

BJT Operating Regions

Electrical Engineering

Which region a bipolar transistor is in, read straight off its junction bias.

Junction bias decides the region; the region decides the model.

Region	Junction bias	Behaviour
Cut-off	Both reverse	No collector current
Active	BE forward, BC reverse	$I_C = \beta I_B$, amplifies
Saturation	Both forward	$V_{CE} \approx 0.2 \text{ V}$, fully on
Reverse active	BE reverse, BC forward	Poor gain, rarely used
Edge of conduction	$V_{BE} \approx 0.7 \text{ V}$	Just entering active

Analogue design lives in the active region. Switching design sits at the two ends and crosses active as fast as it can.