

ELECTRICAL CIRCUITS

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Electrical circuits are not just sketches of wires and elements on paper. This is the fundamental basis of electronics and electrical engineering, a kind of “language” that allows you to describe, analyze and design everything from the simplest flashlight to the most complex spacecraft. Circuits are a diagrammatic representation of real physical connections of components that work together to form a functional electronic device or system. They serve not only to document the project, but also are a powerful tool for modeling, analysis, and, most importantly, for understanding complex energy and information transfer processes.

In essence, an electrical circuit is an abstract model, a simplified representation of a real physical device. The scheme consists of various components that have their own designation, which together perform one function. All components have electrical characteristics that reflect their actions in one way or another. There are many such symbols, all of them have their own names, definitions and applications, for example, there are: thyristors, diodes, Zener diodes, inductors, resistors. In the diagrams, each element is connected by a conductor, and in the graphs it is often represented by a line.

Let’s analyze the main ones:

1. Schematic (functional) diagram: This is probably the most common type of scheme. It shows the functional relationships of components, ignoring their physical location on a printed circuit board or other media. This is a kind of ‘drawing’ that shows how components interact with each other to perform a specific function. The logic of the circuit is important here, not its physical embodiment. Engineers use circuit diagrams at the design stage to analyze and simulate the operation of a future system, predict its behavior in various conditions, and optimize its characteristics. The symbols on the schematic diagram are abstract, focusing only on their electrical properties.

2. Connection diagram: Unlike the schematic, this diagram displays the physical location of the components on a printed circuit board or other media. It is a necessary document for the assembly and debugging of the device. The connection diagram is already a practical ‘guide’ for the assembler, which allows it to accurately place each component on the board and make all the connections correctly. It contains detailed information about the location of the components, pin numbers, and the conductors used to ensure proper assembly of the device.

3. Wiring diagram: It shows exactly how the conductors connect the components, indicating the pin numbers and the wiring paths. The wiring diagram is necessary to understand the precise signal tracing and power supply inside the device. It is of particular importance when working with complex devices, where a large number of components and connections require a detailed description [1].

In conclusion, electrical circuits are a powerful tool for understanding, designing, building, and debugging a wide variety of electronic devices. All based on fundamental principles: simplest circuits with multiple components, most complex systems controlling spacecraft, complex industrial processes. A deep understanding of various types of systems, circuits, and ways to analyze them is a key skill for any power engineer.

The improvement of electrical systems and circuits should take place regularly, every day there are various renovation works and the production of new resources. New materials are being developed in the field of power supply, calculations are being carried out, which can subsequently replace previous materials, significantly reduce the cost of the circuit, and also increase the efficiency of the connection. The system itself will be much more convenient, which will reduce energy costs and will be less susceptible to aging, insulation failure, and increased corrosion resistance.

In the near future, due to the well-coordinated work of power engineers, electrical systems and circuits will reach a new level, and electricity itself, due to the improvement of circuits in the application and generation of energy, will become the most easily accessible resource.

References

1. What Are Electric Circuits? // All about Circuits. – URL: <https://www.allaboutcircuits.com/textbook/direct-current/chpt-1/electric-circuits/> (date of access 13.03.2025).