

Transistor

The transistor is an electronic device used for amplification, switching, stabilizing, and modulating of electric voltage or current. Transistors are basic building blocks in computers, automotive technology, consumer products, telecommunications and so on.

The first transistor was created in 1948 by American physicists J. Bardeen, W. Shockeley and W. Brattain in the Bell Laboratories using the Germanium crystal. The modern transistors are built using silicon technology.



a) first transistor

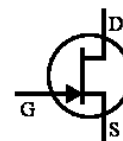
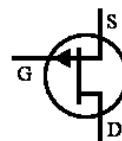
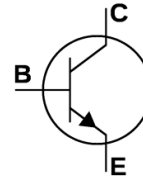
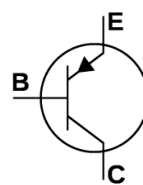


b) modern transistors

Transistor types

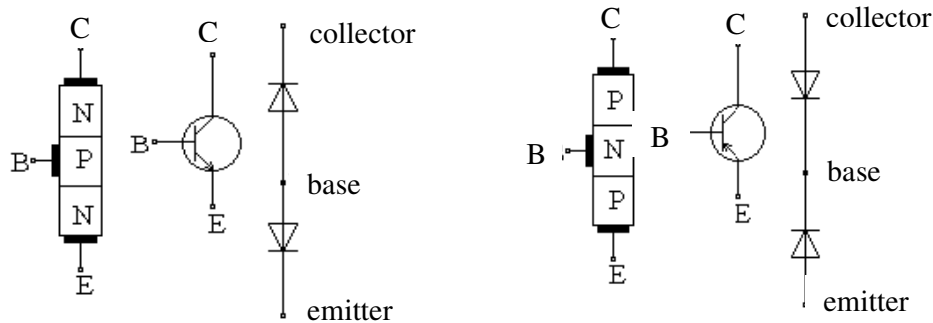
Transistors can be classified into several categories:

- Material used in the during fabrication:
 - silicon (most used)
 - gallium-arsenide
 - germanium
- Internal structure:
 - bipolar (junction transistor)
 - unipolar (field-effect transistor)
- Polarity:
 - bipolar PNP (arrow pointing inside)
 - bipolar NPN (arrow pointing outside)
 - P-channel FET
 - N-channel JFET
- Power rating:
 - Low power
 - High power
- Switching speed:
 - Low frequency
 - High frequency



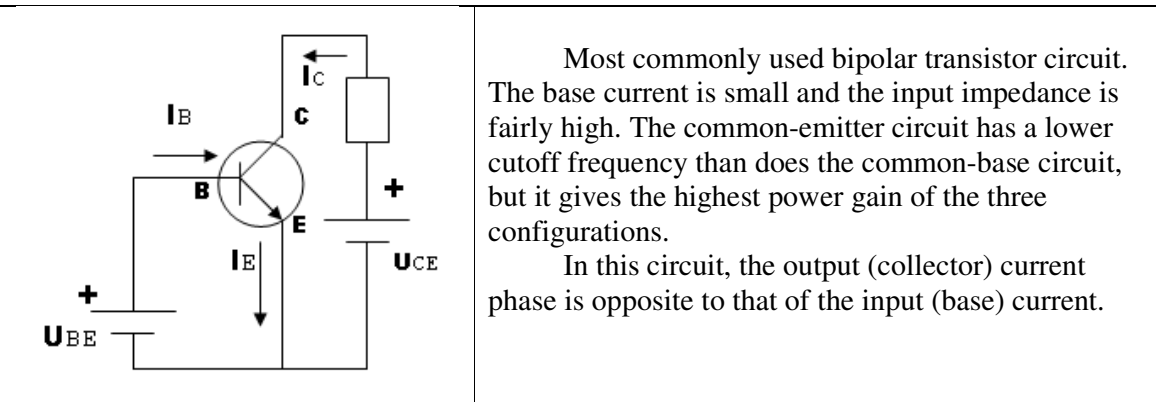
Bipolar transistor

A bipolar transistor consists of a PNP or NPN combination with one type of semiconductor sandwiched between two opposite types to form two opposite junctions. Of three electrodes, one end is the **emitter** (E) to supply electrons or hole-charges to the **base** (B) in the middle; the **collector** (C) at the opposite end receives the emitter charges by injection from the base.

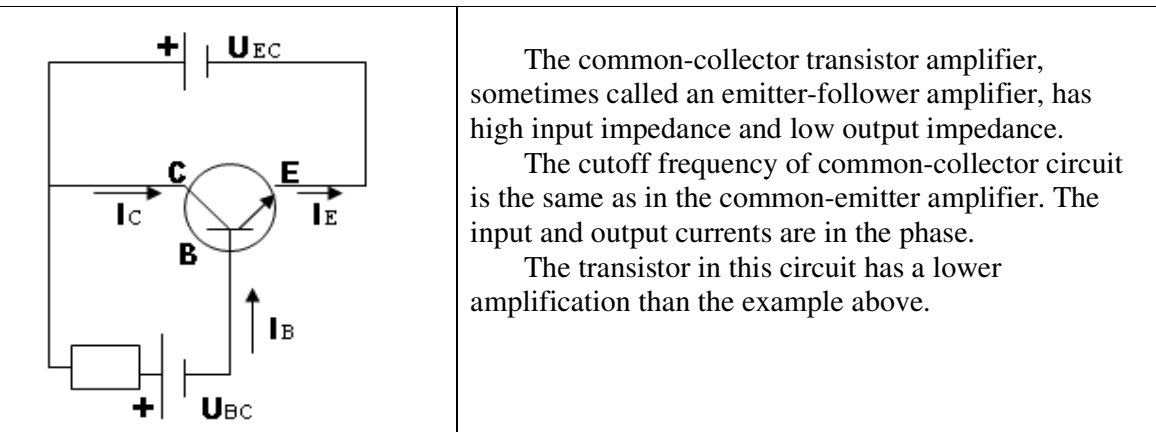


Transistor circuits

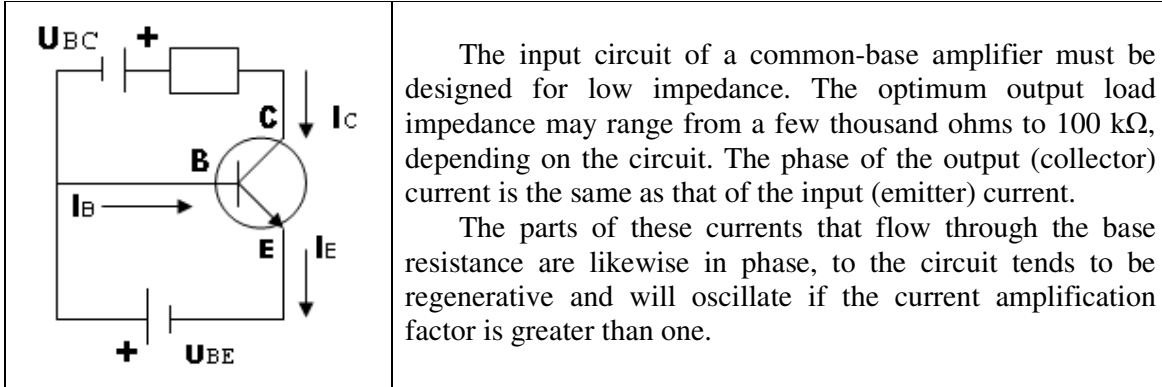
Common-emitter circuit



Common-collector circuit



Common-base circuit



Unipolar transistor

The unipolar transistor relies on an electric field to control the shape and hence the conductivity of a channel of one type of charge carrier in a semiconductor material. It is also referred to as the field-effect transistor or FET transistor.

Types:

- Transistor controlled by an electric field with a gate terminal (JFET)
- Transistor controlled by an electric field with an oxide-insulated gate
 - MIS-FET (metal-insulator-semiconductor)
 - MOS-FET (metal-oxide-semiconductor)
- Transistor controlled by an electric field with Schottky barrier (MESFET)

VOCABULARY

amplification – zosilňovanie

operational amplifier – operačný zosilňovač

charge carrier – nosič náboja

considered – uvažovaný, zvažovaný

semiconductor – polovodič

sandwiched – obložený, *tu*: vrstvený

invention – vynález, výmysel

coined – razil, *tu*: presadzoval

Note:

Bell Telephone Laboratories needed a generic name for the new invention: "Semiconductor Triode", "Solid Triode", "Surface States Triode", "Crystal Triode" and "Iotatron" were all considered, but "transistor," coined by John R. Pierce, won an internal ballot. The word transistor was obtained by combining words **TRANS**fer and res**ISTOR**.