

Analog Electronics Tutorial Series

Bipolar Junction Transistors

BJTs

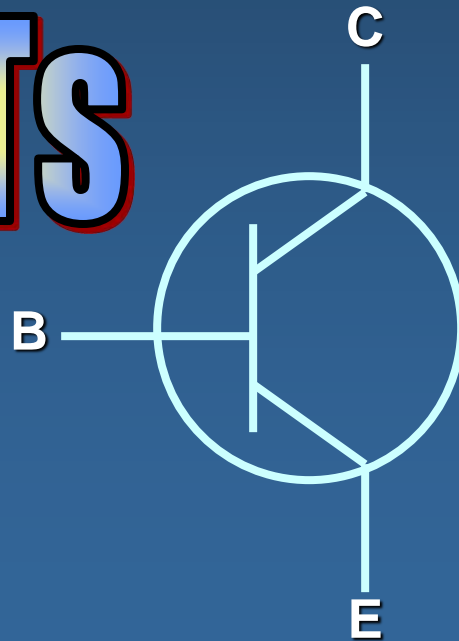


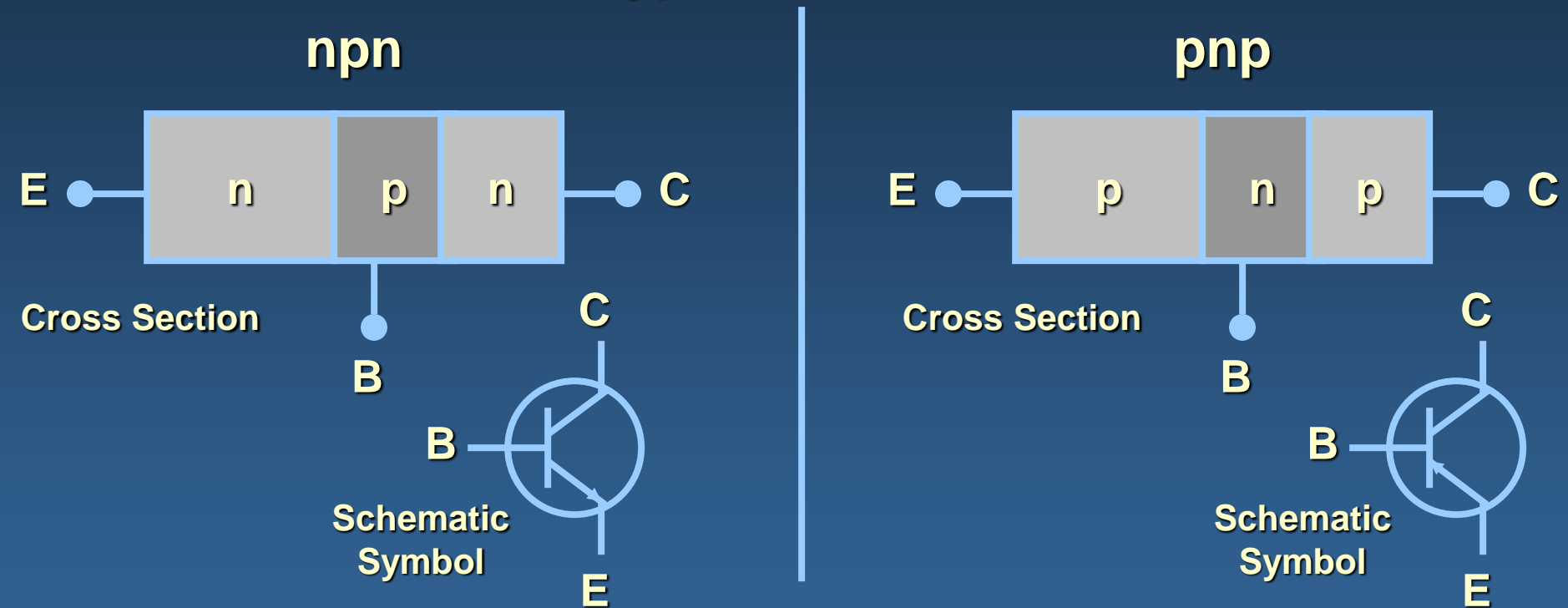
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The BJT – Bipolar Junction Transistor

★ Note: It will be very helpful to go through the Analog Electronics Diodes Tutorial to get information on doping, n-type and p-type materials.

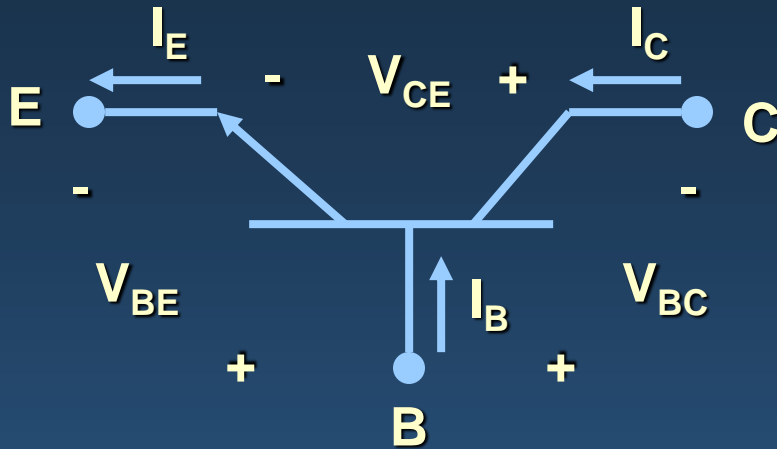
The Two Types of BJT Transistors:



- Collector doping is usually $\sim 10^6$
- Base doping is slightly higher $\sim 10^7 - 10^8$
- Emitter doping is much higher $\sim 10^{15}$



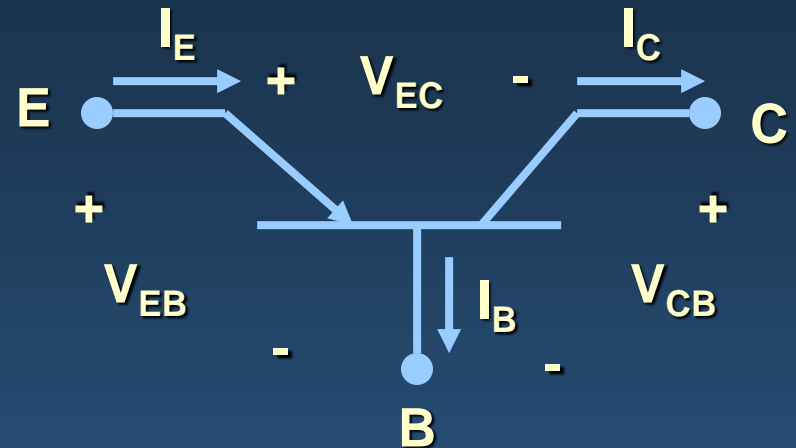
BJT Relationships - Equations



npn

$$I_E = I_B + I_C$$

$$V_{CE} = -V_{BC} + V_{BE}$$



pnp

$$I_E = I_B + I_C$$

$$V_{EC} = V_{EB} - V_{CB}$$

Note: The equations seen above are for the transistor, not the circuit.



DC β and DC α

β = Common-emitter current gain

α = Common-base current gain

$$\beta = \frac{I_C}{I_B} \qquad \alpha = \frac{I_C}{I_E}$$

The relationships between the two parameters are:

$$\alpha = \frac{\beta}{\beta + 1} \qquad \beta = \frac{\alpha}{1 - \alpha}$$

Note: α and β are sometimes referred to as α_{dc} and β_{dc} because the relationships being dealt with in the BJT are DC.