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Semiconductor devices. Their types and uses

The rapid development and expansion of the fields of electronic devices application is due to the improvement of the element base, which is based on semiconductor devices. Therefore, it is necessary to know the device and the principle of operation of the main types of semiconductor devices and to understand the processes of electronic devices functioning.

Silicon (Si), silicon carbide (SiC), gallium and indium compounds are the main materials for the production of semiconductor devices.

The electrical conductivity of semiconductors depends on the presence of impurities and external energy influences. The current flow is caused by two types of charge carriers-electrons and holes. There are pure and semiconductors with some impurities depending on the chemical composition.

Solid semiconductors with a crystalline structure are used for the manufacture of electronic devices.

Semiconductor devices are devices which operation is based on the use of the properties of semiconductor materials.

Classification of semiconductor devices.

1. Semiconductor resistors are made on the basis of non-transitive semiconductors:

- linear resistor;
- varistor;
- posistor;
- thermistor;
- photoresistor;
- strain gauge;

The principle of operation of most semiconductor devices is based on the properties of the electron-hole p-n junction.

2. A semiconductor diode is a semiconductor device that transmits current in only one direction, from the anode to the cathode.

Depending on the purpose, semiconductor diodes are divided into

- rectifier diodes;
- universal diodes;
- pulse diodes;
- zener diodes and stablistors;
- tunnel and reversed diodes;
- LEDs and photodiodes;

3. A transistor is a semiconductor device designed to amplify, generate, and convert electrical signals, as well as to switch electrical circuits.

The ability to be in the open and closed states under the influence of the control signal is the main property of the transistor.

The transistor allows you to adjust the current in the circuit from zero to the maximum value.

Classification of transistors:

- according to the principle of operation: field-effect (unipolar), bipolar, combined;
- by the value of the power dissipated: small, medium and large;
- by the value of the limit frequency: low-frequency medium-frequency high-frequency and ultra-high-frequency;
- according to the value of the operating voltage: low-voltage and high-voltage;

- by functional purpose: universal, amplifying, key, etc.;
- according to the design: unassembled, in the case design, with rigid and flexible terminals.

Transistors can operate in three modes depending on the functions performed:

- Active mode. It is used to amplify electrical signals in analog devices;
- Saturation mode. A transistor is equivalent to a closed relay contact in this mode, since its resistance tends to zero;
- Cut-off mode. The transistor is closed and has a high resistance, that is, it is equivalent to an open relay contact.

A bipolar transistor is a semiconductor device with two p-n junctions and three pins. It provides power amplification of electrical signals.

The plate of a semiconductor, in which three sections are formed with an alternating type of conductivity - electronic and hole, is the basis of a transistor. There are two types of transistor structure depending on the interleaving of layers: n-p-n and p-n-p.

A field-effect transistor is a semiconductor device that regulates the current in a circuit by changing the cross-section of the conducting channel.

There are field-effect transistors with a gate in the form of a p-n junction and with an isolated gate.

In field-effect transistors with an isolated gate, an insulating layer of a dielectric is located between the semiconductor channel and the metal gate.

4. A thyristor is a semiconductor device that operates in two stable states-low conductivity and high conductivity. Structurally, a thyristor has three or more p-n junctions and three outputs: an anode, a cathode, and a control electrode.

Thyristors are used as contactless switches and controlled rectifiers in automation devices and electric current converters. In AC and pulse current circuits, you can change the time of the open state of the thyristor, and therefore the time of current flow through the load. This allows you to adjust the power allocated in the load.