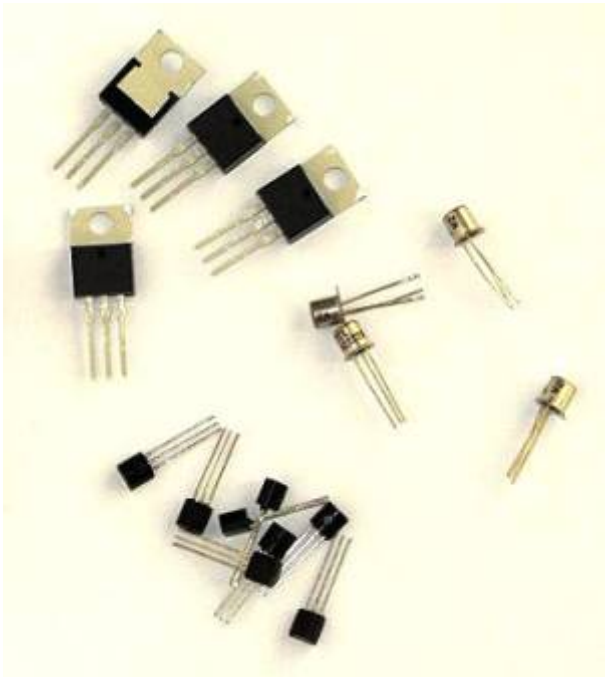
# Transistor



## Introduction

A Transistor is a device composed of semiconductor material that amplifies a signal or opens or closes a circuit, like a switch.

Invented in 1947 at Bell Labs, transistors have become the key ingredient of all digital circuits, including computers. Today's microprocessors contains tens of millions of microscopic transistors. Prior to the invention of transistors, digital circuits were composed of vacuum tubes, which had many disadvantages. They were much larger, required more energy, dissipated more heat, and were more prone to failures. It's safe to say that without the invention of transistors, computing as we know it today would not be possible.

A transistor is a small electronic device that can cause changes in a large electrical output signal by small changes in a small input signal. That is, a weak input signal can be amplified (made stronger) by a transistor. For example, very weak radio signals in the air can be picked up by a wire antenna and processed by transistor amplifiers until they are strong enough to be heard by the human ear.

A transistor consists of three layers of silicon or germanium semiconductor material. Impurities are added to each layer to create a specific electrical positive or negative charged behavior. “P” is for a positive charged layer and “N” is for a negative charged layer.

Transistors are either NPN or PNP in the configuration of the layers. There is no particular difference here except the polarity of voltages that need to be applied to make the transistor operate. The weak input signal is applied to the center layer called the base and usually referenced to ground which is also connected to the bottom layer called the emitter. The larger output signal is take from the collector also referenced to ground and the emitter. Additional resistors and capacitors are required along with at least one DC power source to complete the transistor amplifier.

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