

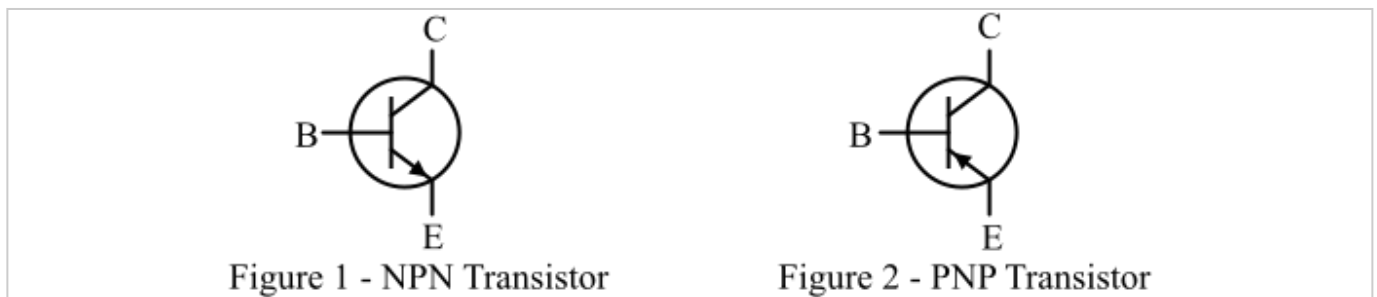
## Difference between NPN and PNP Transistor

A **transistor (or bipolar junction transistor)** is a three-terminal, three-layer and two-junction semiconductor device, used as the digital switch and amplifier in the electronic circuits.

A transistor consists of three layers of P-type and N-type semiconductor materials and the name of these layers are **emitter, base** and **collector**. The three terminals are taken out from these three layers.

Based on the arrangement of the semiconductor layers, the transistors are of two types as –

- NPN Transistor
- PNP Transistor



Read through this article to find out more about NPN transistor (BJT) and PNP transistor and the key differences between them.

### What is NPN Transistor?

An **NPN transistor** is the one in which two layers of N-type semiconductor material are separated by a thin layer of P-type semiconductor material. Hence, in case of NPN transistor, the emitter and collector are of N-type while the base is of P-type. The symbol of the NPN transistor is shown in Figure-1.

### What is PNP Transistor?

When a thin layer of N-type semiconductor material is sandwiched between two layers of P-type semiconductor material, the resulting transistor is known as a **PNP transistor**. In a PNP transistor, the emitter and collector are made of P-type semiconductor material while the base is made of N-type material. The circuit symbol of PNP transistor is shown in Figure-2.

## Difference between NPN and PNP Transistor

The following table highlights the key differences between NPN transistor and PNP transistor –

Difference	NPN Transistor	PNP Transistor
Description	A type of transistor in which a thin layer of P-type semiconductor sandwiched between two layers of N-type semiconductor is known as NPN-transistor.	A type of transistor in which a thin layer of N-type semiconductor sandwiched between two layers of P-type semiconductor is known as PNP transistor.
Terminal polarity	In NPN transistor, the emitter is N-type, base is P-type and collector is N-type.	In PNP transistor, the emitter is P-type, base is N-type and collector is P-type.
Current direction	In NPN transistor, current flows from collector region to emitter region.	In PNP transistor, the direction of current is from emitter to collector.
Majority charge carriers	Electrons are the majority charge carriers in NPN transistor.	Holes are the majority charge carriers in PNP transistor.
Minority charge carries	Holes are the minority charge carrier in NPN transistor.	Electrons are the minority charge carriers in PNP transistor
Switching speed	Switching of NPN transistor is faster due to high drift velocity of electrons.	Switching speed of PNP transistor is low due to low drift velocity of holes.
Switching time	The switching time of NPN transistor is small.	The switching time of PNP transistor is large.
Active region operation	The NPN transistor is said to be operated in active region if emitter is connected to negative terminal of battery with respect to base and the collector terminal is connected to positive terminal with respect to base.	If emitter is connected to positive terminal with respect to base and the collector is connected to negative with respect to base, then PNP transistor will operate in active region.
Saturation region operation	If both the emitter and collected are made negative with respect to the base, then the NPN transistor will operate in saturation region and works as an ON switch.	When emitter and collector are made positive with respect to base, then PNP transistor will operate in saturation region.
Cut-off region operation	For NPN transistor to operate in cut-off region, the emitter and collector are made positive with respect to base.	For PNP transistor to operate in cut-off region, the emitter and collector are made negative with respect to the base.
Ground signal	For an NPN transistor, the ground signal is low.	For a PNP transistor, the ground signal is high.
Starting of conduction	NPN transistor starts conducting once the electrons enter the base region.	PNP transistor starts conducting once the holes enter the base region.

Difference	NPN Transistor	PNP Transistor
Switching ON & OFF	NPN transistor is switched ON by applying a positive voltage at base terminal. While it is switched OFF by reducing the base voltage.	PNP transistor is switched ON by applying a negative voltage at base terminal and is switched OFF by applying a positive voltage.
Direction of base current	In NPN transistor, the base current flows from base to emitter.	In PNP transistor, the base current flows from emitter to base.
Direction of emitter arrow	In the symbol of NPN transistor, the emitter arrow is directed outward.	In the symbol of PNP transistor, the emitter arrow is directed inward.

## Conclusion

From the above discussion, it can be concluded that there are various differences between NPN and PNP transistors. Both of these transistors are widely used in different electronic applications like in switching and amplification, etc. Thus, the knowledge of these differences can help an individual to select the right kind of transistor as per the exact requirements.