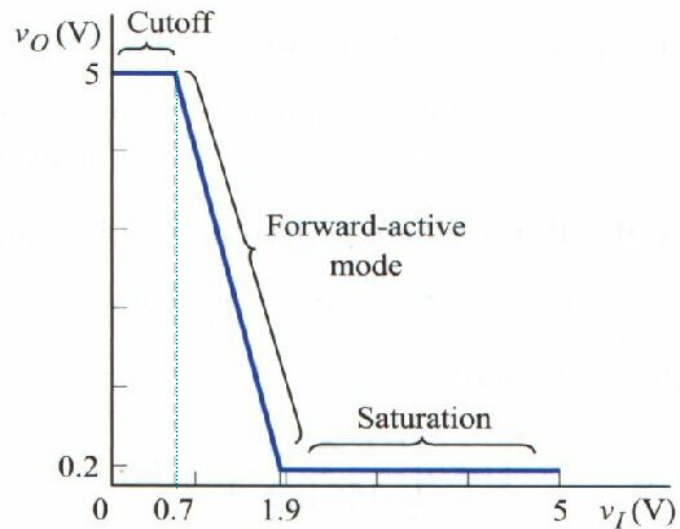
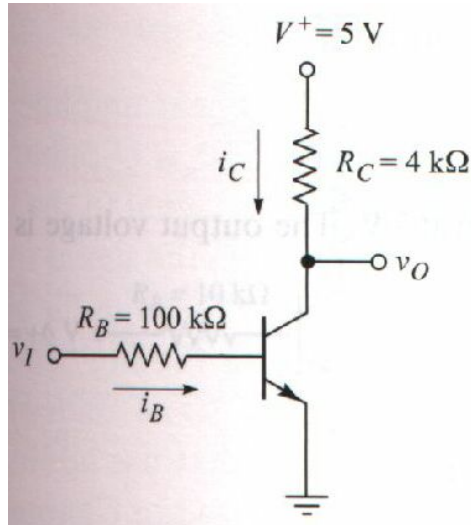


*BJT Transport Model
(Ebers-Moll Model)*

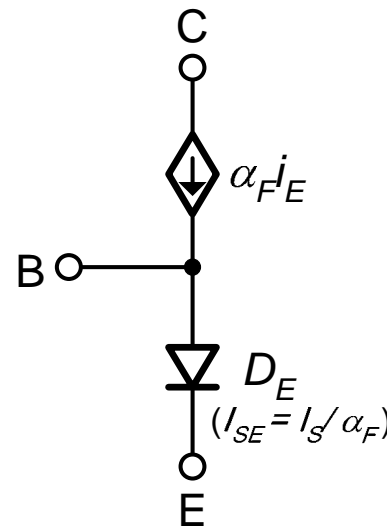
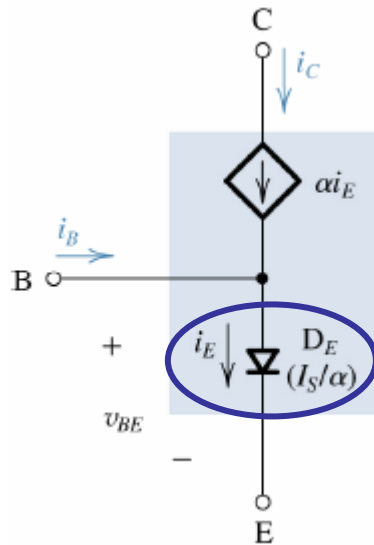


A Question

- In saturation, why current flows into the Collector, whereas B-C is forward-biased?



Equivalent Circuit for **Forward** Active Mode



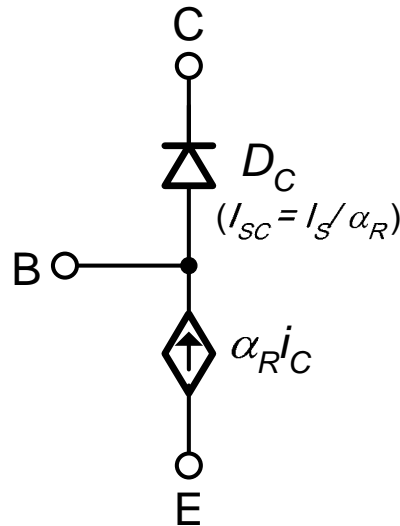
Use α_F to indicate forward active

- Reverse saturation of $D_E = I_S/\alpha$, because:

$$i_E = \frac{i_C}{\alpha} = \frac{I_S}{\alpha} e^{v_{BE}/V_T} I_{SE}$$



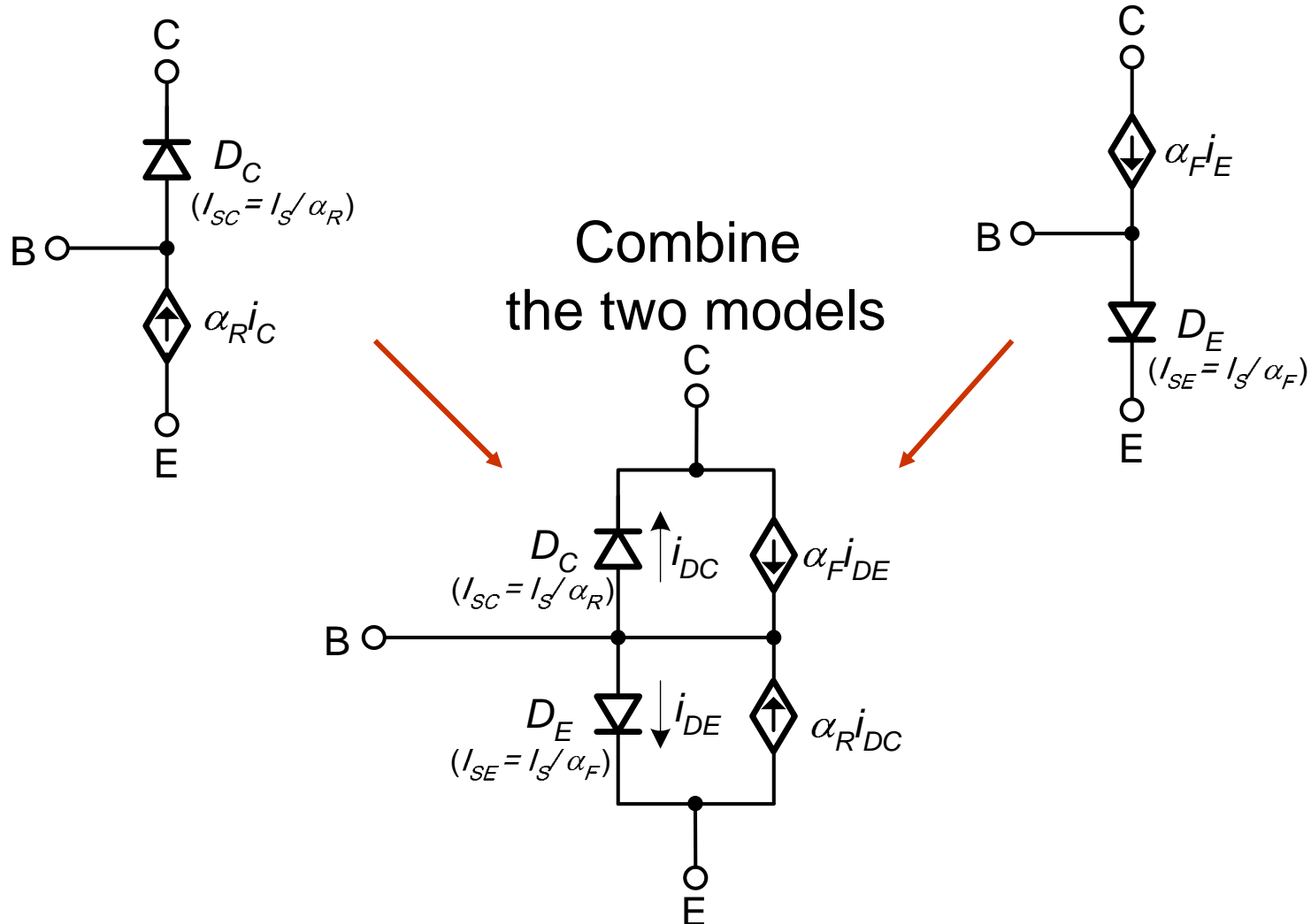
Equivalent Circuit for **Reverse** Active Mode



- B-C forward-biased, B-E reverse-biased
- α_R usually $\ll \alpha_F$

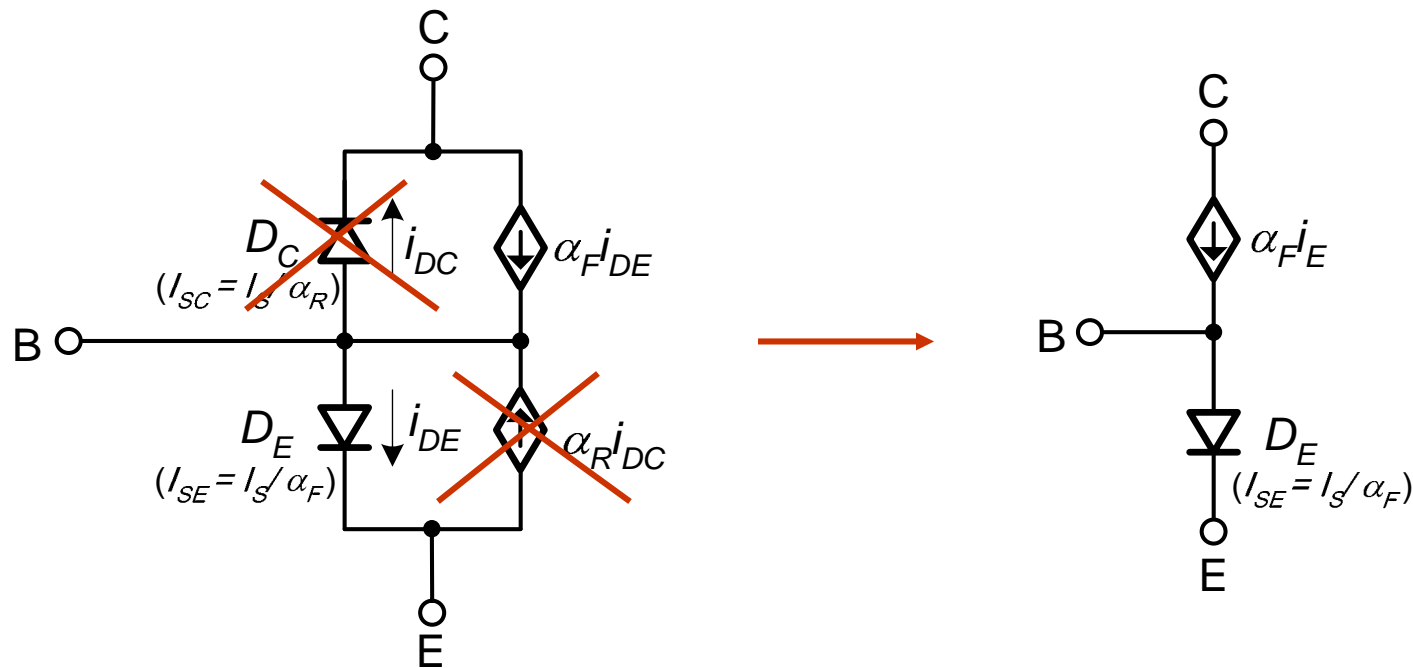


Transport Model / Ebers-Moll Model



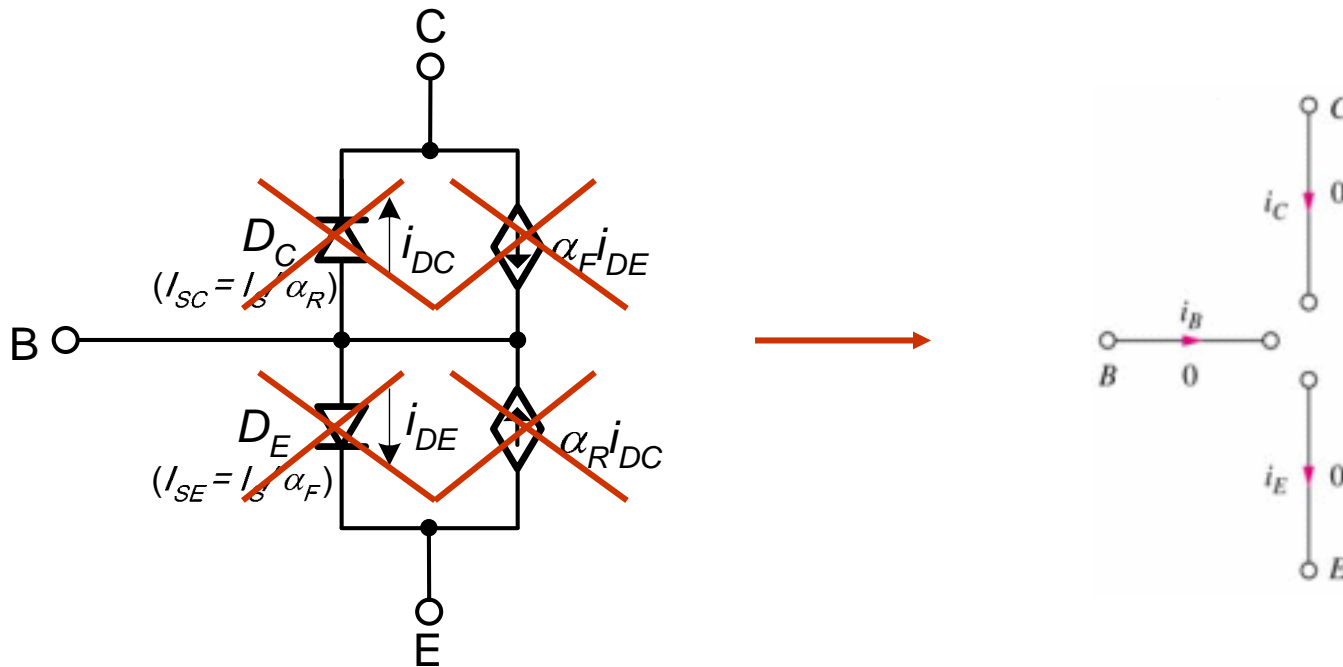
In forward-Active Mode

When
BE forward-biased, and
BC reverse-biased:



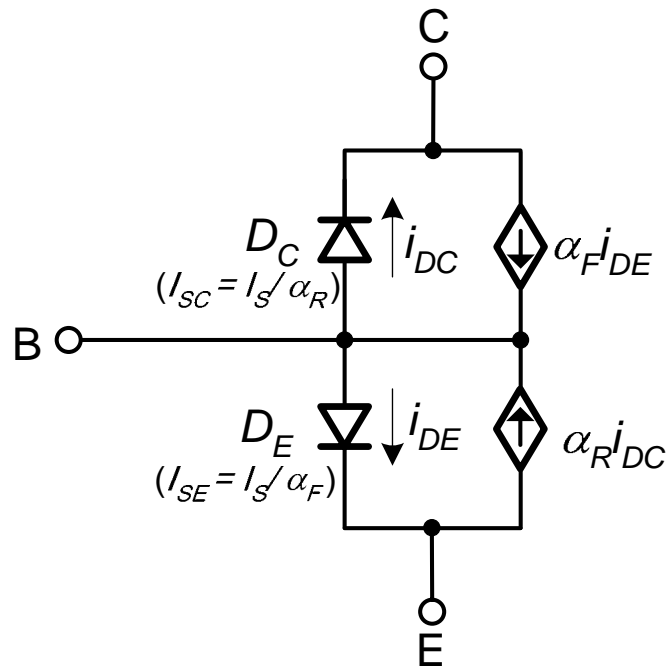
In Cutoff Mode

When
BE reverse-biased, and
BC reverse-biased:



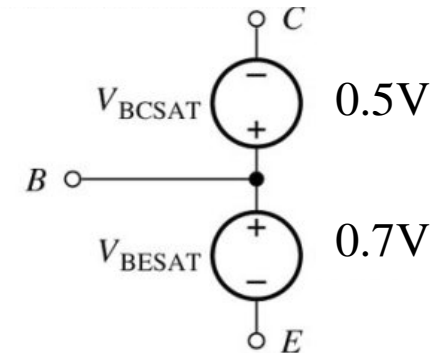
In Saturation Mode

When
BE forward-biased, and
BC forward-biased:



Diodes
simplified
as constant
voltage drops.

Their parallel current
sources can be omitted.



!! Current can enter collector, opposite to i_{DC} .

(Note: Even if a junction is forward-biased, its internal E field still points from n to p. So the α terms are still their.)

