

SUBELEMENT T6

**Electrical components:
semiconductors; circuit
diagrams;
component functions**

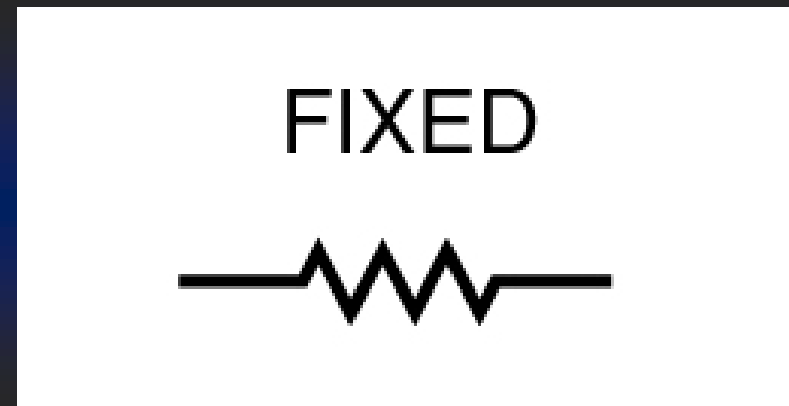
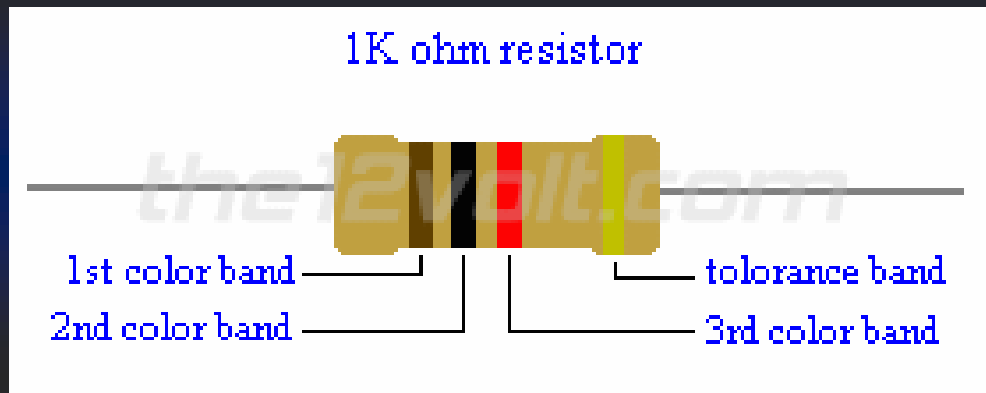
4 Exam Questions - 4 Groups

T6A –

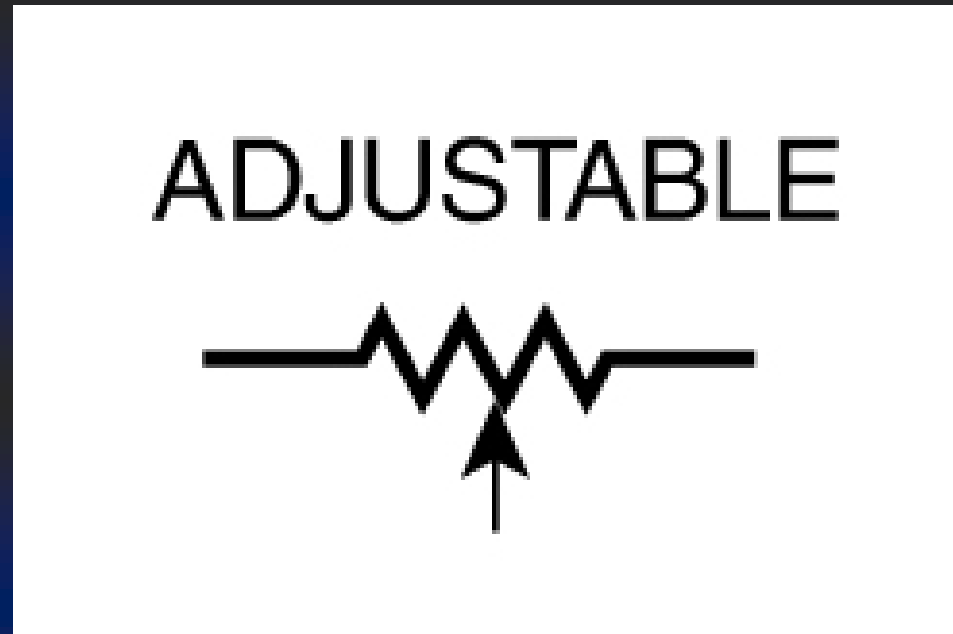
Electrical components: fixed and variable resistors; capacitors and inductors; fuses; switches; batteries

A brief review of some things we learned in section T5 simply because there are some questions about this information also in T6:

- A **resistor** is the electrical component used to oppose the flow of current in a circuit.

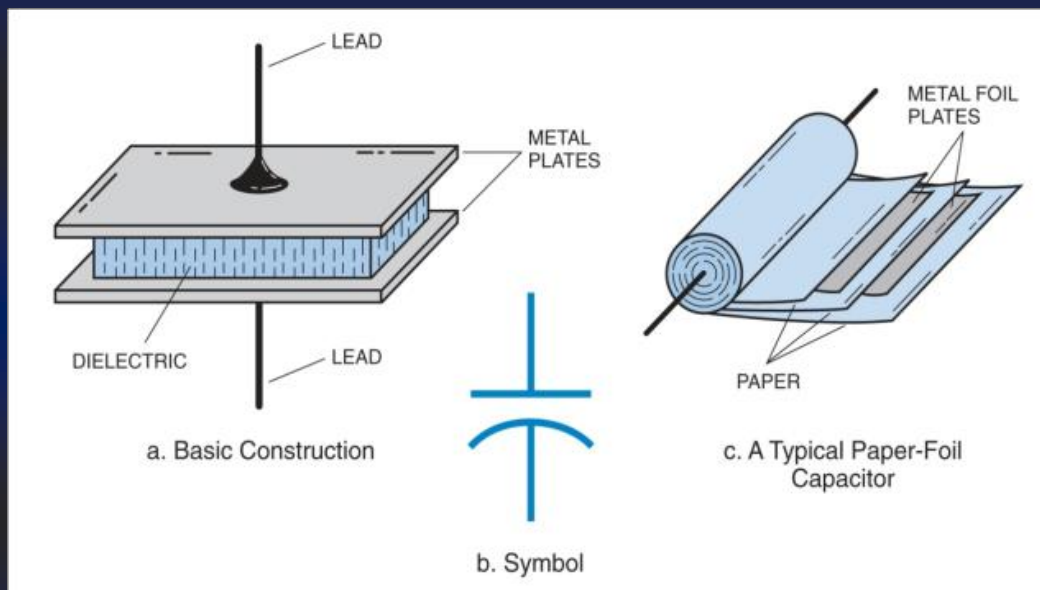


- The **potentiometer** is the type of component often used as an adjustable volume control.



- **Resistance** is the electrical parameter controlled by a potentiometer.

- A **capacitor** is the electrical component that stores energy in an electric field.



- The **capacitor** is the type of electrical component consisting of two or more conductive surfaces separated by an insulator.

- An **inductor** is the type of electrical component that stores energy in a magnetic field.



FIXED



VARIABLE

- The **inductor** is an electrical component usually composed of a coil of wire.

T6A01

What electrical component is used to oppose the flow of current in a DC circuit?

- A. Inductor**
- B. Resistor**
- C. Voltmeter**
- D. Transformer**

T6A01

What electrical component is used to oppose the flow of current in a DC circuit?

B. Resistor

T6A02

What type of component is often used as an adjustable volume control?

- A. Fixed resistor**
- B. Power resistor**
- C. Potentiometer**
- D. Transformer**

T6A02

What type of component is often used as an adjustable volume control?

C. Potentiometer

T6A03

What electrical parameter is controlled by a potentiometer?

- A. Inductance**
- B. Resistance**
- C. Capacitance**
- D. Field strength**

T6A03

What electrical parameter is controlled by a potentiometer?

B. Resistance

T6A04

What electrical component stores energy in an electric field?

A. Resistor

B. Capacitor

C. Inductor

D. Diode

T6A04

What electrical component stores energy in an electric field?

B. Capacitor

T6A05

What type of electrical component consists of two or more conductive surfaces separated by an insulator?

- A. Resistor**
- B. Potentiometer**
- C. Oscillator**
- D. Capacitor**

T6A05

What type of electrical component consists of two or more conductive surfaces separated by an insulator?

D. Capacitor

T6A06

What type of electrical component stores energy in a magnetic field?

A. Resistor

B. Capacitor

C. Inductor

D. Diode

T6A06

What type of electrical component stores energy in a magnetic field?

C. Inductor

T6A07

What electrical component is usually composed of a coil of wire?

- A. Switch**
- B. Capacitor**
- C. Diode**
- D. Inductor**

T6A07

What electrical component is usually composed of a coil of wire?

D. Inductor

Now on to some new stuff.

A switch is an electrical component that is used to connect or disconnect an electrical circuit.

You have used a switch when turning house lights off and on.

A fuse is an electrical component used to protect other circuit components from current overloads.

**Most house electrical boxes
now use breakers. Many years
ago they used fuses.**

**Your car still use fuses. Those
flat colored things with legs!**

Most ham equipment have at least one fuse that will blow (burn out) if there is a sudden increase in current that is not part of the plan.

T6A08

What electrical component is used to connect or disconnect electrical circuits?

A. Magnetron

B. Switch

C. Thermistor

D. All of these choices are correct

T6A08

What electrical component is used to connect or disconnect electrical circuits?

B. Switch

T6A09

What electrical component is used to protect other circuit components from current overloads?

A. Fuse

B. Capacitor

C. Inductor

D. All of these choices are correct

T6A09

What electrical component is used to protect other circuit components from current overloads?

A. Fuse

Hams make use of rechargeable batteries. Think about it. If one uses a handheld radio, he/she would go through a lot of batteries if it were not for rechargeable batteries.

Today's batteries are small and light weight and hold a pretty large charge.

There are several types of rechargeable batteries:

- **Nickel-metal hydride**
- **Lithium-ion**
- **Lead-acid gel-cell**
- **All of these choices are correct**

1.2 volts is the nominal voltage of a fully charged nickel-cadmium cell. Six cells or more make up a handhelds battery.

They are all in a case nice and neatly soldered together for a total voltage of 7.4 volts or more.

A **carbon-zinc** battery type is not rechargeable. This would be your normal dry cell battery used in flashlights, toys, etc.

Trying to recharge one of these batteries is very dangerous and can possibly lead to an explosion. Don't try it!

T6A10

Which of the following battery types is rechargeable?

A. Nickel-metal hydride

B. Lithium-ion

C. Lead-acid gel-cell

D. All of these choices are correct

T6A10

Which of the following battery types is rechargeable?

D. All of these choices are correct

T6A11

Which of the following battery types is not rechargeable?

A. Nickel-cadmium

B. Carbon-zinc

C. Lead-acid

D. Lithium-ion

T6A11

Which of the following battery types is not rechargeable?

B. Carbon-zinc

T6B –

Semiconductors: basic principles and applications of solid state devices; diodes and transistors

Transistors are a class of electronic components capable of using a voltage or current signal to control current flow. Transistors can be used as an electronic switch or as an amplifier.

The **transistor** is a component that is made of three layers of semiconductor material. The three electrodes of a PNP or NPN transistor are the **Emitter, base, and collector.**

The abbreviation "FET" stands for **Field Effect Transistor**. The three electrodes of a field effect transistor are the **Source, gate, and drain**.

The **transistor** is an electronic components that can amplify signals. **Gain** is the term that describes a transistor's ability to amplify a signal.

T6B01

What class of electronic components is capable of using a voltage or current signal to control current flow?

- A. Capacitors**
- B. Inductors**
- C. Resistors**
- D. Transistors**

T6B01

What class of electronic components is capable of using a voltage or current signal to control current flow?

D. Transistors

T6B03

Which of these components can be used as an electronic switch or amplifier?

- A. Oscillator**
- B. Potentiometer**
- C. Transistor**
- D. Voltmeter**

T6B03

Which of these components can be used as an electronic switch or amplifier?

C. Transistor

T6B04

Which of the following components can be made of three layers of semiconductor material?

A. Alternator

B. Transistor

C. Triode

D. Pentagrid converter

T6B04

Which of the following components can be made of three layers of semiconductor material?

B. Transistor

T6B05

Which of the following electronic components can amplify signals?

- A. Transistor**
- B. Variable resistor**
- C. Electrolytic capacitor**
- D. Multi-cell battery**

T6B05

**Which of the following
electronic components can
amplify signals?**

A. Transistor

T6B08

What does the abbreviation FET stand for?

- A. Field Effect Transistor**
- B. Fast Electron Transistor**
- C. Free Electron Transition**
- D. Field Emission Thickness**

T6B08

What does the abbreviation FET stand for?

A. Field Effect Transistor

T6B10

What are the three electrodes of a PNP or NPN transistor?

- A. Emitter, base, and collector**
- B. Source, gate, and drain**
- C. Cathode, grid, and plate**
- D. Cathode, drift cavity, and collector**

T6B10

What are the three electrodes of a PNP or NPN transistor?

A. Emitter, base, and collector

T6B11

What are the three electrodes of a field effect transistor?

- A. Emitter, base, and collector**
- B. Source, gate, and drain**
- C. Cathode, grid, and plate**
- D. Cathode, gate, and anode**

T6B11

What are the three electrodes of a field effect transistor?

B. Source, gate, and drain

T6B12

What is the term that describes a transistor's ability to amplify a signal?

A. Gain

B. Forward resistance

C. Forward voltage drop

D. On resistance

T6B12

What is the term that describes a transistor's ability to amplify a signal?

A. Gain

A **diode** is an electronic component that allows current to flow in only one direction.

Anode and cathode are the names of the two electrodes of a diode. A semiconductor diode's cathode lead is usually identified **with a stripe.**

An LED, or **Light Emitting Diode**, can be used as light indicators to show whether a switch is off or on.

The LED have also become popular in flashlights and are just now showing up as light bulbs.

This is because the low current drain of LED's make them more efficient for lighting than even the economical fluorescent light bulb.

T6B02

What electronic component allows current to flow in only one direction?

A. Resistor

B. Fuse

C. Diode

D. Driven Element

T6B02

What electronic component allows current to flow in only one direction?

C. Diode

T6B06

How is the cathode lead of a semiconductor diode usually identified?

A. With the word cathode

B. With a stripe

C. With the letter C

D. All of these choices are correct

T6B06

How is the cathode lead of a semiconductor diode usually identified?

B. With a stripe

T6B07

What does the abbreviation LED stand for?

- A. Low Emission Diode**
- B. Light Emitting Diode**
- C. Liquid Emission Detector**
- D. Long Echo Delay**

T6B07

What does the abbreviation LED stand for?

B. Light Emitting Diode

T6B09

What are the names of the two electrodes of a diode?

- A. Plus and minus**
- B. Source and drain**
- C. Anode and cathode**
- D. Gate and base**

T6B09

What are the names of the two electrodes of a diode?

C. Anode and cathode

T6C –

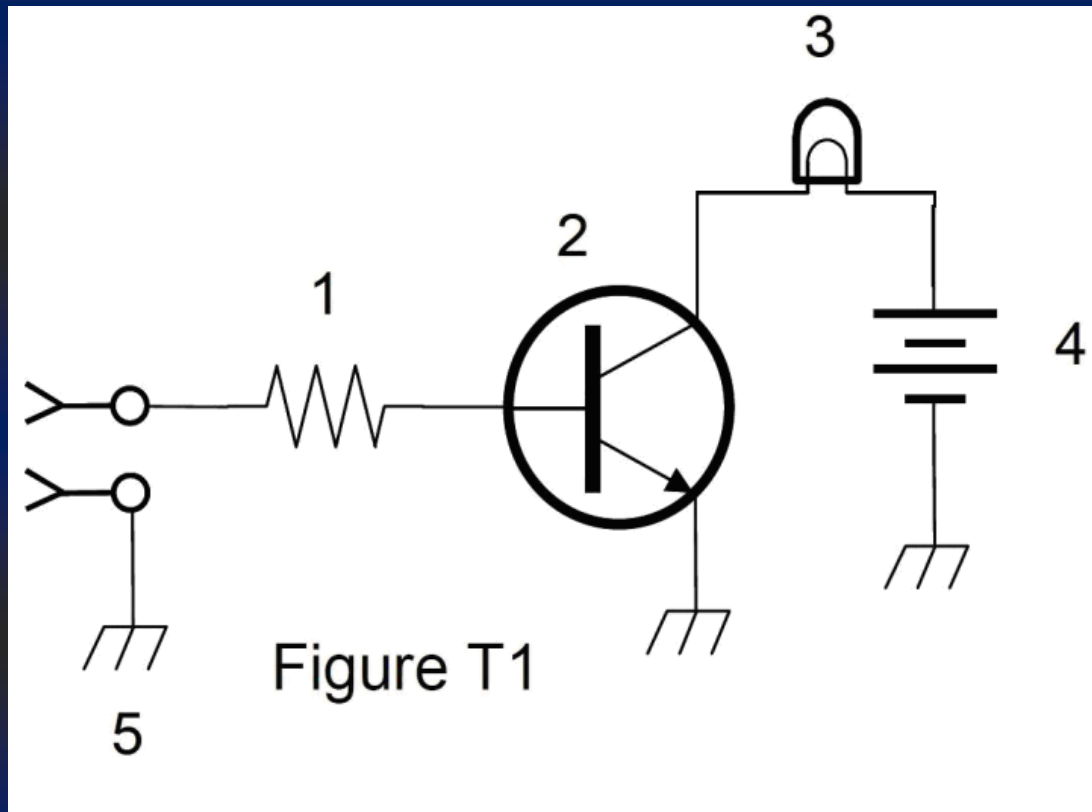
Circuit diagrams; schematic symbols

- **Schematic symbols** is the name for standardized representations of components in an electrical wiring diagram.

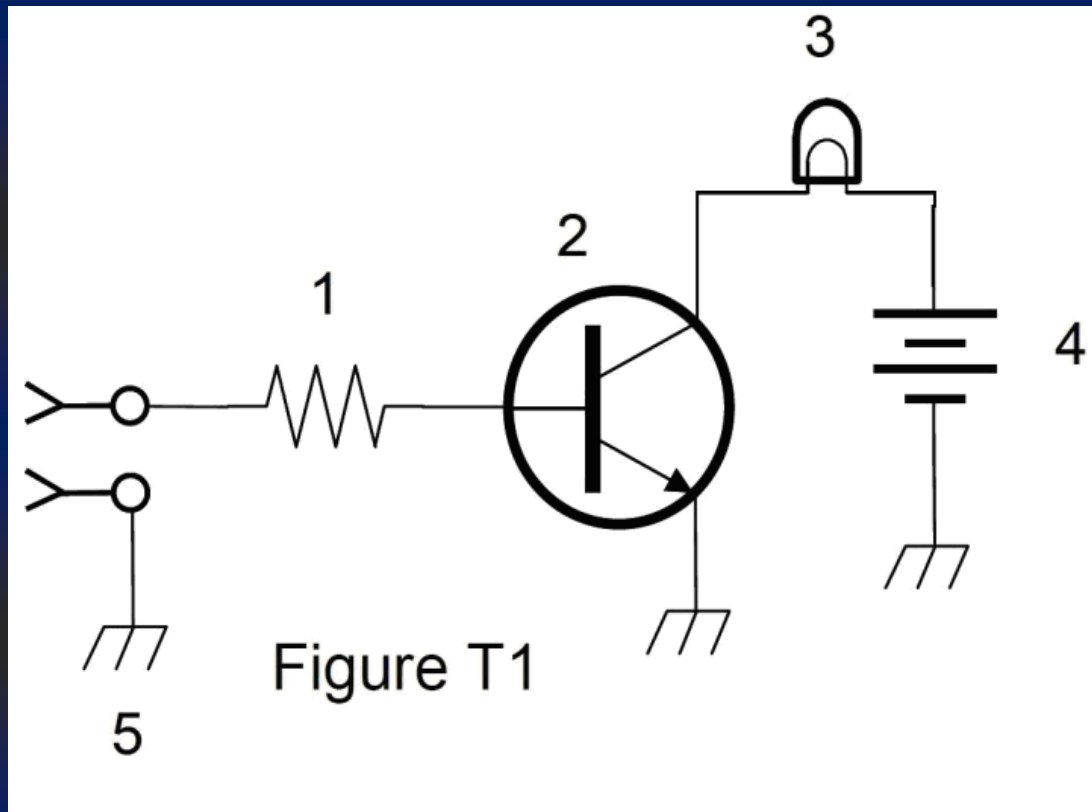
- **The symbols on an electrical schematic diagram represent electrical components.**

- **The way electrical components are interconnected accurately represent schematic diagrams.**

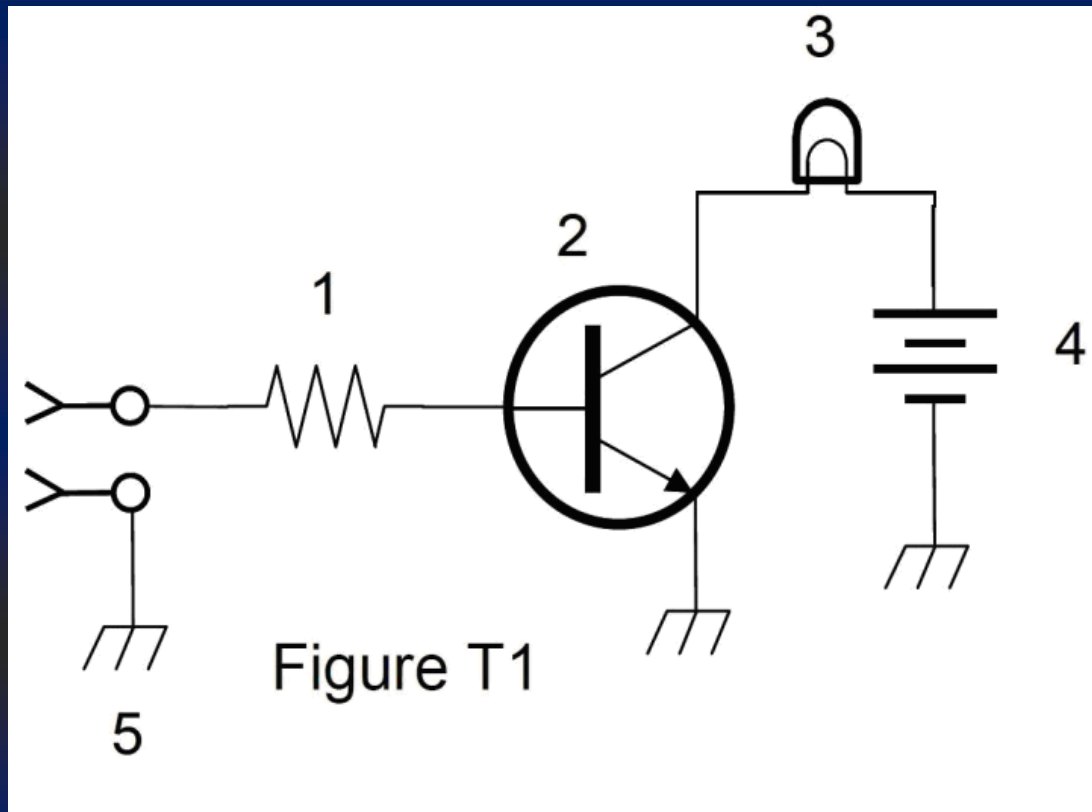
Here are the schematic symbols you will need to know to pass the Technician Class exam:



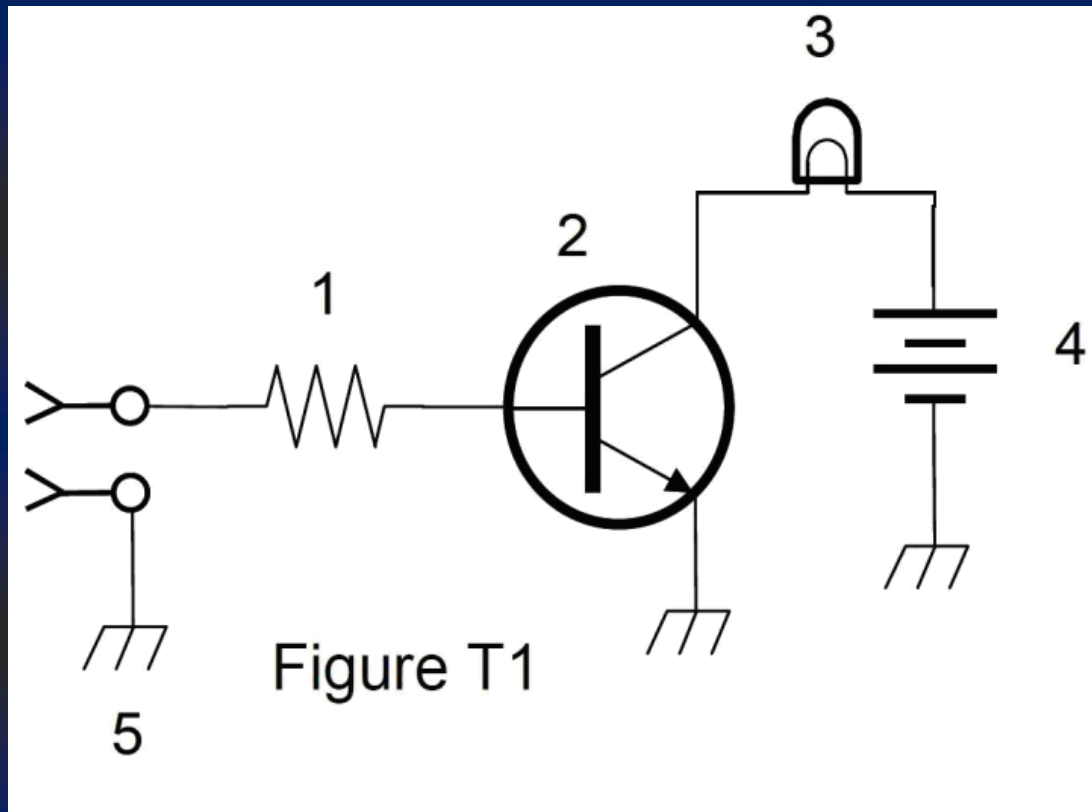
- Component 1 in figure T1 is a **resistor**.



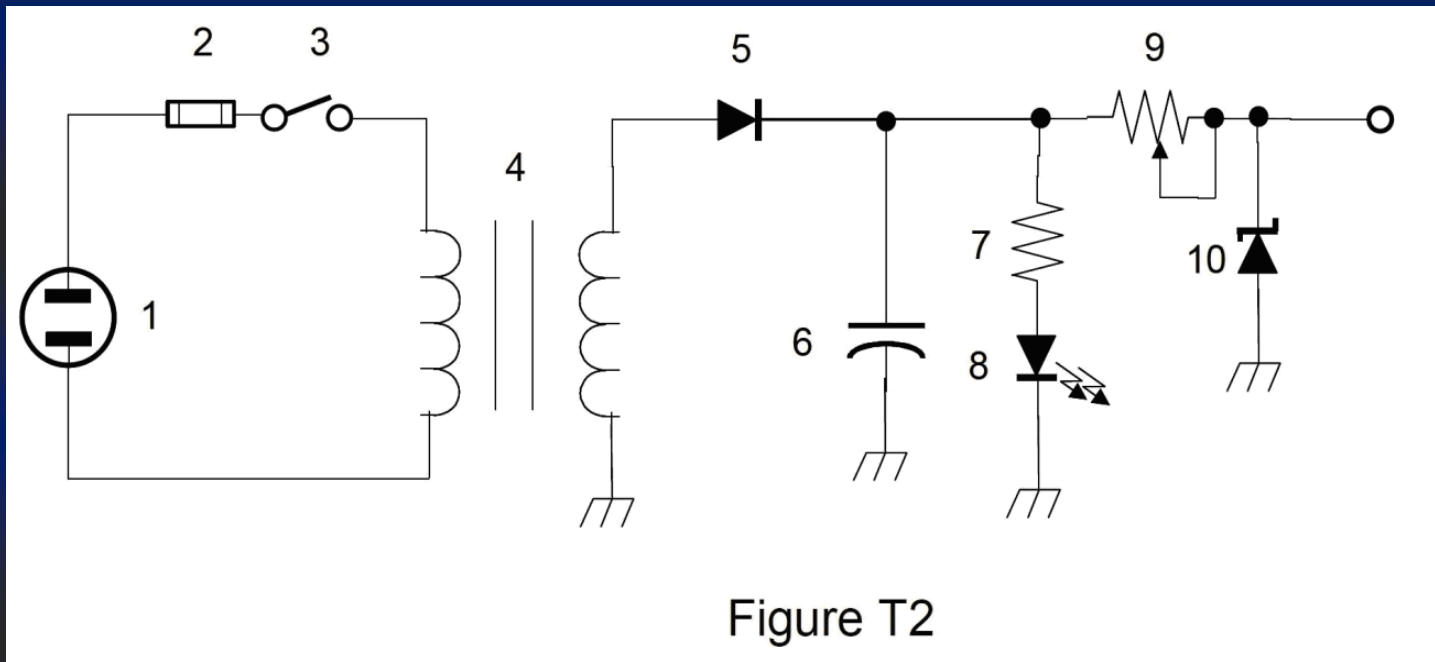
- Component 2 in figure T1 is a **transistor**.



- Component 3 in figure T1 is a **lamp**.



- **Component 4 in figure T1 is a battery.**



- Component 6 in figure T2 is a **capacitor**.

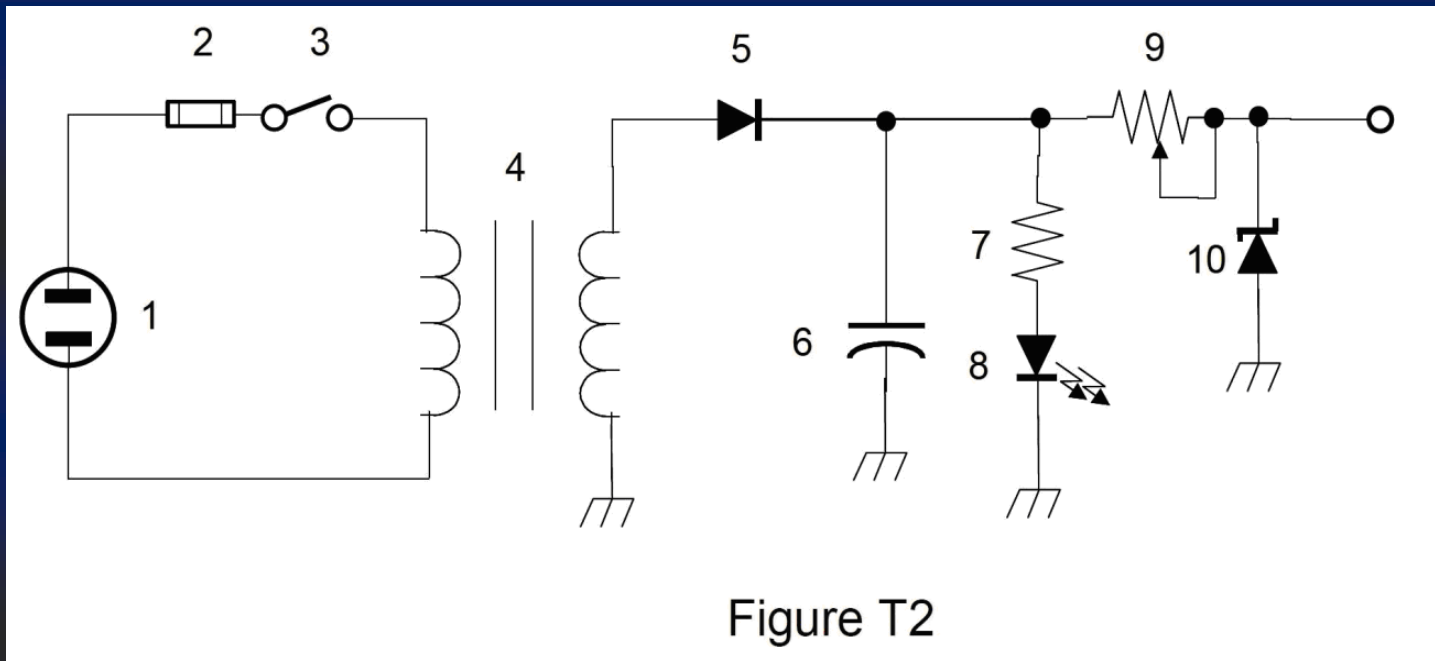
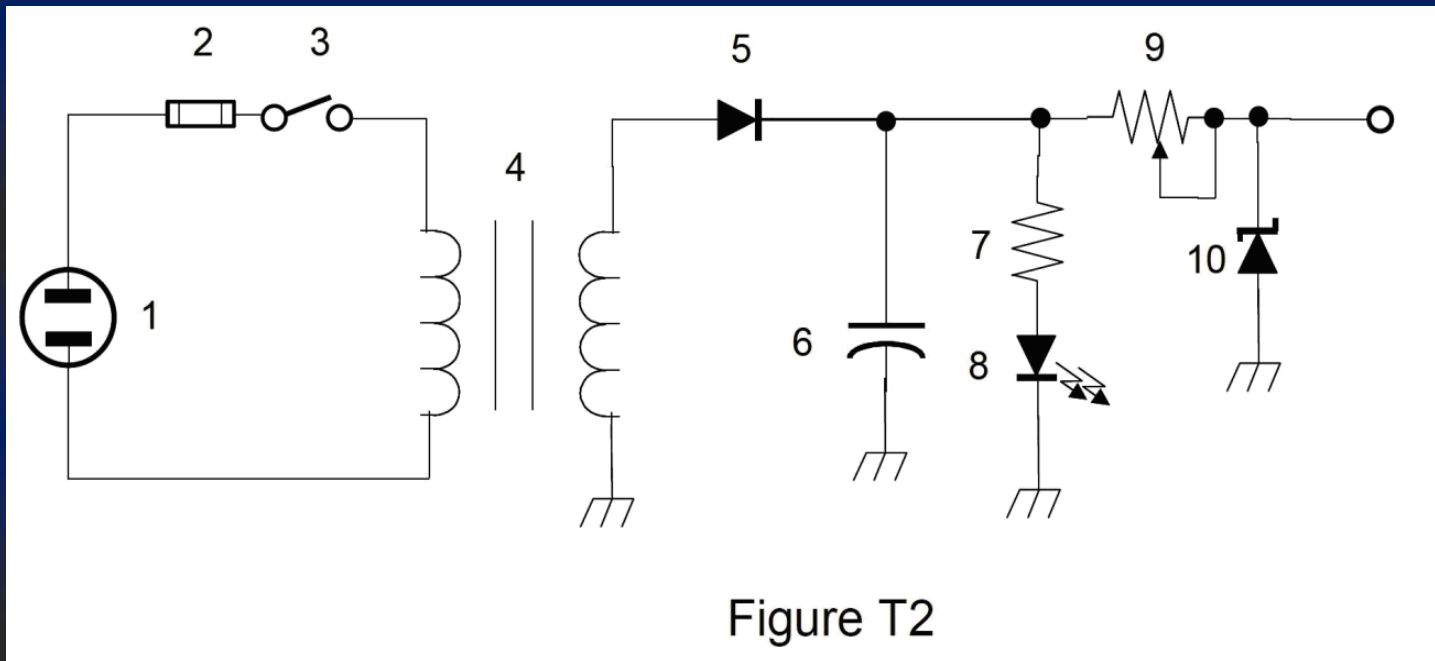
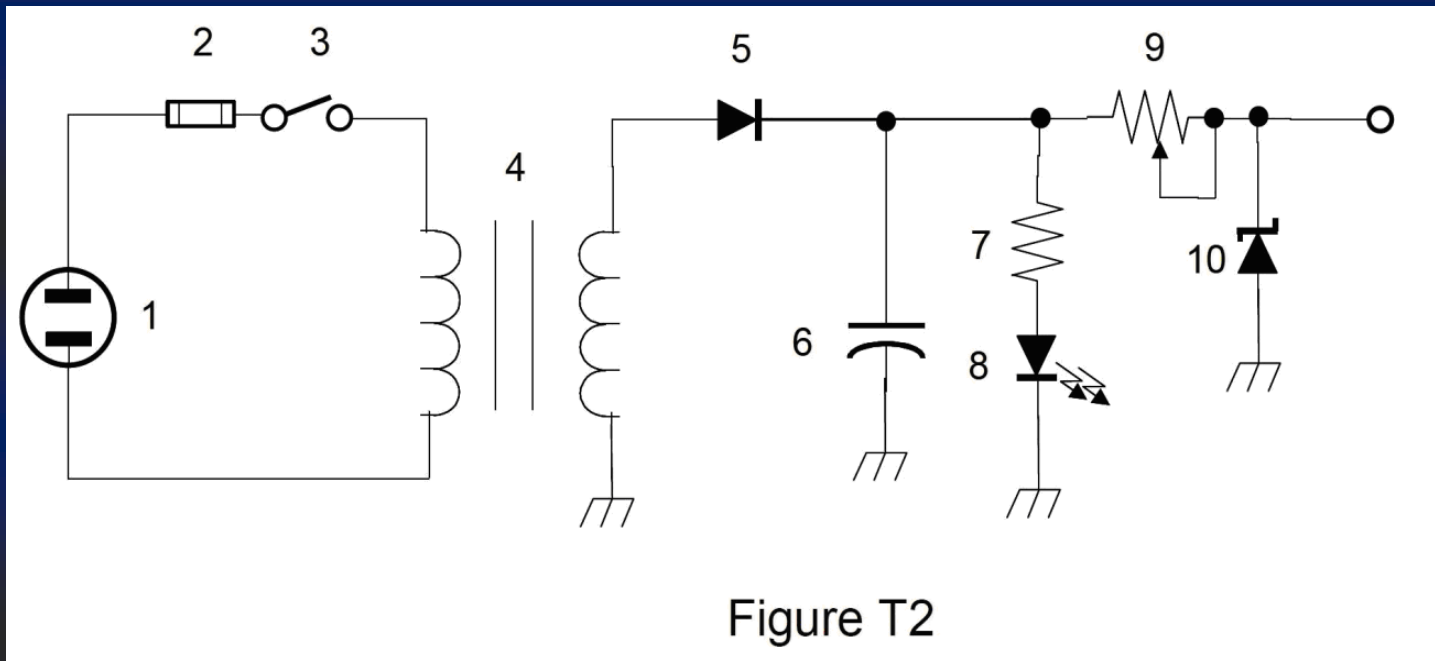


Figure T2

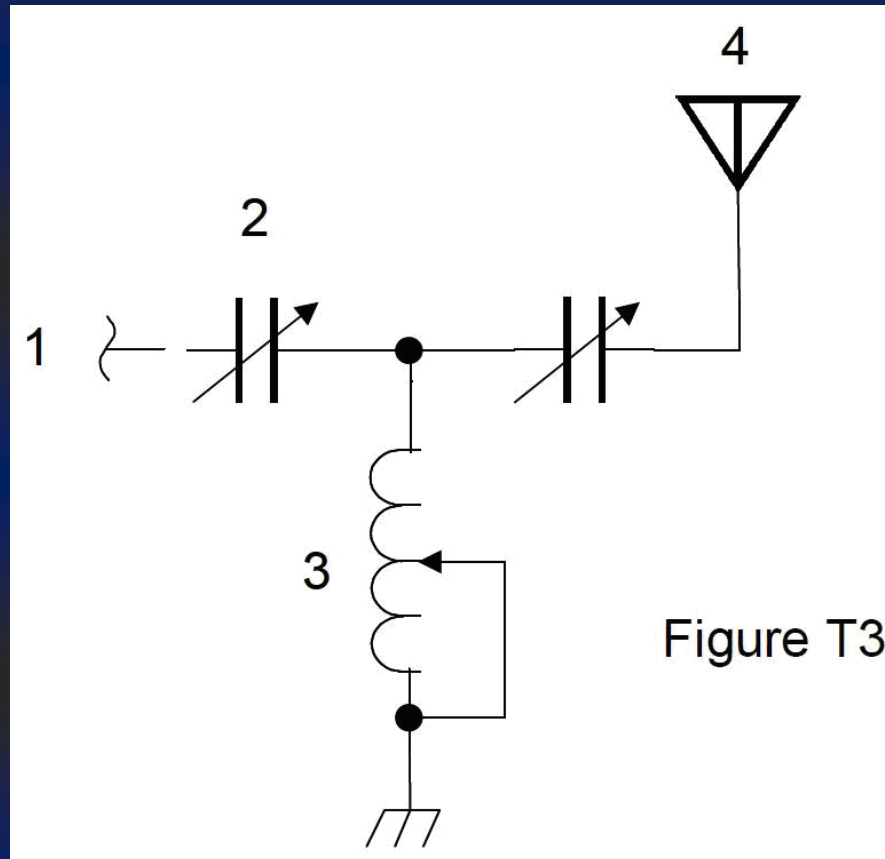
- Component 8 in figure T2 is a **light emitting diode.**



- Component 9 in figure T2 is a **variable resistor**.



- Component 4 in figure T2 is a **transformer**.



- Component 3 in figure T3 is a **variable inductor**.

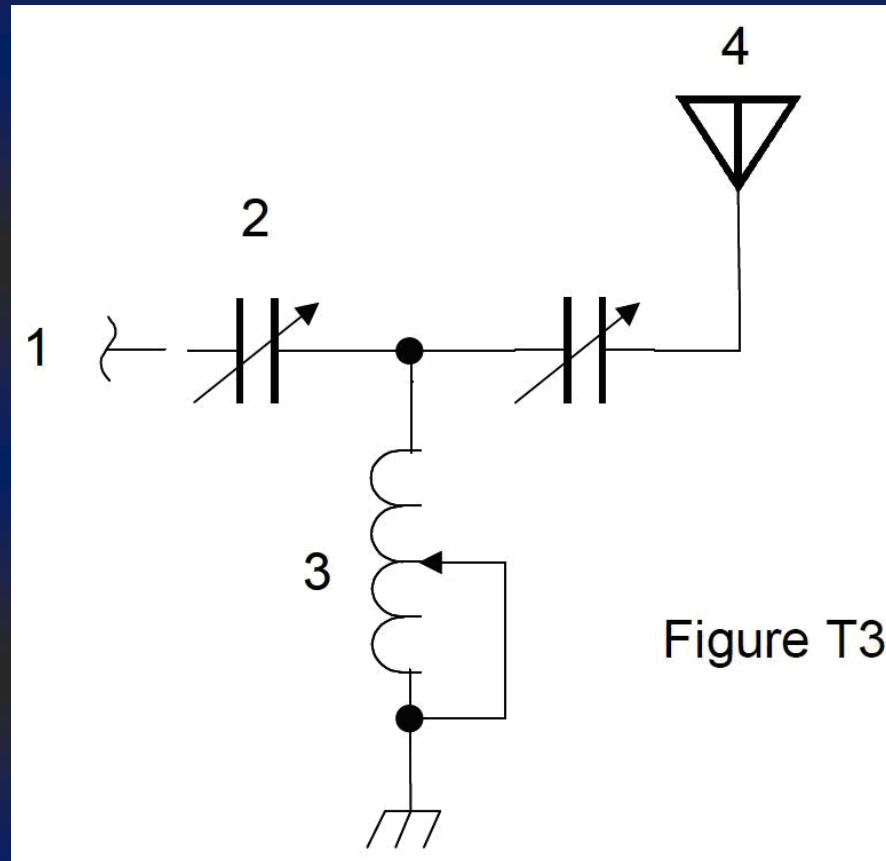


Figure T3

- Component 4 in figure T3 is an **antenna**.

T6C01

What is the name for standardized representations of components in an electrical wiring diagram?

- A. Electrical depictions**
- B. Grey sketch**
- C. Schematic symbols**
- D. Component callouts**

T6C01

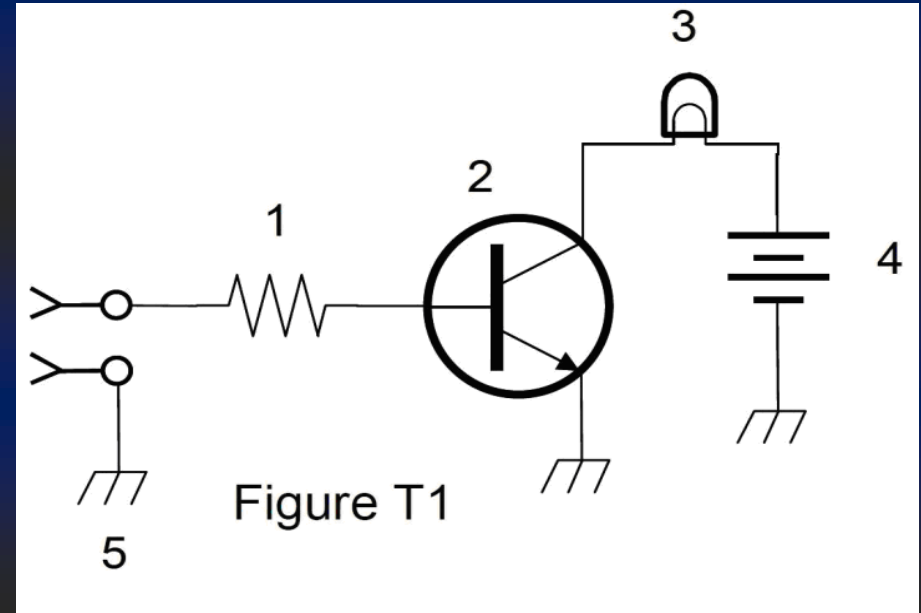
What is the name for standardized representations of components in an electrical wiring diagram?

C. Schematic symbols

T6C02

What is component 1 in figure T1?

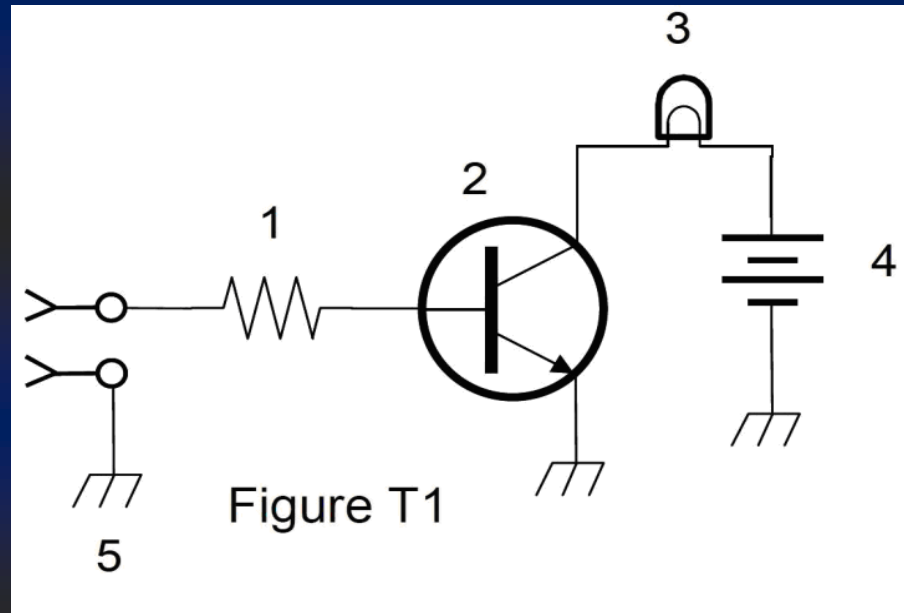
- A. Resistor
- B. Transistor
- C. Battery
- D. Connector



T6C02

What is component 1 in figure T1?

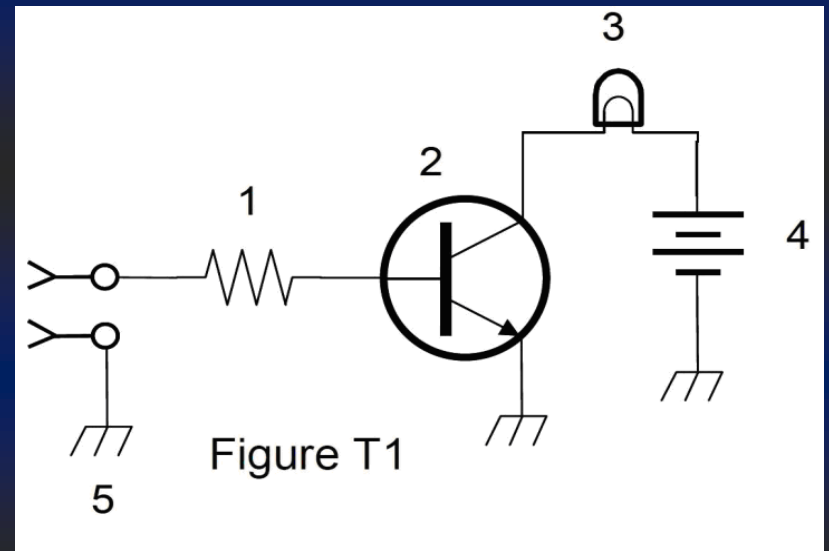
A. Resistor



T6C03

What is component 2 in figure T1?

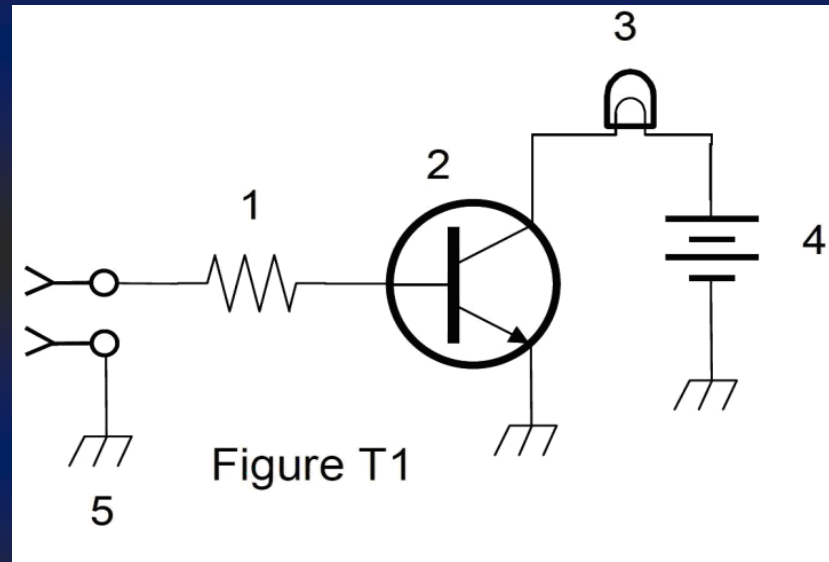
- A. Resistor
- B. Transistor
- C. Indicator lamp
- D. Connector



T6C03

What is component 2 in figure T1?

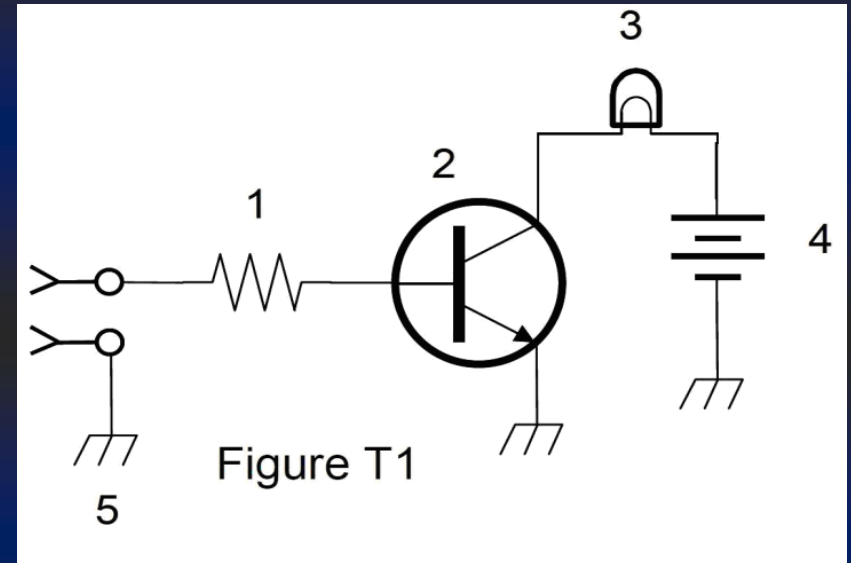
B. Transistor



T6C04

What is component 3 in figure T1?

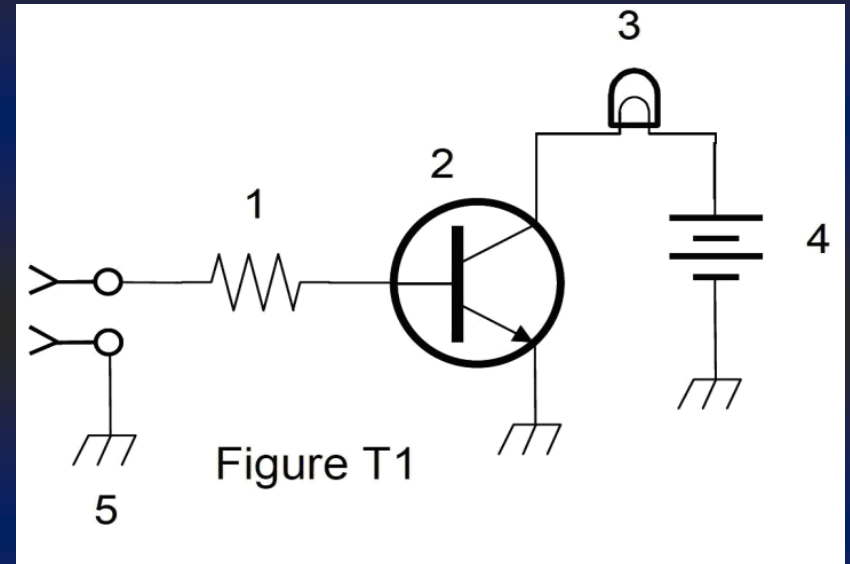
- A. Resistor
- B. Transistor
- C. Lamp
- D. Ground symbol



T6C04

What is component 3 in figure T1?

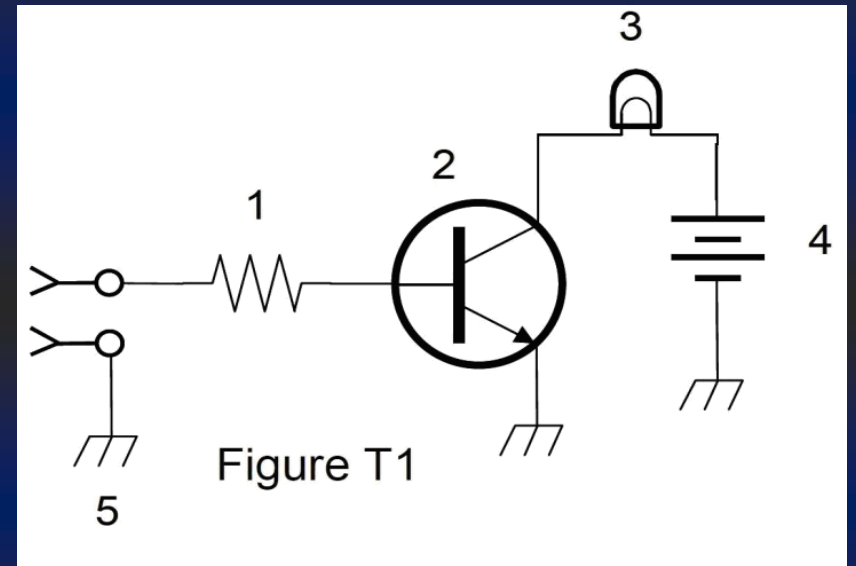
C. Lamp



T6C05

What is component 4 in figure T1?

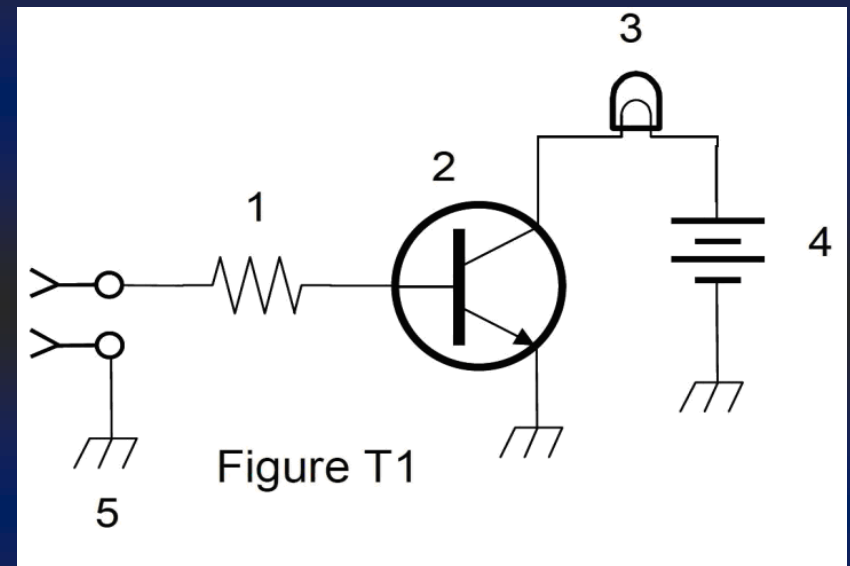
- A. Resistor
- B. Transistor
- C. Battery
- D. Ground symbol



T6C05

What is component 4 in figure T1?

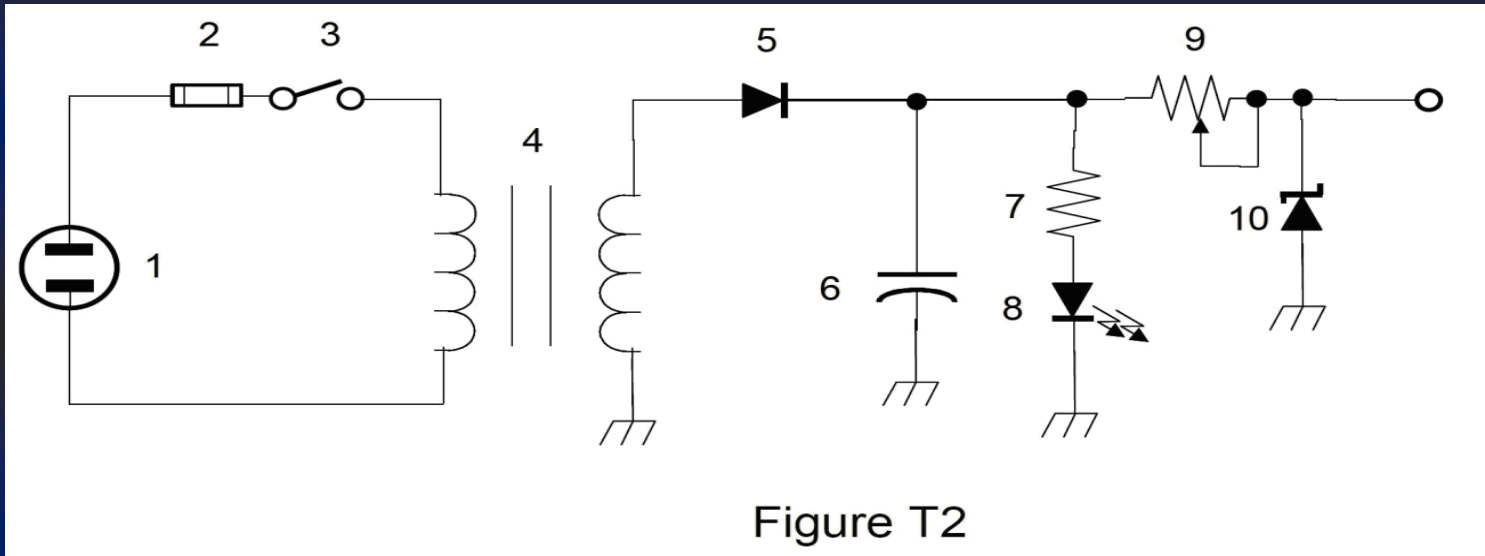
C. Battery



T6C06

What is component 6 in figure T2?

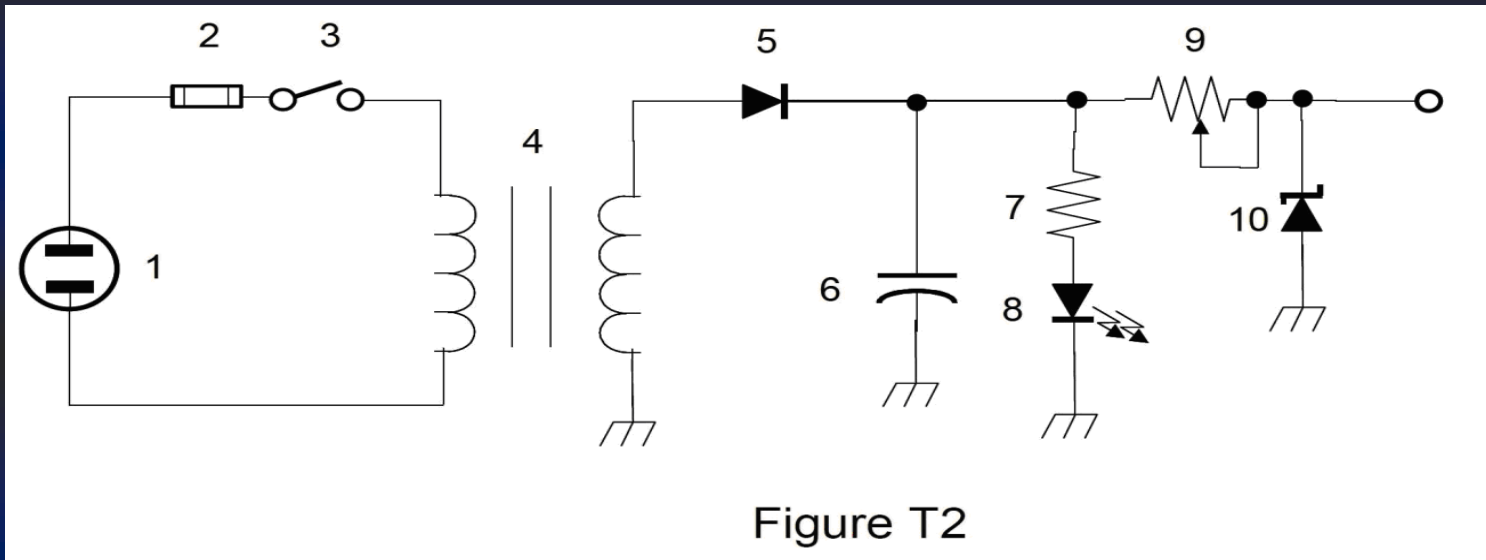
- A. Resistor
- B. Capacitor
- C. Regulator IC
- D. Transistor



T6C06

What is component 6 in figure T2?

B. Capacitor



T6C07

What is component 8 in figure T2?

- A. Resistor
- B. Inductor
- C. Regulator IC
- D. Light emitting diode

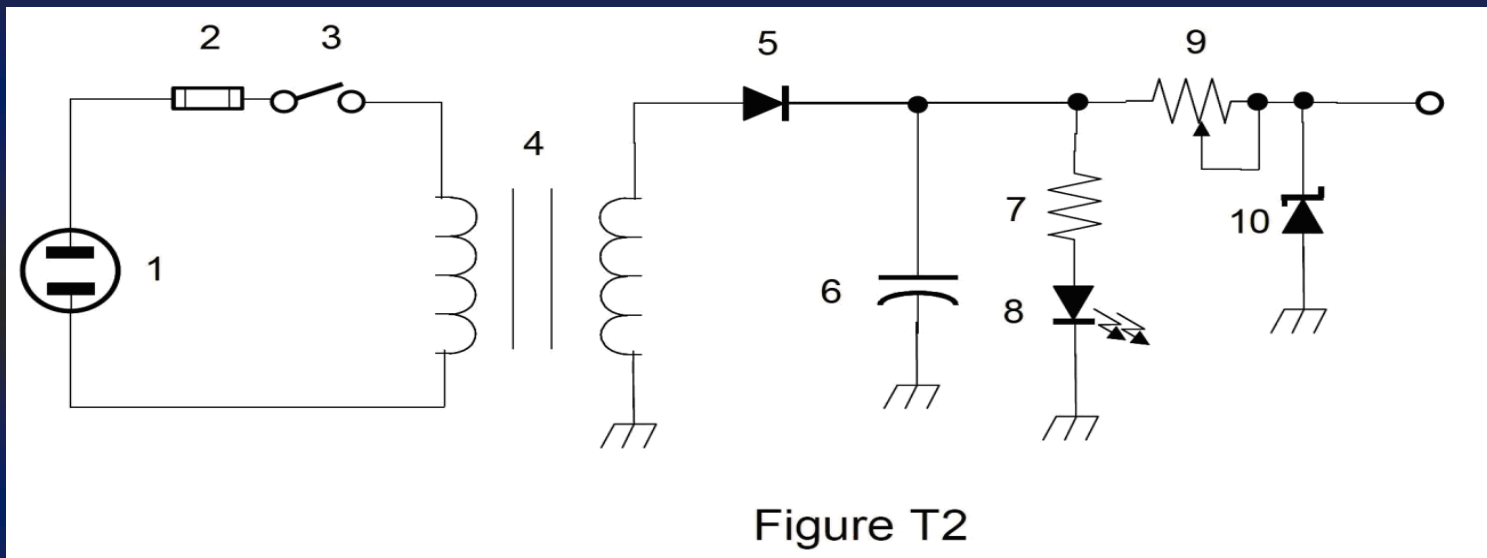
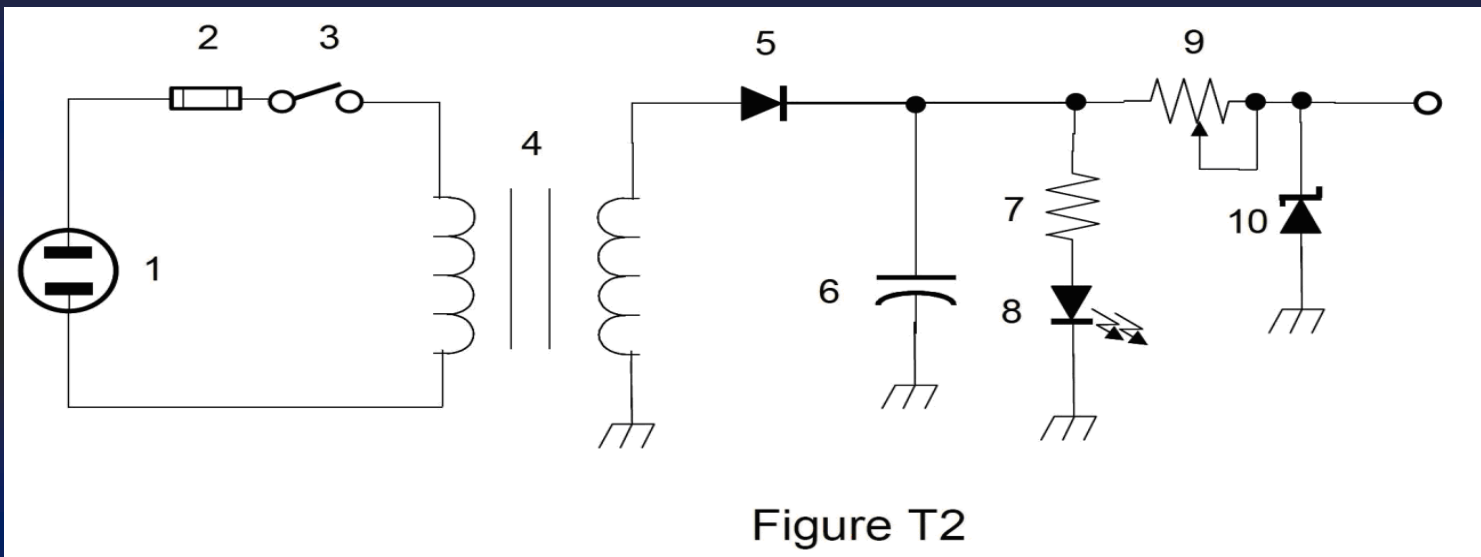


Figure T2

T6C07

What is component 8 in figure T2?

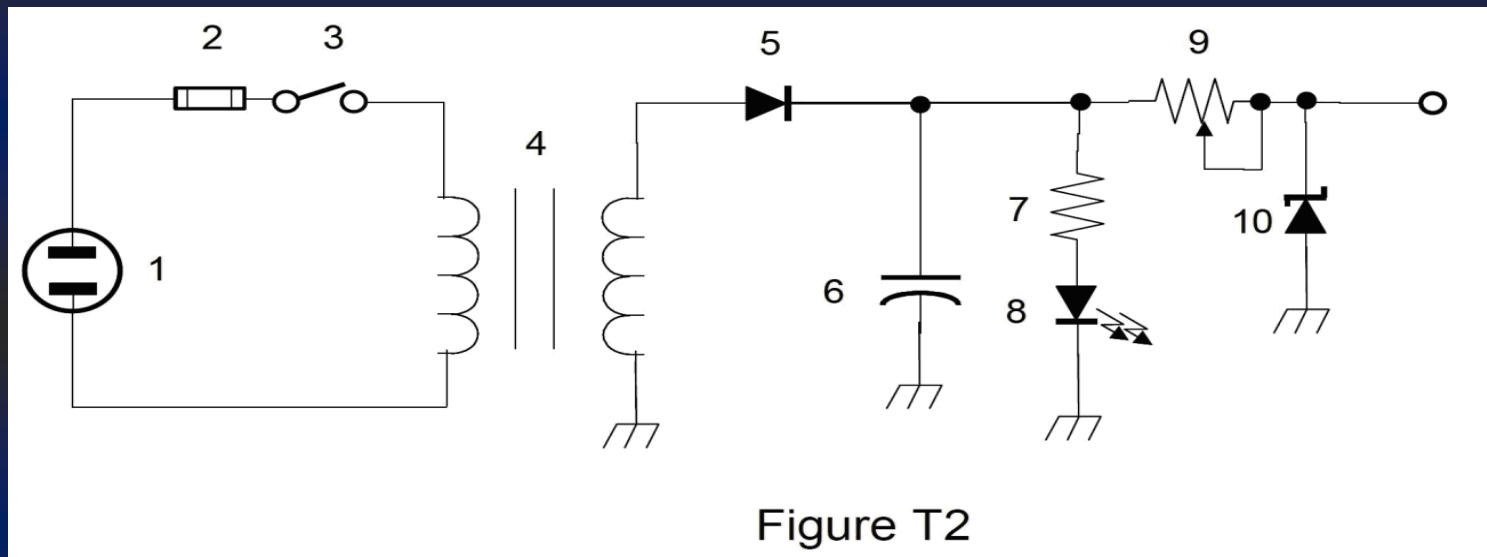
D. Light emitting diode



T6C08

What is component 9 in figure T2?

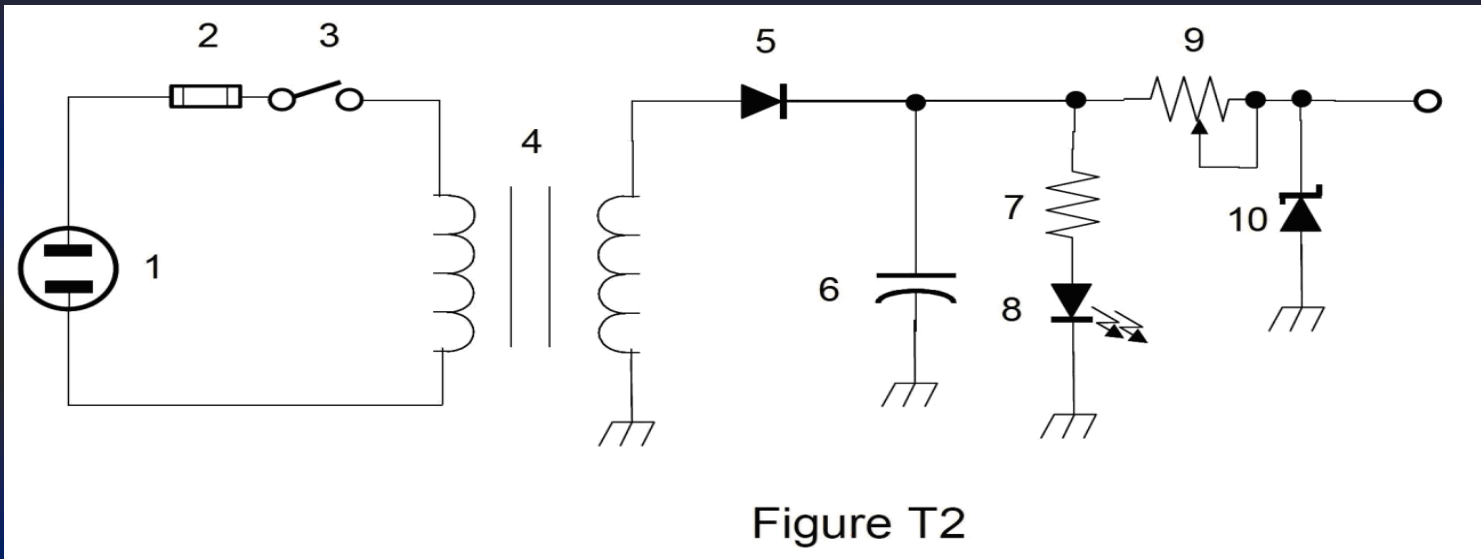
- A. Variable capacitor
- B. Variable inductor
- C. Variable resistor
- D. Variable transformer



T6C08

What is component 9 in figure T2?

C. Variable resistor



T6C09

What is component 4 in figure T2?

- A. Variable inductor
- B. Double-pole switch
- C. Potentiometer
- D. Transformer

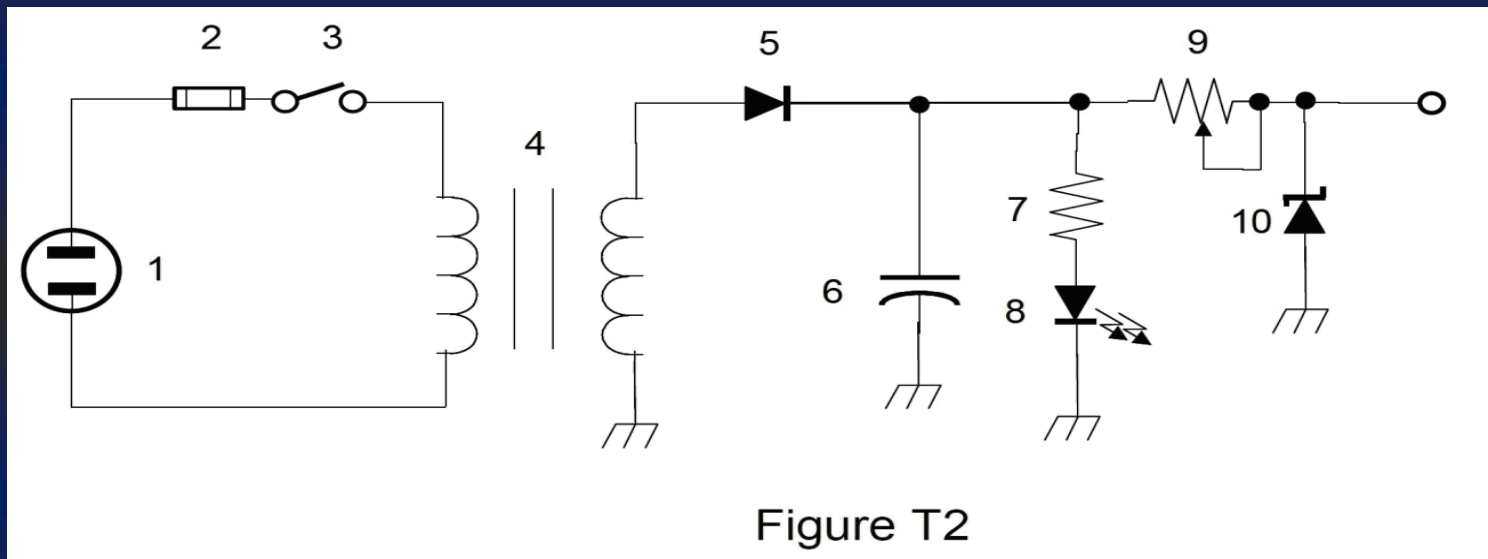


Figure T2

T6C09

What is component 4 in figure T2?

D. Transformer

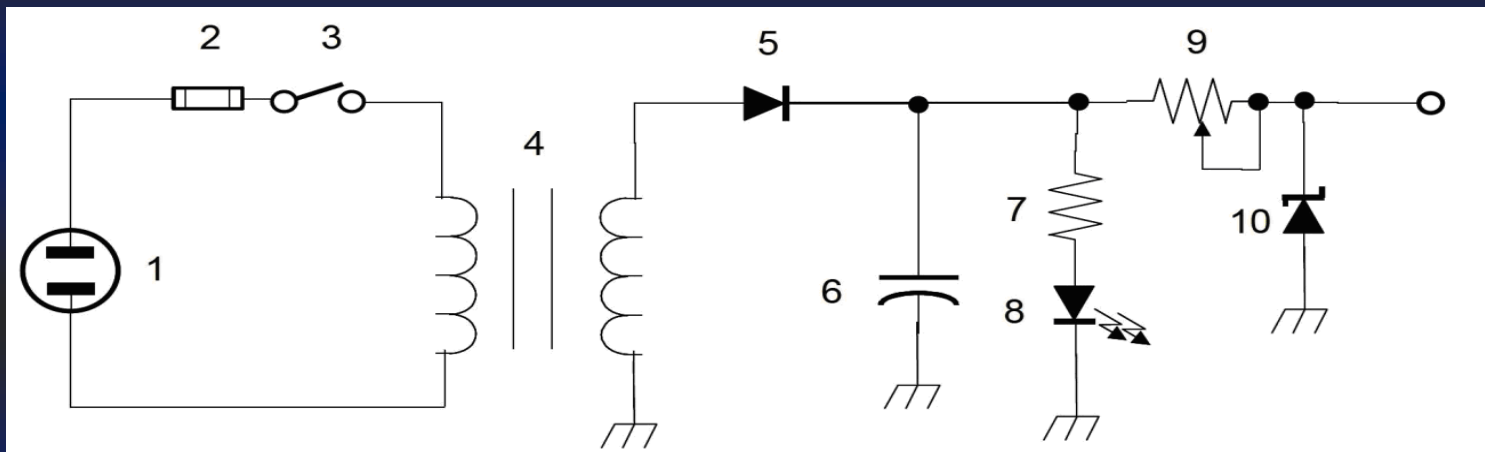


Figure T2

T6C10

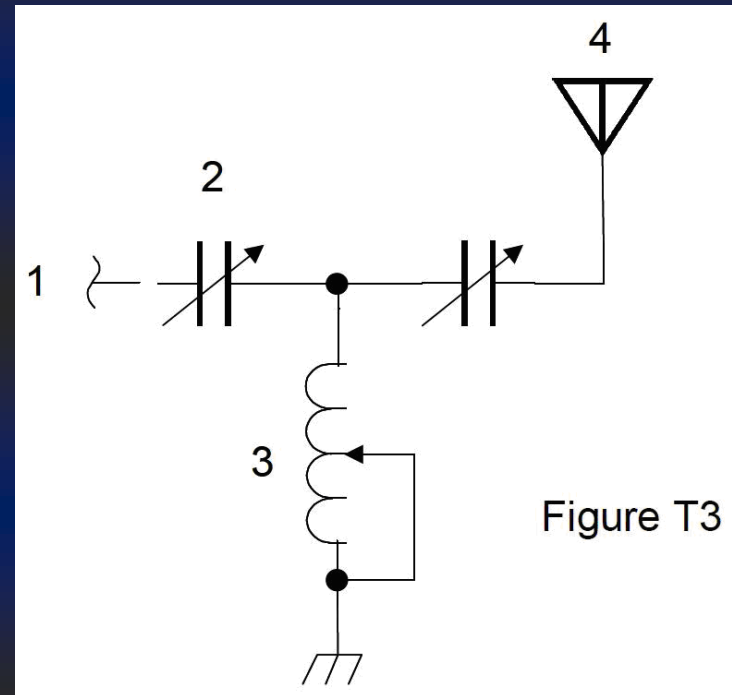
What is component 3 in figure T3?

A. Connector

B. Meter

C. Variable capacitor

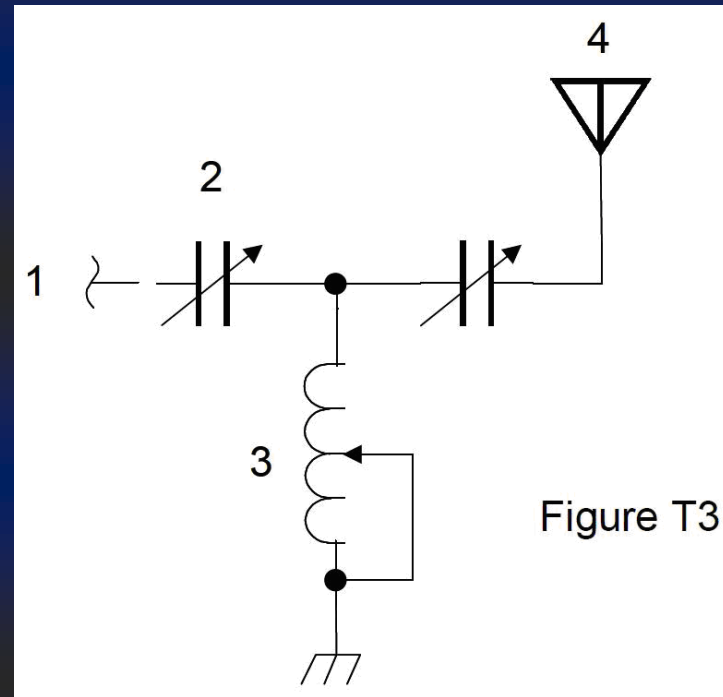
D. Variable inductor



T6C10

What is component 3 in figure T3?

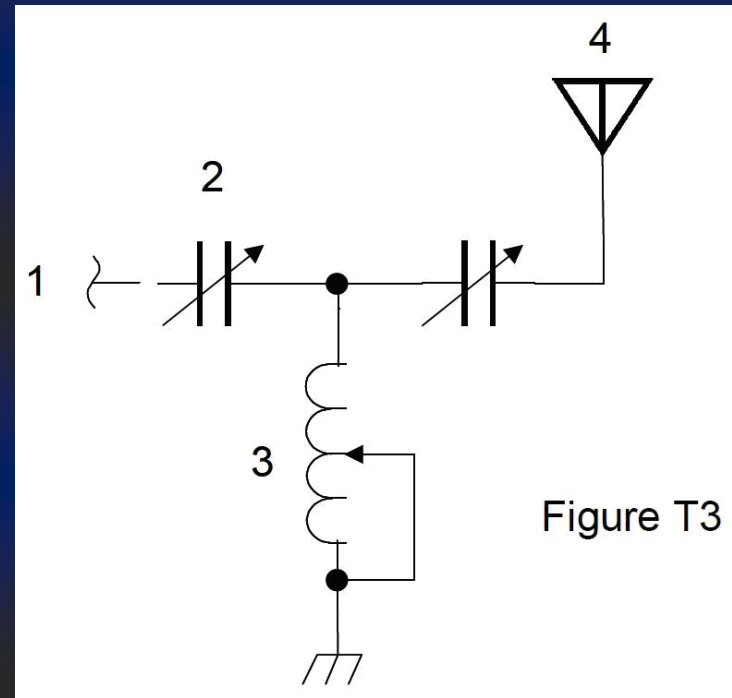
D. Variable inductor



T6C11

What is component 4 in figure T3?

- A. Antenna
- B. Transmitter
- C. Dummy load
- D. Ground



T6C11

What is component 4 in figure T3?

A. Antenna

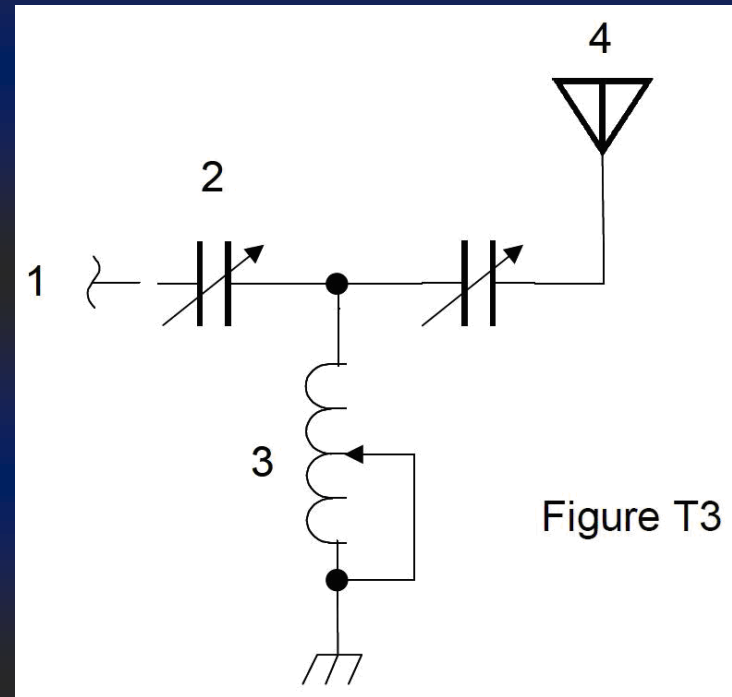


Figure T3

T6C12

What do the symbols on an electrical circuit schematic diagram represent?

- A. Electrical components**
- B. Logic states**
- C. Digital codes**
- D. Traffic nodes**

T6C12

What do the symbols on an electrical circuit schematic diagram represent?

A. Electrical components

T6C13

Which of the following is accurately represented in electrical circuit schematic diagrams?

A. Wire lengths

B. Physical appearance of components

C. The way components are interconnected

D. All of these choices are correct

T6C13

Which of the following is accurately represented in electrical circuit schematic diagrams?

C. The way components are interconnected

T6D –

**Component functions:
rectification; switches;
indicators; power supply
components; resonant circuit;
shielding; power transformers;
integrated circuits**

Rectifiers change an alternating
into a varying direct current.
Remember previously it was
said that a diode will convert AC
to DC?

Well, a rectifier is nothing more than a diode rated for the current level at which a power supply would be designed for.

There are ways to configure multiple rectifiers so that the convert DC component is a less pulsating or varying current signal.

A **transformer** is a component commonly used to change 120V AC house current to a lower AC voltage for other uses.

**Remember that our mobile and
most base radios require 12
Volts DC.**

In order for a power supply to reduce the 117 Volts AC down to something our equipment expects to see, one needs to use a transformer.

A **regulator** is a type of circuit that controls the amount of voltage from a power supply.

A regulator is used in conjunction with the transformer, rectifier, and other circuitry in a power supply to keep a power supply regulated very closely to the 12 volts required by today's ham radios.

**A switch controlled by an
electromagnet best describes a
relay.**

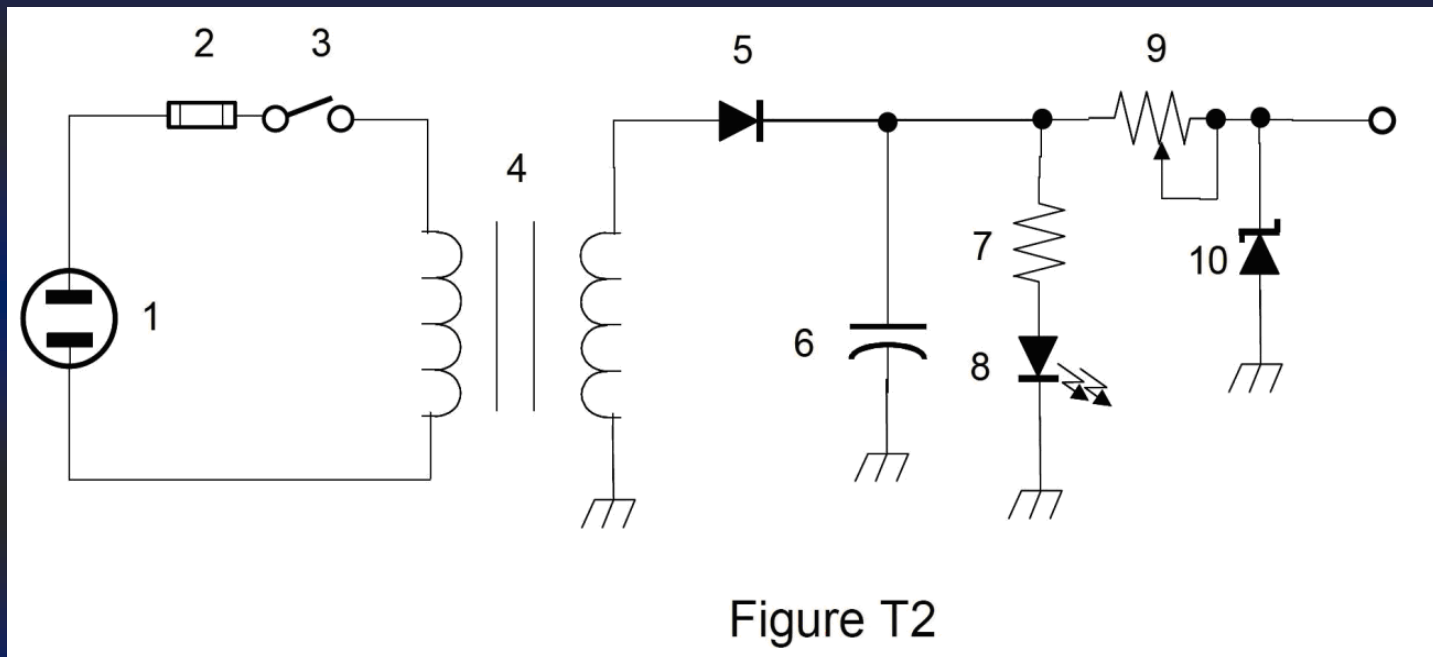
A relay is usually used in some remote application. A good example of a relay would be a remote antenna switch out on a hams radio tower.

**There would be multiple relays
built into this switch so that
many different antennas may be
selected.**

All the individual antenna feed lines would go to this switch but only one feed line would go into the radio room (called “radio shack” or just “the shack” in ham lingo).

The remote antenna switch would be controlled by a manual switch at the operating desk which will feed voltage to the selected antenna relay, thus energizing the electromagnet and engaging the relay.

A single-pole single-throw switch is represented by item 3 in figure T2



T6D01

Which of the following devices or circuits changes an alternating current into a varying direct current signal?

A. Transformer

B. Rectifier

C. Amplifier

D. Reflector

T6D01

Which of the following devices or circuits changes an alternating current into a varying direct current signal?

B. Rectifier

T6D02

What best describes a relay?

- A. A switch controlled by an electromagnet**
- B. A current controlled amplifier**
- C. An optical sensor**
- D. A pass transistor**

T6D02

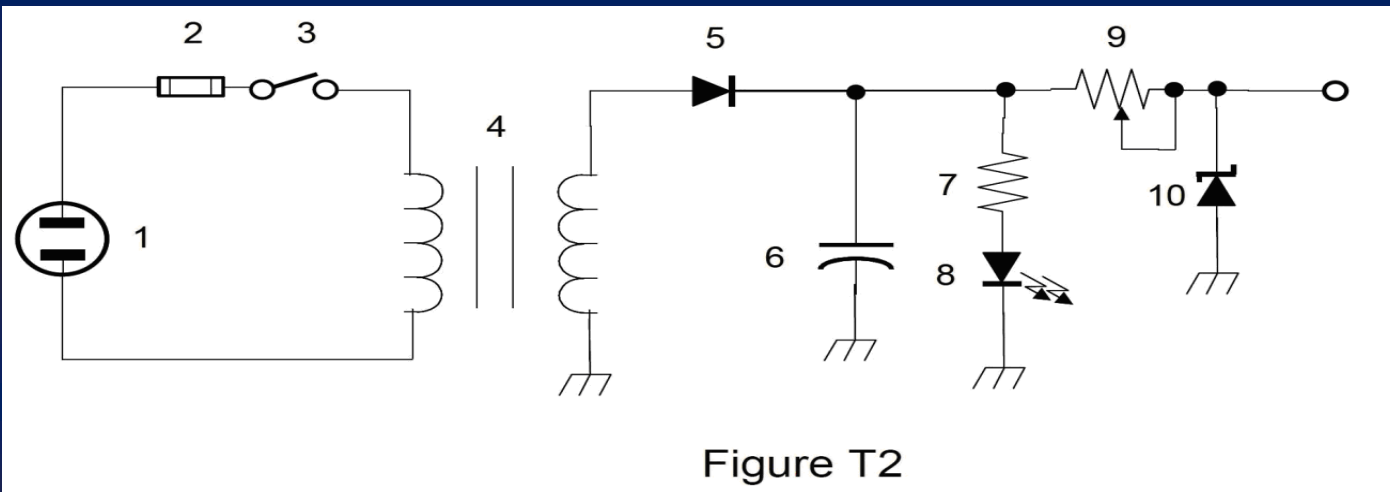
What best describes a relay?

A. A switch controlled by an electromagnet

T6D03

What type of switch is represented by item 3 in figure T2?

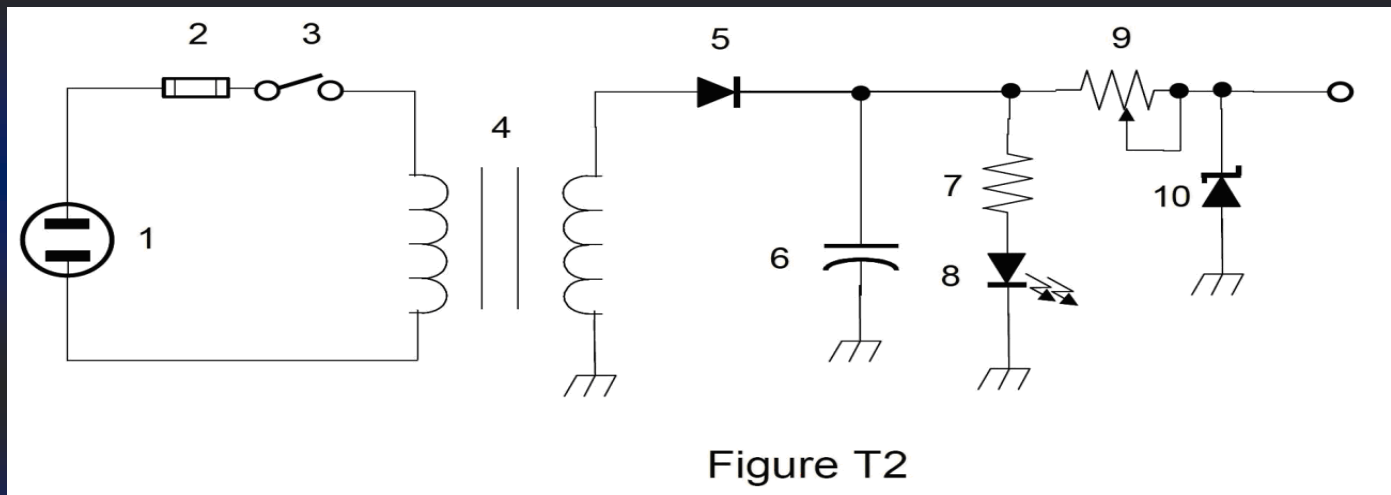
- A. Single-pole single-throw
- B. Single-pole double-throw
- C. Double-pole single-throw
- D. Double-pole double-throw



T6D03

What type of switch is represented by item 3 in figure T2?

A. Single-pole single-throw



T6D05

What type of circuit controls the amount of voltage from a power supply?

- A. Regulator**
- B. Oscillator**
- C. Filter**
- D. Phase inverter**

T6D05

What type of circuit controls the amount of voltage from a power supply?

A. Regulator

T6D06

What component is commonly used to change 120V AC house current to a lower AC voltage for other uses?

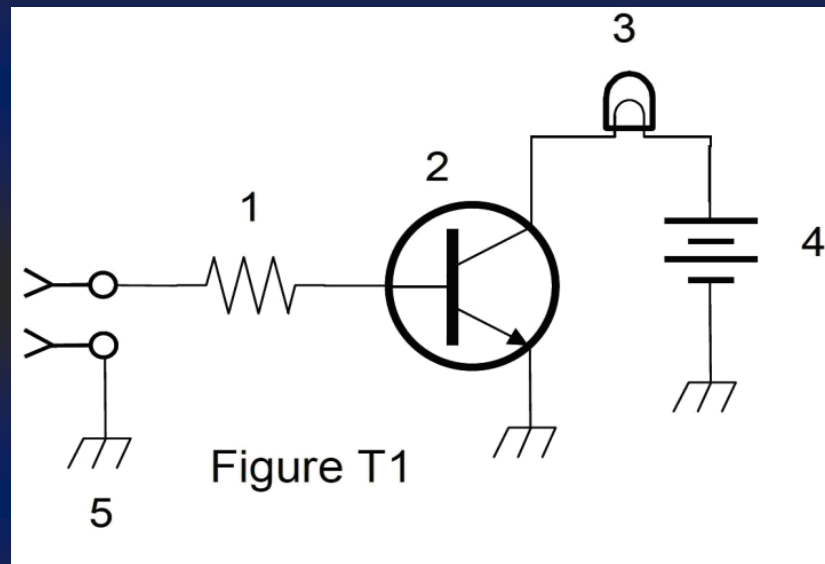
- A. Variable capacitor**
- B. Transformer**
- C. Transistor**
- D. Diode**

T6D06

What component is commonly used to change 120V AC house current to a lower AC voltage for other uses?

B. Transformer

To **control the flow of current** is the function of component 2 in Figure T1. We have already talked about transistors. This is what a transistor does.



Integrated circuit is the name of a device that combines several semiconductors and other components into one package.

An integrated circuit can contain hundreds of diodes, transistors, and other components in a size often smaller than your thumbnail. And they are getting smaller!

A capacitor is used together with an inductor to make a tuned circuit. In a receiver or transmitter, this could determine your frequency or affect how much power goes to the antenna.

An inductor and a capacitor connected in series or parallel to form a filter is an example of a simple resonant or tuned circuit.

It is common practice to use shielded wire **To prevent coupling of unwanted signals to or from the wire.**

An example of this might be using shielded wire from a tuned circuit to the oscillator circuit in a transmitter.

A **meter** can be used to display signal strength on a numeric scale. This is called an “S” meter and is a common way to display the relative signal strength of the station being received.

An **LED** is commonly used as a visual indicator. This has been mentioned previously. It is mentioned here again simply because there is one question pertaining to it in this section.

T6D04

Which of the following can be used to display signal strength on a numeric scale?

A. Potentiometer

B. Transistor

C. Meter

D. Relay

T6D04

Which of the following can be used to display signal strength on a numeric scale?

C. Meter

T6D07

Which of the following is commonly used as a visual indicator?

A. LED

B. FET

C. Zener diode

D. Bipolar transistor

T6D07

Which of the following is commonly used as a visual indicator?

A. LED

T6D08

Which of the following is used together with an inductor to make a tuned circuit?

- A. Resistor**
- B. Zener diode**
- C. Potentiometer**
- D. Capacitor**

T6D08

Which of the following is used together with an inductor to make a tuned circuit?

D. Capacitor

T6D09

What is the name of a device that combines several semiconductors and other components into one package?

- A. Transducer**
- B. Multi-pole relay**
- C. Integrated circuit**
- D. Transformer**

T6D09

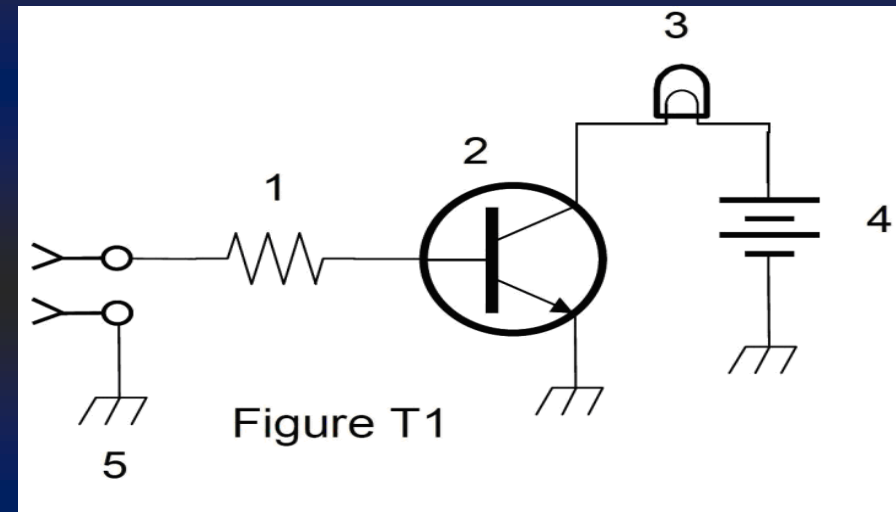
What is the name of a device that combines several semiconductors and other components into one package?

C. Integrated circuit

T6D10

What is the function of component 2 in Figure T1?

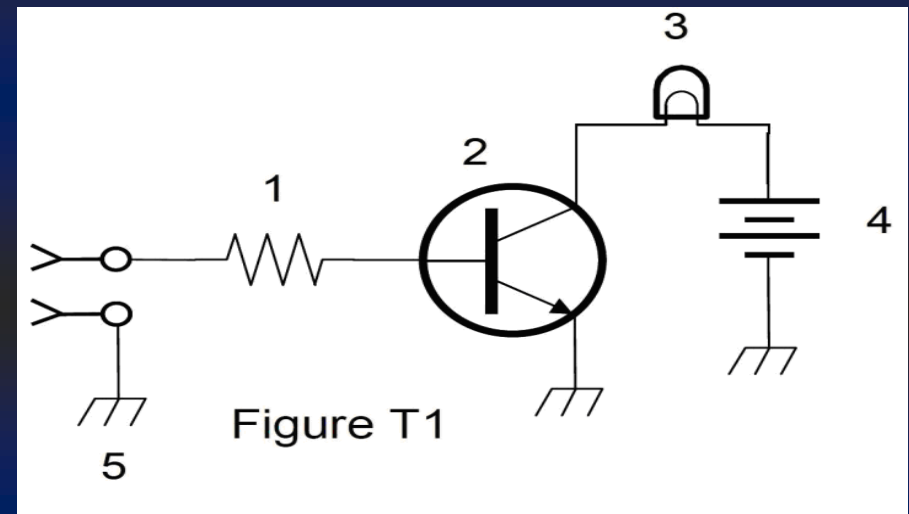
- A. Give off light when current flows through it**
- B. Supply electrical energy**
- C. Control the flow of current**
- D. Convert electrical energy into radio waves**



T6D10

What is the function of component 2 in Figure T1?

C. Control the flow of current



T6D11

What is a simple resonant or tuned circuit?

- A. An inductor and a capacitor connected in series or parallel to form a filter**
- B. A type of voltage regulator**
- C. A resistor circuit used for reducing standing wave ratio**
- D. A circuit designed to provide high fidelity audio**

T6D11

What is a simple resonant or tuned circuit?

A. An inductor and a capacitor connected in series or parallel to form a filter

T6D12

Which of the following is a common reason to use shielded wire?

A. To decrease the resistance of DC power connections

B. To increase the current carrying capability of the wire

C. To prevent coupling of unwanted signals to or from the wire

D. To couple the wire to other signals

T6D12

Which of the following is a common reason to use shielded wire?

C. To prevent coupling of unwanted signals to or from the wire