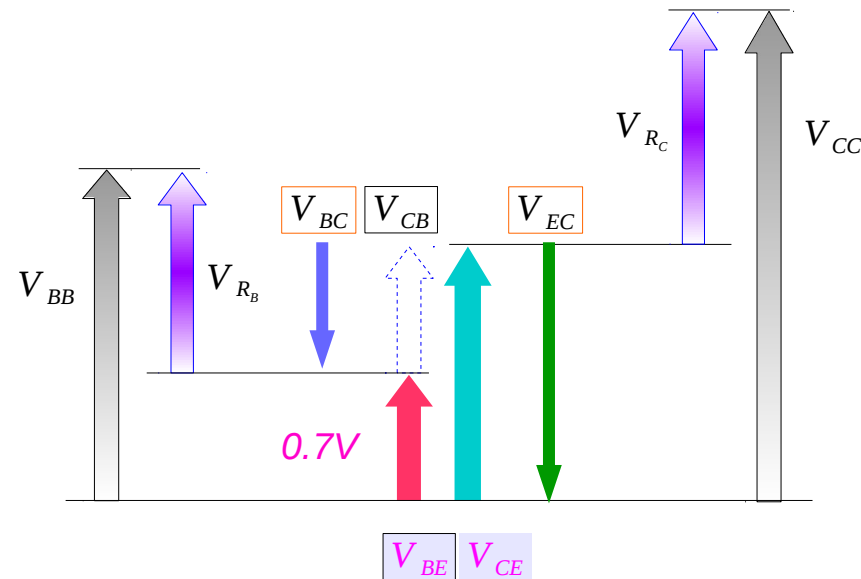
Active region

CC Amplifier : Voltage drops across resistors

Common Collector 3

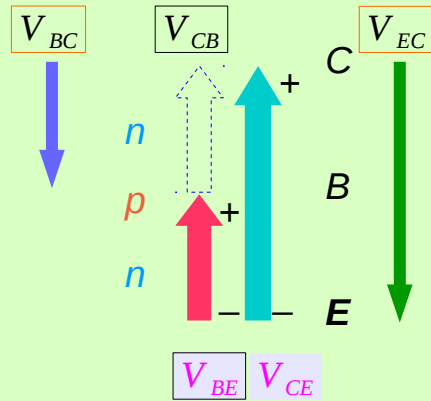
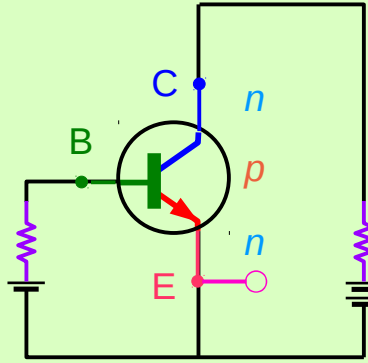


Active region



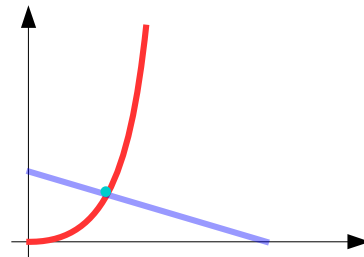
CC Amplifier : Load lines

Common Collector 3

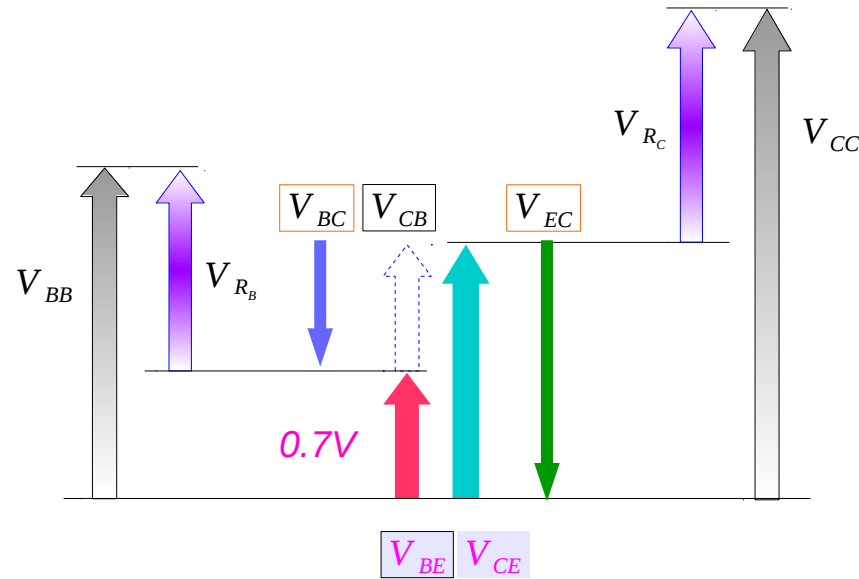
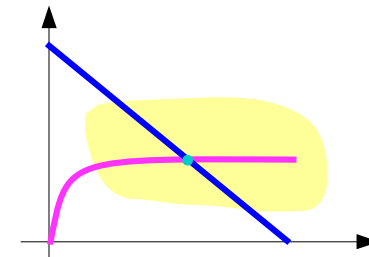


Active region

Input Characteristics

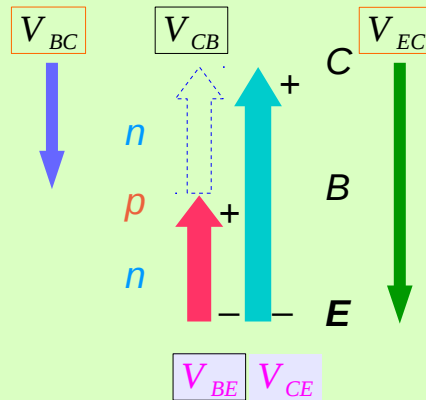
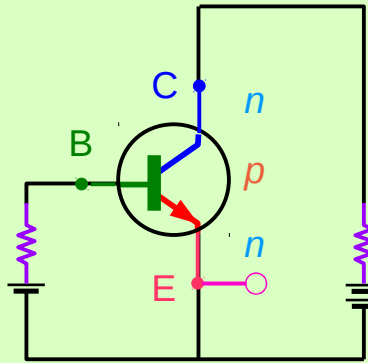


Output Characteristics

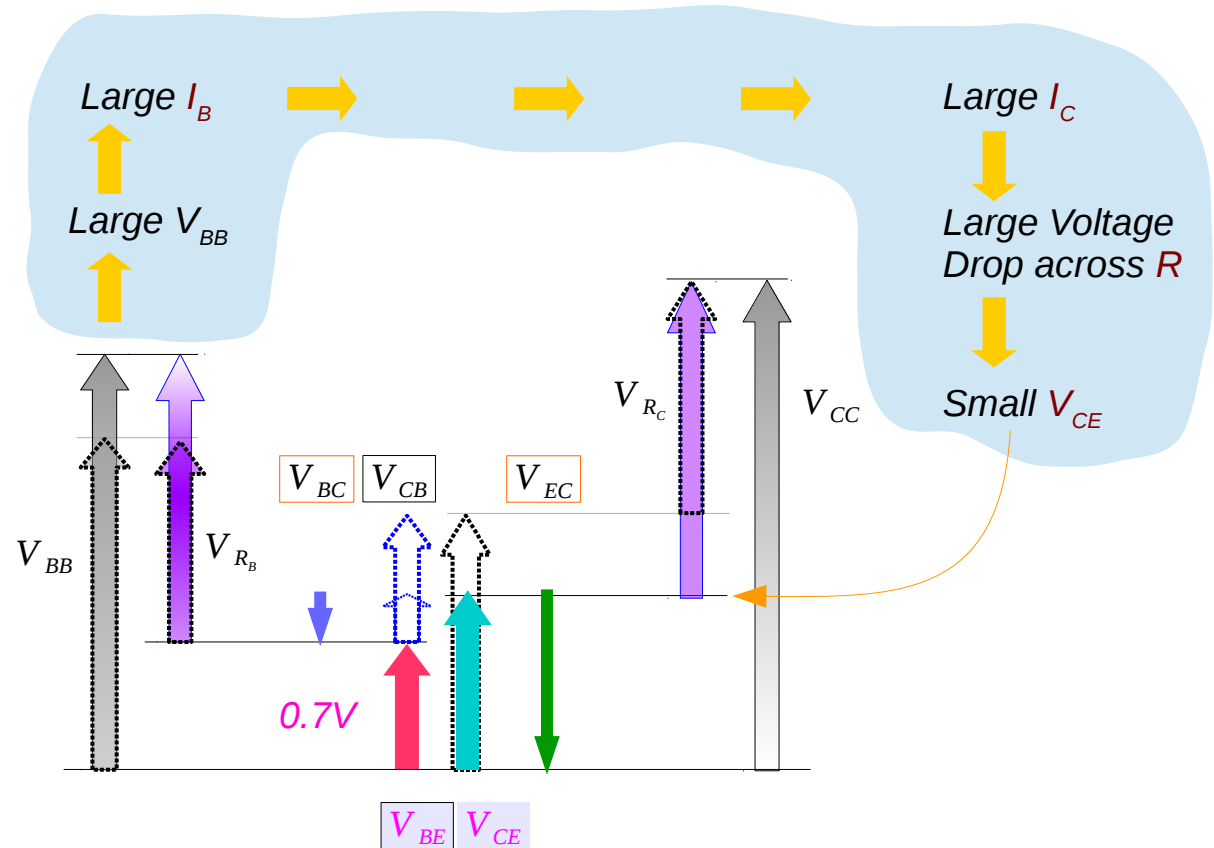


CC Amplifier : increasing $V_{BB} \rightarrow$ increasing V_R

Common Collector 3

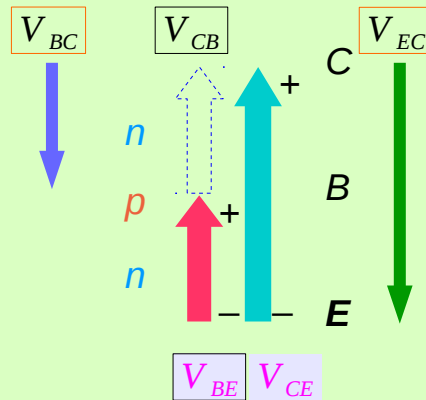
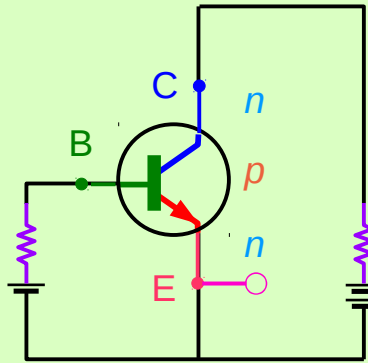


Active region



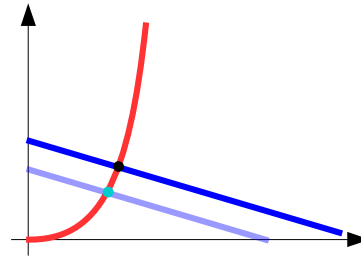
CC Amplifier : increasing $I_B \rightarrow$ decreasing $-V_{EC}$

Common Collector 3

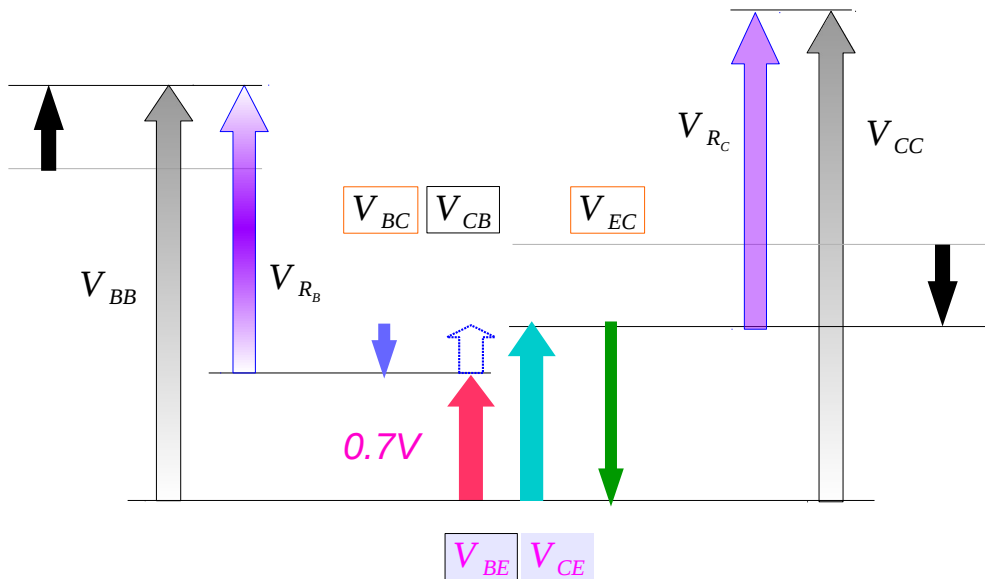
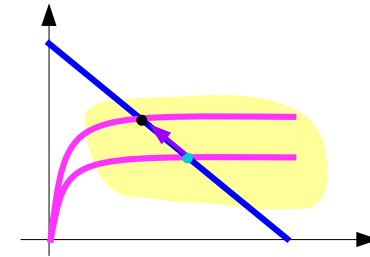


Active region

Input Characteristics

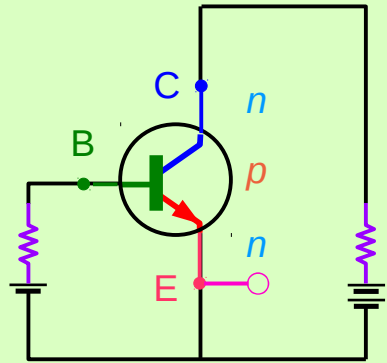


Output Characteristics

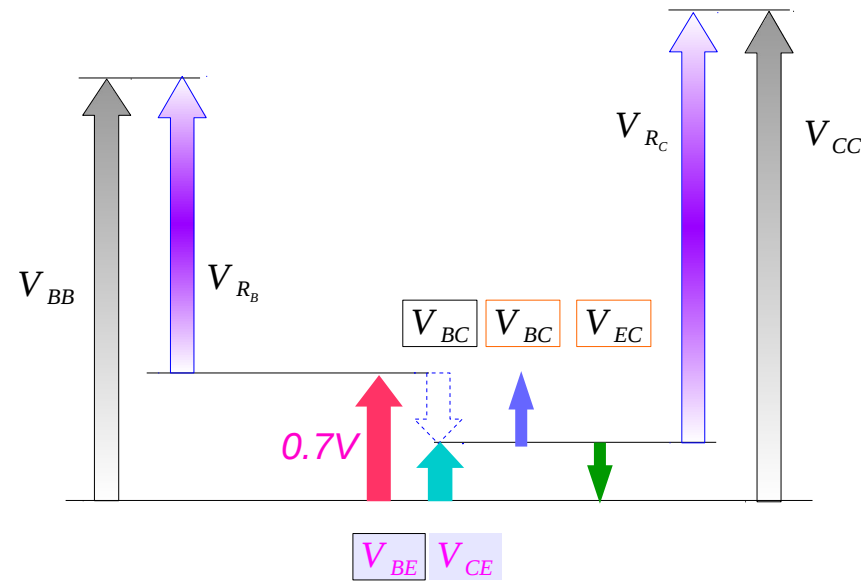
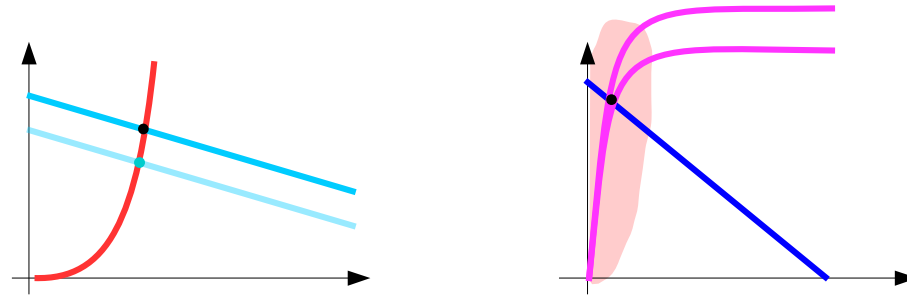
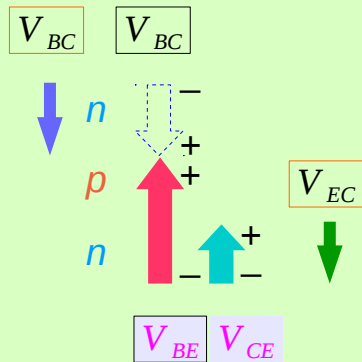


CC Amplifier : Saturation when $V_{RC} \approx V_{CC}$

Common Collector 3

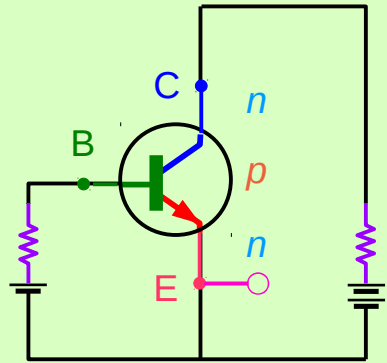


saturation

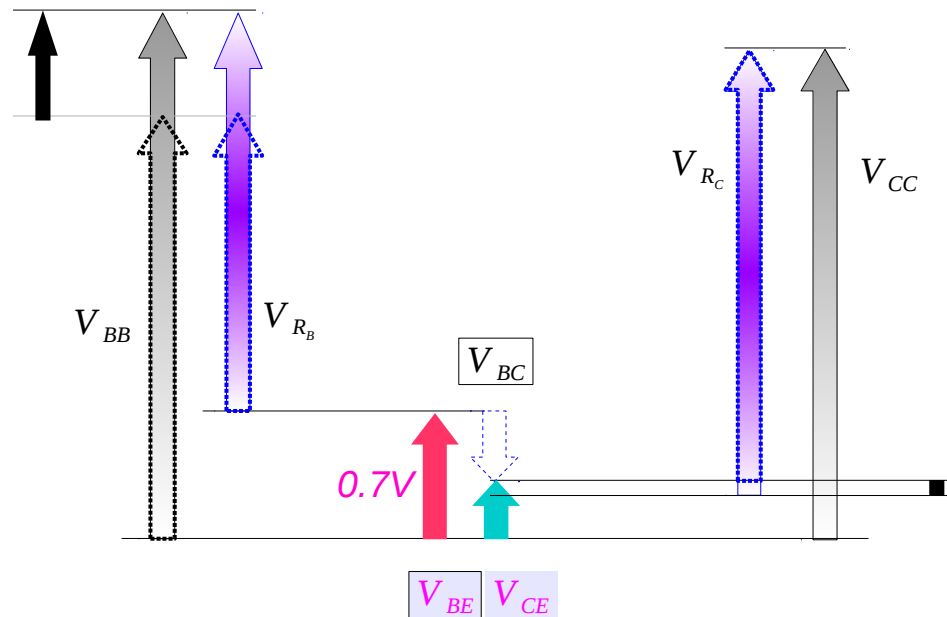
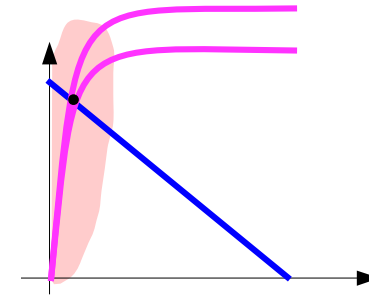
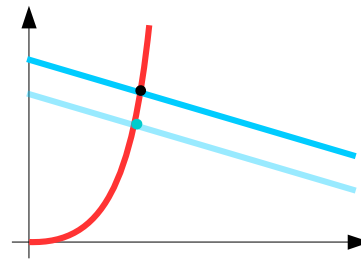
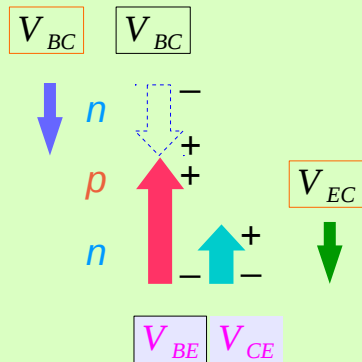


CC Amplifier : increasing $I_B \nrightarrow$ decreasing $-V_{EC}$: Saturation

Common Collector 3

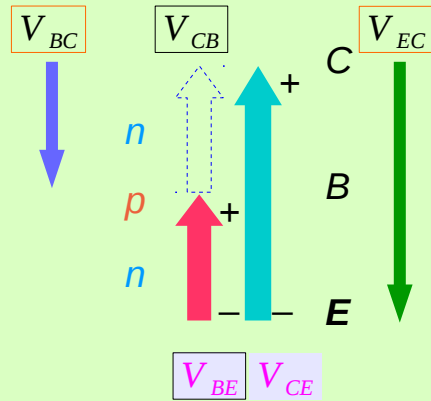
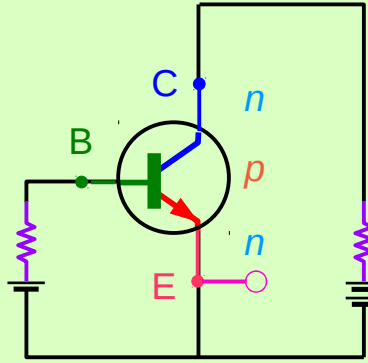


saturation



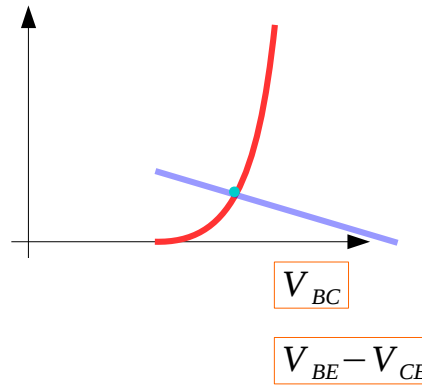
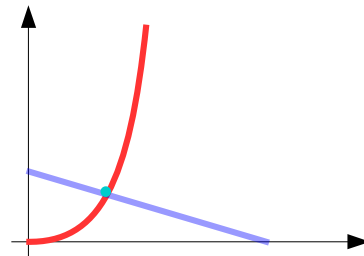
CC Amplifier : Load lines

Common Collector 3

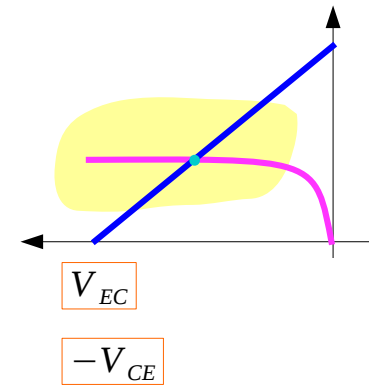
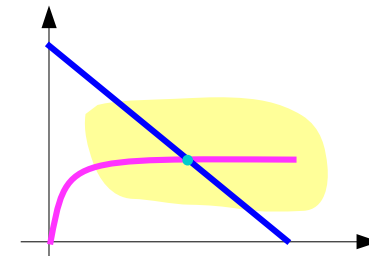


Active region

Input Characteristics



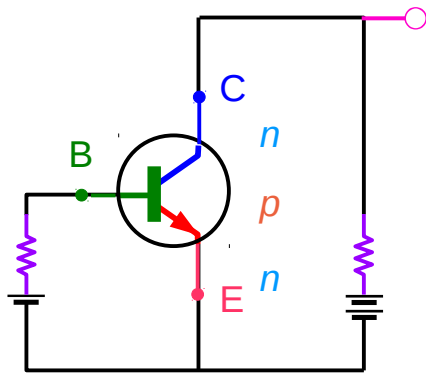
Output Characteristics



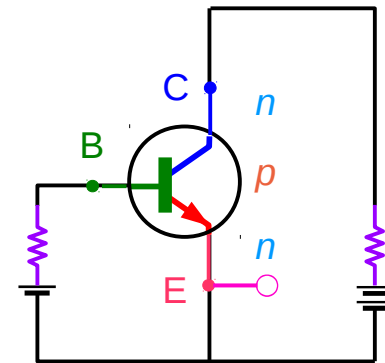
AC Equivalent Circuits

3. DC Characteristics of CB Amplifiers

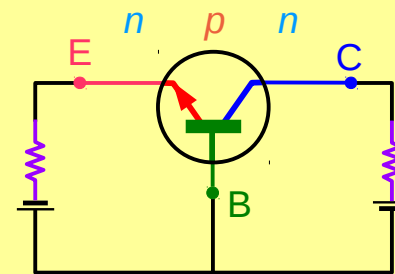
Common Emitter



Common Collector 3

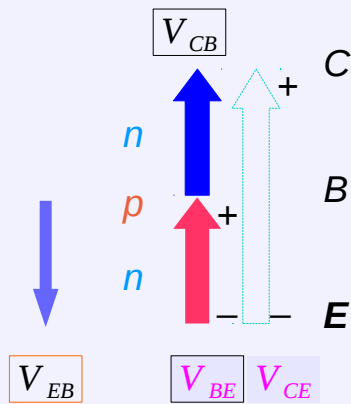
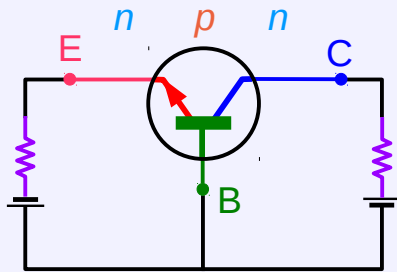


Common Base

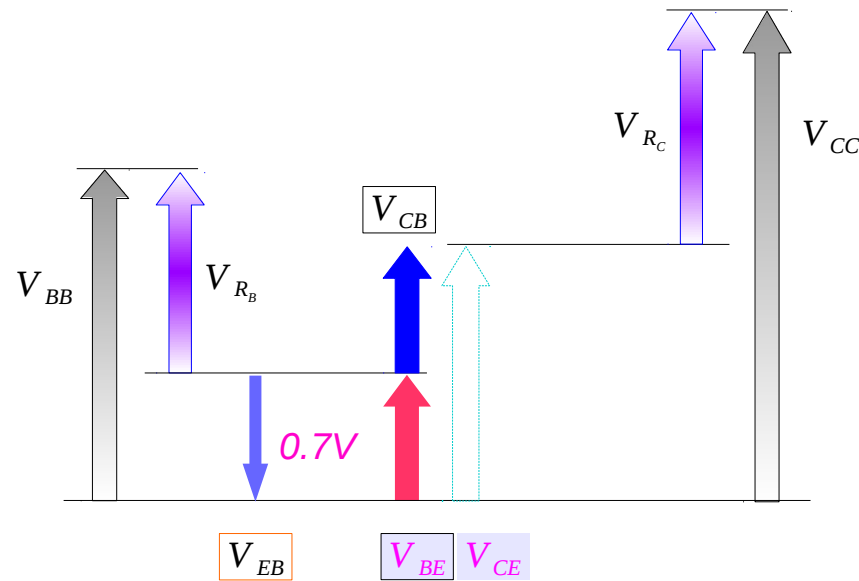


CB Amplifier : Voltage drops across resistors

Common Base

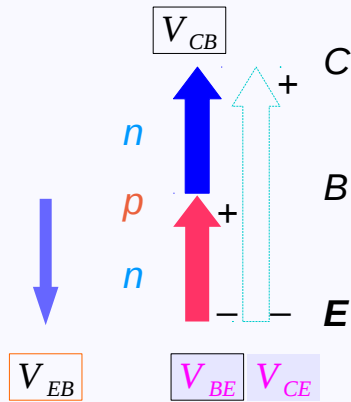
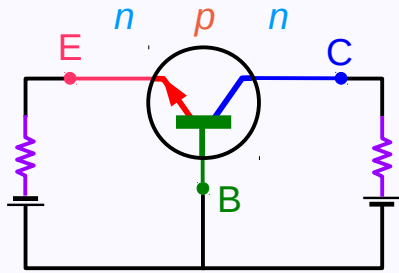


Active region



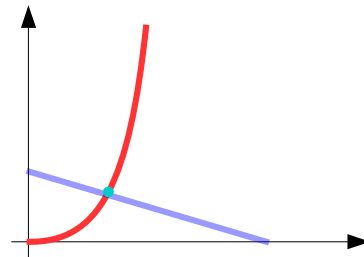
CB Amplifier : Load lines

Common Base

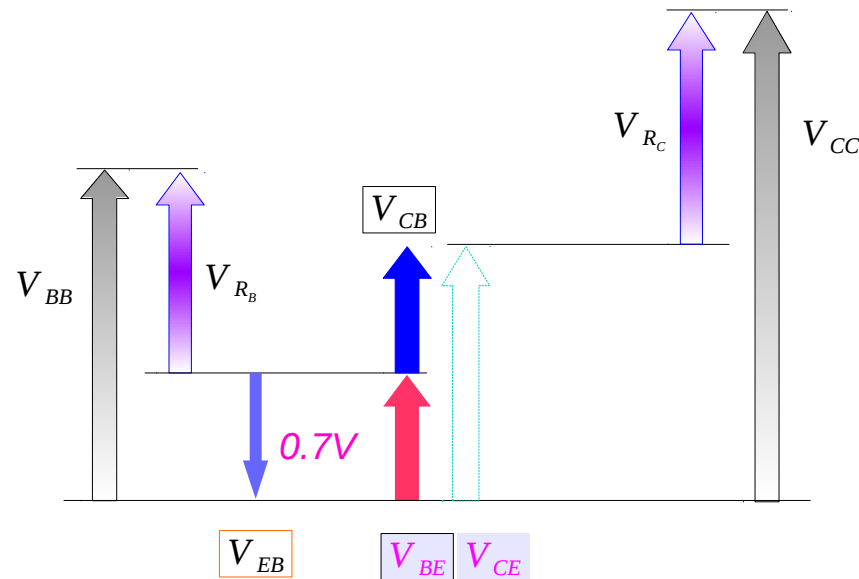
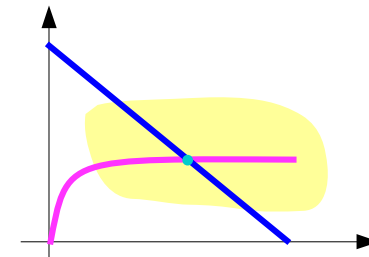


Active region

Input Characteristics

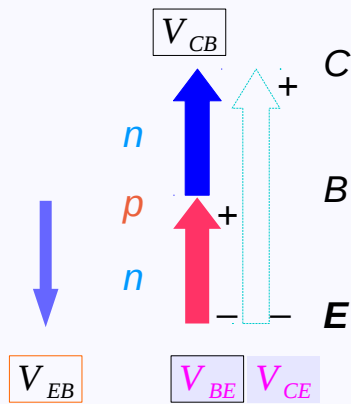
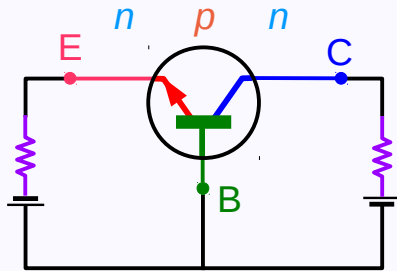


Output Characteristics

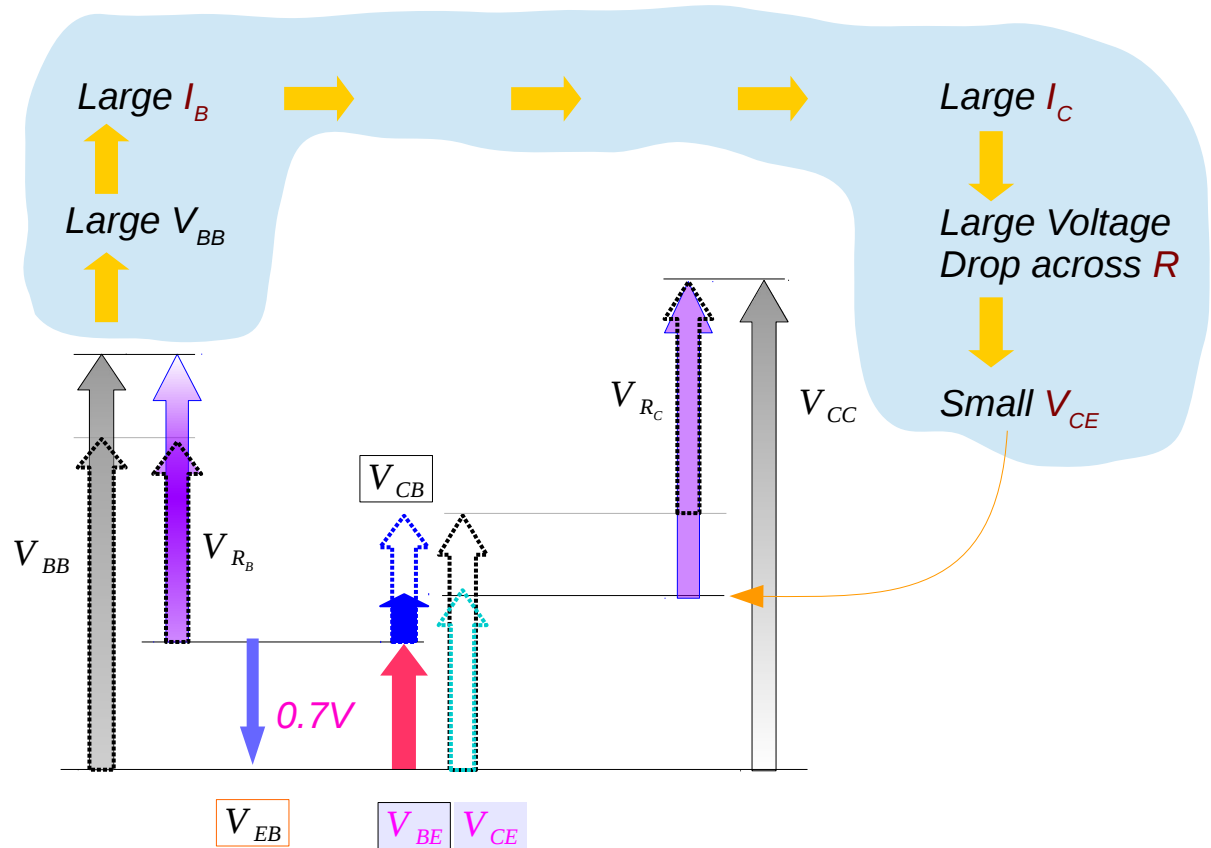


CB Amplifier : increasing $V_{BB} \rightarrow$ increasing V_R

Common Base

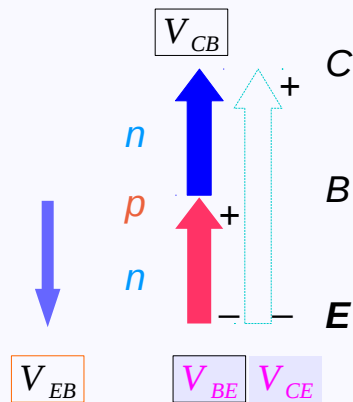
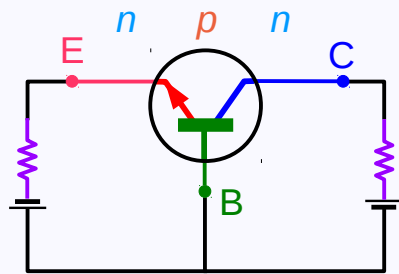


Active region



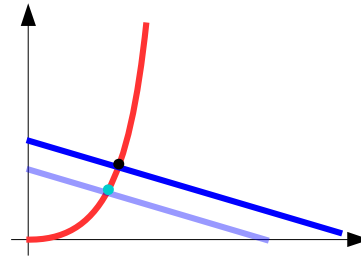
CB Amplifier : increasing $I_B \rightarrow$ decreasing V_{CE}

Common Base

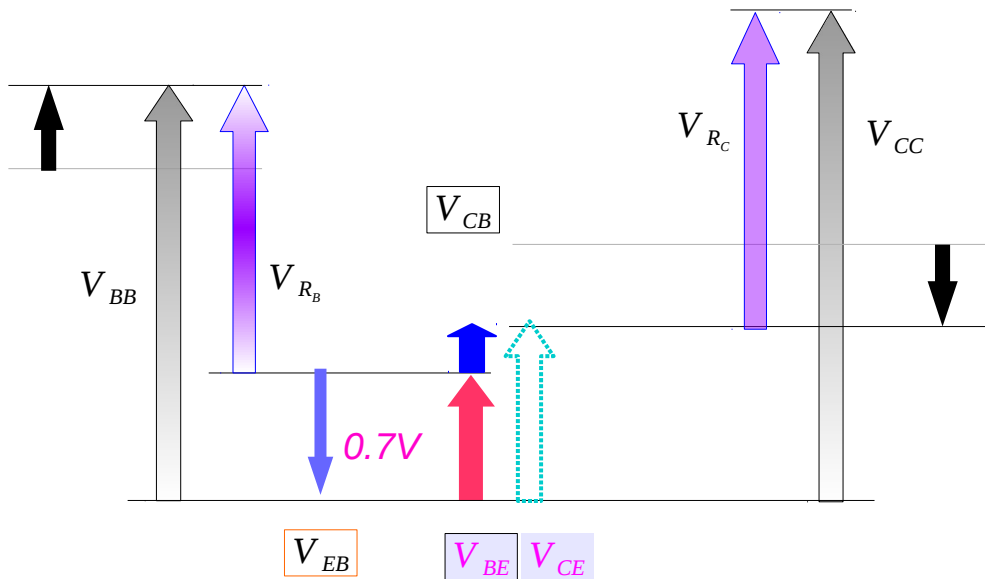
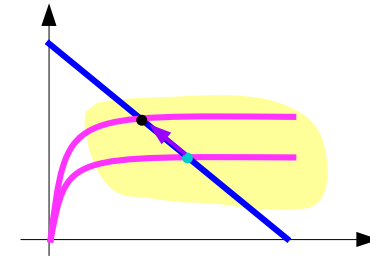


Active region

Input Characteristics

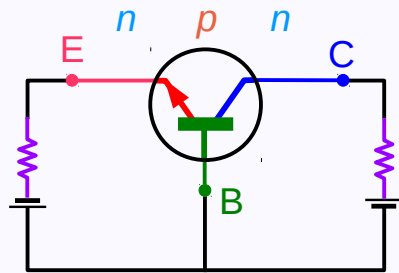


Output Characteristics

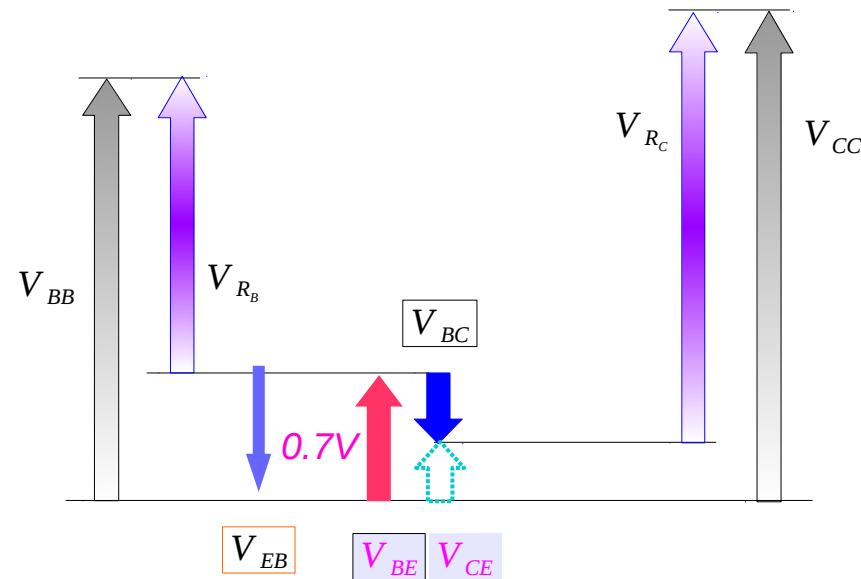
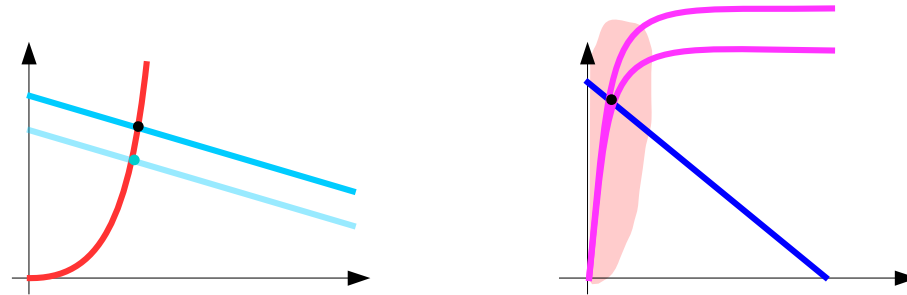
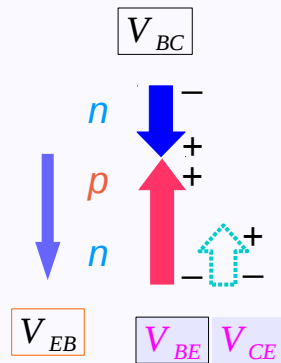


CB Amplifier : Saturation when $V_{RC} \approx V_{CC}$

Common Base

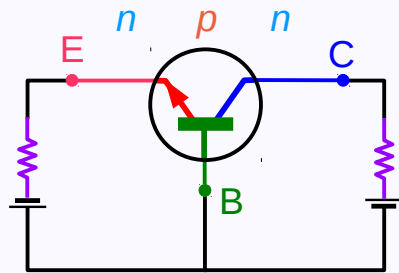


saturation

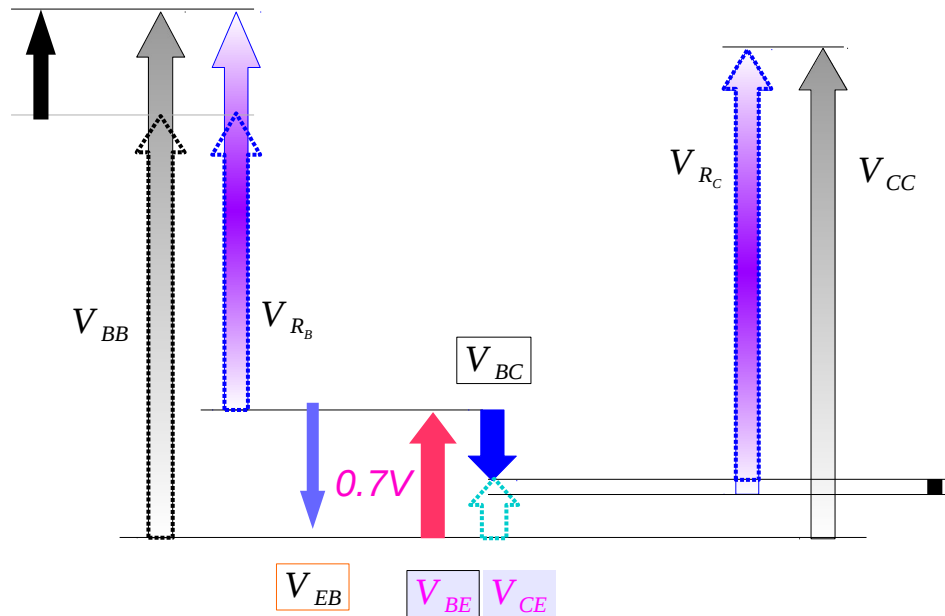
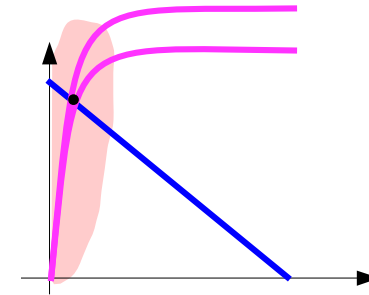
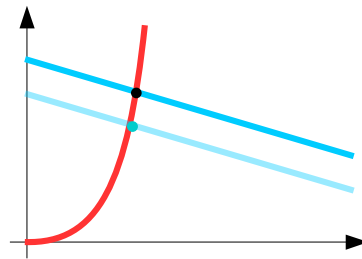
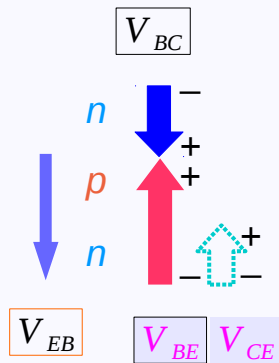


CB Amplifier : increasing $I_B \not\rightarrow$ decreasing V_{CE} : Saturation

Common Base

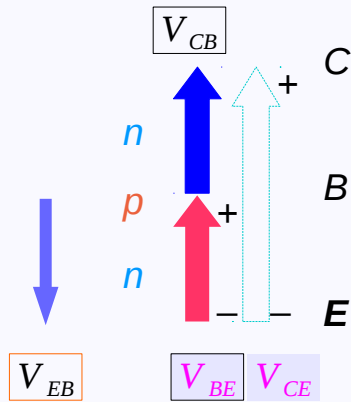
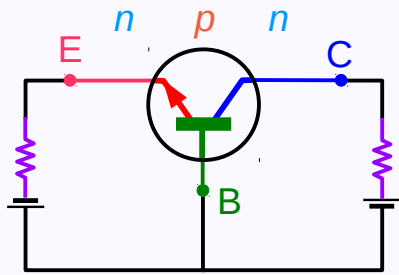


saturation



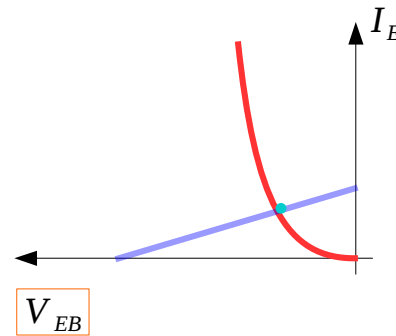
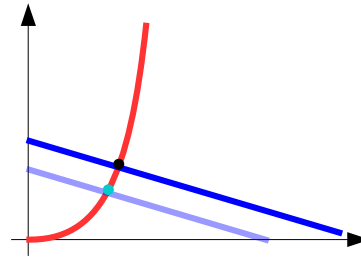
CB Amplifier : Load lines

Common Base

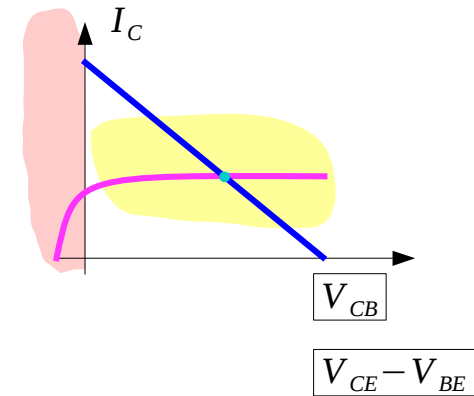
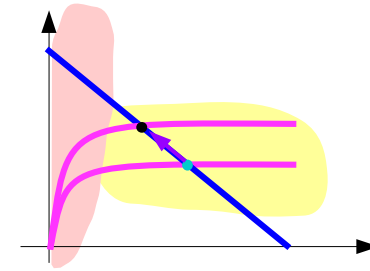


Active region

Input Characteristics



Output Characteristics



References

[1] <http://en.wikipedia.org/>

[2] J.H. McClellan, et al., Signal Processing First, Pearson Prentice Hall, 2003