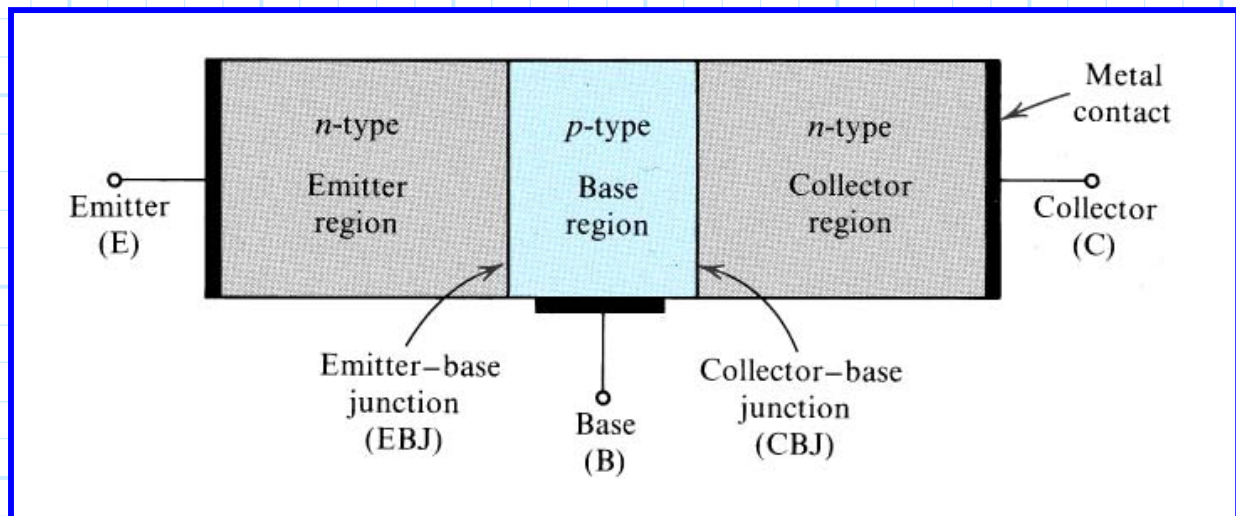


BJT Structure and Modes of Operation

First, let's start with the *npn* Bipolar Junction Transistor (BJT). As the name implies, the *npn* BJT is simply a hunk of p-type Silicon sandwiched between two slices of *n*-type material:



Each of the three Silicon regions has one terminal electrode connected to it, and thus the *npn* BJT is a three terminal device.

The three terminals are named:

1. Collector
2. Base
3. Emitter

Note that this BJT structure creates two p - n junctions !

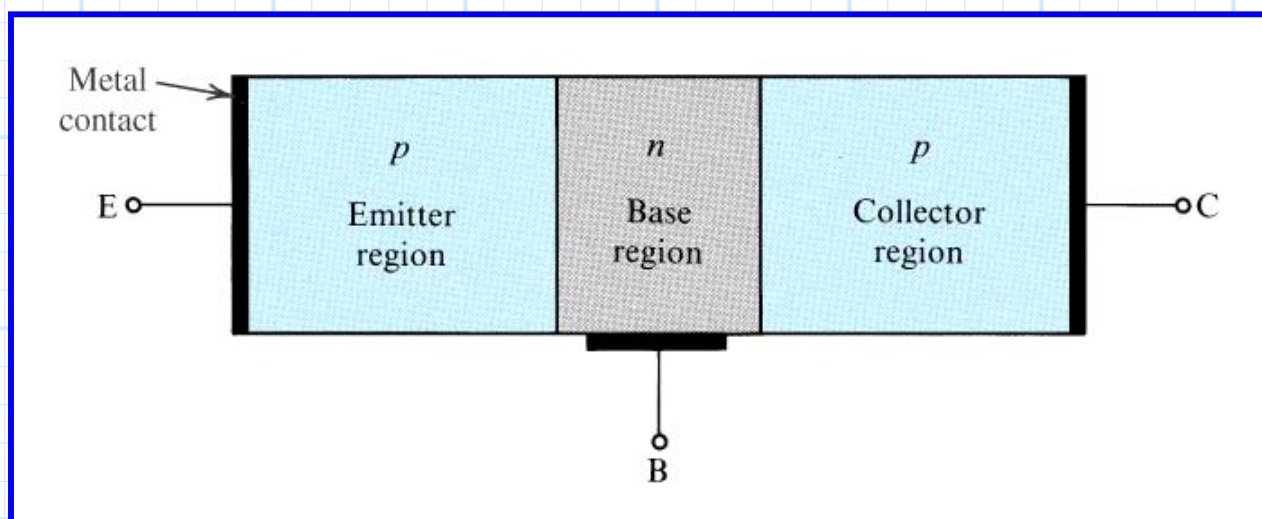
* The junction between the n -type collector and the p -type base is called the **Collector-Base Junction (CBJ)**.

Note for the CBJ, the anode is the _____, and the cathode is the _____.

* The junction between the n -type emitter and the p -type base is called the **Emitter-Base Junction (EBJ)**.

Note for the EBJ, the anode is the _____, and the cathode is the _____.

Now, we find that the pnp BJT is simply the complement of the npn BJT—the n -type silicon becomes p -type, and vice versa:



Thus, the *pn*p BJT likewise has **three** terminals (with the same names as the *n*pn), as well as **two** *p-n* junctions (the CBJ and the EBJ).

For the *pn*p BJT, the **anode** of the CBJ is the _____, and the **cathode** of the CBJ is the _____.

Likewise, the **anode** of the EBJ is the _____, and the **cathode** of the EBJ is the _____.

Now, we know that each *p-n* junction (for either *n*pn or *pn*p) has **three** possible modes:

1. forward biased
2. reverse biased
3. breakdown

We find that **breakdown** is **not** generally a useful mode for transistor operation, and so we will **avoid** that mode.

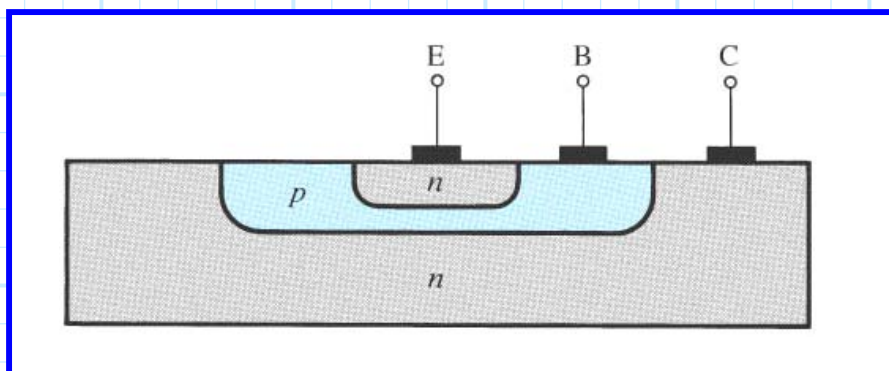
Given then that there are **two** useful *p-n* junction modes, and **two** *p-n* junctions for each BJT (i.e., CBJ and EBJ), a BJT can be in one of **four** modes!

MODE	EBJ	CBJ
1	Reverse	Reverse
2	Forward	Reverse
3	Reverse	Forward
4	Forward	Forward

Now, let's give each of these four BJT modes a name:

MODE	EBJ	CBJ
Cutoff	Reverse	Reverse
Active	Forward	Reverse
Reverse Active	Reverse	Forward
Saturation	Forward	Forward

We will find that the **Reverse Active** mode is of **limited** usefulness, and thus the **three basic operating modes** of a BJT are **Cutoff, Active, and Saturation**.



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