Continue



```
Contributors: MikeGrusin Welcome to circuits 101! One of the first things you'll encounter when learning about electronics is the concept of a circuit. This tutorial will explain what a circuit is, as well as discuss voltage in further detail. A simple circuit, involving a button, an LED, and a resistor, built two different ways. Suggested Reading There are a
few concepts you should have a good understanding of to help you get the most out of this tutorial. You've probably heard that a battery or a wall outlet has a certain number of volts. This is a measurement of the electrical potential produced by the battery, or the utility grid connected to the wall outlet. All those volts are sitting there waiting for you
to use them, but there's a catch: in order for electricity to do any work, it needs to be able to move. It's kind of like a blown-up balloon; if you pinch it off, there is air in there that could do something if it's released, but it won't actually do anything until you let it out. Unlike air coming out of a balloon, electricity can only flow through materials that can
conduct electricity, such as copper wire. If you connect a wire to a battery or wall outlet (WARNING: the voltage in a wall outlet is dangerous, don't do this!), you will be giving the electricity won't have anywhere to go and still won't move. What makes electricity move?
Electricity wants to flow from a higher voltage and a lower voltage and a lower voltage, electricity will flow along that path. And if you create a conductive path between a higher voltage and a lower voltage, electricity will flow along that path. And if you
insert something useful into that path like an LED, the flowing electricity will do some work for you, like lighting up that LED. Huzzah! So, where do you find a higher voltage and a lower voltage? Here's something really useful to know: every source of electricity has two sides. You can see this on batteries, which have metal caps on both ends, or your
wall outlet that has two (or more) holes. In batteries and other DC (Direct Current) voltage sources, these sides (often called terminals) are named positive (or "-"). Why does every source of electricity to
flow. It sounds silly, but you can't have a difference without two things to be different. In any power supply, the positive side will have a higher voltage than the negative side is 0 volts, and the positive side is however many volts the supply can
provide. Electrical sources are like pumps. Pumps always have two sides, an outlet that blows something in. Batteries and generators and solar panels work the same way. Something inside them is hard at work moving electricity towards the outlet (the positive side), but all that electricity leaving the device
creates a void, which means that the negative side needs to pull electricity in to replace it.* What have we learned so far? Voltage is potential, but electricity needs a path to flow through, which must be an electricity needs to flow to do anything useful. Electricity needs a path to flow through, which must be an electricity needs to flow through the flow th
voltage. DC voltage sources always have two sides, called positive and negative, with the positive side a higher voltage than the negative side of a voltage source, through something that does some work such as a Light Emitting Diode (LED), and
back to the negative side of the voltage source; electricity, or current, will flow. And we can put things when current flows through them, like LEDs that light up. This circuit is a path that starts and stops at the
same place, which is exactly what we're doing. Click this link to see a simulation of current flowing through a simple circuit. This simulation requires Java to run. *Benjamin Franklin originally wrote that electrons actually flow
in the opposite direction - at the atomic level, they come out of the negative side and loop back to the positive side. Because engineers followed Franklin's lead for hundreds of years before the truth was discovered, we still use the "wrong" convention to this day. Practically speaking this detail doesn't matter, and as long as everyone uses the same
convention, we can all build circuits that work just fine. The reason we want to build circuits is to make electricity do useful things for us. The way we do that is by putting things are called loads, because they "load down" the power supply, just like you're
"loaded down" when you're carrying something. The same way you could be loaded down with too much weight, it's possible to load down a circuit too little - this may let too much current flow (imagine running too fast if you weren't
carrying any weight), which can burn out your parts or even the power supply. You'll learn all about voltage, current, and loads in the next tutorial: Voltage, Current, Resistance, and Ohm's Law. But for now, let's learn about two special cases of circuit: short circuit, and open circuit. Knowing about these will help tremendously when you're
troubleshooting your own circuits. Short Circuit DON'T DO THIS, but if you connect a wire directly from the positive to the negative side of a power supply, you'll create what is called a short circuit. This is a very bad idea. This seems like the best possible circuit, so why is it a bad idea? Remember that electrical current wants to flow from a higher
voltage to a lower voltage, and if you put a load into the current, you can do something useful like light up an LED. If you DO have a load in the current flow, which is usually a very small amount. However, if you DON'T put anything in to restrict the current flow,
there won't be anything to slow down the current, and it will try to be infinite! Your power supply can't provide as much as it can, which may be a lot. This could cause your wire to burn up, damage the power supply, drain your battery, or other exciting things. Most of the time your power supply will have some sort
of safety mechanism built into it to limit the maximum current in the event of a short circuit, but not always. This is the reason all homes and buildings have circuit breakers, to prevent fires from starting in the event of a short circuit somewhere in the wiring. A closely related problem is accidentally letting too much current flow through part of your
circuit, causing a part to burn up. This isn't quite a short circuit, but it's close. This most often happens when you use the incorrect resistor value, which lets too much current flow through another component such as an LED. The bottom line: if you notice that things are suddenly becoming hot or a part suddenly burns out, immediately turn off the
power and look for possible short circuit. The opposite of a short circuit at all). Unlike the short circuit where the loop isn't fully connected (and therefore this isn't really a circuit work either. If you're new at circuits, it can often be hard
to find where the break is, especially if you're using breadboards where all the conductors are hidden. If your circuit, so be sure to look for those as well.) TIP: if you can't
easily find where your circuit is open, a multimeter can be very useful tool. If you set it to measure voltage at various points in your powered circuit, and eventually find the point where voltage isn't getting through. You've just learned, in its most basic form, what a circuit is. As you keep learning, you'll encounter more
complex circuits that have multiple loops and many more electronic components. But ALL circuits, no matter how complex, will follow the same rules as the basic one-loop circuit you just learned about. Your journey into electronics is just beginning, here are some suggested next topics to explore: Breadboards are useful tools that let you quickly build
temporary circuits using jumper wires. We use them all the time. You also may want to master working with wire to help you build your circuits. A multimeter lets you measure voltage, current, and resistance and is a great help when trying to troubleshoot malfunctioning circuits. Circuits come in all different sizes, shapes, and configurations. Check
out the series vs parallel circuits tutorial to see circuits taken to the next level. Here are some tutorials on the most components you'll use when building circuits taken to the next level. Here are some tutorials on the most widely used components in
circuits. Capacitors are also found in most circuits are the basis of electronics, so, let's take a few moments to break them down and discuss what they actually are. A circuit is a loop through which current can flow. A power source, such as a battery, provides the energy for the circuit to work. Electrons flow from the negative
side of the power source, through the circuit is complete. Our favorite example of a simple circuit is connected to the power source, the circuit is connected to the power source, the circuit is an LED connected to a battery. When the negative lead on the LED is connected to the negative side of the power source, the circuit is an LED connected to a battery.
connected to the positive side, power flows from the battery through the LED, causing the LED, causing the LED to light up. Components of a Circuit At their base level, circuits can be broken down into three parts: Voltage Source - this provides the electrons that flow through the circuit in order to power it. Common voltage sources are batteries and electrical
connections such as outlets. Load - this consumes the power created by the voltage source. Loads are what make a circuit light up, make noise, run a program and more. In simple circuits, the load may be a single light bulb, but in more complex circuits, the load may be a combination of resistors, capacitors, light bulbs, buzzers and more.
Conductive Path - this is the route the current follows through the circuit. It must be made of conductive materials in order to allow electricity to flow. The path starts at the voltage source, travels through the load and returns to the voltage source. In order to allow electricity to flow.
provide power, circuits must be closed. This happens when a complete loop is formed from one side of the voltage source to the other side. If there are any interruptions in this loop, the electrons cannot complete their loop, creating an open circuit. Technically speaking, the term "open circuit" is an oxymoron since the very definition of a circuit
requires a closed loop. However, the term "open circuit" is often used to refer to a circuit that has been broken on purpose (through something like a switch or button) or through an error (such as a broken or loose component). Short Circuits When the conductive path of a circuit connects directly from one end of the voltage source to the other
without first powering a load, the result is a short circuit. Photo Credit: Dummies Current flows everywhere it can, and if it can find a shorter path, it will take it. This is why conductive wires are coated in an insulator - to prevent accidental short-circuiting through wires touching. Short circuits can be very dangerous and cause wires to burn up,
damage the power supply, drain the battery, start a fire and more. Most of the time your power supply will have some sort of safety mechanism built into it to limit the maximum current in the event of a short circuit, but not always. This is the reason all homes and buildings have circuit breakers, to prevent fires from starting in the event of a short circuit, but not always.
circuit somewhere in the wiring. If you notice a part of your circuit suddenly becoming hot or a part suddenly burns out, immediately turn off the power and look for possible short circuits. It is important to note that current does not limit itself to choosing just one path, it will take every available path it can find. Which means that even if a short
circuit is present, a small amount of power may still be supplied to your load. Going Further Now that you know what a circuit is, it's time to try building one. As we mentioned above, we love starting with just a battery and an LED. From there, try adding more components through a paper circuit, which uses copper tape to build the conductive path
or by building a circuit on a breadboard using jumper wires, resistors and LEDs. Take a look at the SparkFun Inventor's Kit Guidebook to learn more about building your own circuits. We're developing a physician-focused, patient-
centric process that will revolutionize how people engage with their healthcare. Learn About Us Understanding the fundamentals of electricity and electronics starts with grasping the concept of a circuit. In this article, we will delve deep into what a circuit is, how it works, the different types of electric circuits, and more. Whether you're a student,
hobbyist, or just curious about the world of electronics, this guide will provide you with a solid foundation. Basic Definition A circuit, in the context of electronics engineering, is a closed path through which electric current flows. This path can be as simple as a single wire connected to a battery and a light bulb or as complex as the
integrated circuits found in modern computers. A simple Electric Circuit The essential components include a power source (like a battery), conductive path (such as wires), and a load (which could be a light bulb, resistor, or any device that uses electricity). Key Components of a Circuit Following are the Key Components: Power Source Provides the
necessary energy for the current to flow. Examples include batteries, solar cells, and power supplies. Conductive Path Wires or traces on a circuit board that connect different components and allow current to travel. Load Any device or component that consumes electrical energy, like light bulbs, resistors, capacitors, and motors. Switch (Optional) A
device that can open or close the circuit, controlling the flow of electricity. How Does a Circuit to function, it must be closed, meaning there are no breaks or gaps in the path. When it is closed, the power source pushes electrons through the conductive path. This movement of electricity.
then flows through the load, allowing it to perform its intended function, such as lighting up a bulb or powering a motor. The Role of Voltage and Current Voltage (V): The potential difference between two points in a circuit. It is the driving force that pushes the current through the circuit.
measured in amperes (A). Ohm's Law, which states that V = I * R (where R is resistance), describes the relationship between voltage, current, and resistance in a circuit. This fundamental law helps us understand how different components in a circuit.
different purposes and having unique characteristics. Here are the main types of electric circuits: Here, components are connected end-to-end in a single path for the current to flow. The current to flow. The current is the same through all components, but the voltage across each component can vary. Characteristics: If one component fails, the entire circuit is
interrupted. Voltage is divided among components or junctions, creating multiple paths for the current to flow. Characteristics: Each component receives the same voltage. If one component fails, the others can still operate. Common in
household wiring systems. This type combines elements of both series and parallel circuits. Some components are connected in parallel circuits. Used in complex electronic devices to optimize performance and reliability. Electric Circuit
Examples Understanding electric circuits can be enhanced by looking at practical examples. Here are a few common ones: Example 1: Flashlight A flashlight is a simple circuit is closed, allowing current to flow from the battery to the bulb,
lighting it up. Example 2: Home Lighting System Hom
Motherboard A computer motherboard is a complex circuit with numerous components connected in series, parallel, and series-parallel configurations. It includes microprocessors, memory modules, and various input/output devices, all working together to perform computing tasks. How to Explain a Simple Circuit to Kids Explaining a simple circuit to
kids can be both fun and educational. Here's a way to make it understandable: Using a Simple Light Bulb Circuit Materials Needed: A battery is like a power plant that stores energy. Wires: These are like roads that carry the energy from the battery
to the light bulb. Light Bulb: This is the device that uses the energy to produce light. Connecting: Show how connecting one wire from the bulb to the battery's negative end to the bulb and another from the bulb to the battery's negative end to the bulb and another from the bulb to the battery's negative end to the bulb and another from the bulb to the bulb and another from the bulb to the battery's negative end to the bulb and another from the bulb the b
Learning Use diagrams to show the flow of electricity. Allow kids to build their own simple circuit susing safe, low-voltage components. Explain the concept of a switch by showing how breaking the circuit turns the light off. How to Make a Simple Circuit Building a simple circuit is a great hands-on way to learn about electricity. Here's a step-by-step
guide: Materials Needed A 9-volt battery A small light bulb or LED Two pieces of insulated wire Electrical tape A switch (optional) Step-by-Step Instructions Strip the Wires: Use a wire stripper to remove about 1 inch of insulation from both ends of each wire. Connect the Battery: Attach one end of the first wire to the positive terminal of the battery
using electrical tape. Attach the Light Bulb/LED: Connect the other end of the first wire to the positive terminal of the light bulb or LED. Final Connection: Connect the other end of the second wire to the negative terminal of the light bulb or LED. Final Connection: Connect the other end of the second wire to the negative terminal of the light bulb or LED.
Once everything is connected, the light up. If using a switch, insert it between one of the wires to control the flow of electricity. What Does a Battery Do in a Circuit? A battery is a crucial component in many circuits, serving as the power source. It converts chemical energy into electricity energy into electricity.
to push current through the circuit. How a Battery Works - A Short Guide Chemical Reaction: Inside the battery, a chemical reaction occurs, creating a potential difference causes electrons to flow from the negative terminal through the circuit to the positive
terminal. Consistent Voltage: Batteries provide a steady voltage, ensuring that the connected load operates smoothly. What is Short Circuit? A short circuit?
lead to fires or equipment damage. Usually caused by faulty wiring or damaged insulation. What is Open Circuit? An open circuit has a break in the path, preventing current flows, so the circuit does not operate. Used intentionally in switches to
control devices. Read Also: Integrated Circuit - Various Types, Construction, Application and Advantage Bridge Rectifier Circuit - Working, Types, Characteristics and Applications An electric circuit is a closed loop path through which electric current flows. It includes components that add, limit, transform, or utilize the electric energy. Circuits
provide controlled power and signals for countless electrical devices and systems. This comprehensive guide covers electric circuit fundamentals including circuit fundamentals circuit fundamentals circuit fundamentals circuit fundamentals circuit fundamentals circuit fundamental fundamental fundamental fundamental fundamental fundamental fundamental fundamental fundamen
is a conductive path through which electric Circuit The key aspects of an electric circuit are: Closed loop
conductive path from source to load and back Ability to control, transform or utilize electrical energy Components such as sources, switches, loads, and protection Conductive interconnections or wires between elements Continuous flow of electrons when circuit is complete Circuits enable the safe, regulated flow of electricity to perform useful
functions across a massive range of applications. Standardized symbols are used to draw circuit diagrams that model the components and interconnections in an electric circuit. These symbols improve understanding and communication. Common Circuit Symbols Some of the most common electrical symbols include: Battery - Voltage source Ground -
Common reference point Wires - Conductive connections Resistor - Resists current flow Capacitor - Stores electric charge Inductor - Stores energy in magnetic field Diode - Allows one-way current flow LED - Light emitting diode Transistor - Electronic switch Integrated circuit - Multi-component chip Standardized symbols provide intuitive visual
representations of real-world circuit components. A circuit diagram visually represents the components and interconnects in an electric circuit diagrams enable analysis, communication and testing. Example Circuit diagrams include: Symbols represent real-world components Lines show
conductive connections Power sources such as batteries Passive components like resistors, capacitors and inductors Active components such as transistors and ICs Input and output interfaces Labels provide reference designations May include dimensions, values and ratings Circuit diagrams provide an intuitive way to visualize circuit topologies and
functions. Simulators can analyze them. Current is the flow of electric charge carriers through a conductor or circuit. It is driven by an electromotive force such as a battery or generator. Current is measured in Amperes. In conductors like copper, current flow comprises free electrons moving through the metal lattice: Voltage causes electrons to
move Electrons scatter but overall motion is directional Rate of flow depends on conductivity Current Flow in a Wire In semiconductors like silicon, current flows via electrons or holes Applied voltage causes directional flow Much lower conductivity than metals
Controlling this flow enables transistor switches and integrated circuits. There are two main types of current (DC) - Continuous flow in one direction cycles between positive and negative DC comes from sources like batteries while AC comes from generators and power grids. Each enables
eventually depletes chemicals. Electromagnetic induction - Changes in magnetic fields induce a voltage. Used in generators to transform mechanical energy into voltage. Voltage has positive and negative polarity indicating direction: Positive - Higher potential Negative - Lower potential Current flows from positive to negative through a load.
 Voltages can be DC or AC: DC voltage - Constant polarity over time AC voltage - Alternates between positive and negative sine waves DC comes from steady sources like batteries while AC comes from rotating generators. Voltage and current together determine circuit behavior and how energy is conveyed and utilized. There are two fundamental
 ways components are interconnected to form circuits: series and parallel configurations. In a series circuit, current passes through each component sequentially in a single loop: Series Circuit Characteristics of series circuits. Single path so current is constant everywhere Voltage divides across each component Total resistance is the sum of all
individual resistances Faults can disable the entire circuit Series configurations are simple but lack redundancy. Used for voltage dividers and filtering. In parallel circuits include: Multiple branch paths for current to flow Total current is the sum
of currents in each branch Voltage is constant across all components Total resistance decreases as more parallel paths are added Provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy; a fault disables only one branch Parallel is complex but provides redundancy is a fault disable for the parallel is complex but provides redundancy is a fault disable for the parallel is complex but provides redundancy is a fault disable for the parallel is complex but provides redundancy is a fault disable for the parallel is complex but provides redundancy is a fault disable for the parallel is a fault 
Recognize standard vs. custom components ymbols Follow current flow direction using source and ground points Identify series and bidirectional lines Associate symbols with real-world components Check for values, labels and designators Follow signal and
power flows through circuit Imagine electrons moving when circuit is energized Practice tracing current flows and visualizing voltage, current and power parameters: Relates current, voltage and resistance: V = I \times R Where V 
is current, and R is resistance. Allows calculating one value when the other two are known. Sum of currents into a node equals sum of currents out: I1 = I2 + I3 Conserves current flow at junction points in a circuit. Charge
cannot build up. Power equals voltage multiplied by current: P = V x I Where P is power in Watts, V is voltage, and I is current. Determines electrical power consumption. These fundamental laws enable analyzing, designing and predicting circuit behaviors. Components perform key functions within circuits such as regulating voltage and current flow.
storing energy, generating signals, modulating electricity, and more: Resistors limit and control current flow. Common types include: Fixed value resistors Variable resistors Variable resistors limit and control current flow.
Types include: Ceramic disc capacitors Variable capacitors Variable capacitors Variable inductors Common mode chokes Inductors Common types: Air core inductors Variable inductors Variable inductors Common mode chokes Inductors Variable capacitors Variable switching and
amplification. Types include: Bipolar junction transistors (BJT) Field effect transistors (FET) Insulated gate bipolar transistors (IGBT) Various Transistors, diodes, resistors and capacitors on a tiny silicon die: Analog ICs - Amplifiers, filters,
comparators, audio Digital ICs - Logic gates, microcontrollers, memory Mixed signal ICs - Data converters, SoCs Assorted Integrated Circuits These and other components enable the wide range of circuit functions needed in electronics. There are many types of electric circuits specialized for particular applications: Process continuously variables
analog signals using components like transistors, op amps, diodes, resistors and capacitors: Amplifiers Filters Oscillators Analog control loops Enable processing of audio, video, measurement signals and more. Represent signals digitally using discrete voltage levels and perform logical operations using gates: Combinational logic Sequential logic
Microcontrollers Microprocessors ASICs and FPGAs Enables sophisticated signal processing, computing and memory. Control and distribute electrical power for electronics. Generate and process high frequency
radio waves: Oscillators and synthesizers Mixers Amplifiers Modulators RFID Enable wireless communication, radar, and other applications. Specialized circuits provide tailored solutions across the realm of electrical engineering. Printed circuit boards (PCBs) house interconnected circuits and components: Populated Printed Circuit Board Key
miniaturization PCBs provide the foundation to assemble complex reliable circuits in compact packages. Analyzing circuits involves: Creating circuits involves: Creating circuit diagrams Identifying known values Labeling voltages, currents and power Determining passive component values from codes Applying Ohm's law and Kirchhoff's laws Developing equations describing the complex reliable circuits involves: Creating circ
behavior Calculating unknown variables Validating against expected performance Thorough analysis predicts circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation Software Benefits of simulation: Simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually: Circuit simulation programs like SPICE model the behavior of circuits virtually and circuits virtually 
Performs complex analysis Models non-ideal component effects Determines theoretical limits and tradeoffs Optimizes designs faster and cheaper Verifies proper performance Provides building blocks for larger systems Simulation enables optimizing circuits and tradeoffs Optimizes designs faster and cheaper Verifies proper performance Provides building blocks for larger systems Simulation enables optimizes designs faster and cheaper Verifies proper performance Provides building blocks for larger systems Simulation enables optimizes designs faster and cheaper Verifies proper performance Provides building blocks for larger systems Simulation enables optimizes designs faster and cheaper Verifies proper performance Provides building blocks for larger systems Simulation enables optimizes designs faster and cheaper Verifies proper performance Provides building blocks for larger systems Simulation enables optimizes designs faster and cheaper Verifies proper performance Provides building blocks for larger systems Simulation enables optimized by the proper performance Provides building blocks for larger systems Simulation enables optimized by the proper performance Provides building blocks for larger systems Simulation enables optimized by the proper performance Provides building blocks for larger systems of the proper performance Provides Building blocks for larger systems of the proper performance Provides Building blocks for larger systems of the provides Building Building blocks for larger systems of the provides Buildin
functionality across countless electrical and electronic systems: Power supplies, amplifiers, microcontrollers, data converters, drivers, relays, regulators, process controllers, instrumentation amplifiers, solenoids. Antennas, oscillators, mixers, filters,
modulators/demodulators, frequency synthesizers, power amplifiers, receivers. Memory, microprocessors, cache, disk controllers, motherboards, interface buses, power regulation. Engine and stability control, infotainment, power windows/locks, active suspension, safety systems. Electric circuits bring functionality, intelligence and control across
electrical engineering. Debugging faulty circuits involves: Understanding normal operation Reproducing failure conditions Making observations - symptoms, readings Forming failure hypotheses Changing one variable at a time Ruling out potential causes Proceeding methodically until defect found Repairing faults - blown capacitors, cold solder, etc
Confirming root cause and fix restored operation Systematic circuit troubleshooting identifies malfunctions and guides repairs. Designing optimized circuits involves: Specifying requirements - function, environment, interfaces Researching design approaches and selecting architecture Sourcing components from trusted suppliers Modeling and
simulating candidate circuits virtually Prototyping circuit on breadboard or PCB Testing prototype thoroughly against requirements Analyzing results to identify improvements Iterating on design to enhance performance Repeating integration, testing and analysis Finalizing design once validated to meet specifications Careful iterative design delivers
robust, optimized electric circuits. In summary, electric circuits provide the pathways for controlled electrical currents and voltages to power everyday devices and systems ranging from simple switches to smartphones to massive computing centers and industrial plants. Circuit analysis techniques, simulations, prototyping, and testing enable
optimized designs while troubleshooting maintains reliable operation. The wide diversity of configurations, components and circuit types enables limitless functional solutions across electrical engineering. As technology progresses into areas such as renewable energy, electric vehicles, IoT edge devices, and AI acceleration, continued electric circuit
innovation will provide the robust foundations underlying these advancements. Electronic Circuit for Beginners. An Electronic Circuit is a structure to direct and control electric currents perform some useful function. The very name "circuit" implies that the structure is closed, something like a loop, unbroken. Electronic Circuit Definition An
electronic circuit is a network of interconnected electronic components, such as resistors, capacitors, and transistors, designed to perform specific functions, such as amplification, signal processing, or computation, through the controlled flow of electrical currents. What is Electric Current? The name "current" refers to some type of flow, and in this electrical currents.
case it is flow of electric charge, which is usually just called charge because electric Circuit An Electric Circuit and Electric Circu
voltage and load. An ON / OFF switch and a fuse is also used in between the source and load. Read: Types of Electronic Circuit When is a Circuit Called Electronic Circuit Cir
either through-hole or SMD. These components or devices are connected to each other via conductive wires through which electronic components are soldered onto a PCB to perform a predefined work. A circuit to be called "Electronic Circuit" rather than are
"Electrical Circuit" must have at least one active component. What are Active Electronic Components? Active electronic components are those that can control flow of electricity. Most PCB (Printed Circuit Board) have at least one active component. Example: Transistors, Integrated Circuits or ICs, Logic Gates, Vacuum Tubes,
Symbols Types of Electronic Circuit A circuit are those in which signals may vary continuously with time to correspond to the information being represented. Example: Electronic Equipment like voltage amplifiers, power amplifiers, tuning circuits,
radios, and televisions are mainly analog. 2. Digital Circuit A Simple Digital Circuit A digital circuit is a circuit where the signal is either of the two discrete levels - ON / OFF or 0 / 1 or True / False. Transistors are used to create logic gates perform Boolean logic. Example: Multiplexers, De-multiplexers, Decoders, Decoders, Counter, Flip-Flop 3.
Mixed-Signal Circuit A Mixed-Signal Circuit A Mixed-Signal Circuit, are also called hybrid circuit, are also called hybrid circuit and Digital Converters), and DACs (Digital-to-Analog Converters). Types of Electric Circuit FAQs: Circuit in Electronics An
electronic circuit is an interconnected arrangement of electronic components like resistors, capacitors, transistors, and integrated circuits work by controlling the flow of electric current through various components. Voltage sources drive
current, which flows through components following specific paths, controlled by the circuit design. Components manipulate the current to achieve desired functions, such as switching, amplification, or modulation. Electronic circuits consist of essential components such as resistors (to limit current), capacitors (to store and release charge), inductors
(to store energy in a magnetic field), and transistors (to amplify or switch signals). These components are interconnected to create functional circuits. To design an electronic circuit, follow these steps: Define the circuit's purpose and functional circuits.
component connections. Design a printed circuit board (PCB) layout for physical implementation. Build and test the circuit, making adjustments as needed. Electronic circuits are crucial in modern life as they power devices we use daily, such as smartphones, computers, televisions, and medical equipment. They enable communication, entertainment
transportation, healthcare, and automation, making them integral part of of life. Related Posts: Electrical circuit is key to creating an effective and safe project. Each circuit has its specific use, which needs to be understood to avoid blocks while building
your electronic project. In the following article, we'll highlight the fundamentals of circuits and the different types of circuit for you. There are 4 main parts of a circuit, the following are explained below; Parts Of A Circuit Cell: The cell is the main power source source to the fundamentals of circuits available in the market, so you can build in peace knowing you've found the right circuit for you.
This component powers up a Circuit and has two terminals, which are negative and positive. The negative terminal is the source that is connected to the circuit and supplies it with energy. Switch : The switch is the next component in a circuit and supplies it with energy. Switch : The switch is the next component in a circuit and supplies it with energy.
relation here) Wire: A wire acts as a connector between all the components. It is established using a thin strand of metal which acts as a conductor that allows electricity to pass through Light bulb is the last component in a circuit. It produces light using electricity to pass through Light bulb is the last component in a circuit. It produces light using electricity to pass through Light bulb is the last component in a circuit.
which is known as tungsten which emits light. Usage Of A circuit To discuss the usage of a circuit, it's essential to first understand that a circuit is a closed loop that allows an electric current to flow from a power source, through a set of electrical components, and back to the source. Here are some common usages of circuits in various contexts:
Electronic Devices: Circuits are the backbone of all electronic devices, such as smartphones, computers, and TVs. They help in processing information, executing commands, and powering the device. Lighting: Circuits are used in residential and commercial lighting systems, including LED lights, which require a constant flow of electricity to operate
Industrial Machinery: In industrial settings, circuits control machinery, enabling operations such as automation, motor control, and air conditioners use circuits to function, manage power distribution, and control various settings. Communication Systems:
Circuits are crucial in telecommunications, enabling the functioning of radios, satellites, and network systems for data transmission. Transportation: Modern vehicles, including cars, trains, and planes, rely on complex circuits for engine management, lighting, entertainment systems, and safety features. Renewable Energy Systems: In solar panels and
wind turbines, circuits help convert and regulate power, ensuring stable energy supply and distribution. Medical Equipment: In the medical field, circuits are used in devices like pacemakers, MRI machines, and monitoring systems to ensure they operate reliably and effectively. Types Of Circuits Electric Circuit An electrical circuit is the most basic
form of a circuit. It is a path that allows electric current to flow through various components may include wires, cells, a switch, and a component to absorb the power which is called the load(eg, a light bulb). There are many applications for an electric circuit that range from basic appliance operation to lighting systems. Open
Circuit An open circuit is a type of circuit that has a break in the path of current from reaching the direction it was supposed to. This sort of Circuit could be used for testing and troubleshooting as it helps in identifying
any faults in an electrical device. Closed Circuit The opposite of an open Circuit is a closed circuit. This has no breaks in the path between each end. This allows for a full loop of electricity, which isn't interrupted by anything. When components like a bulb and battery are added to the Circuit, the bulb has a constant glow because of the constant flow
of current. Oftentimes, these are in battery-operated devices to ensure the flow of current to a part of a Circuit An unwanted flow of current to a part of a Circuit. This allows for an excessive flow of current, which can bypass the
intended path and cause damage to your circuit or, in some cases, even start a fire. Series circuit. In this style of circuit, there is only one path for the current to flow and all components share that path. If any part of the series fails or if the source of
power is disconnected, the entire Circuit will stop functioning because current to flow. This type of Circuit has multiple components and a single source of power for each component and the flow of current is divided between each of
them. The setup is much more reliable when contrasted with the series circuit, as it ensures the independence of a circuit. If one component is faulty the other component will still work as it allows multiple components to function even if one path is interrupted. Series- Parallel Circuit A combination of the series Circuit and the parallel Circuit makes
the series-parallel circuit. This blends the configuration of both types of circuits, where principles of current consistency and voltage division are applied from the series part of a series Circuit, and the principles of current consistency and voltage division are applied from the knowledge of how a parallel Circuit functions. AC
Circuit Alternating currents, AKA AC circuits, are known for their functionality of regularly reversing current flow. It occurs in a smooth wave-like pattern called a sinusoidal wave, which ensures a more stable fluctuation of voltage. A common application for the circuit would be when electricity flows for long distances. Although AC circuits are
powerful it's important to note there may be a risk of electrical shocks so careful consideration should be maintained when configuring this type of circuit. It allows the current to flow in a single constant direction. Generally used in more simple applications, where electricity flows for shorter
distances. Unlike a fluctuating source of voltage, the DC Circuit uses constant voltage and are commonly found in appliances like mobile phones, computers, and other small devices. Where the stability of the power source shouldn't be affected by the direction of current flow. Single-Phase Circuit In a single-phase circuit, an AC type of power is used.
This kind of Circuit allows the voltage to flow in smooth wave-like patterns. To make such kinds of Circuit work you only require a single phase to function, which means only two wires to complete the circuit. One of which is called the phase to function, which means only two wires to complete the circuit.
circuit by carrying the current back. Polyphase Circuit, there will be three different electrical waves that need to be spaced 120° apart from each other. And to set up the system you would require three to four wires. The Circuit is used for complex
applications and has a more stable and efficient power supply compared to a single-phase system. Star-Delta Circuit The name for the star-delta circuit comes from the shape of how different components are connected. They come in either a star (Y) or delta (\Delta) configuration. These systems differ from parallel or series circuits. To switch between
them, you can use different calculations to aid in transformations from one configuration into another, which helps simplify circuit analysis. star-delta circuits are built to be consistent and have predictable behavior. Which means, parameters
don't change no matter how much current or voltage is applied. These would maintain a stable resistance, capacitance, and inductance change
depending on the amount of current or voltage. Which means the Circuit doesn't behave in a straightforward or predictable way, and its behavior can vary with different levels of current flows in a singular direction, so if you were to change the direction of voltage.
or current the Circuit wouldn't operate. An example of the operation of a unilateral Circuit would be in power in an AC source. Another example would be a diode, which is used in rectification. It allows current to only flow in a singular direction. Bi-Lateral Circuits Whereas bi-lateral circuits let current flow
in both directions and the Circuit would work and behave the same even if you change the direction of the flow of current. These circuits are found in signal amplification, where a bi-directional current flow is needed. Resonant Circuit also known as a tuned circuit is designed to oscillate at a particular frequency which is known as
the resonance frequency. It consists of inductors and capacitors to store energy and transfer it back and forth between magnetic and electrical fields. When the input signal matches the circuit's natural frequency, it passes through easily while other frequency, it passes through easily while other frequency.
tune specific frequencies. Integrated Circuits One of the smallest types of circuits is integrated circuits host many components such as transistors, resistors, and capacitors. These are then shrunken and fixed to a piece of silicone, allowing ICs to perform a range of functions from signal amplification to data
processing. Integrated circuits are one of the most efficient and cost-effective types of circuits are electrical circuits are electrical circuits and are found in almost every piece of modern tech. Digital circuits are electrical circuits are electrical circuits and enable
complex computation and decision-making processes. Digital circuits form the foundation for modern technologies such as phones and computers which use immense processing to work. Analog Circuits Unlike digital circuits which use immense processes data, analog circuits use continuous signals to process data
over a range. They're essential to amplify, filter, and modulate signals which is used when technologies relating to sound or radios or other technologies which help
power the circuit. Such circuits help amplify signals or power devices because they have external power to amplify its signal. Passive Circuit In comparison to active circuits, passive circuits don't use EMF. Instead, it
relies on the energy that's present in the circuit, such as the one which is stored in capacitors or inductors. Such circuit with just resistors and capacitors, without any batteries or power supplies, is a passive circuit. Magnetic
reactions. Sequential Circuit Sequential circuits are a byproduct of digital circuits, they store and use previous data to determine their future behavior. Found in digital systems to create state machines, timers, and memory elements in sequential circuits are often implemented with flip flops which store binary values
and retain their state even when inputs change. Combinational circuit which are designed using multiple interconnected logic gates (AND OR NOT) where the output solely depends on its present input and there is no element memory involved, so the circuit's output changes immediately in response to
changes in the input. Many times these types of circuits are found in logical and arithmetic operations in CPUs. Mixed Signal Circuit that contains both analog and digital circuit that contains both analog and digital circuit that contains both analog and digital circuit mechanisms on a single chip is known as a mixed signal circuit. It handles both types of signals (analog and digital) which allows them to be used in
variety of applications. This includes custom-designed circuits for specific tasks (ASICs). You'll find applications of these circuits here are a few answers to some frequently asked questions which you may be having. Also check: AC
 Resistive Circuits AC Capacitive Circuits AC Inductive Circuit S a closed path through which electric current flows, composed of components like resistors, capacitors, and power sources. Kirchhoff's Circuit Laws, including Kirchhoff's First Law (current law) and Kirchhoff's Second Law (voltage law), are essential for analyzing circuit
behavior. Circuits are found in applications from household electronics to industrial machinery, controlling and directing electric current, typically consisting of components like resistors, inductors, and transistors. These elements are connected
by conductive wires or traces through which electrons travel, creating a complete path for current, consisting of a battery, a resistor, and an LED connected end-to-end. Simple Parallel Circuit A circuit with multiple paths for current, consisting of a battery and two or more
resistors connected across common points. Light Switch Circuit A household circuit in a flashlight, where batteries provide power, a switch controls the flow, and a bulb emits
light when the circuit is complete. Voltage Divider Circuit A circuit with a resistor and capacitor in series, used to produce a specific voltage lower than the source voltage by dividing the input voltage. RC (Resistor-Capacitor) Circuit A circuit with a resistor and capacitor in series or parallel, used in timing applications like creating delays or filters in electronic
devices. LC (Inductor-Capacitor) Circuit A circuit with an inductor and capacitor, often used in radio tuning circuit A precise measurement circuit used to determine unknown resistances by balancing two legs of a bridge circuit. Operational Amplifier Circuit A circuit
using an operational amplifier (op-amp) for various applications like signal amplification, filtering, or mathematical operations such as addition and integration. Digital Logic Circuit A circuit using logic gates (AND, OR, NOT, etc.) to perform logical operations, forming the basis of digital systems like computers and calculators. Pulse Width Modulation
(PWM) Circuit A circuit used to control the power delivered to electrical devices by varying the duty cycle of a pulse signal, commonly used in motor speed control. Temperature Sensor Circuit A circuit using a thermistor (temperature sensitive resistor) to monitor and respond to temperature changes, often used in thermostats. Transistor Amplifier
Circuit A circuit using a transistor to amplify weak electrical signals, widely used in a and radio frequency amplification. Timer Circuit (555 Timer) A circuit using the 555 timer IC to generate precise time delays or oscillations, used in clocks, pulse generation, and LED flashers. Solar Cell Circuit A circuit that converts sunlight into electrical energy
using solar cells, with components like diodes and batteries for storage and usage. Series Circuit: Components are connected end-to-end, forming a single path for current flow. In a series circuit, the same current flows through each components are
simple to construct but can be problematic if one component fails, as it can break the entire circuit. Parallel Circuit: Components are connected across multiple paths, each having its own branch. Current divides among the branches based on their resistance. Each branch receives the same voltage (Kirchhoff's Voltage Law). Parallel circuits offer
redundancy, as the failure of one branch doesn't affect others, and they allow for easier addition or removal of components. However, they can be complex to design and troubleshoot due to multiple paths. Series and parallel configurations. Components may be grouped in series, and these groups are
connected in parallel, or vice versa. Series-parallel circuits are commonly used in complex electrical networks where different loads require different configurations. Open Circuit: An open circuit has a break or gap, preventing current flow. Devices in the circuit won't function until the circuit is closed. Closed Circuit: A closed circuit provides a
complete path for current flow from the source through components and back to the source. It allows devices to operate normally as current flow uninterrupted. AC Circuits, the direction of current flow uninterrupted. AC Circuits, the direction of current flow uninterrupted. AC Circuits can be series, parallel, or a combination of both, similar to DC circuits. The
behavior of components such as resistors, and inductors in AC circuits can differ due to factors like impedance, reactance, and industrial applications due to the efficiency of power transmission over long distances. AspectSeries CircuitParallel
CircuitConnectionComponents are connected end-to-end in a single path. Components are connected across multiple paths. Current flows through all components based on resistance. Each branch receives the same
voltage.Redundancy, failure of one components without affecting circuit. Redundancy; failure of one branch does not affect others. Ease of Addition Difficult to add or remove components without affecting circuit. Redundancy; failure of one branch does not affect others. Complex it components without affecting circuit. Redundancy is failure of one branch does not affect others. Ease of Addition Difficult to add or remove components without affecting circuit. Redundancy is failure of one branch does not affect others. Ease of Addition Difficult to add or remove components without affecting circuit. Redundancy is failure of one branch does not affect others. Ease of Addition Difficult to add or remove components without affecting circuit. Easier to add or remove components without affecting circuit. Easier to add or remove components without affecting circuit. Easier to add or remove components without affecting circuit. Easier to add or remove components without affecting circuit.
to design and troubleshoot due to multiple paths. Applications. Used where redundancy or different voltages are needed, like household wiring. Understanding circuits involves several fundamental rules that govern their behavior and operation. Here are the key rules for circuits: Ohm's Law: This
law relates the voltage (V), current (I), and resistance (R) in a circuit and states that V=I×R. It helps determine how voltage, current, and resistance interact within a circuit is equal to the total current leaving the junction. In other words, the
sum of currents entering a node equals the sum of currents leaving the node. Kirchhoff's Voltage Law (KVL): KVL states that the sum of all voltages around any closed loop in a circuit is zero. It emphasizes the conservation of energy in electrical circuits. Series Circuit Rules: The total resistance in a series circuit is the sum of the individual
resistances. The current through each component in a series circuit is the same. The total voltage across each branch (parallel path) of a circuit resistance of resistance. The total voltage across each branch (parallel path) of a circuit resistance of resistance of resistance.
is the same. The total current in a parallel circuit is the sum of the currents in each branch. Power in Circuits: The power (P) consumed by a circuit element can be calculated using P=V×I or P=I2×R or P=V2R, depending on the given parameters (voltage, current, resistance). Circuit Analysis Techniques: Mesh Analysis: Used to analyze circuits with
multiple loops, applying KVL to each loop. Nodal Analysis: Used to analyze circuits with multiple nodes, applying KCL at each node. An electric circuit is a path through which electric current flows. It typically includes a power source, conductor is
directly proportional to the voltage across it and inversely proportional to the resistance, expressed as V=IR. Basic components include a power source (battery), conductors (wires), and electric current in a circuit, providing resistance
measured in ohms (Ω). A capacitor is a device that stores electrical energy in an electric field, used to smooth voltage fluctuations in circuits. A short circuit occurs when a low-resistance path bypasses part of a circuit, causing excessive current flow, which can lead to damage or overheating. A circuit breaker is a safety device that automatically
interrupts the flow of electricity in a circuit when it detects an overload or short circuit. A switch controls the flow of electricity in a circuit by opening (interrupting) or closing (completing) the electrical path. Alternating current that periodically reverses direction, commonly used in household power supplies. Direct current
(DC) is an electric current that flows in one direction, typically provided by batteries and used in electronic devices. Add Tone Friendly Formal Casual Instructive Professional Empathetic Humorous Serious Optimistic Neutral 10 Examples of Public speaking 20 Examples of Gas lighting What does Ohm's Law state? Choose the correct answer The
voltage across a conductor is equal to the product of its resistance and current. The current through a conductor is equal to the product of its resistance. What is the unit of electrical resistance? Choose
the correct answer In a series circuit, how is the total resistances by the number of resistances. By adding the individual resistances together. By dividing the reciprocal of the resistances together. By dividing the individual resistances together.
current calculated in a parallel circuit? Choose the correct answer By adding the currents through each parallel branch. By multiplying the currents through each parallel branch. By dividing the currents through each parallel branch. By multiplying the currents through each parallel branch parallel branch. By multiplying the currents through each parallel branch parallel br
answer It resists the flow of current. It converts electrical energy into magnetic energy temporarily. What is the purpose of a fuse in an electrical circuit? Choose the correct answer To increase the current flow. To prevent overcurrent by breaking the circuit
when excessive current flows. To measure the voltage in the circuit. To store electrical energy temporarily. What is the formula for calculating power in an electrical circuit? Choose the correct answer A circuit
with high resistance. A circuit where current flows through an unintended path with very low resistance. A circuit with no current flow. A circuit that stores electrical energy. In a parallel circuit, how does the voltage across each branch. It is zero in each branch. It is zero in each branch. It is zero in each branch. It is the same across
all branches. It is the sum of the voltages in each branch. What happens to the total resistance if you add more resistors in series? Choose the correct answer
```