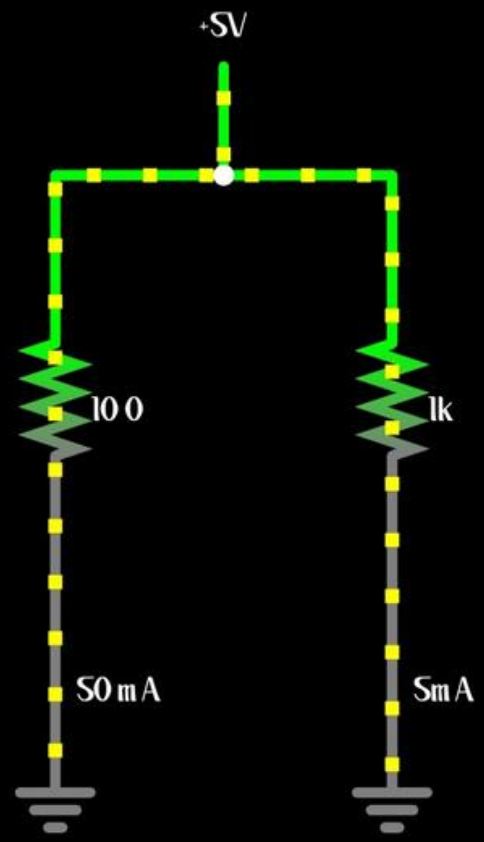
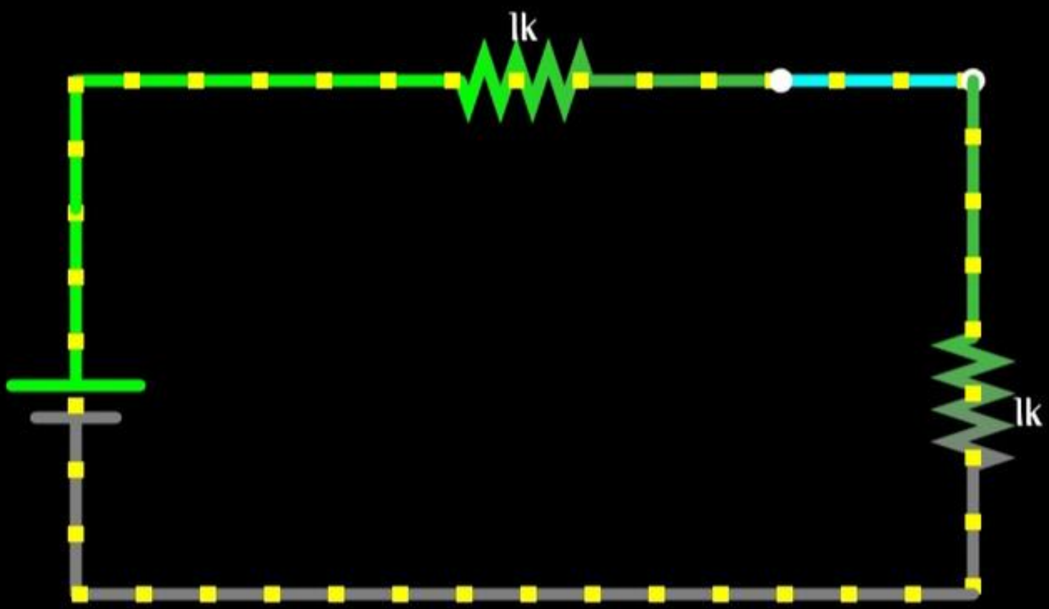
Basic Circuit



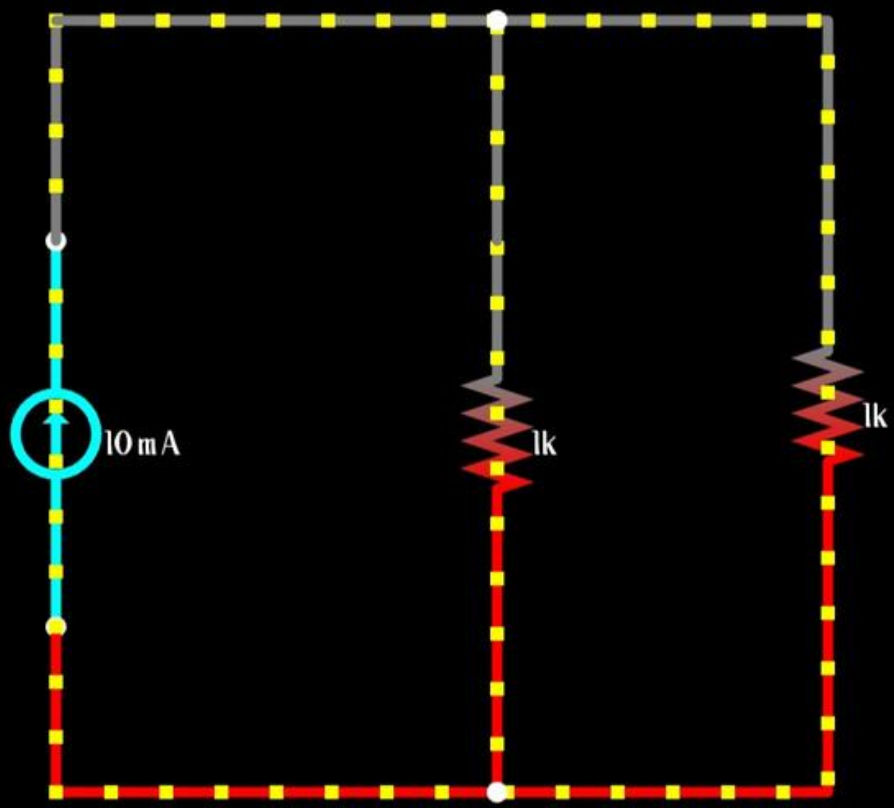
- This is a basic resistor circuit that demonstrates Ohm’s Law.
- The circuit consists of a resistor connected series with a power source.
- The main goal is to calculate the current flowing through the resistor based on its resistance and the applied voltage, using Ohm’s Law (I = V/R).

Voltage divider



- This is a voltage divider circuit that splits an input voltage into smaller, proportional output voltages.
- The circuit consists of two resistors connected in series across a power supply.
- The circuit demonstrates how to use the voltage divider formula (V_out = V_in * R2 / (R1 + R2)) to calculate the output voltage.

Current divider

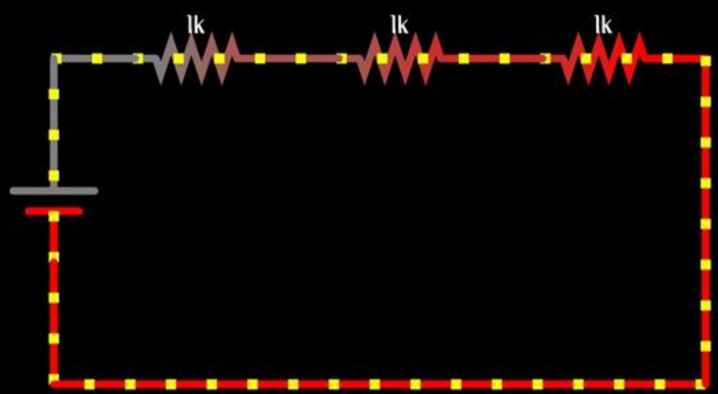


🔶 This is a current divider circuit that splits the total current into smaller currents across multiple parallel branches.

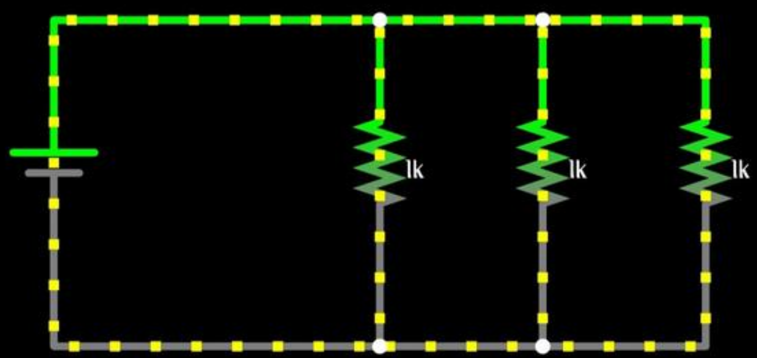
🔶 The circuit consists of two resistors connected in parallel to a power source.

🔶 Based on the current divider rule (I1 = I_total * (R2 / (R1 + R2)) and I2 = I_total * (R1 / (R1 + R2))).

Series circuit



Parallel circuit

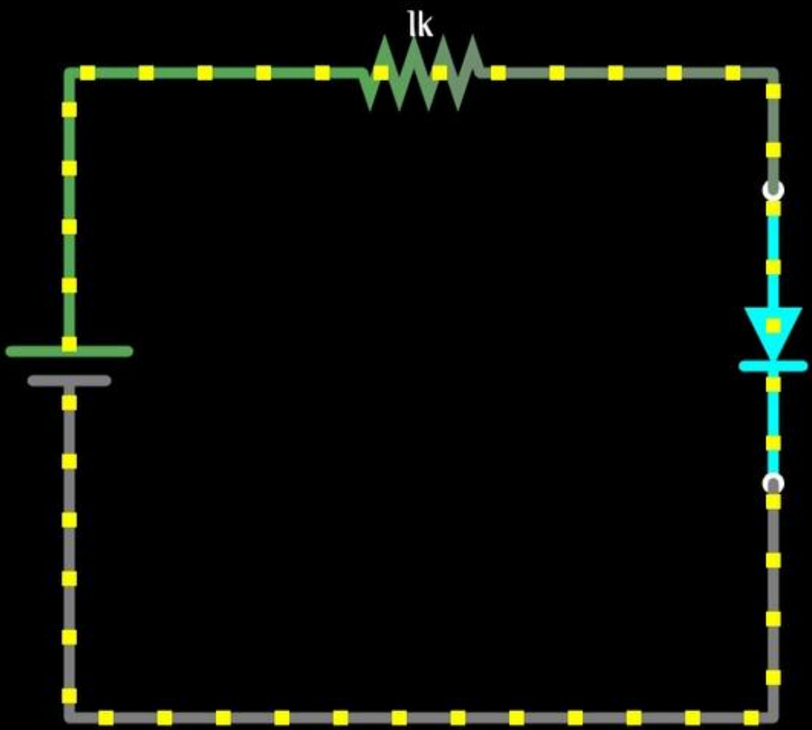


◆ This is a combination of series and parallel circuits designed to demonstrate the difference in behavior between the two configurations.

◆ In the series circuit, resistors are connected end-to-end.

◆ In the parallel circuit, resistors are connected across the same voltage source,

LED controlled circuit

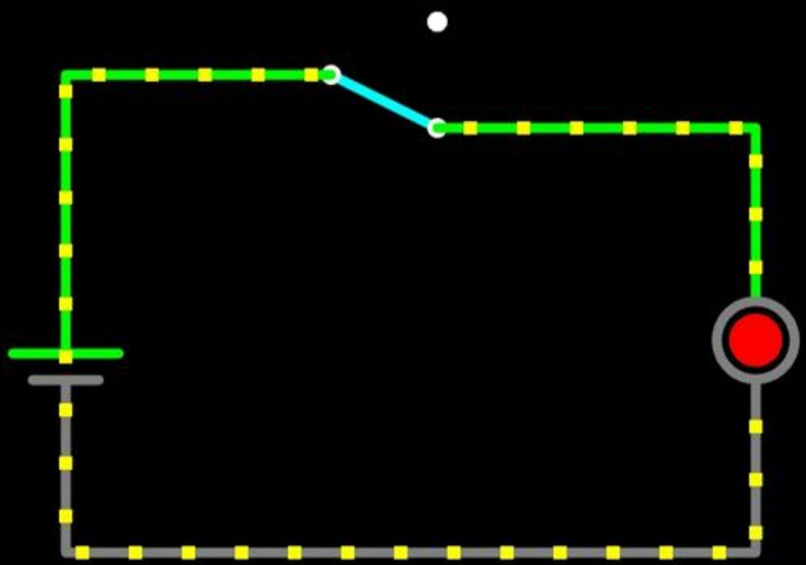


◆ This is a basic LED control circuit that regulates the current flow to light an LED based on a control switch.

◆ The circuit consists of an LED connected in series with a current-limiting resistor .

◆ This circuit demonstrates how to control the operation of an LED .

Switch controlled LED



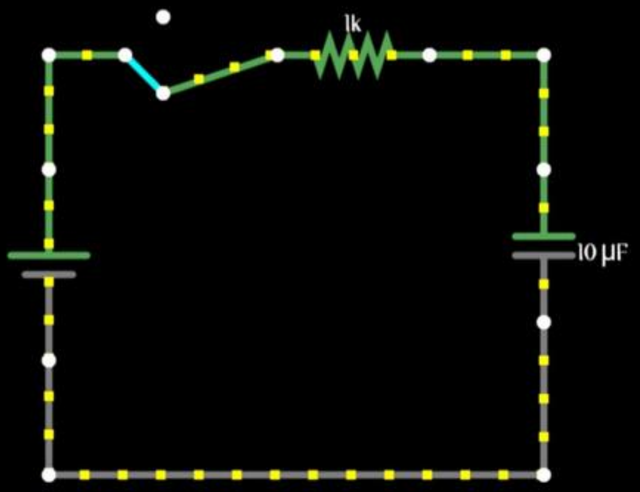
◆ This is a switch-controlled LED circuit that allows the user to turn an LED on and off by opening or closing a switch.

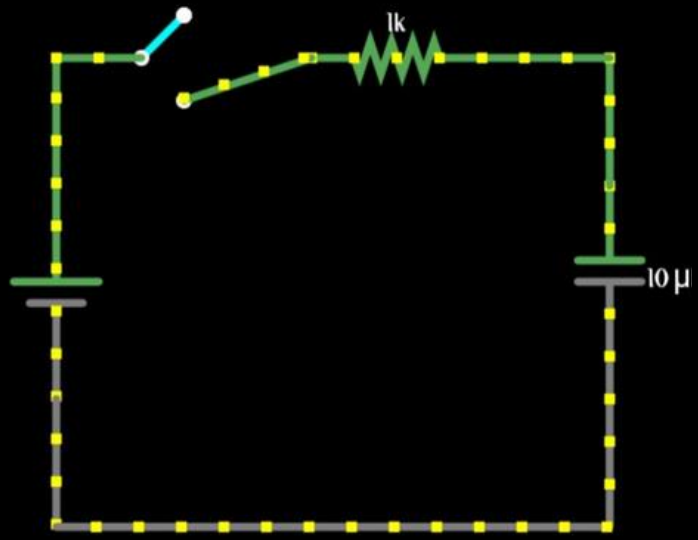
◆ When the switch is closed, current flows through the circuit, causing the LED to light up.

◆ When the switch is open, the circuit is incomplete, and the LED turns off.

Capacitor discharging

Capacitor charging



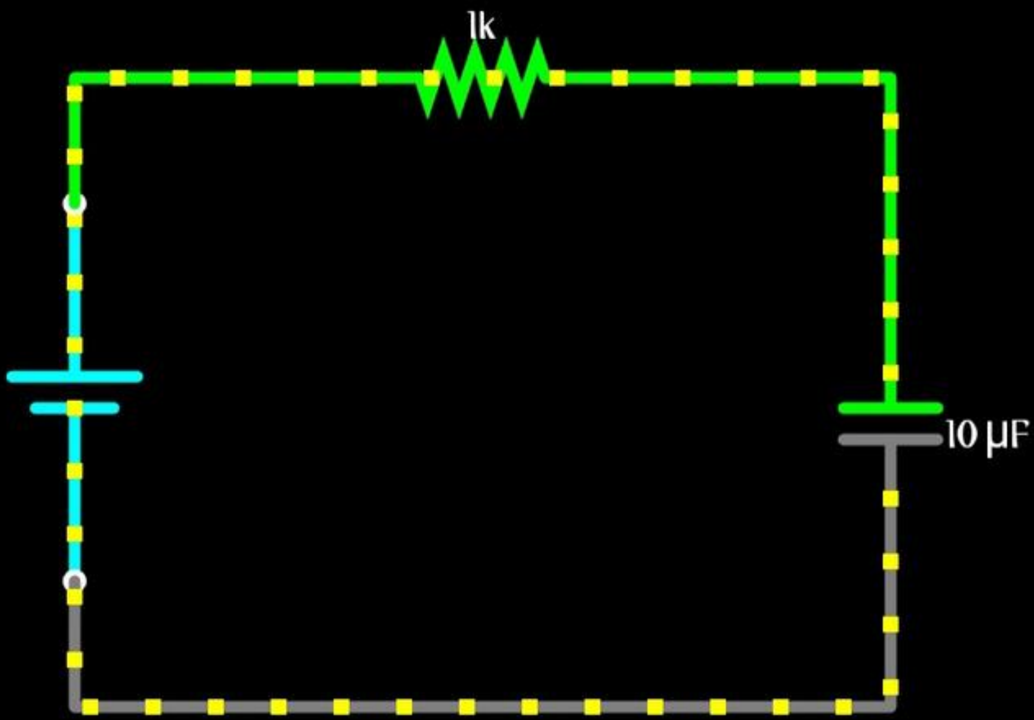


◆ This circuit demonstrates the charging and discharging behavior of a capacitor in an RC (resistor-capacitor) circuit.

◆ During the charging phase, when the power supply is connected, the capacitor gradually accumulates charge, and its voltage increases.

◆ During the discharging phase, when the power supply is disconnected, the capacitor releases its stored charge through the resistor, and its voltage decreases

RC time constant circuit



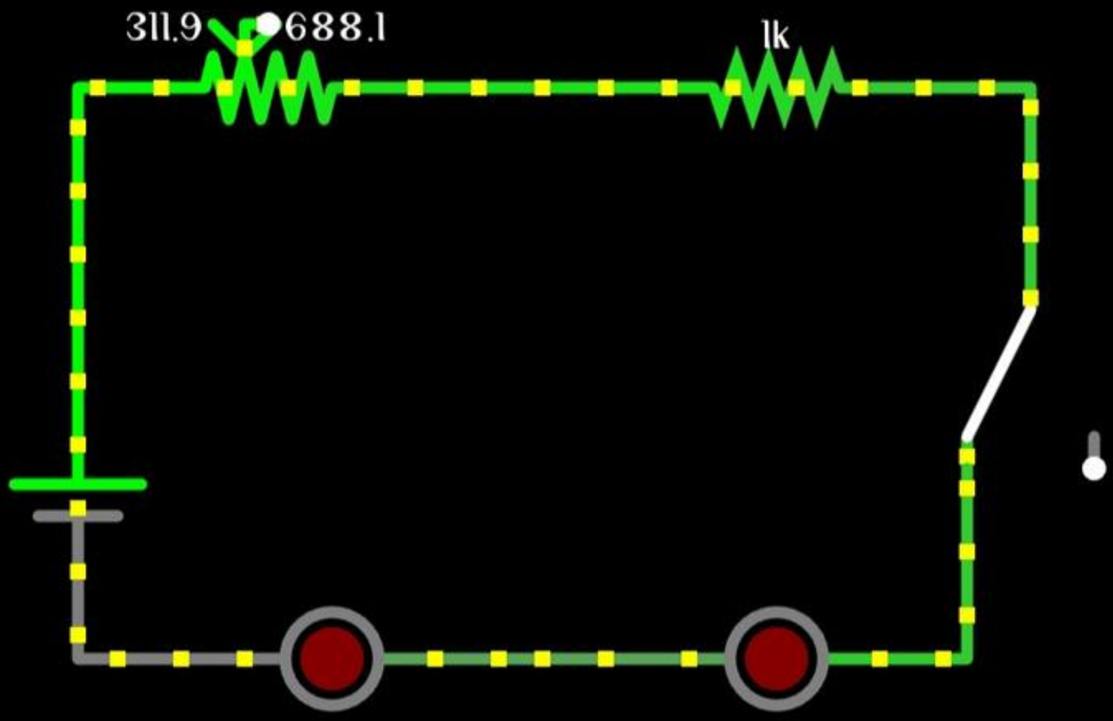
🔶 This circuit demonstrates the RC time constant, which defines the rate at which a capacitor charges and discharges in an RC circuit.

🔶 The circuit consists of a resistor, a capacitor, and a power supply.

🔶 The time constant (τ) is given by the formula

$\tau = R * C$,

Battery tester circuit

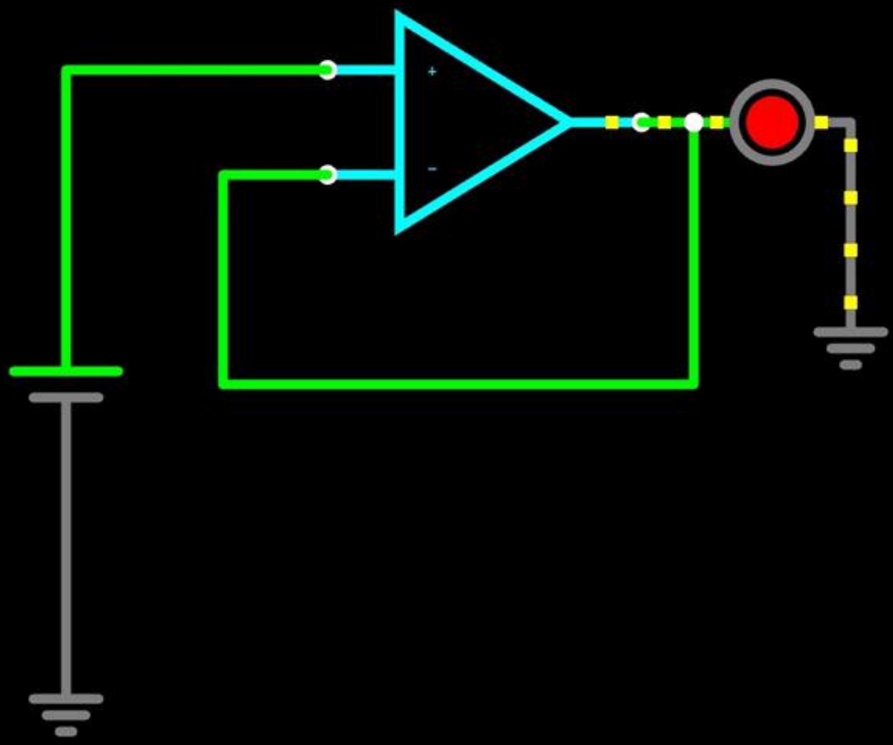


◆ This is a simple battery tester circuit designed to measure the voltage of a battery and indicate its charge level.

◆ The resistor is used to limit the current and prevent damage to the components.

◆ If the voltage is above a certain threshold, the LED lights up

Voltage follower circuit

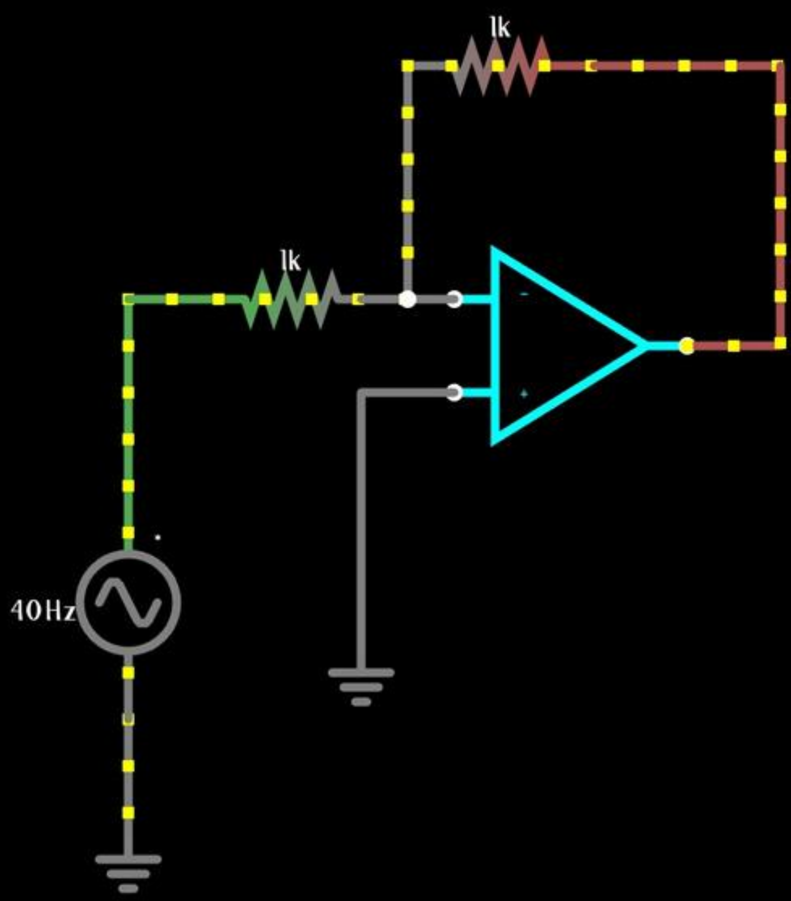


🔶 This is a voltage follower (also known as a buffer amplifier) circuit that provides unity gain while isolating the input and output stages.

🔶 The circuit typically consists of an operational amplifier (op-amp) .

🔶 The primary function of the voltage follower is to ensure that the voltage at the output is the same as the input voltage (V_out = V_in)

Inverting amplifier

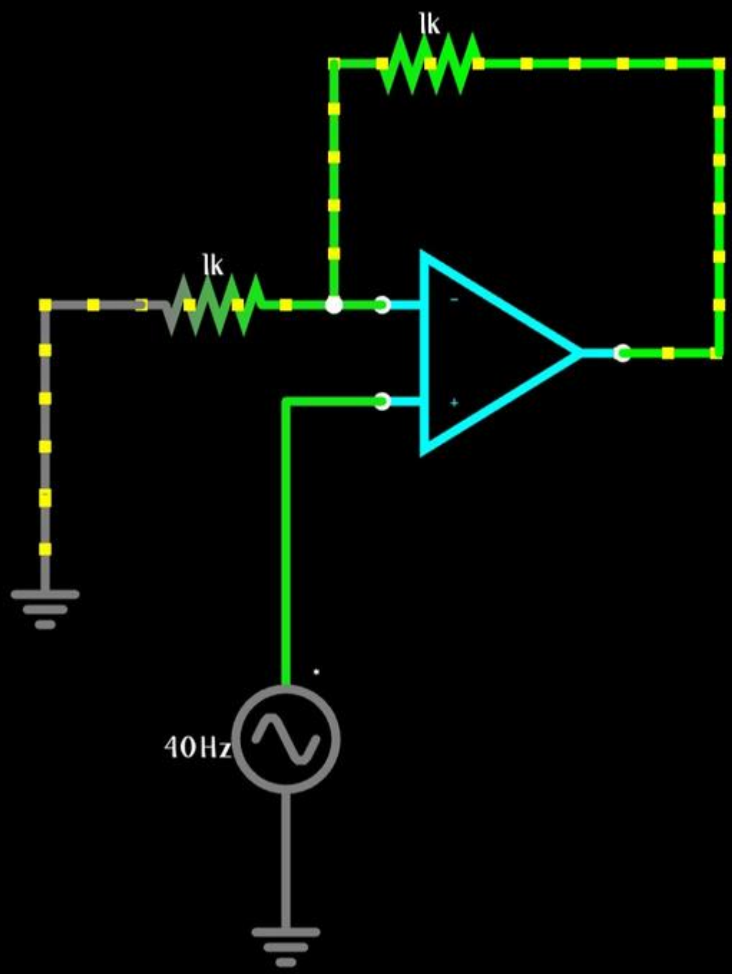


🔶 This is an inverting amplifier circuit that uses an operational amplifier (op-amp) to invert and amplify an input signal.

🔶 The circuit consists of an op-amp, a resistor connected to the input signal, and a feedback resistor connected between the output and the inverting input of the op-amp.

🔶 This circuit is commonly used in applications where signal inversion is required, such as audio processing, signal conditioning, and waveform generation.

Non-inverting amplifier

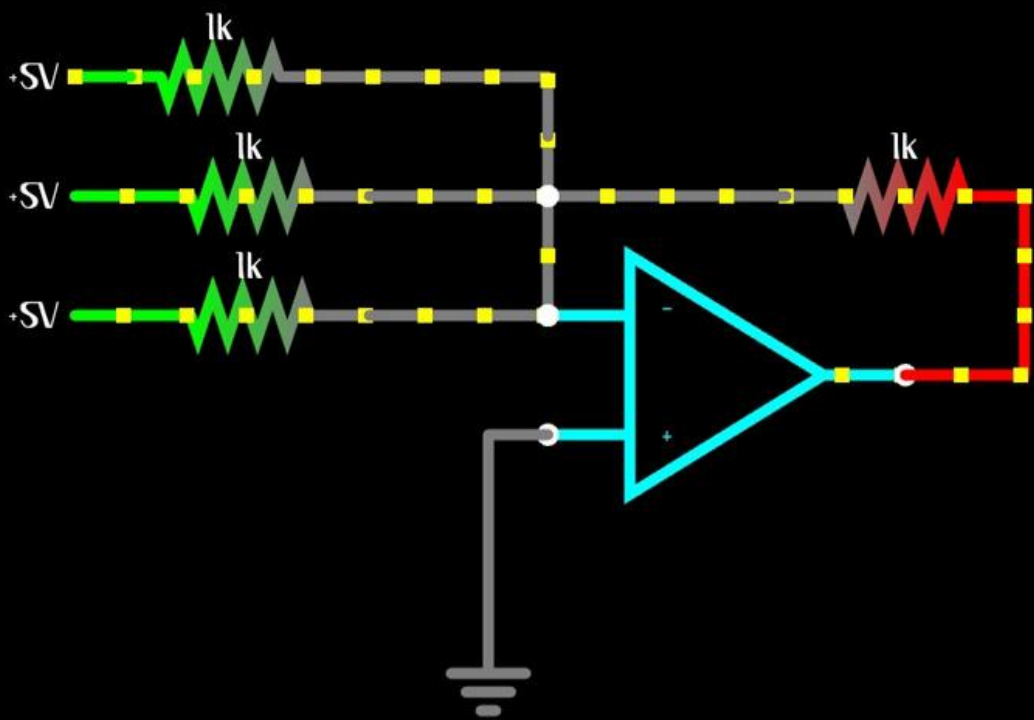


🔶 This is a non-inverting amplifier circuit that uses an operational amplifier (op-amp) to amplify an input signal without inverting its phase.

🔶 The input signal is applied to the non-inverting input of the op-amp.

🔶 This circuit is widely used in applications requiring signal amplification with preserved polarity, such as audio amplification, sensor signal conditioning.

Summing amplifier

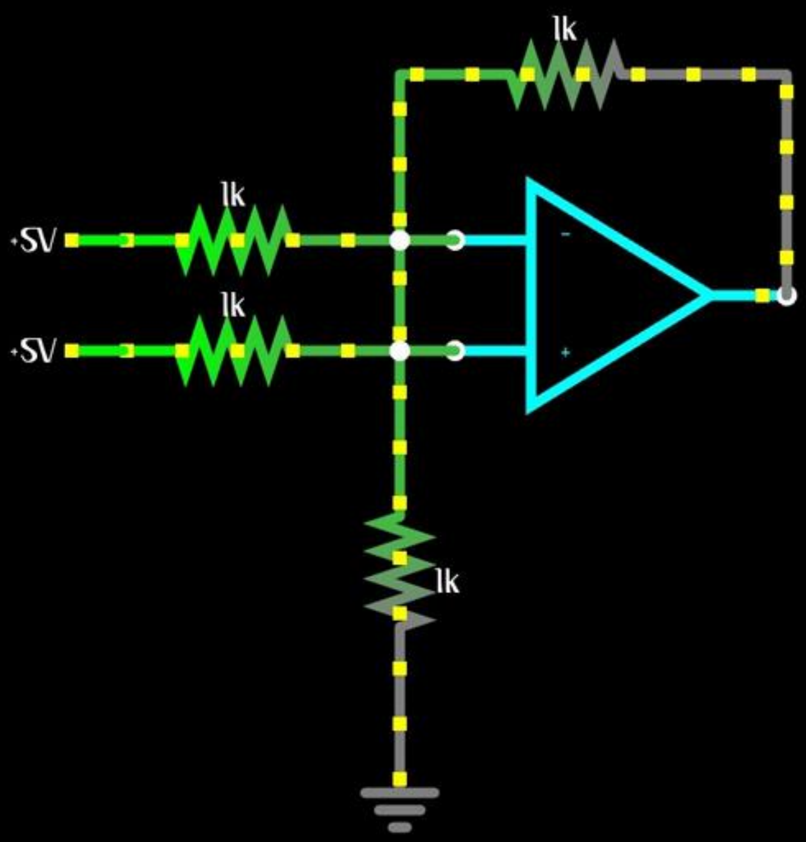


◆ This is a summing amplifier circuit that combines multiple input signals into a single output signal, which is the weighted sum of the inputs.

◆ The circuit typically consists of an operational amplifier (op-amp), multiple input resistors, and a feedback resistor.

◆ This circuit is used in applications such as audio mixing, signal processing, and analog computing,

Differential amplifier

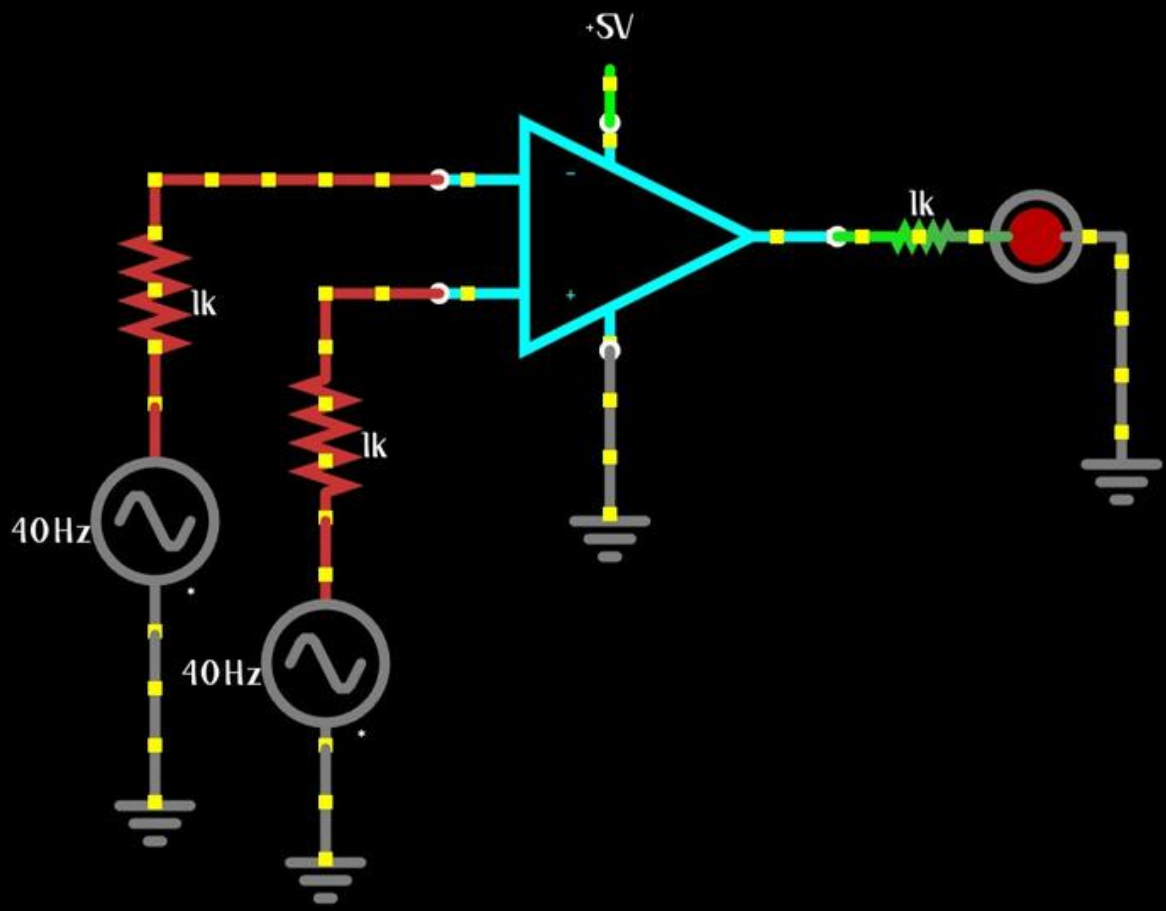


🔶 This is a differential amplifier circuit that amplifies the difference between two input signals while rejecting any common-mode signals (signals that are common to both inputs).

🔶 The differential amplifier outputs a voltage proportional to the difference between the two input voltages.

🔶 This circuit is crucial for applications requiring precise measurement of voltage differences, such as in instrumentation, sensor interfacing.

comparator circuit

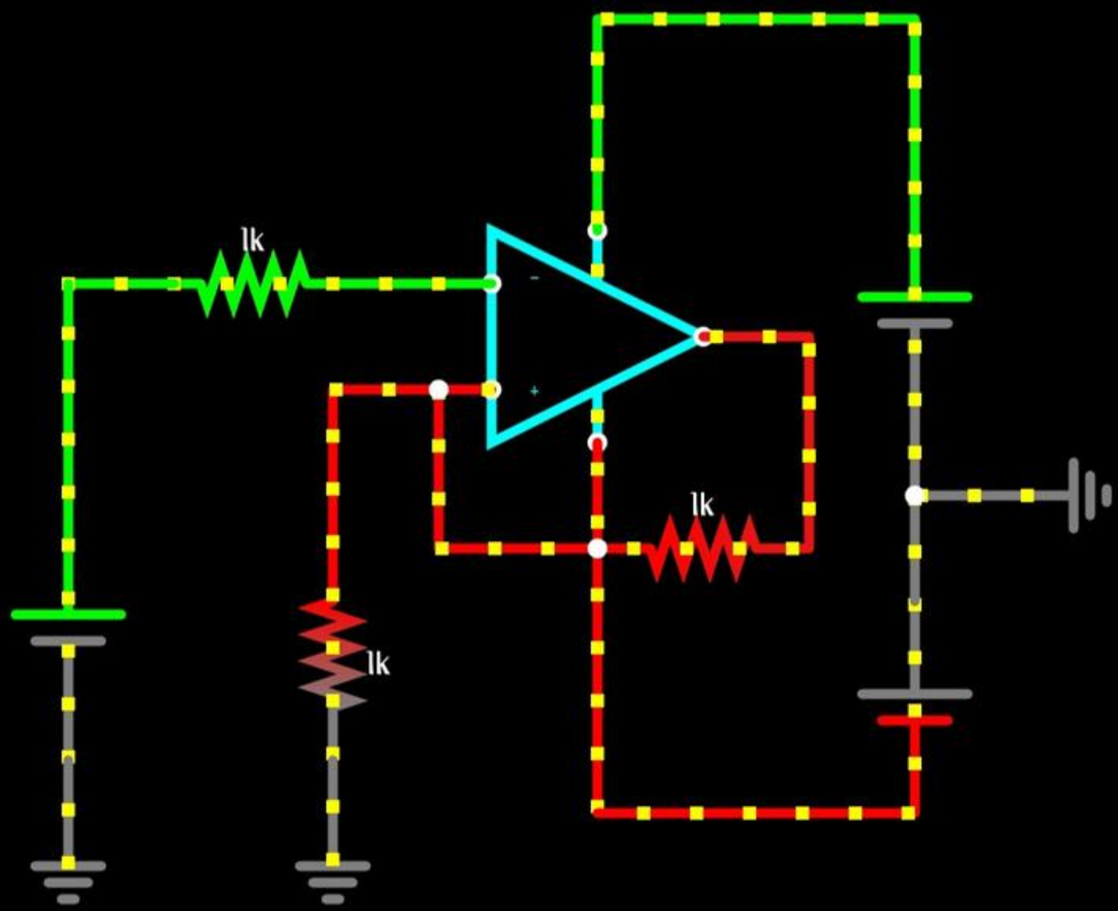


🔶 This comparator circuit compares two input voltages and outputs a high or low voltage depending on which input is greater.

🔶 It uses an operational amplifier to generate a digital output that indicates which input voltage is higher.

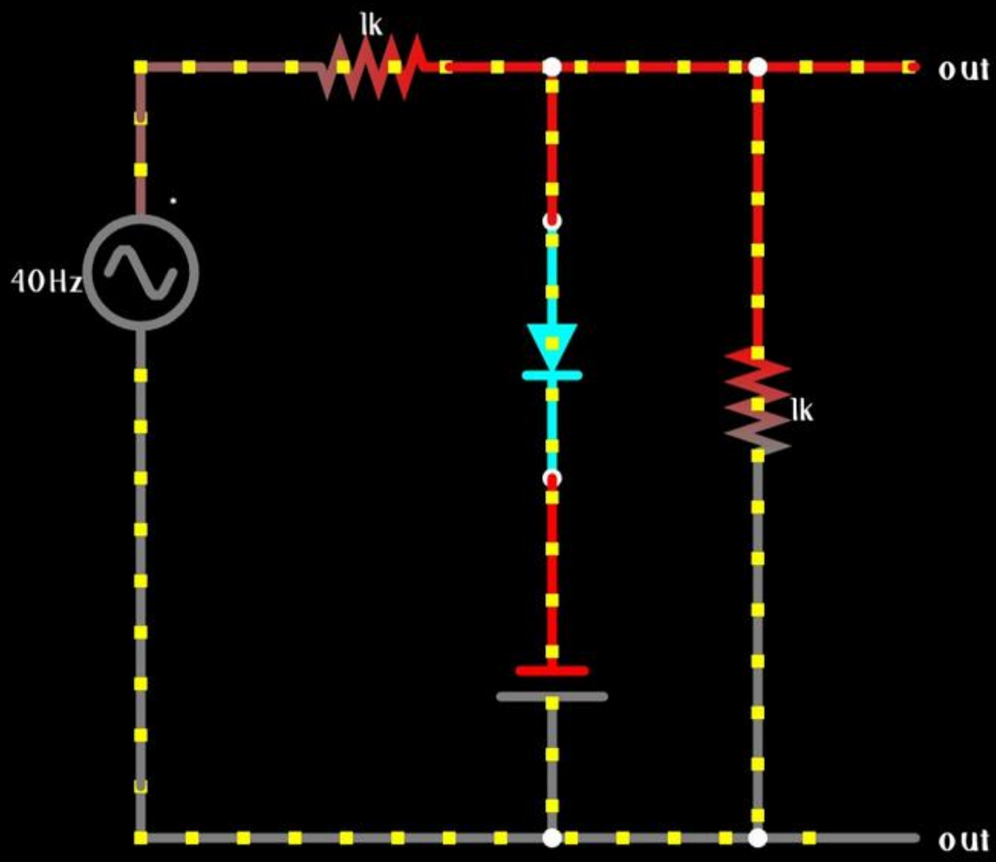
🔶 Making it useful in applications like voltage level detection, zero-crossing detection, and pulse-width modulation.

Schmitt trigger



◆ The Schmitt trigger converts noisy or slow-varying signals into clean digital outputs by introducing hysteresis.
◆ It uses positive feedback to set distinct upper and lower threshold voltages, ensuring stable transitions.
◆ This circuit is commonly used in signal conditioning, noise filtering, and waveform shaping.

Voltage clipper circuit

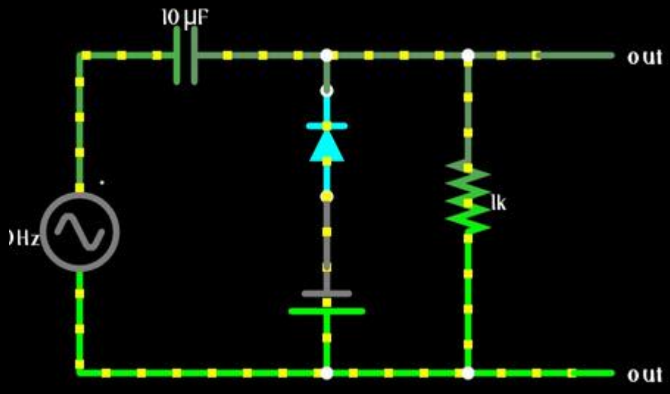


◆ Limits the voltage in a circuit by "clipping" any voltage that exceeds a predefined threshold.

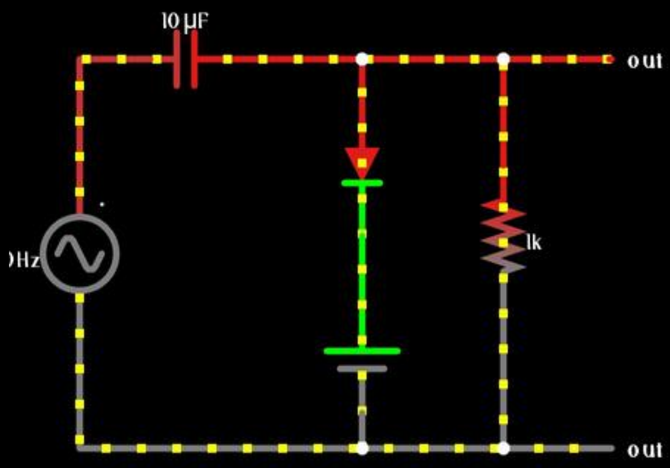
◆ Uses diodes to conduct and protect the circuit when the input voltage surpasses the set limit.

◆ Commonly used in signal protection, waveform shaping, and preventing overvoltage damage in electronic circuits.

Positive clamper with negative bias



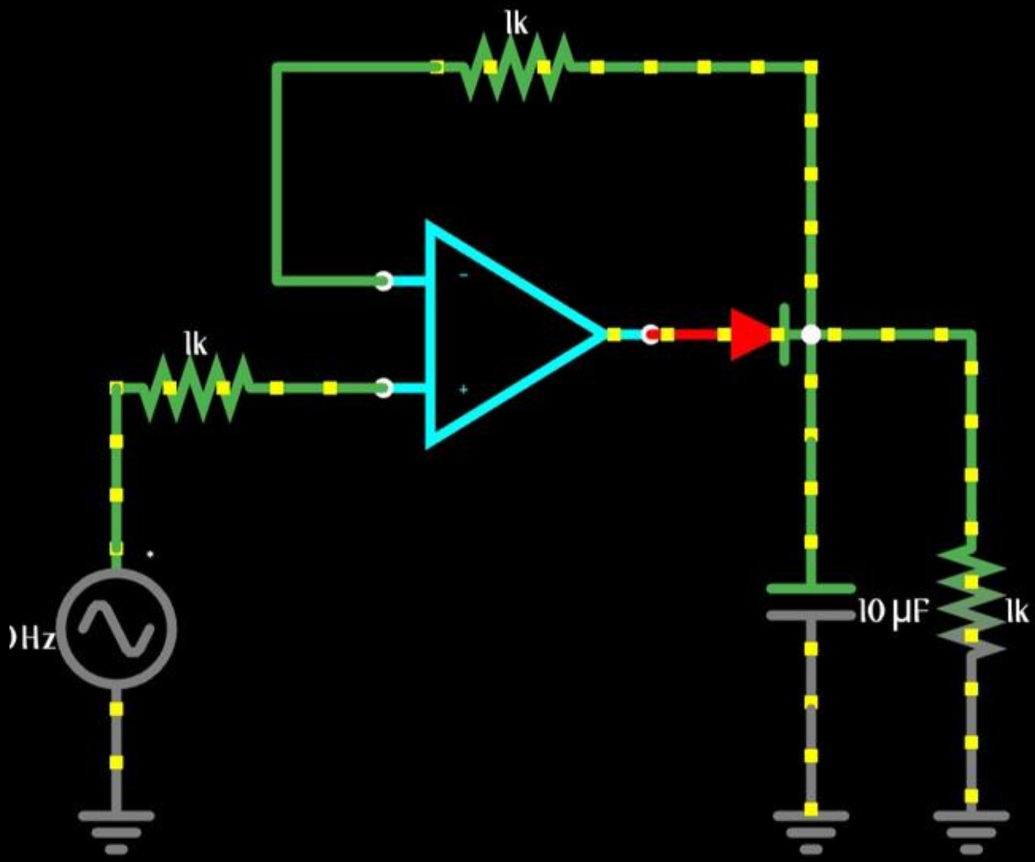
Negative clamper with positive bias



◆ Positive Clamper: Shifts the entire input signal upward by adding a DC voltage, ensuring the signal stays above a certain reference level. Typically uses a diode and capacitor.

◆ Negative Clamper: Shifts the input signal downward by subtracting a DC voltage, ensuring the signal stays below a certain reference level. It also uses a diode and capacitor.

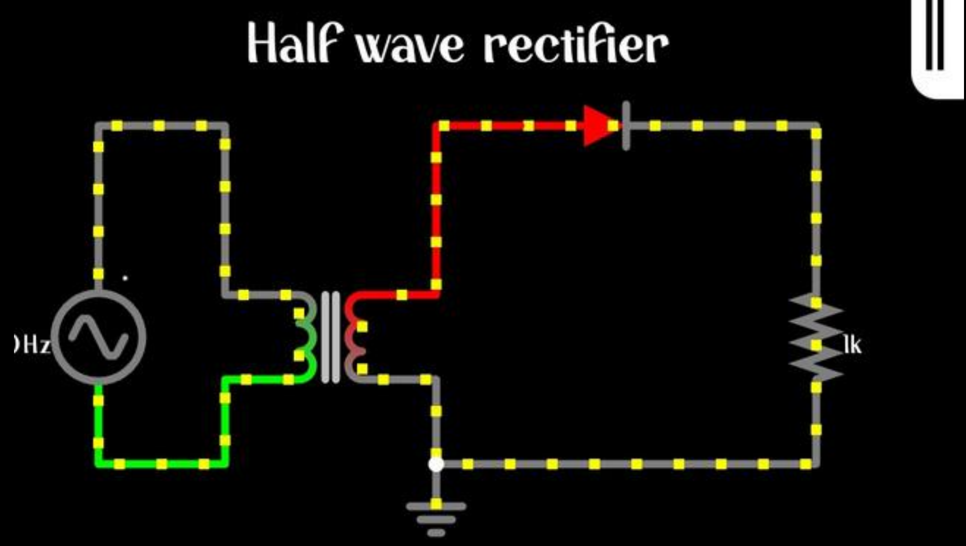
Peak detector circuit

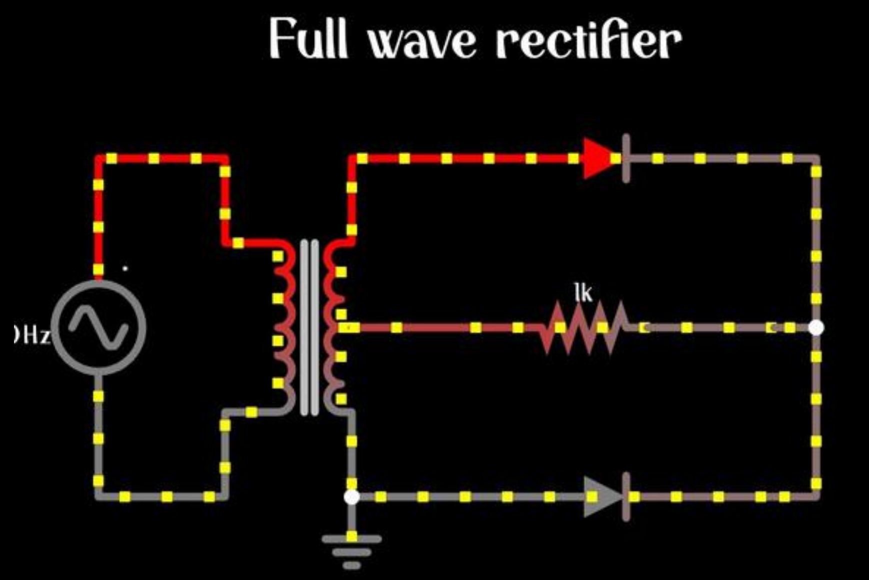


◆ Detects and holds the peak (maximum) value of an input signal, maintaining this value for a certain period.

◆ Uses a diode, capacitor, and resistor to capture the peak voltage and prevent the signal from dropping below that level.

◆ Commonly used in signal processing, audio peak detection.

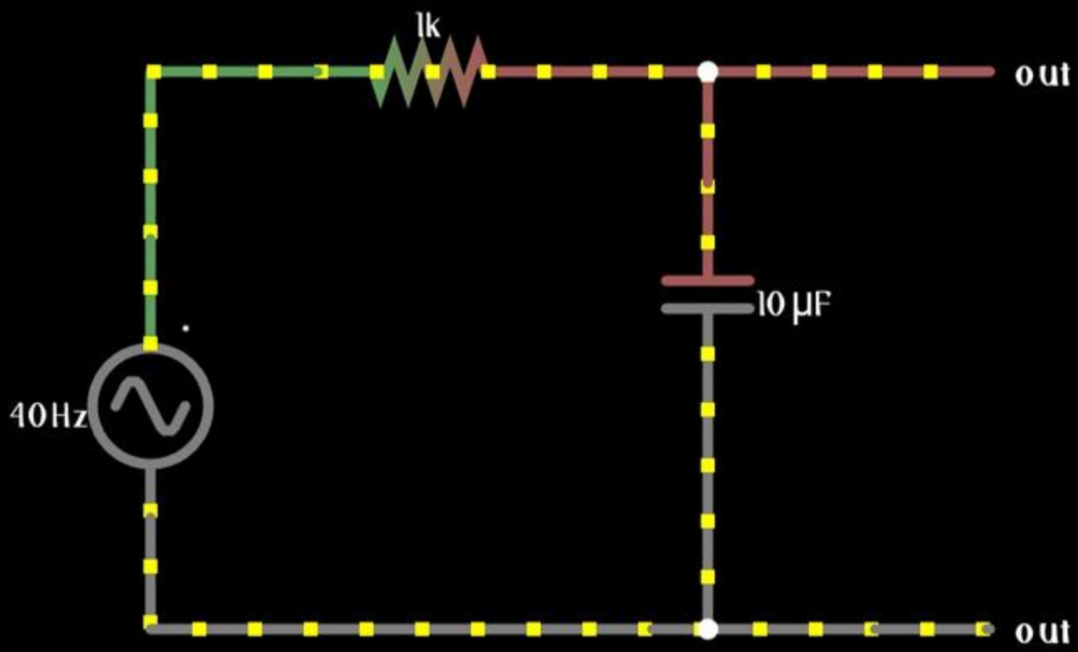




🔶 Half-Wave Rectifier: Converts only one half (positive or negative) of an AC signal into DC by allowing current to flow through the load during one half-cycle, using a single diode.

🔶 Full-Wave Rectifier: Converts both halves of an AC signal into DC by using two or four diodes in a bridge configuration, providing smoother output with a higher average DC voltage.

Low pass RC filter

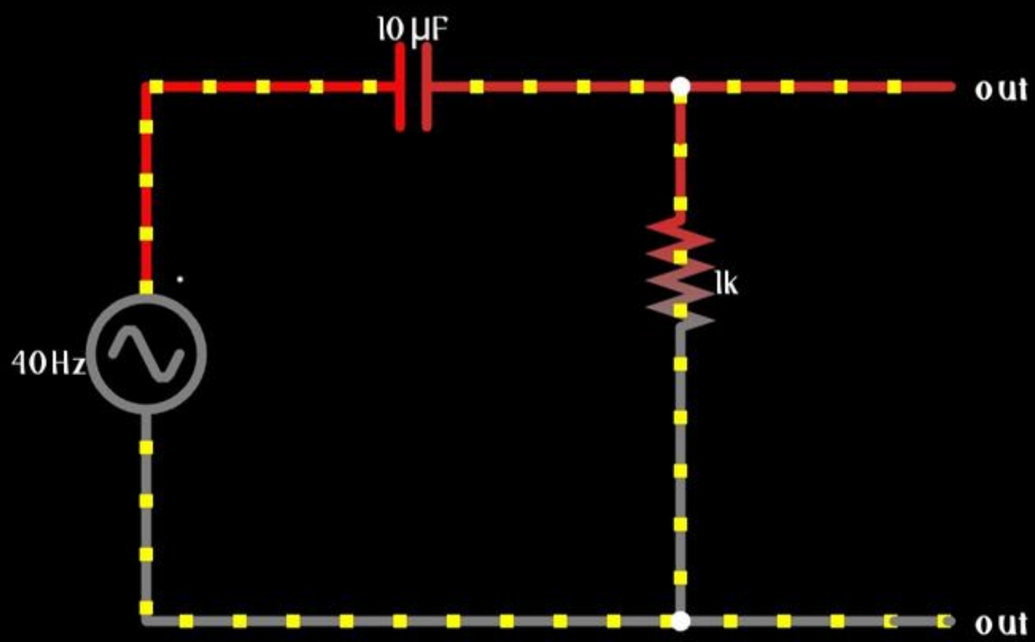


◆ Allows low-frequency signals to pass through while attenuating high-frequency signals.

◆ Typically consists of a resistor and capacitor (RC filter) or an inductor and capacitor (LC filter), with the cutoff frequency .

◆ Used in audio systems, signal processing, and noise reduction to remove high-frequency noise or smooth out signals.

High pass RC filter

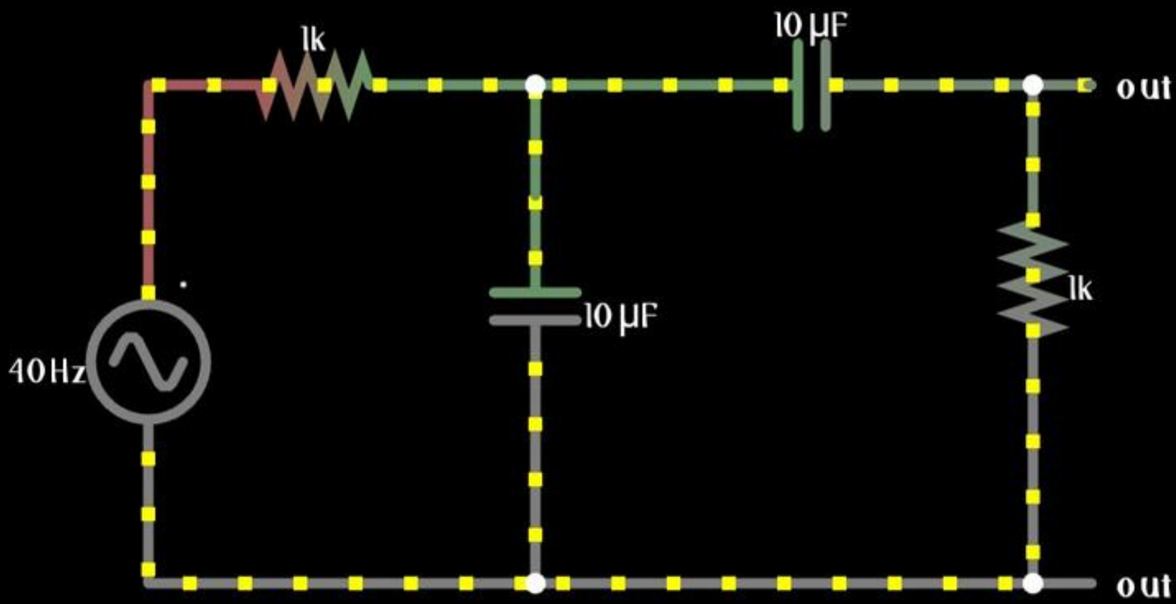


◆ Allows high-frequency signals to pass through while attenuating low-frequency signals.

◆ Typically uses a resistor and capacitor (RC filter) or an inductor and capacitor (LC filter), with the cutoff frequency .

◆ Used in audio processing, signal conditioning, and noise filtering to eliminate low-frequency noise or unwanted components from a signal.

Band pass filter

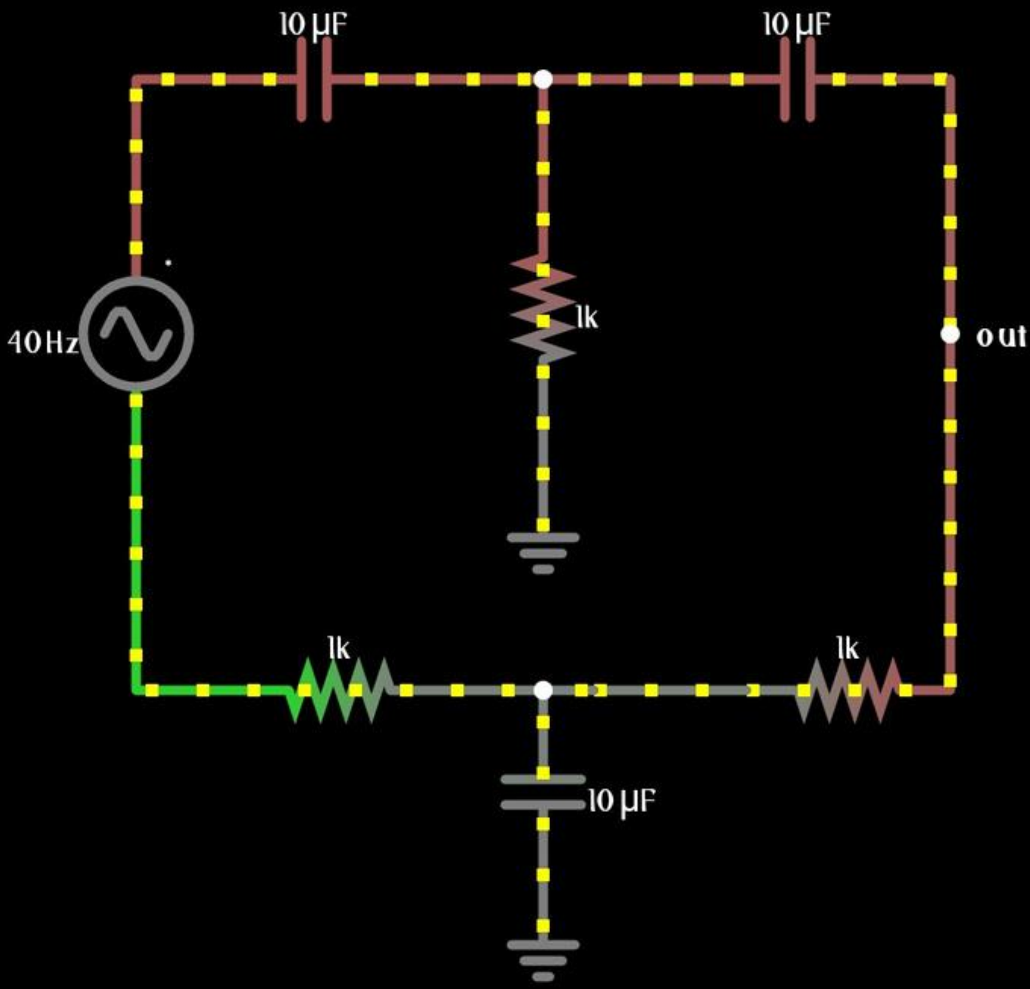


◆ Allows signals within a specific frequency range to pass through while attenuating frequencies outside this range.

◆ Combines a low-pass filter and a high-pass filter to define the lower and upper cutoff frequencies, creating a band of allowed frequencies.

◆ Used in wireless communication, audio processing, and instrumentation to isolate desired frequency bands from a signal.

Band stop filter

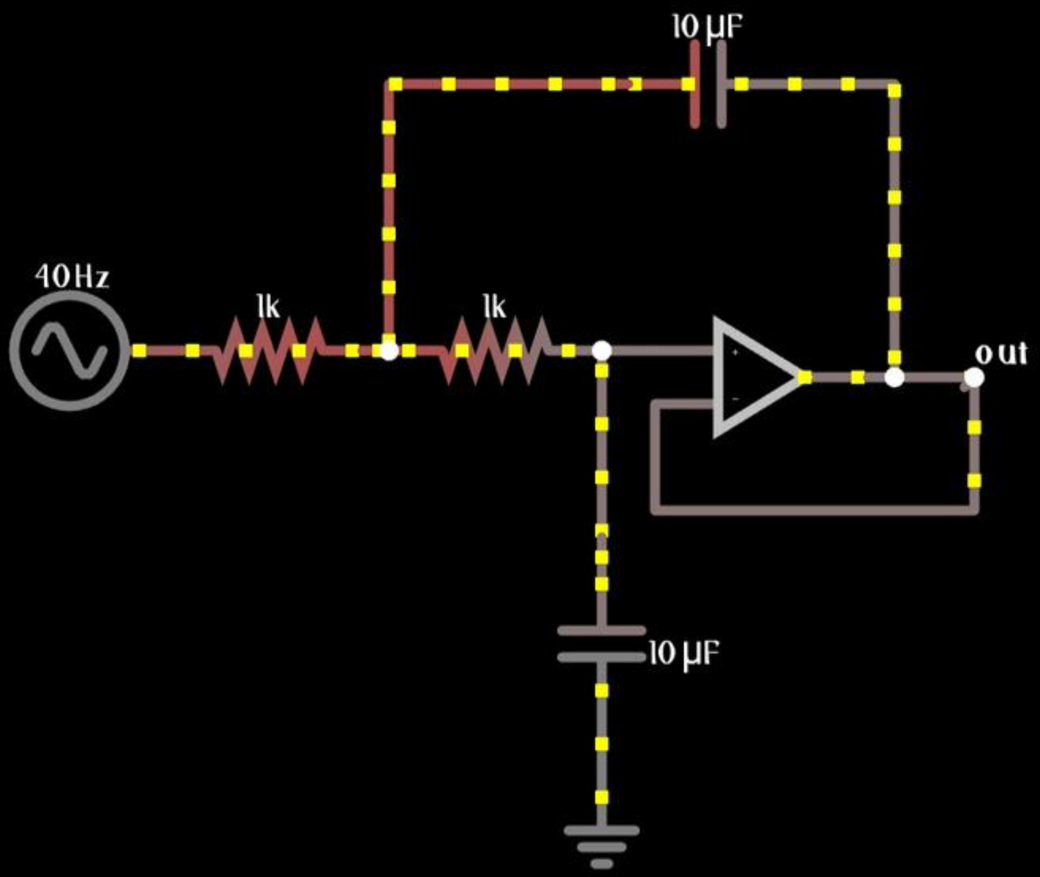


🔶 Attenuates signals within a specific frequency range while allowing frequencies outside this range to pass through.

🔶 Combines a low-pass filter and a high-pass filter in parallel, creating a "notch" where the undesired frequencies are blocked.

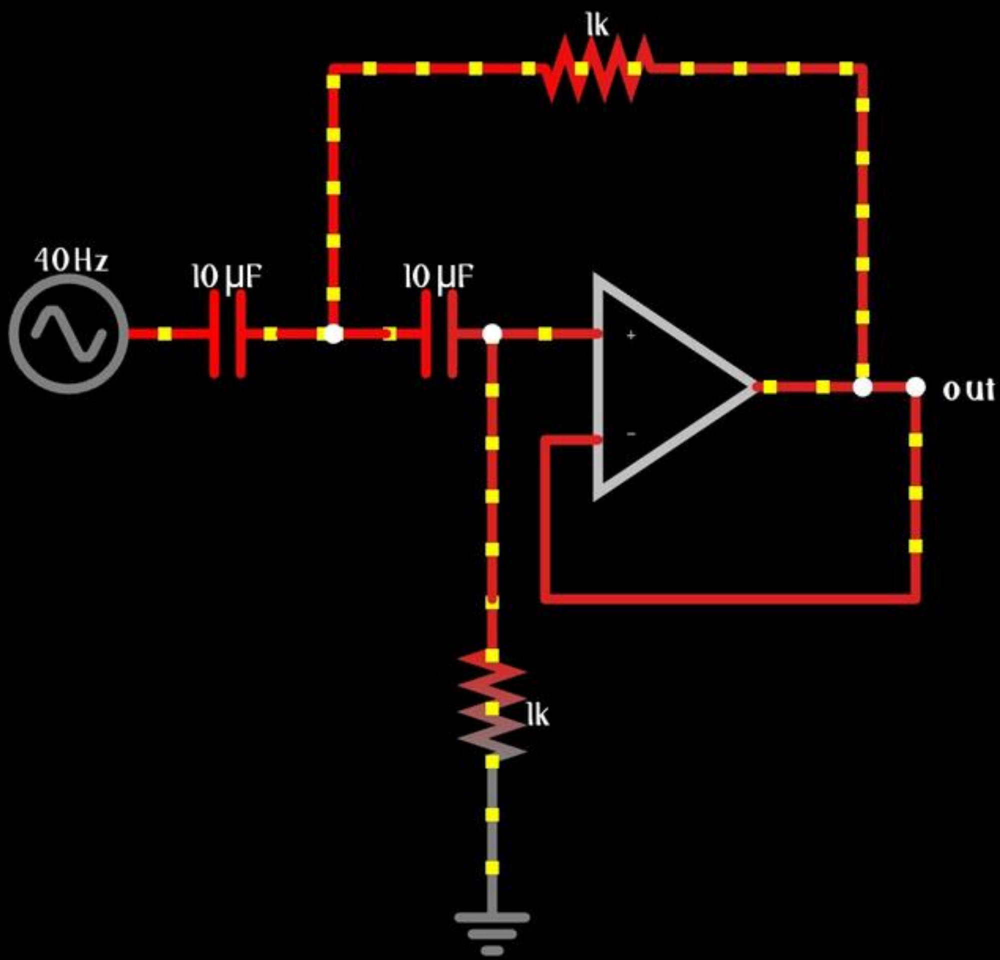
🔶 Used in communication systems, audio processing, and power systems to eliminate interference.

Active low pass filter



- Passes low-frequency signals while attenuating high-frequency signals, with added amplification.
- Uses an operational amplifier (op-amp) along with resistors and capacitors to improve gain and performance compared to passive filters.
- Commonly used in audio systems, signal processing, and communication systems for noise reduction and smoothing signals.

Active high pass filter

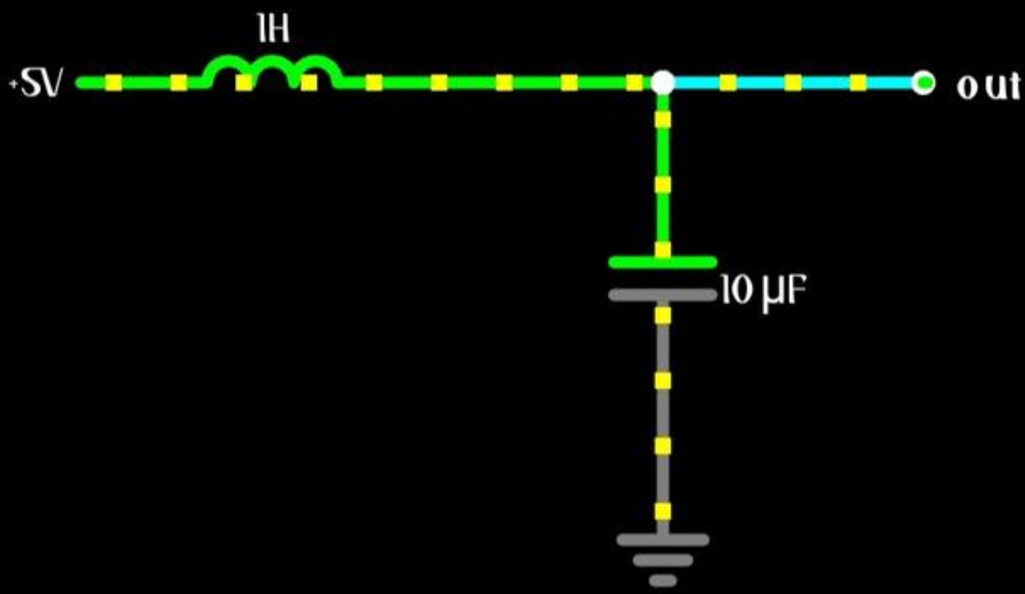


🔶 Passes high-frequency signals while attenuating low-frequency signals, with added amplification.

🔶 Utilizes an operational amplifier (op-amp) with resistors and capacitors to improve gain and performance over passive filters.

🔶 Used in audio processing, communication systems, and signal conditioning to remove low-frequency noise or interference.

LC filter

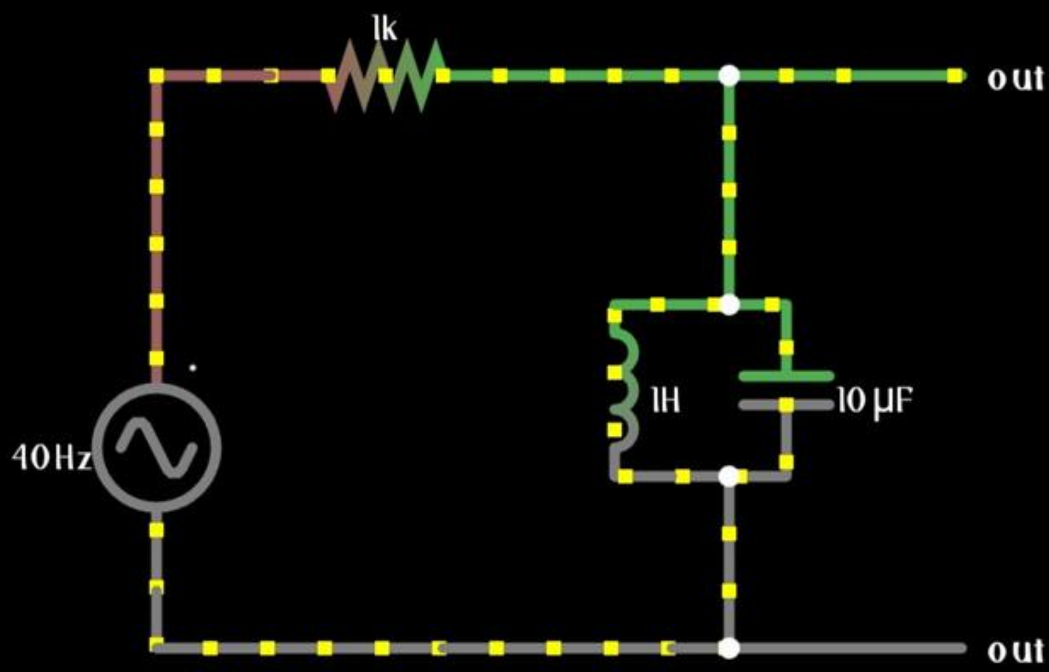


🔶 Filters signals by allowing specific frequencies to pass while attenuating others, using inductors (L) and capacitors (C).

🔶 The inductor and capacitor work together to create low-pass, high-pass, bandpass, or band-stop filter characteristics, depending on the configuration.

🔶 Commonly used in power supplies, radio frequency (RF) circuits, and audio systems .

RLC band pass filter

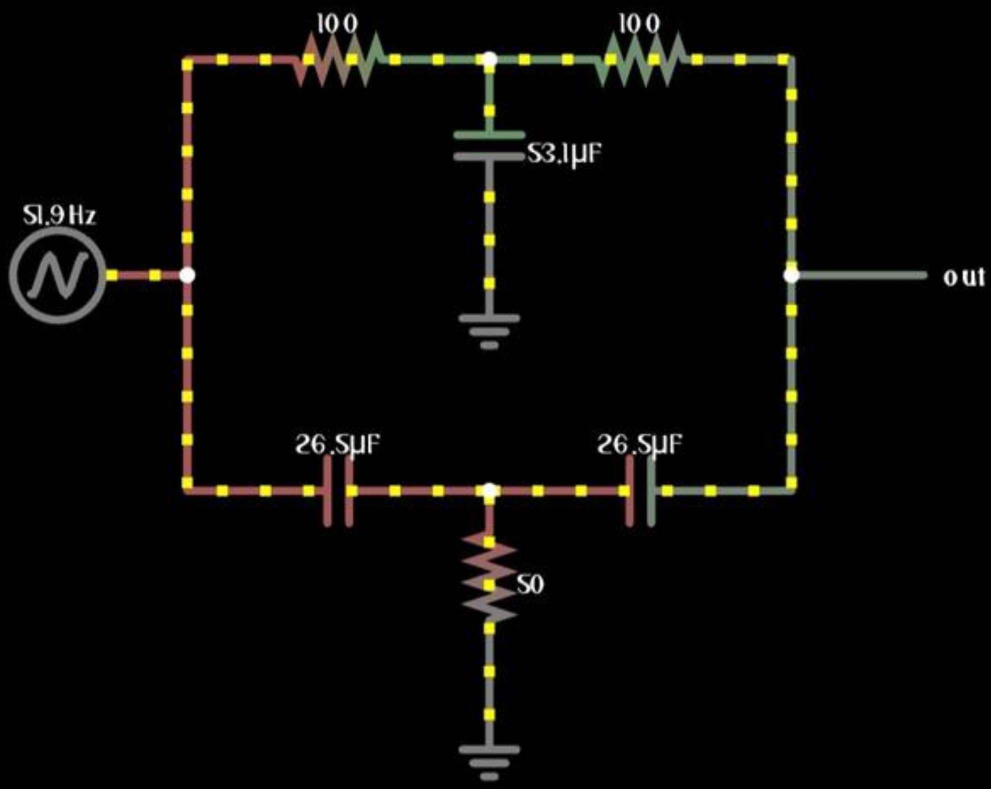


◆ Allows signals within a specific frequency range to pass through while attenuating frequencies outside this range.

◆ Combines a resistor (R), inductor (L), and capacitor (C) in series or parallel, with the resonant frequency determined by the values of L and C.

◆ Used in communication systems, audio processing, and RF circuits to isolate or amplify desired frequency bands.

Twin-t notch filter

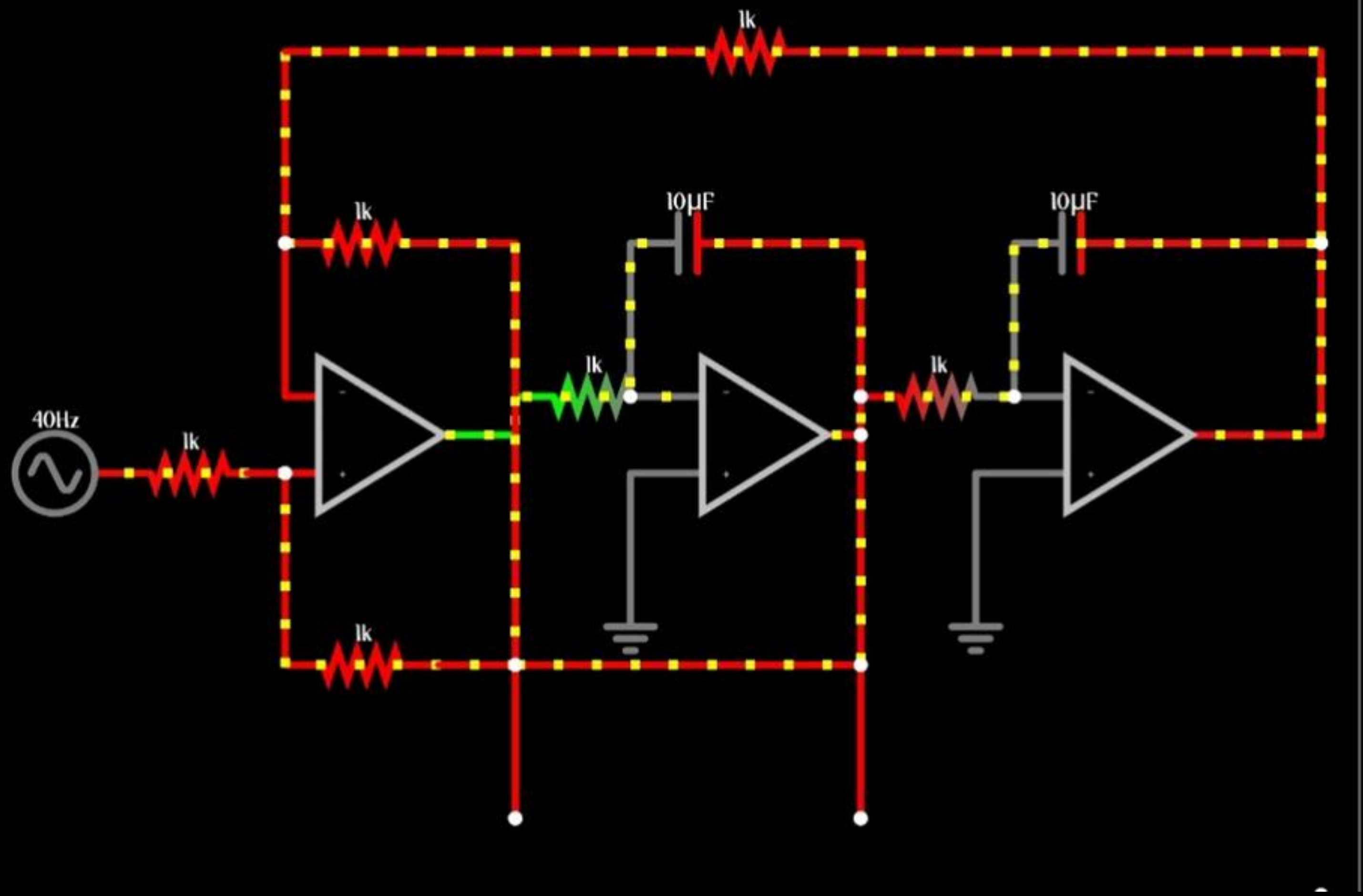


◆ Attenuates a specific frequency (notch frequency) while allowing other frequencies to pass, creating a sharp "notch" in the frequency response.

◆ Uses two T-shaped resistor-capacitor (RC) networks arranged in parallel, one for high-pass and the other for low-pass, to effectively cancel signals at the notch frequency.

◆ Commonly used in audio systems, instrumentation, and communication systems .

State variable filter

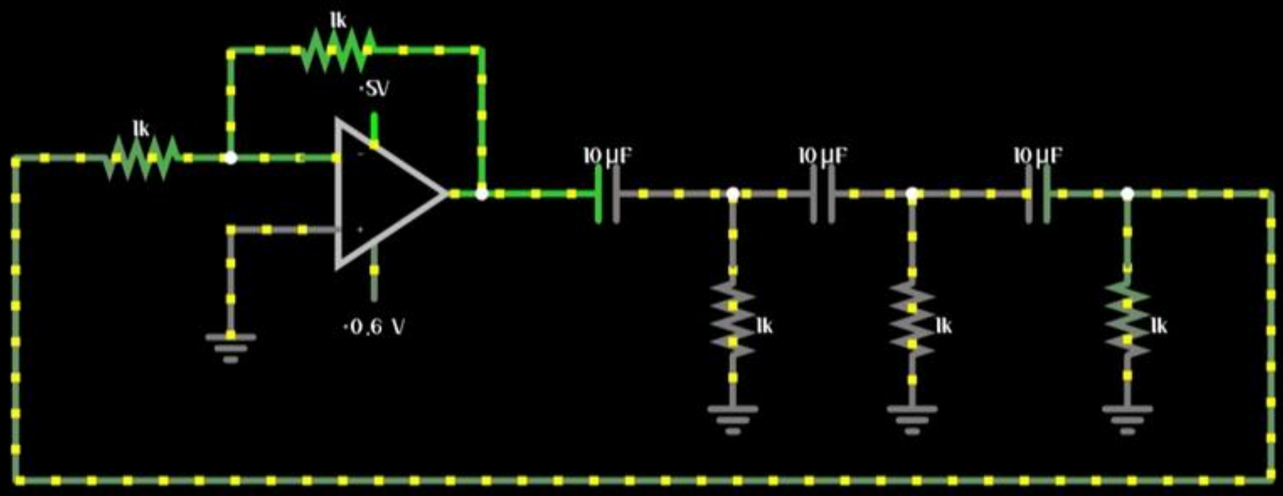


◆ Provides simultaneous low-pass, high-pass, and band-pass outputs, allowing versatile filtering of input signals.

◆ Utilizes multiple operational amplifiers (op-amps) in a feedback configuration with resistors and capacitors to define the filter characteristics and cutoff frequencies.

◆ Commonly used in audio processing, signal analysis, and communication systems .

Simple RC oscillator

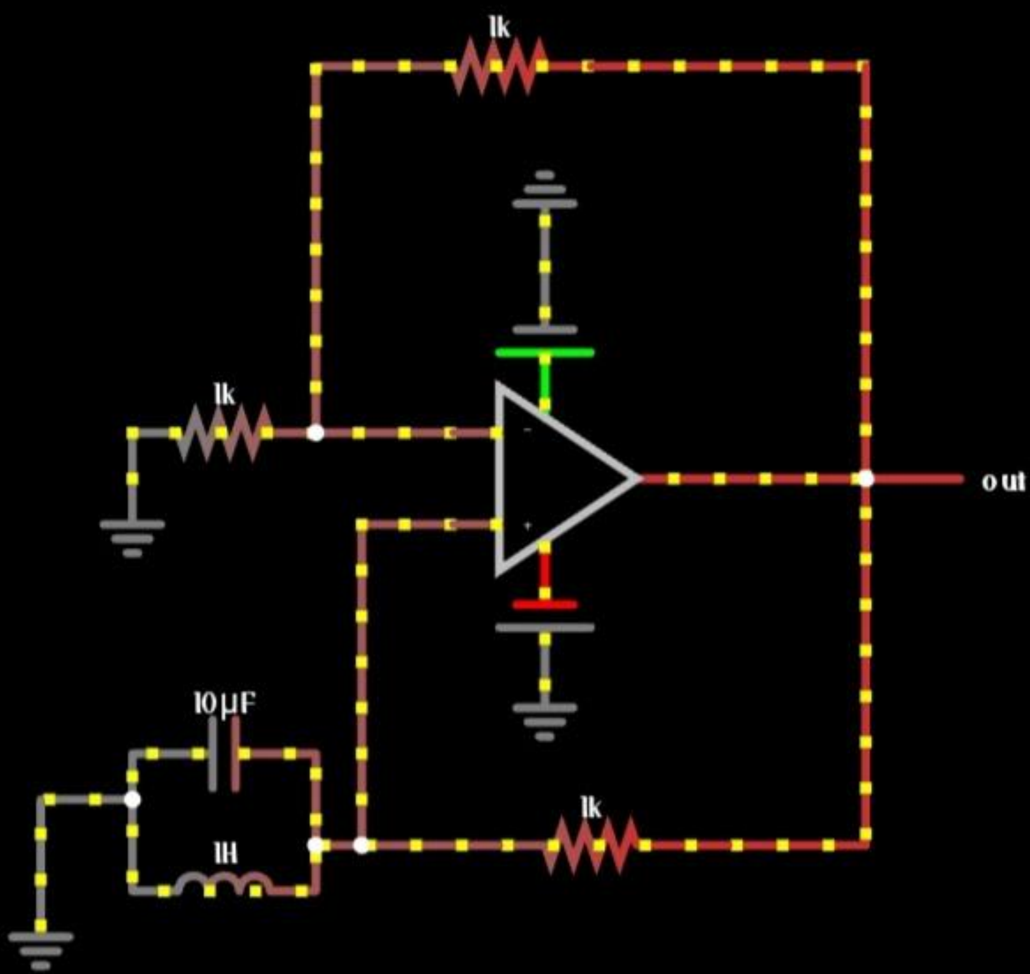


◆ Generates a sinusoidal waveform at a specific frequency using resistors and capacitors (RC network).

◆ Uses an RC network for frequency determination and an amplifier (like an op-amp or transistor) to sustain oscillations based on positive feedback.

◆ Used in audio signal generation, function generators, and as clock signals in low-frequency applications.

LC oscillator

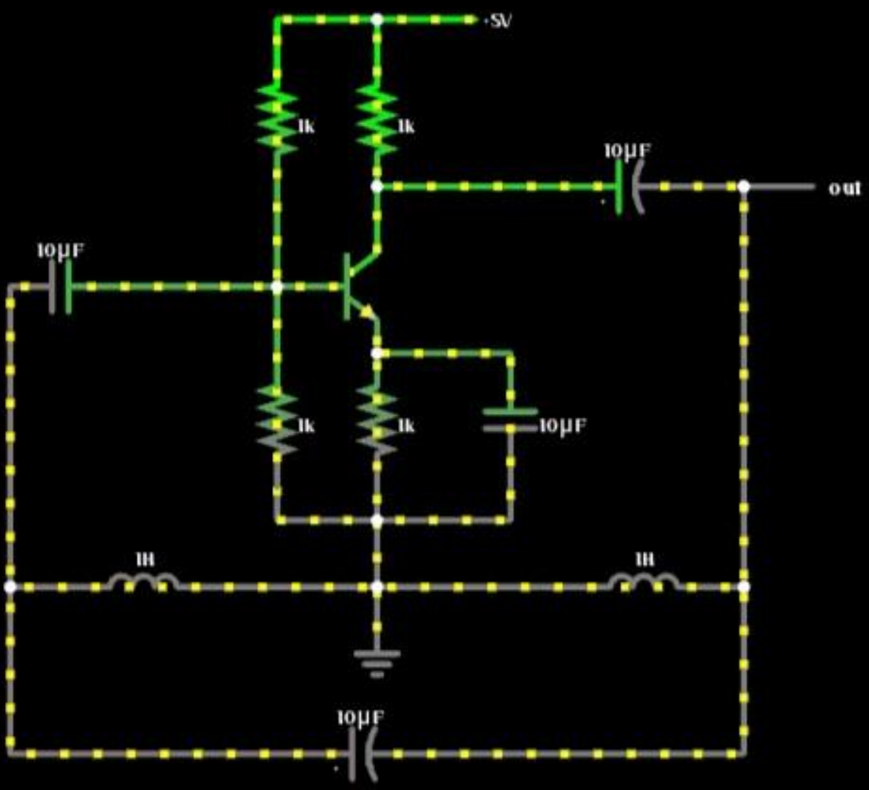


◆ Generates sinusoidal waveforms at high frequencies using an inductor (L) and capacitor (C) as the frequency-determining components.

◆ The LC circuit forms a resonant tank that oscillates at a specific frequency, sustained by positive feedback from an amplifier.

◆ Commonly used in radio transmitters, receivers, and signal generation for communication systems and RF circuits.

Hartley Oscillator

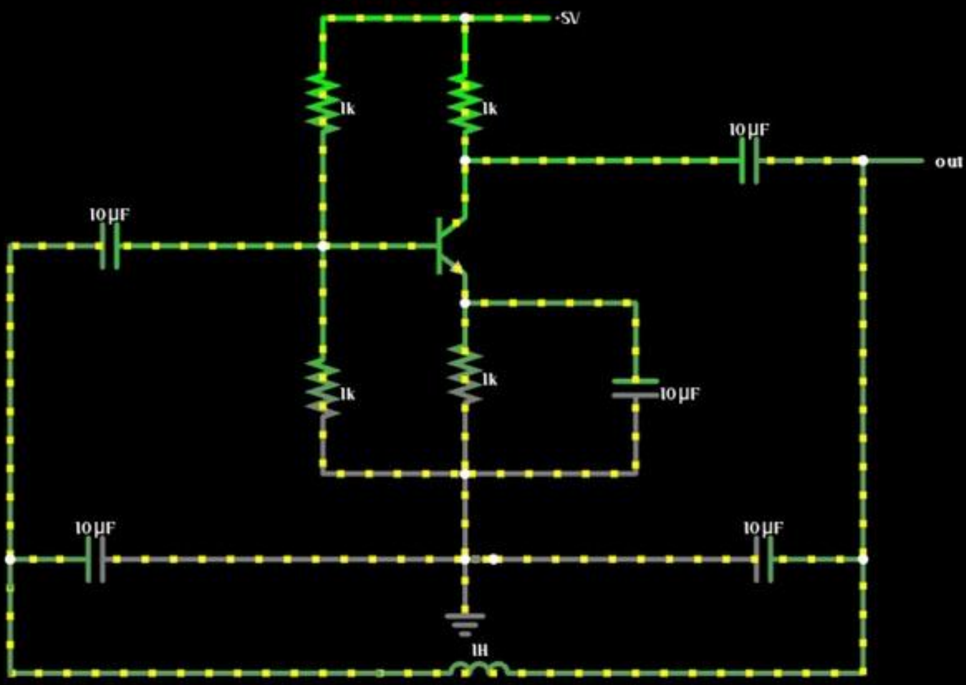


🔶 Generates sinusoidal waveforms, typically in the radio frequency (RF) range, using an LC circuit with a tapped inductor.

🔶 determine the oscillation frequency, with positive feedback provided by the tapped inductor to sustain oscillations.

🔶 Widely used in RF oscillators, signal generators, and communication systems.

Colpitts oscillator

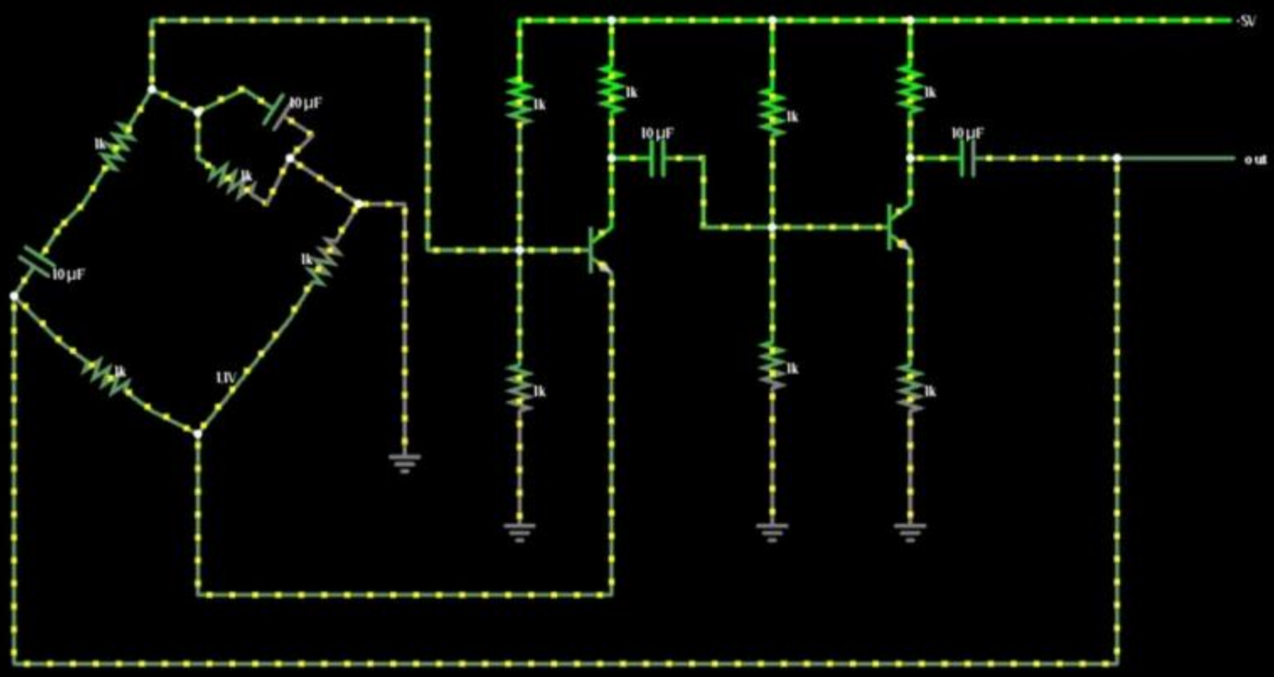


◆ Generates sinusoidal waveforms at high frequencies typically used in RF and communication systems.

◆ Uses an LC tank circuit with a capacitive voltage divider to determine the oscillation frequency, with positive feedback provided by the divider.

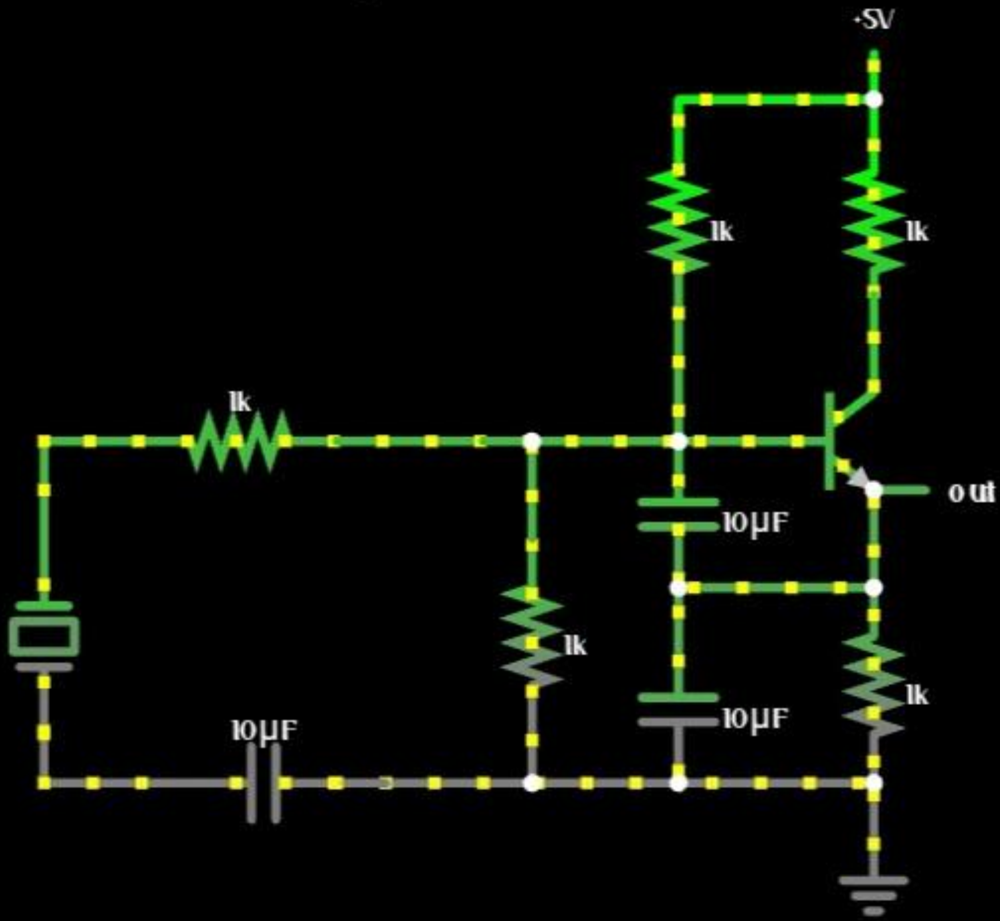
◆ Commonly used in RF signal generation, local oscillators in transmitters, and frequency synthesizers due to its stability and simplicity.

Wien-bridge oscillator



- Generates low-frequency sinusoidal waveforms with excellent frequency stability.
- Uses an RC network (Wien Bridge) for frequency selection and an amplifier (usually an op-amp) with positive feedback to sustain oscillations.
- Commonly used in audio signal generation, testing equipment, and function generators due to its simplicity.

Crystal oscillator

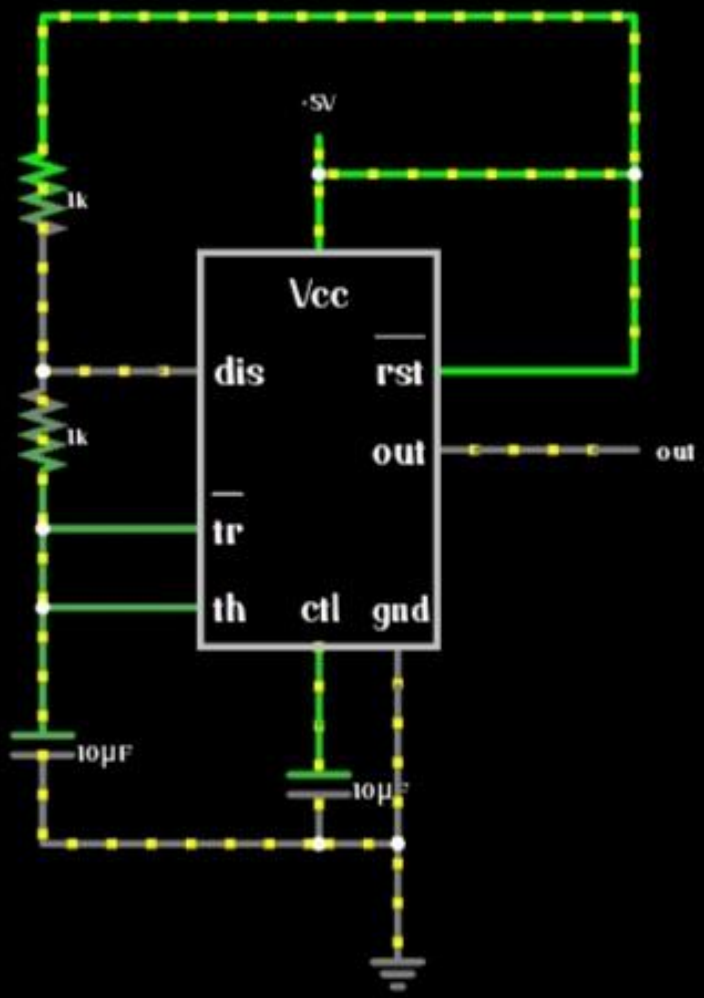


◆ Generates highly stable sinusoidal waveforms with precise frequency control using a quartz crystal.

◆ Utilizes the piezoelectric properties of the quartz crystal to create oscillations at a fixed natural frequency, sustained by an amplifier circuit.

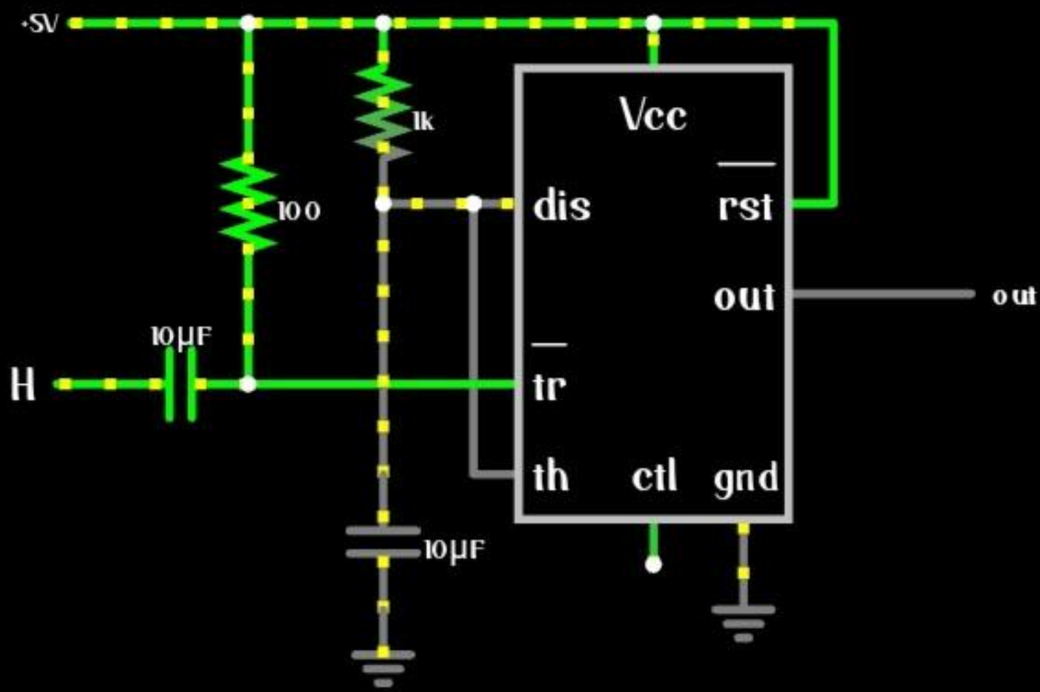
◆ Widely used in clocks, microcontrollers, communication systems.

555 Timer astable oscillator



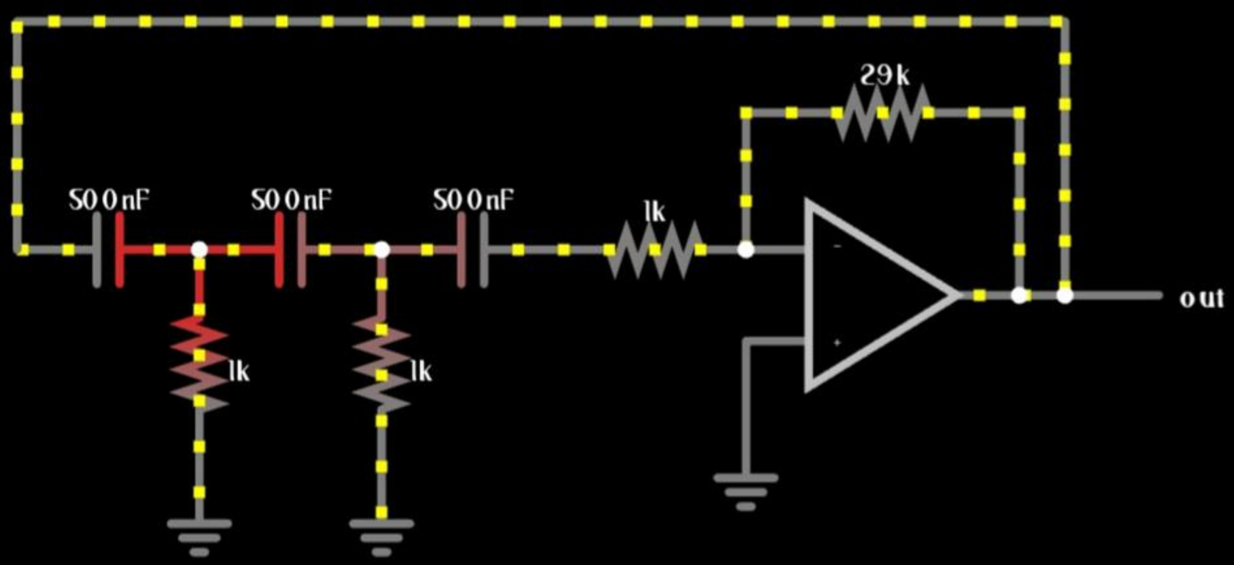
◆ Generates a continuous square wave output without requiring an external trigger.
◆ Configures the 555 timer in astable mode using resistors and a capacitor to set the frequency and duty cycle of the oscillation.
◆ Commonly used in pulse generation, clock signals, LED and motor control, and other timing-related circuits.

555 Timer monostable oscillator



- Generates a single pulse of a fixed duration in response to an external trigger.
- Configures the 555 timer in monostable mode, where the pulse width is determined by a resistor and capacitor connected to the circuit.
- Used in timing applications like pulse width generation, debouncing switches, and creating delay circuits.

Phase shift oscillator

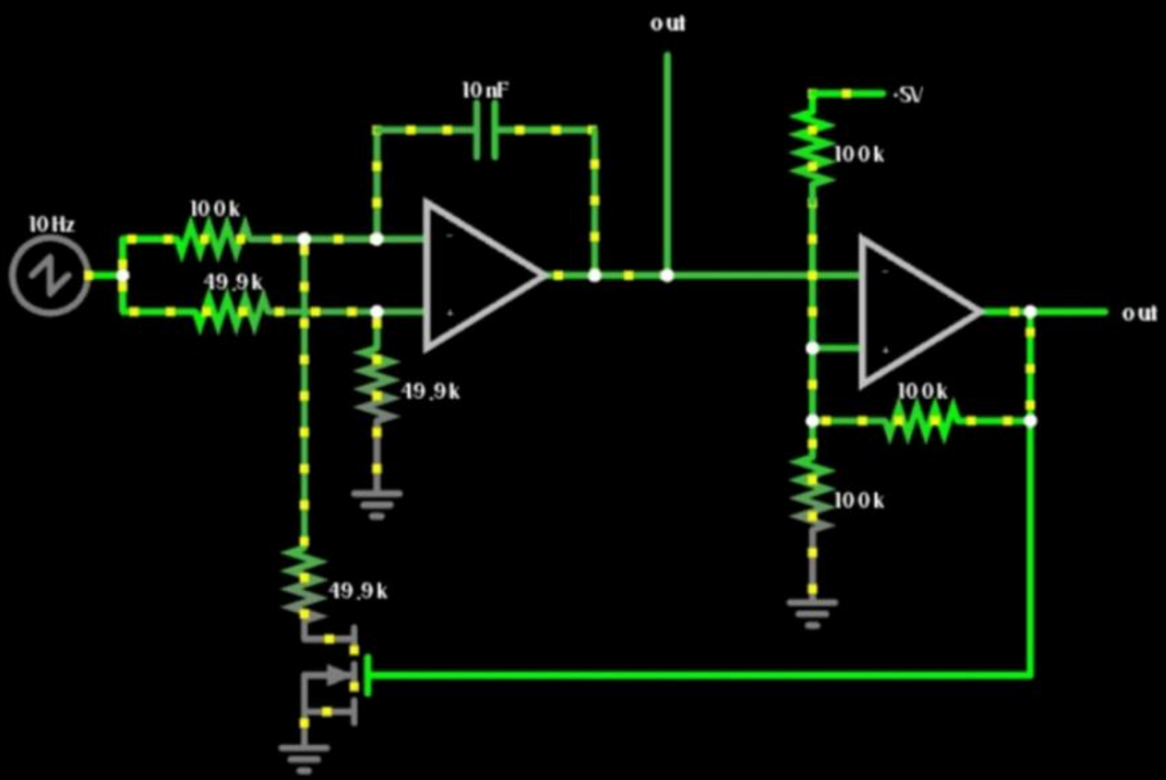


◆ Generates sinusoidal waveforms at low to mid-range frequencies using phase shift networks.

◆ Uses an amplifier (like a transistor or op-amp) and a series of RC networks to produce a 180-degree phase shift, combined with amplifier feedback to sustain oscillations.

◆ Commonly used in audio frequency generation, signal processing, and testing equipment .

Voltage - controlled oscillator

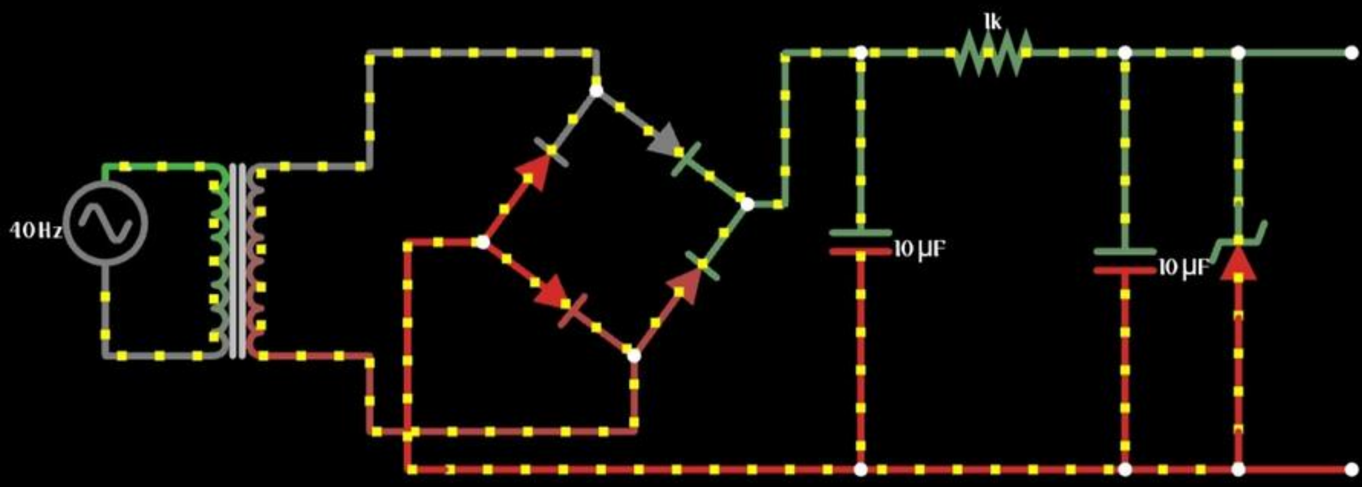


🔶 Generates a frequency that is directly proportional to an input control voltage, allowing the frequency to be adjusted dynamically.

🔶 Uses an electronic oscillator circuit where the control voltage modulates the timing components (e.g., capacitors or inductors) to change the oscillation frequency.

🔶 used in communication systems, frequency modulation, synthesizers, and signal generation .

Basic power supply

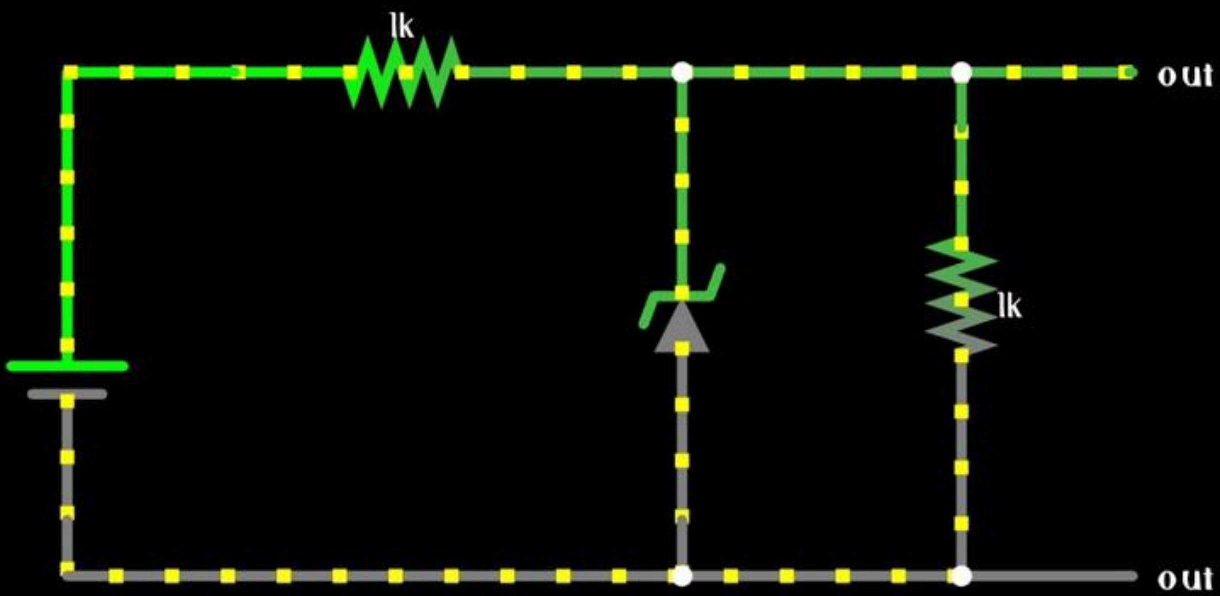


◆ Converts AC (alternating current) to DC (direct current) to provide power to electronic devices.

◆ Typically includes a transformer to step down voltage, a rectifier to convert AC to DC, a filter to smooth the output, and a voltage regulator to provide a stable DC output.

◆ Used in powering low-voltage devices, such as electronic circuits, microcontrollers, and communication equipment.

Zener diode as voltage regulator

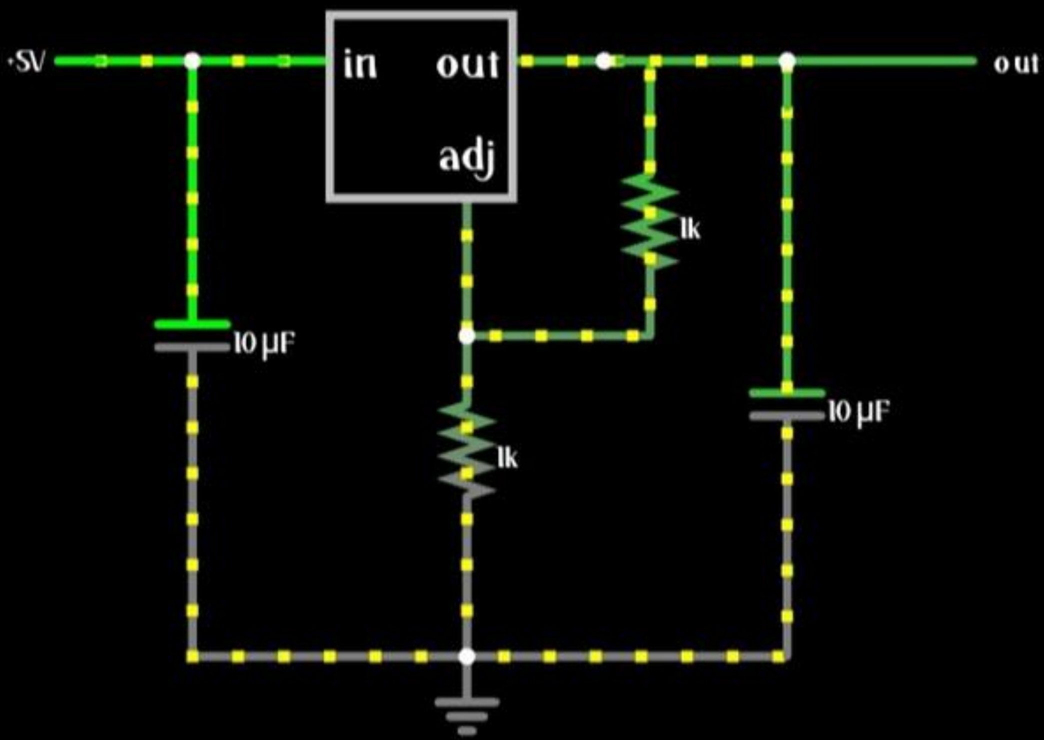


🔶 Maintains a constant output voltage by allowing current to flow in the reverse direction once the Zener diode reaches its breakdown voltage.

🔶 The Zener diode is placed in reverse bias across the load, and when the input voltage exceeds the Zener voltage.

🔶 Commonly used in low-power voltage regulation applications, providing stable voltage for circuits like power supplies, protection circuits.

LM 317 adjustable regulator

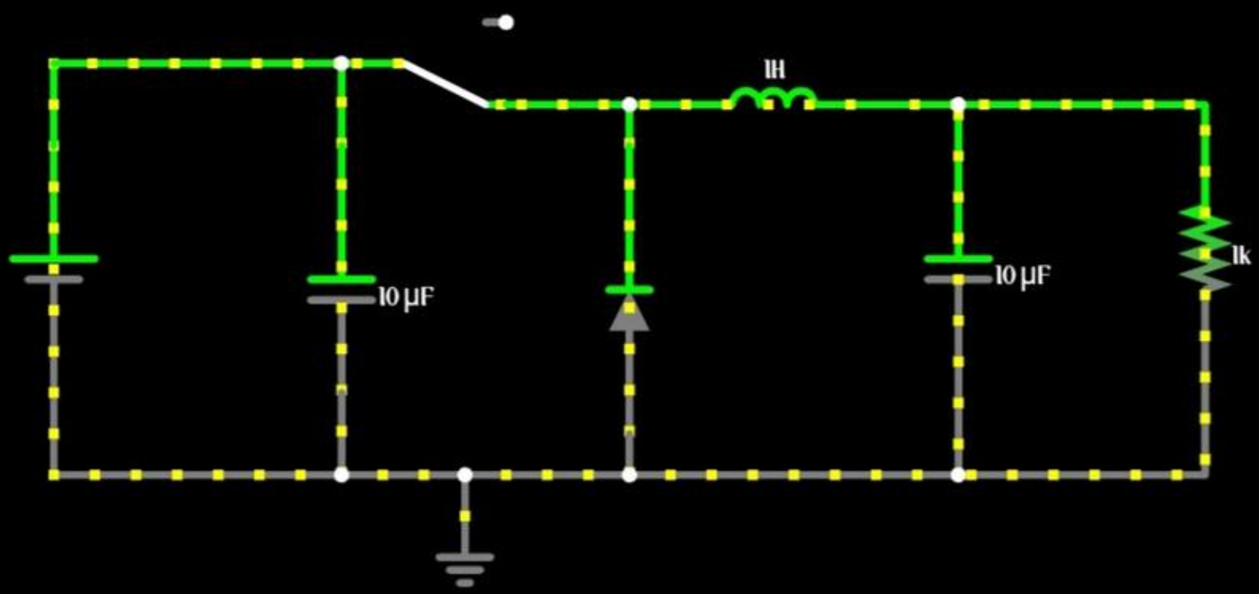


◆ Provides a stable output voltage that can be adjusted within a specific range by using external resistors.

◆ The LM317 adjusts the output voltage based on the ratio of two external resistors connected to its adjustment pin, allowing for a wide range of output voltages.

◆ Used in power supplies, battery chargers, and other applications where a stable and adjustable DC voltage is required .

Switch regulator

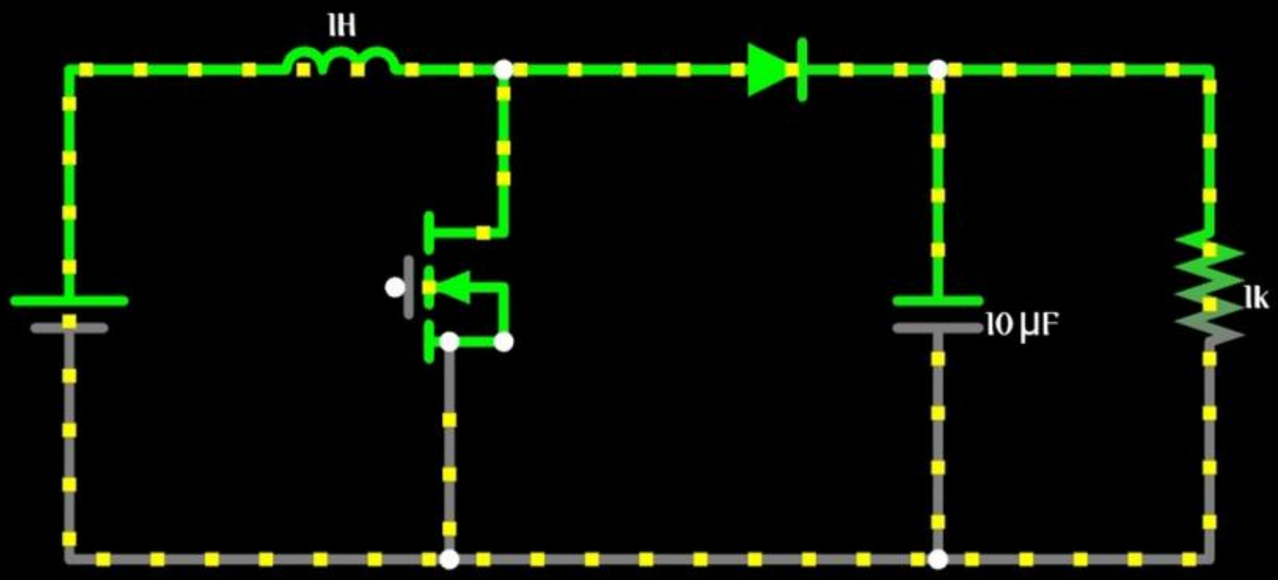


◆ Converts an input voltage to a different, stable output voltage using a high-efficiency switching method, either step-up (boost) or step-down (buck).

◆ Utilizes inductors, capacitors, and semiconductor switches to rapidly switch the input voltage on and off, storing energy in the inductor and then releasing it to regulate the output voltage.

◆ Commonly used in power supplies, battery-operated devices, and energy-efficient circuits.

Boost converter

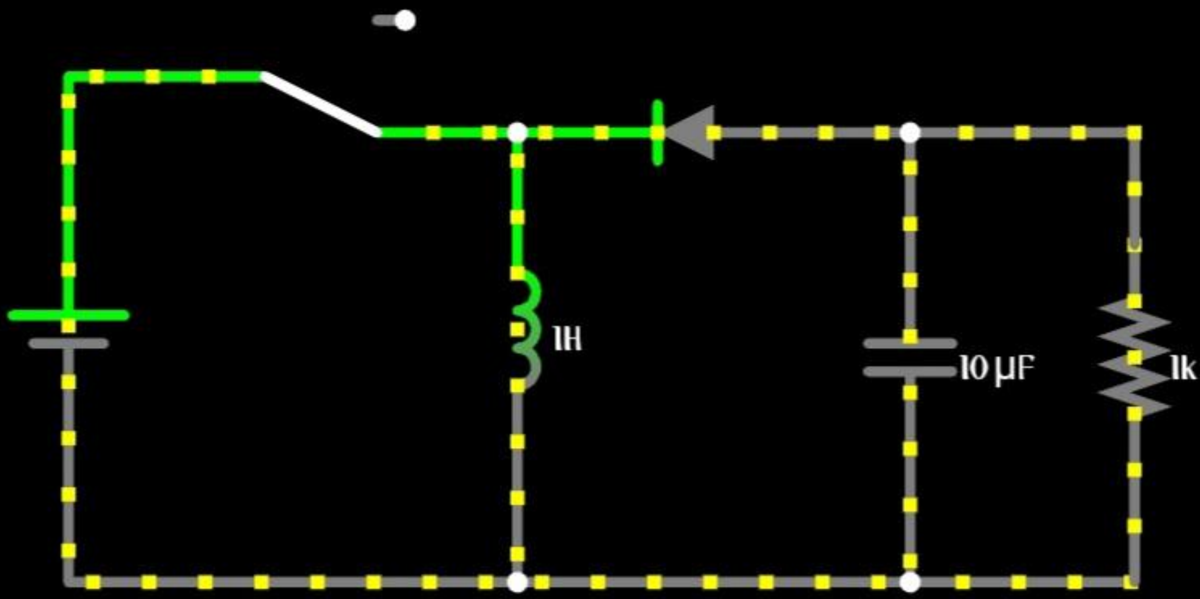


◆ Steps up (increases) a lower input voltage to a higher, stable output voltage.

◆ Uses an inductor, a diode, a switch (typically a transistor), and a capacitor to store energy during the "on" phase and release it during the "off" phase, boosting the voltage.

◆ Commonly used in battery-powered devices, power supplies, and renewable energy systems where a higher voltage is required.

Buck-boost converter

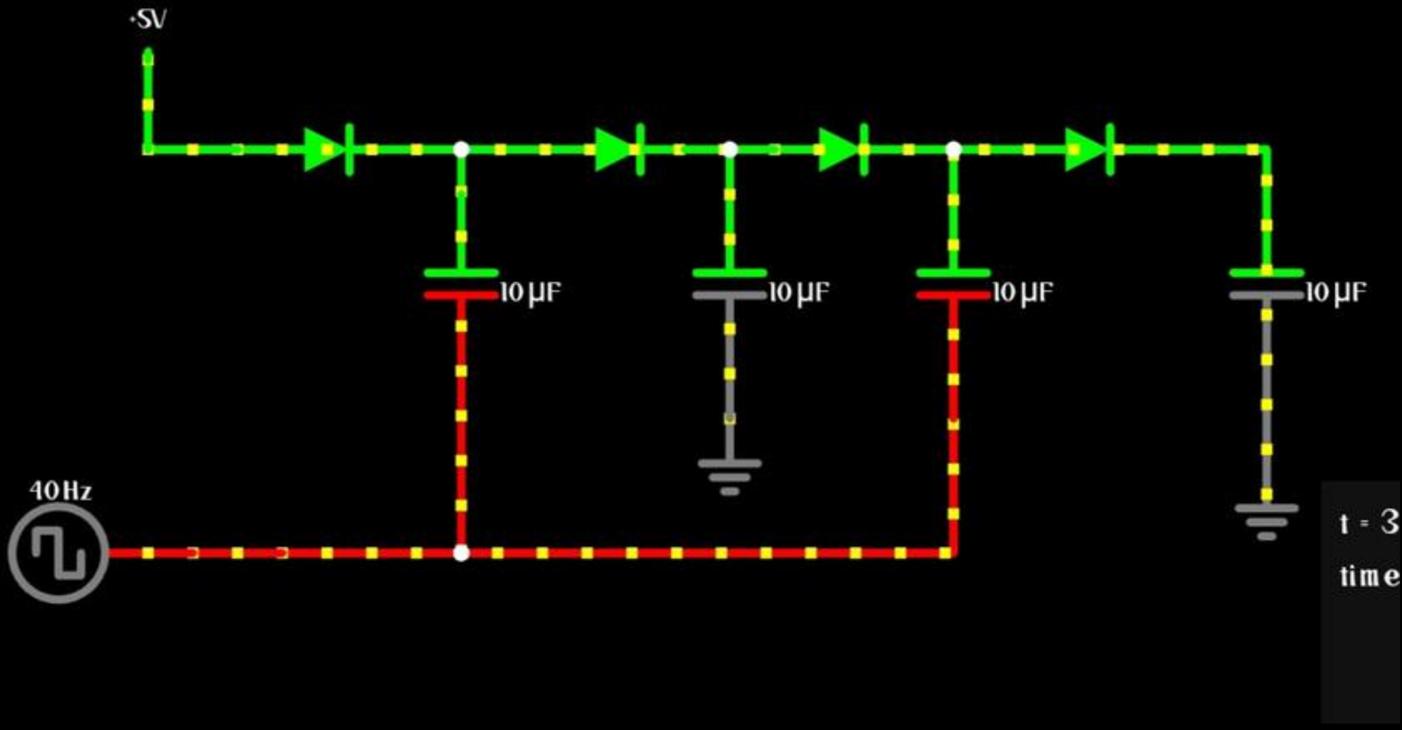


◆ Provides a stable output voltage that can be either higher or lower than the input voltage, depending on the configuration and load requirements.

◆ Combines the principles of both buck (step-down) and boost (step-up) converters, using an inductor, switch, diode, and capacitor to regulate the voltage.

◆ Used in applications where the input voltage can vary above or below the desired output voltage, such as in battery-powered devices.

Charge pump circuit

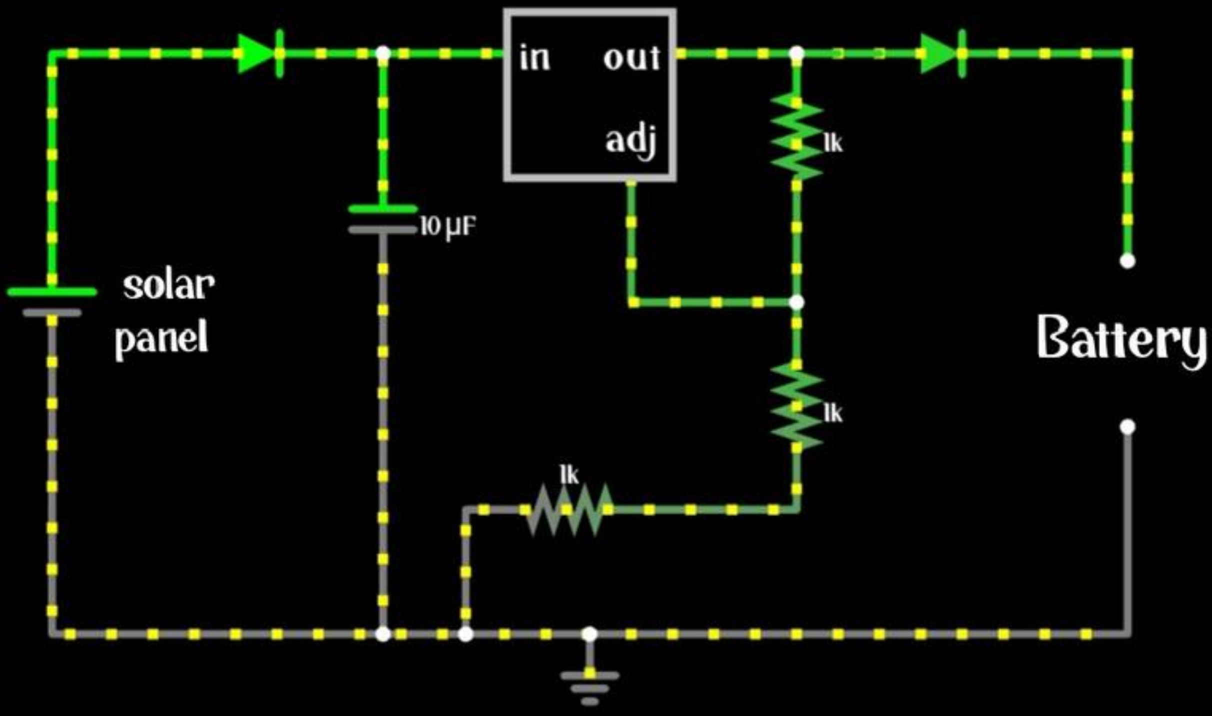


🔶 Converts DC voltage from a lower level to a higher (boost) or lower (inverted) level using capacitors as energy storage elements instead of inductors.

🔶 Uses a series of capacitors and switches (typically diodes or transistors) to transfer and "pump" charge in a sequence, changing the voltage level.

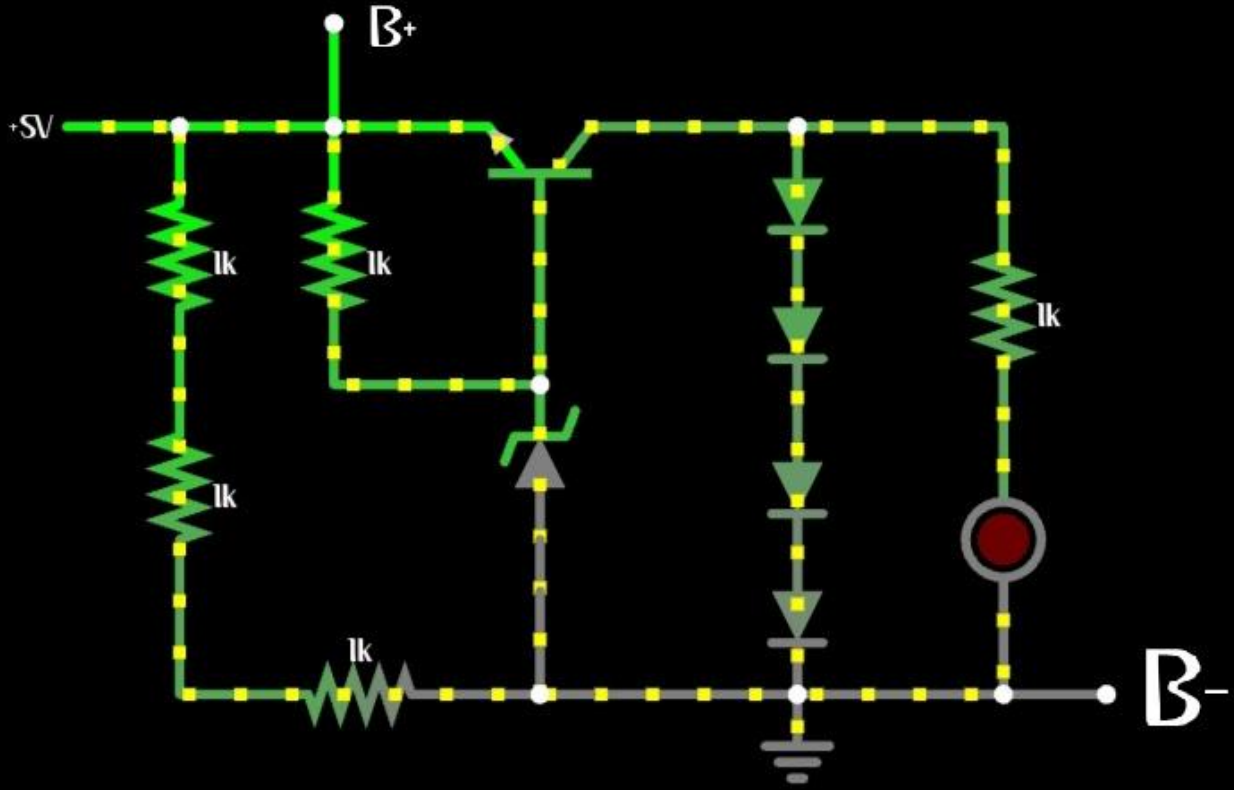
🔶 Often used in low-power applications, such as in voltage doubling, inverting, or generating higher voltage rails .

Solar charger circuit



- Converts solar energy into electrical energy to charge batteries or power electronic devices.
- Uses a solar panel to convert sunlight into DC electricity, which is then regulated by a charge controller to safely charge the battery and prevent overcharging.
- Commonly used in solar-powered devices, off-grid systems, and portable battery charging solutions .

Battery manegement circuit

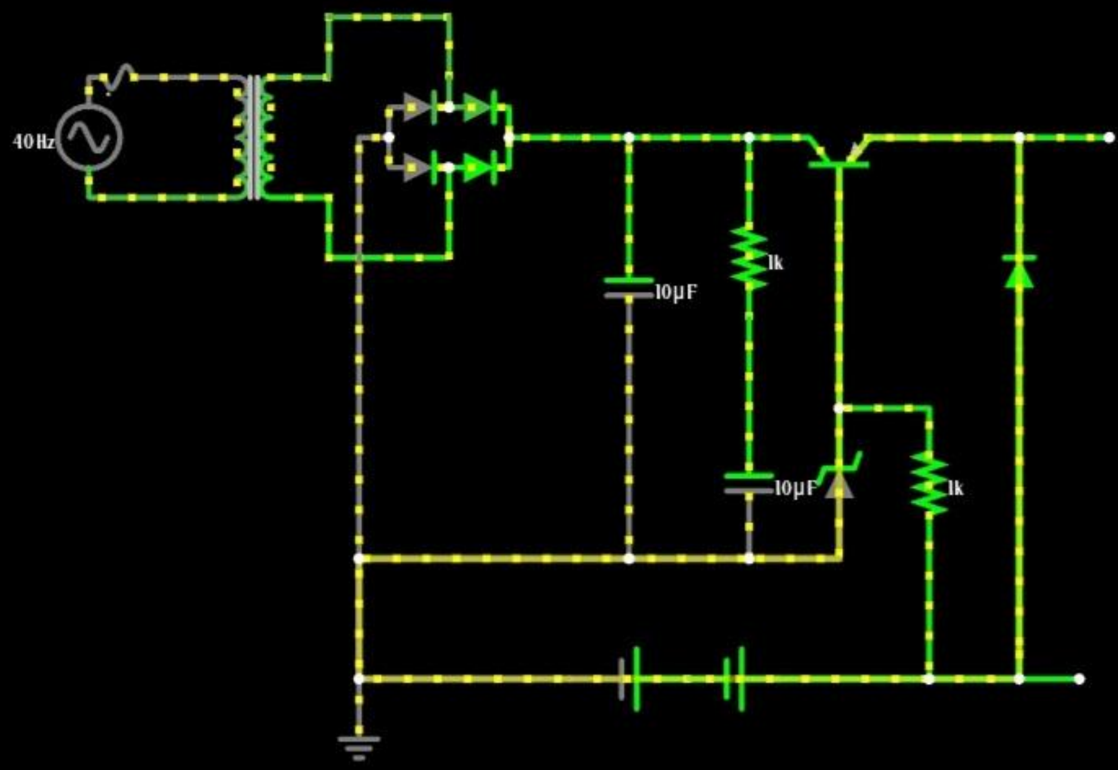


◆ Manages the charging, discharging, and overall health of a rechargeable battery to ensure safe and efficient operation.

◆ Includes a battery protection circuit to prevent overcharging, over-discharging, and excessive current, as well as a charge controller to regulate charging.

◆ Commonly used in lithium-ion and other rechargeable battery-powered devices, including electric vehicles, power banks.

Uninterruptible power supply
(UPS)

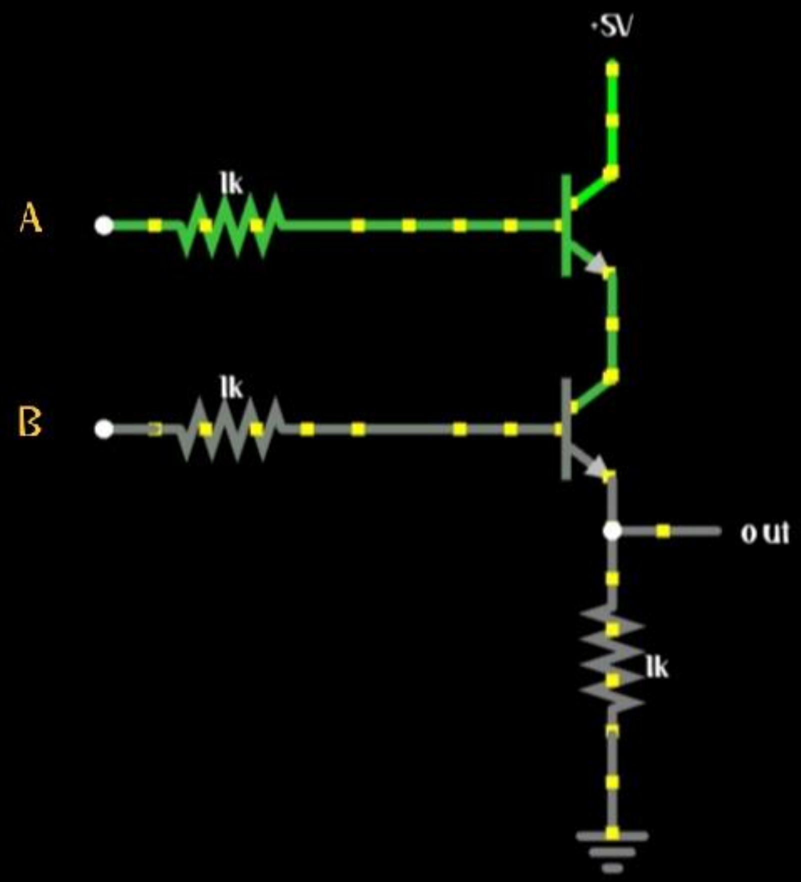


◆ Provides backup power to electronic devices during power outages, ensuring continuous operation and preventing data loss.

◆ Consists of a battery, charger, and inverter system, which stores energy in a battery and supplies it to connected devices .

◆ Widely used in homes, offices, and data centers to protect sensitive equipment like computers, servers, and medical devices.

AND gate using transistor

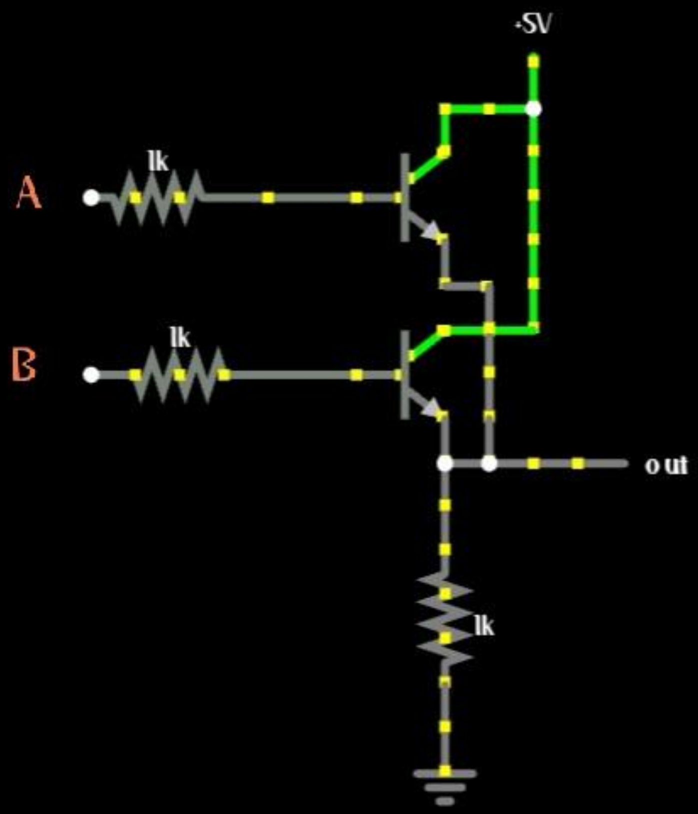


◆ Implements the logical AND operation, outputting a high signal only when both inputs are high.

◆ Uses two transistors in series, with each transistor acting as a switch. The output is high only when both transistors are turned on by their respective inputs, completing the circuit.

◆ Commonly used in digital logic circuits for performing binary operations.

OR gate using transistor

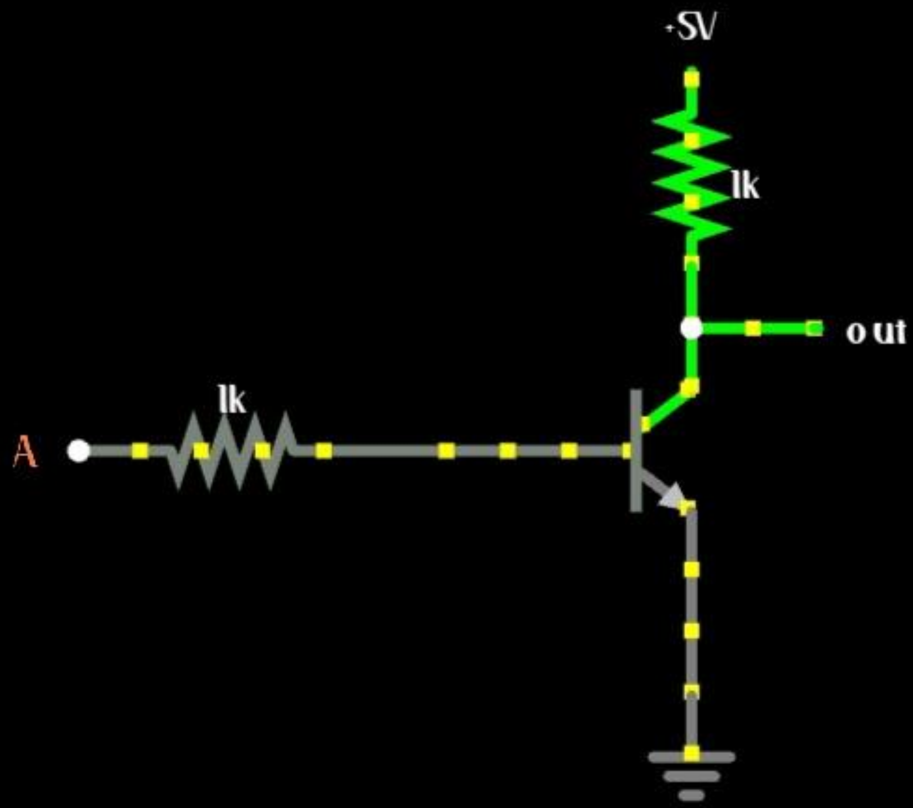


◆ Implements the logical OR operation, outputting a high signal when at least one of the inputs is high.

◆ Uses two transistors in parallel, with each transistor acting as a switch. The output is high if either of the transistors is turned on by its respective input, completing the circuit.

◆ Commonly used in digital circuits for decision-making processes, binary logic operations.

NOT gate using transistor

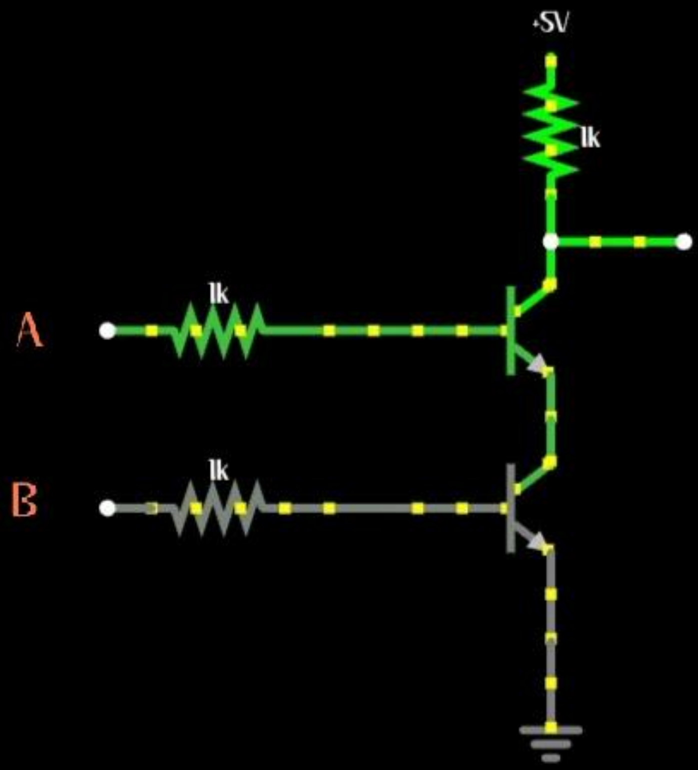


◆ Implements the logical NOT operation, inverting the input signal (output is high when input is low and vice versa).

◆ Uses a single transistor, typically in a common-emitter configuration, When the input is high, the transistor conducts and the output is low; when the input is low, the transistor is off, and the output is high.

◆ Used in digital logic circuits, signal inversion, and in building more complex logic gates and circuits.

NAND gate

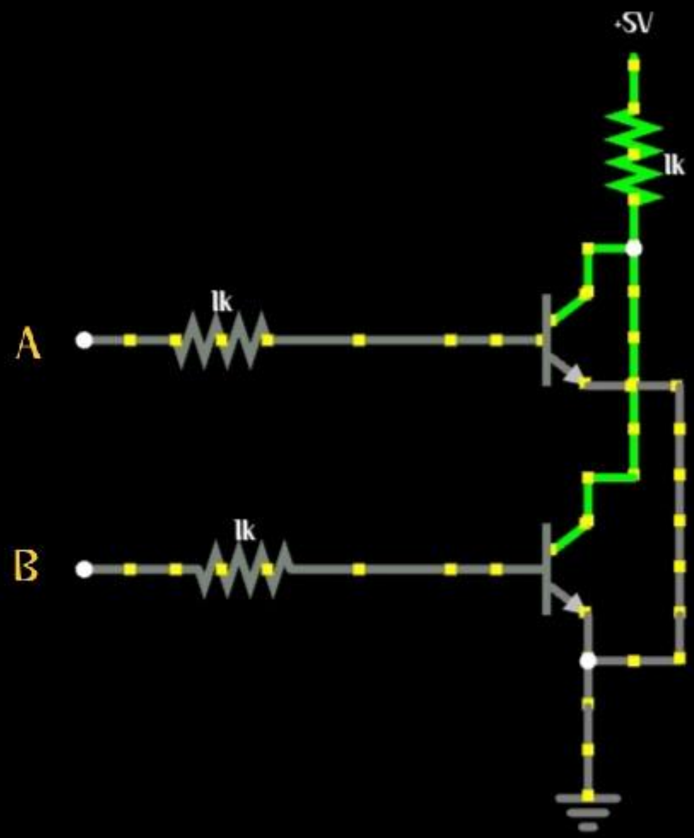


◆ Implements the logical NAND operation, outputting a low signal only when both inputs are high; otherwise, it outputs a high signal.

◆ Uses two transistors in series (similar to an AND gate), but with a NOT operation applied to the output. When either input is low, at least one transistor is off, and the output is high.

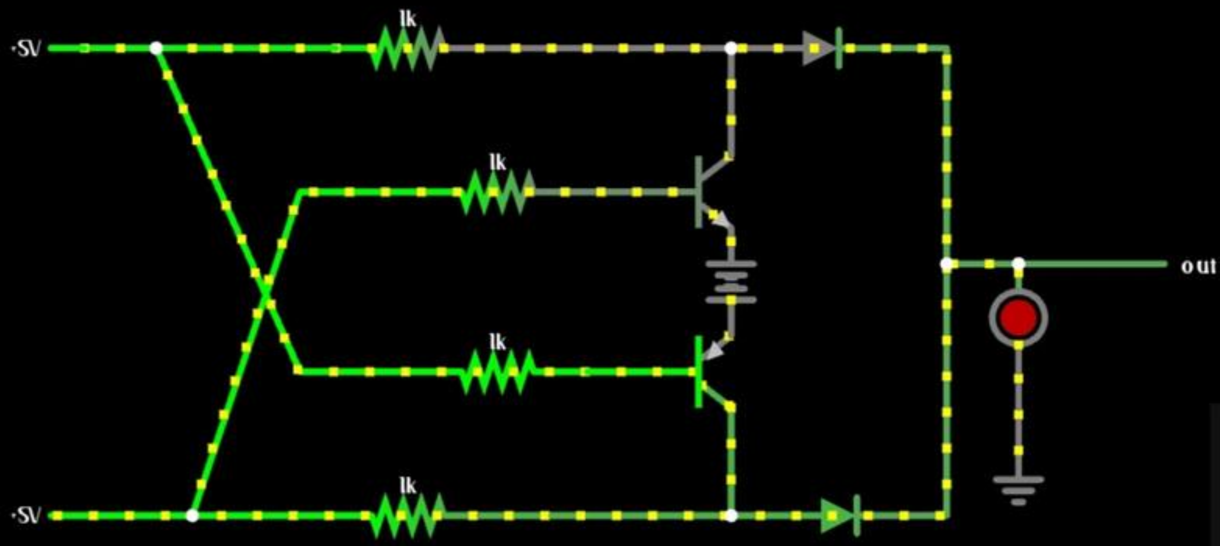
◆ Commonly used in digital electronics for building more complex logic circuits, memory storage, and arithmetic operations.

NOR gate



- Implements the logical NOR operation, outputting a high signal only when both inputs are low; otherwise, it outputs a low signal.
- Uses two transistors in parallel, arranged in a way that when both inputs are low, neither transistor conducts, and the output is high.
- Used in digital logic circuits, especially in building other complex gates, memory circuits, and for performing decision-making operations .

XOR gate

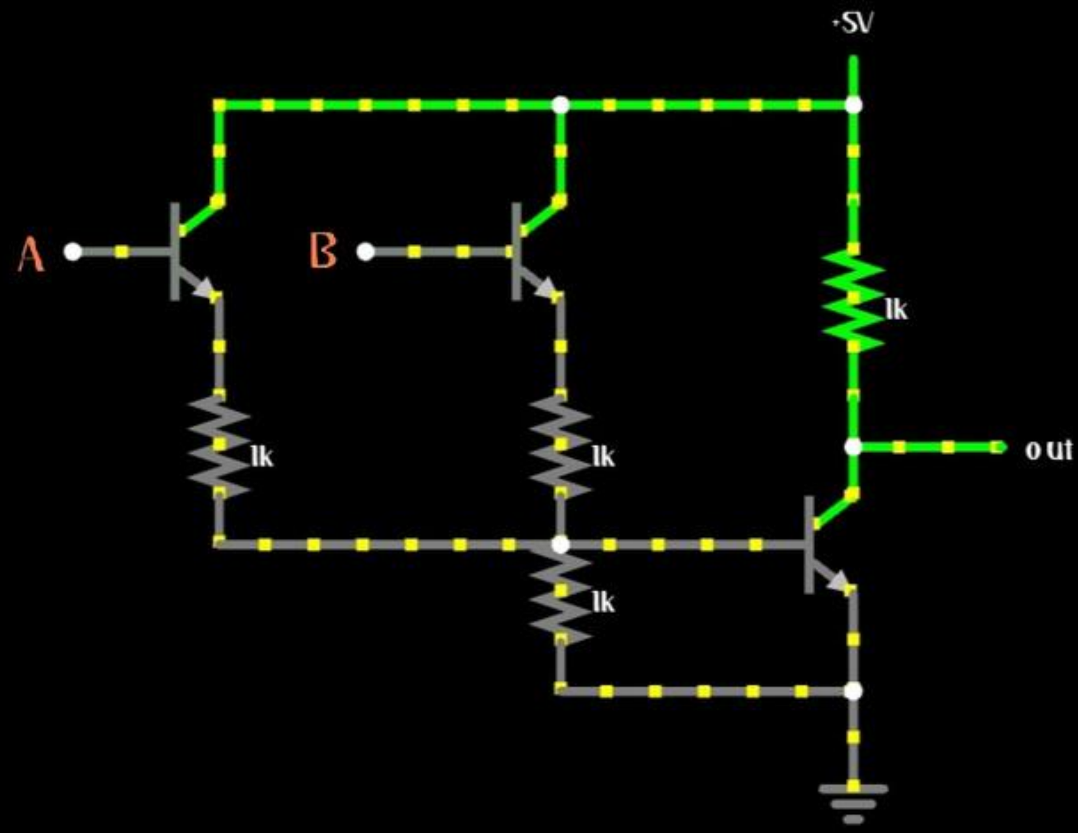


◆ Implements the logical XOR (exclusive OR) operation, outputting a high signal when the inputs are different (one high, one low), and a low signal when the inputs are the same (both high or both low).

◆ The output is high only when exactly one of the two inputs is high, as the transistors switch accordingly.

◆ Used in digital circuits for tasks such as error detection, arithmetic operations (like adders), and signal comparison in logic systems.

XNOR gate

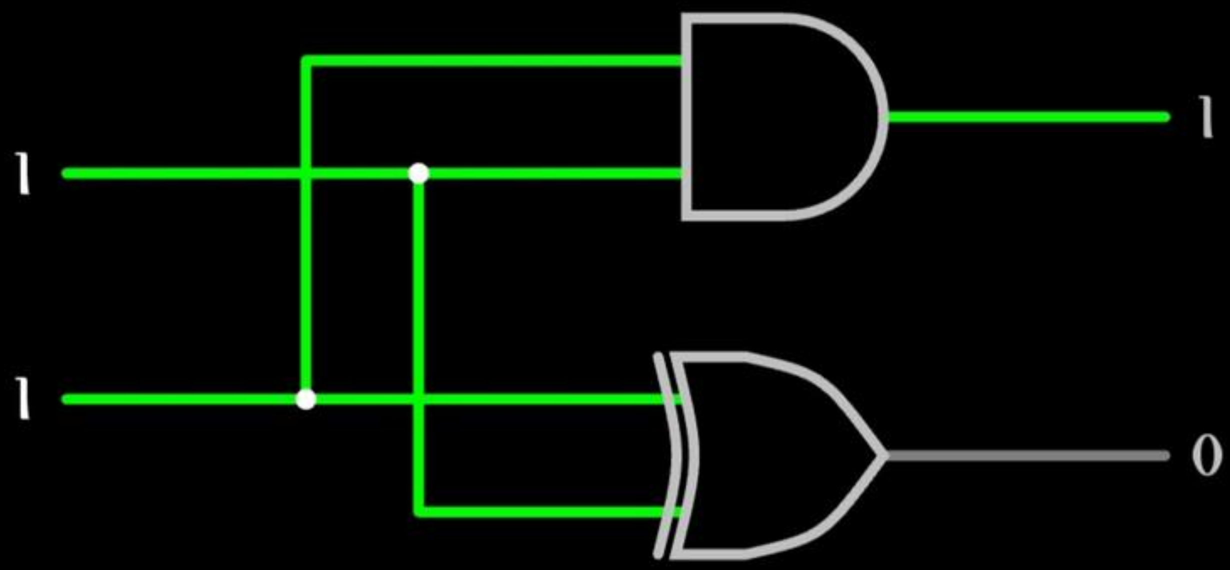


🔶 Implements the logical XNOR (exclusive NOR) operation, outputting a high signal when the inputs are the same (both high or both low), and a low signal when the inputs are different.

🔶 Typically uses a combination of XOR and NOT gates. The circuit is built with multiple transistors arranged in series and parallel .

🔶 Commonly used in digital circuits for equality comparison, parity checking.

Half adder

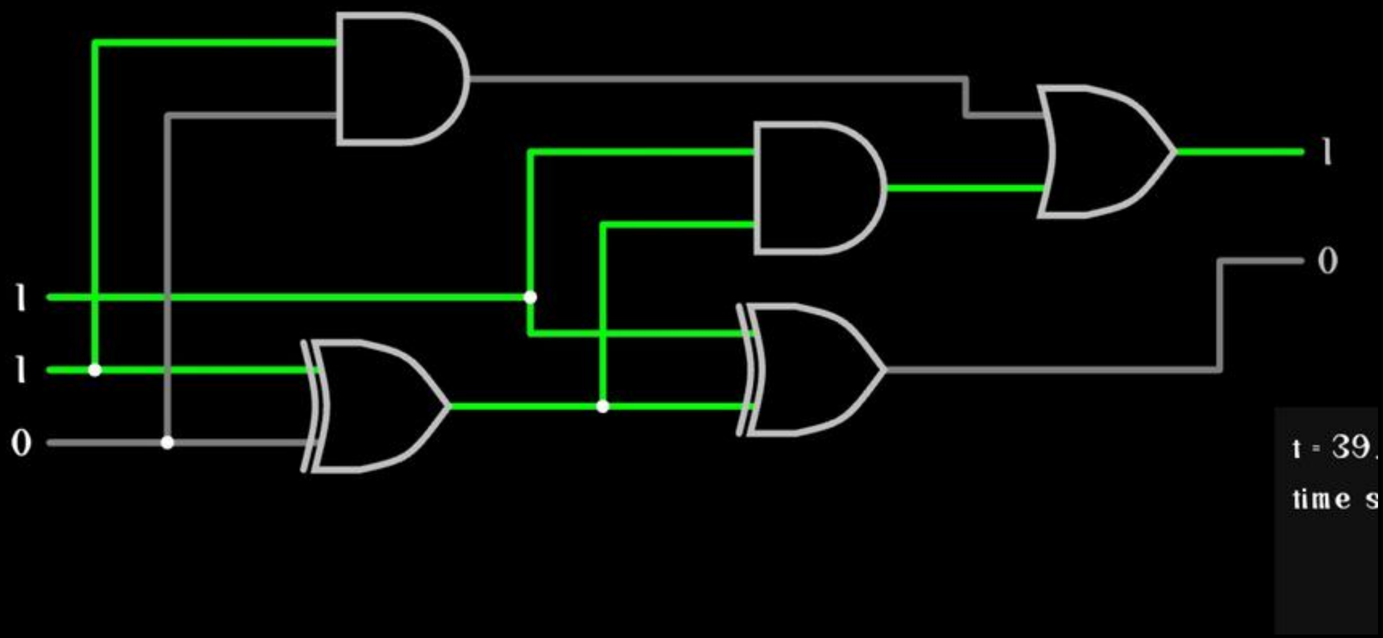


◆ Performs the addition of two single-bit binary numbers, providing a sum and a carry output.

◆ The sum output is generated by an XOR gate, and the carry output is generated by an AND gate. The circuit adds the two input bits and handles carry-over when both bits are 1.

◆ Used in digital systems, particularly in arithmetic logic units (ALUs), binary addition operations.

Full adder

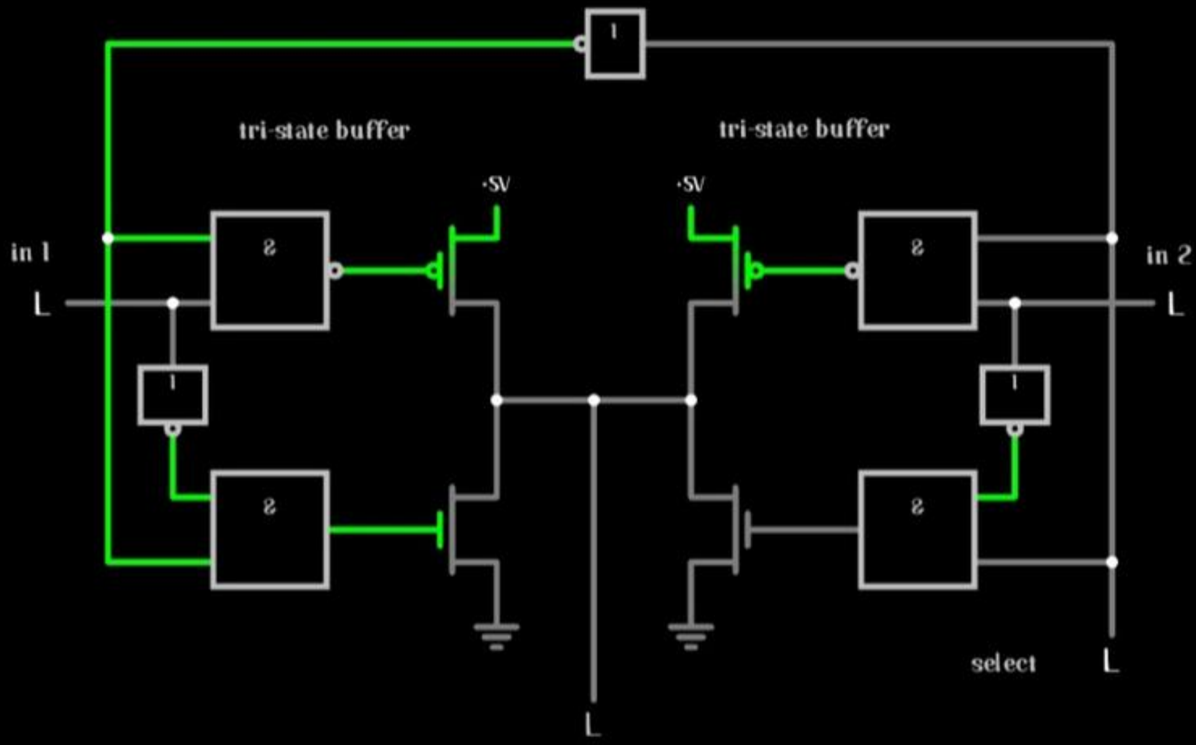


🔶 Adds three input bits and produces a sum and a carry-out.

🔶 The sum output is generated by an XOR gate (for the two input bits and carry-in), while the carry-out is determined by an OR gate combining the results of two AND gates, each evaluating the carry conditions from the inputs.

🔶 Used in digital arithmetic operations, including in the construction of ALUs .

Multiplexer (2:1)

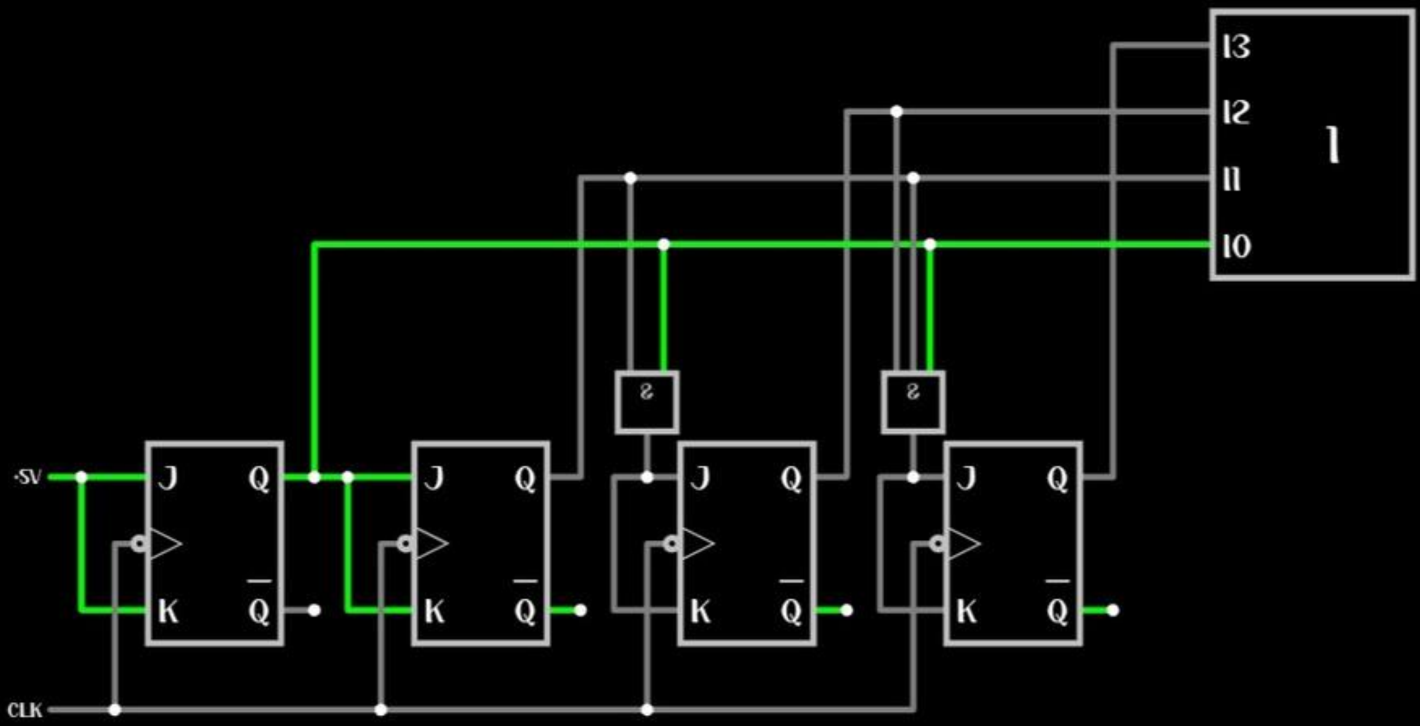


◆ Selects one of two input signals based on a control (select) line and outputs the chosen signal.

◆ The MUX has two data inputs (I0 and I1), one select input (S), and one output (Y). The output is determined by the value of the select input: when S is 0, the output is I0; when S is 1, the output is I1.

◆ Commonly used in digital systems for data routing, signal multiplexing, and in applications requiring the selection between two data sources.

Synchronous counter



- Selects one of two input signals based on a control (select) line and outputs the chosen signal.
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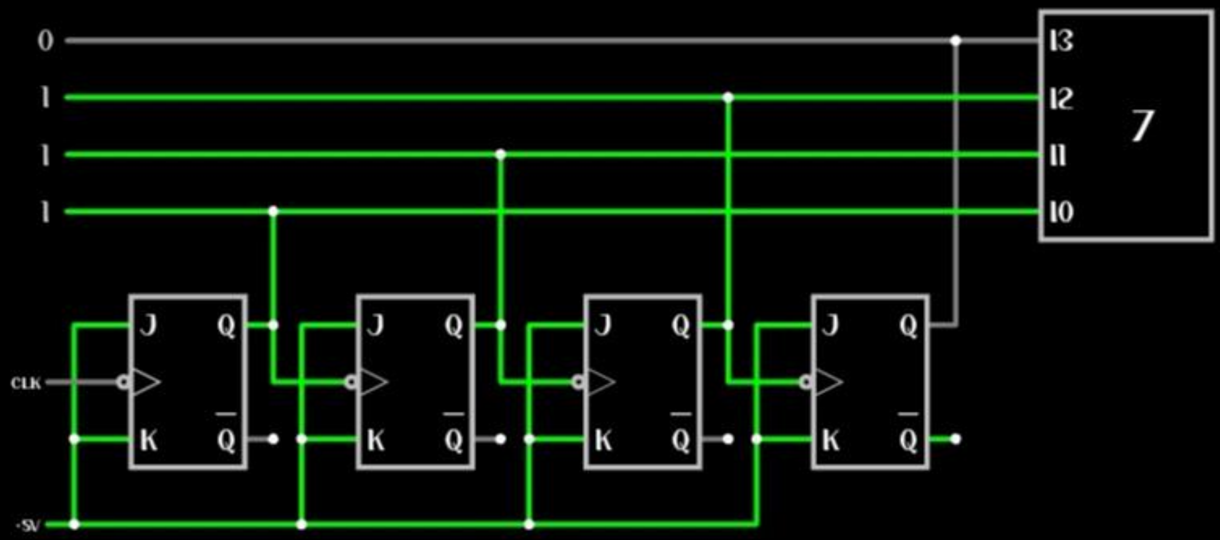
- Commonly used in digital systems for data routing, signal multiplexing.

Asynchronous counter

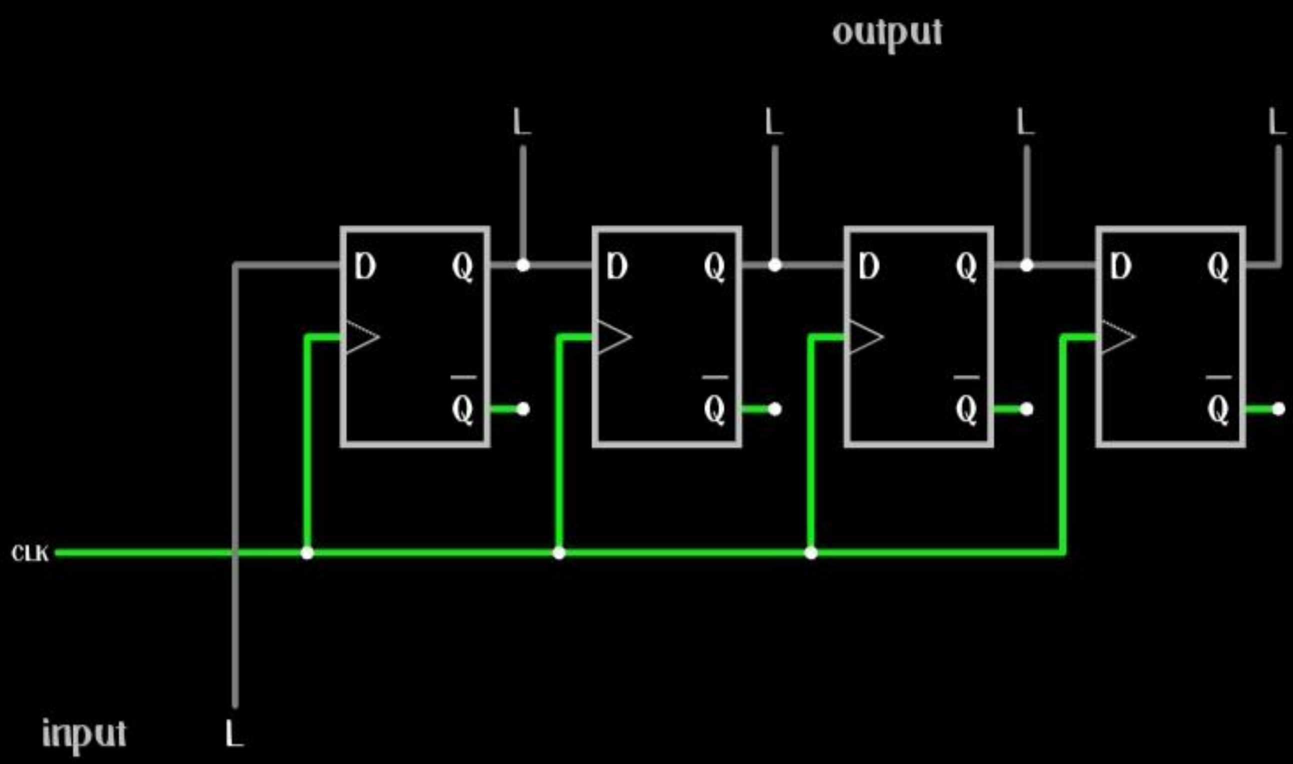


🔶 Counts in a sequence based on clock pulses, where all flip-flops receive the clock signal simultaneously, ensuring synchronized operation.

🔶 Each flip-flop in the counter changes state in sync with the clock signal, and the output changes according to the binary counting sequence (e.g., 0-1-2-3, etc.).

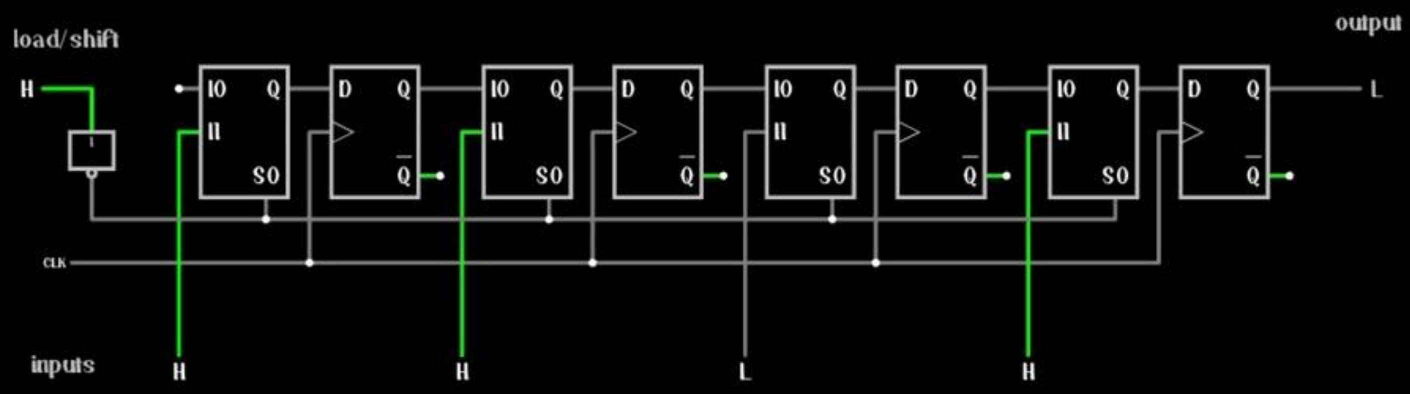
🔶 Used in applications requiring synchronized counting, such as timers, frequency division, and digital clocks.

Serial in - parallel out shift register



🔶 Converts serial input data into parallel output, shifting data bit by bit through a series of flip-flops, with each flip-flop storing one bit of data.
🔶 Data is fed serially into the first flip-flop, and as the clock pulses, each flip-flop shifts its data to the next one. After several clock cycles, the data is available in parallel at the outputs.
🔶 Commonly used in data transfer applications where serial data needs to be converted to parallel form.

Parallel in - serial out shift register

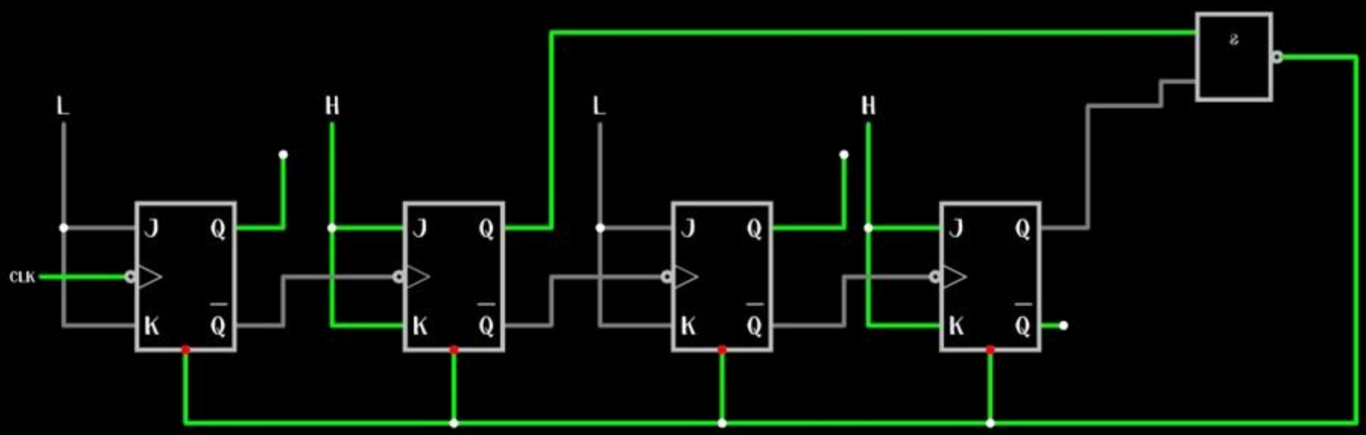


◆ Converts parallel input data into serial output, allowing multiple bits of data to be loaded simultaneously and then shifted out one bit at a time.

◆ Data is loaded in parallel into the shift register's flip-flops. With each clock pulse, the data is shifted through the register, and eventually, it is output serially from the last flip-flop.

◆ Used in digital systems for applications such as data transmission, serial data storage systems.

BCD counter

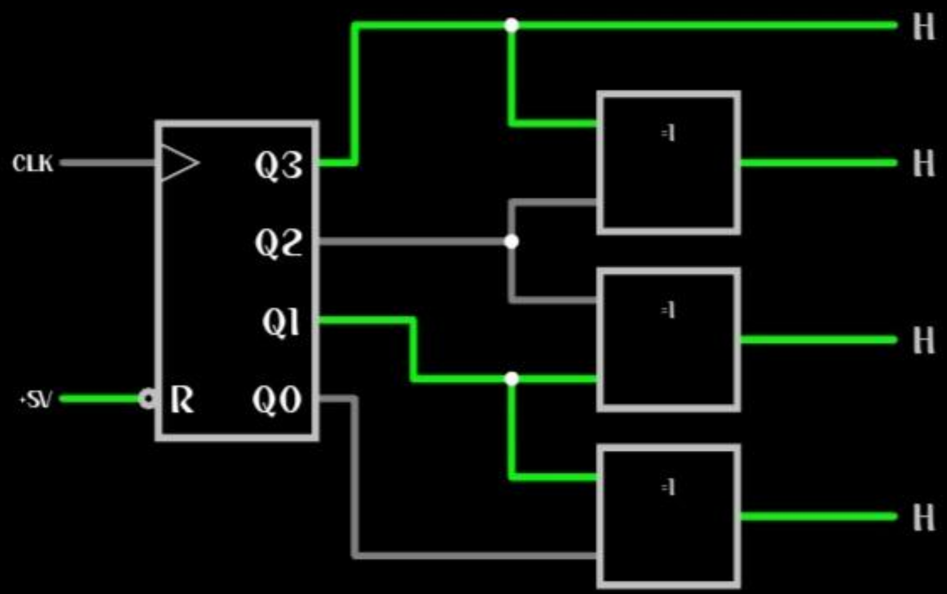


◆ A counter that counts in BCD, representing decimal digits (0-9) in binary form, where each digit is encoded using four bits.

◆ The counter increments in binary but resets after reaching 9 (1001 in binary), ensuring it only counts valid decimal digits, typically used for displaying decimal numbers.

◆ Commonly used in digital clocks, seven-segment displays, and other systems.

Gray code counter

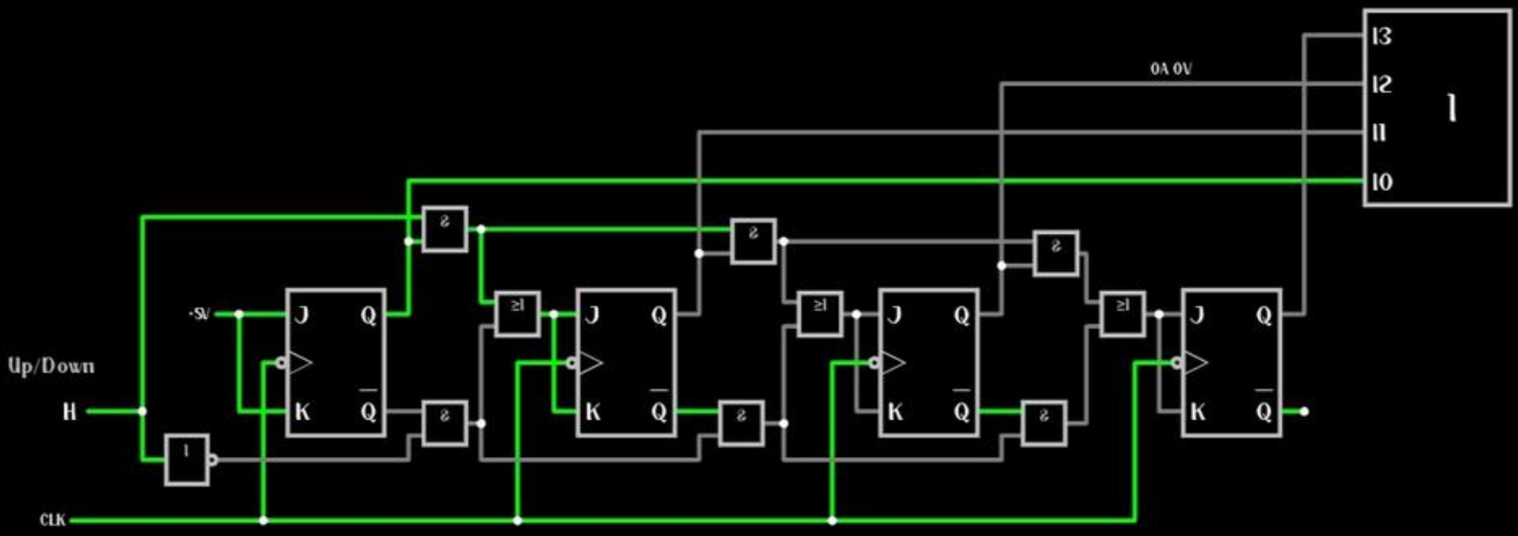


◆ A counter that counts in Gray code, where each successive value differs from the previous one by only one bit.

◆ The counter generates a sequence of Gray code values, where each output bit changes in such a way that only one bit changes at a time.

◆ Used in rotary encoders, digital position tracking, and in systems where minimizing errors during state transitions is critical.

Up-down counter

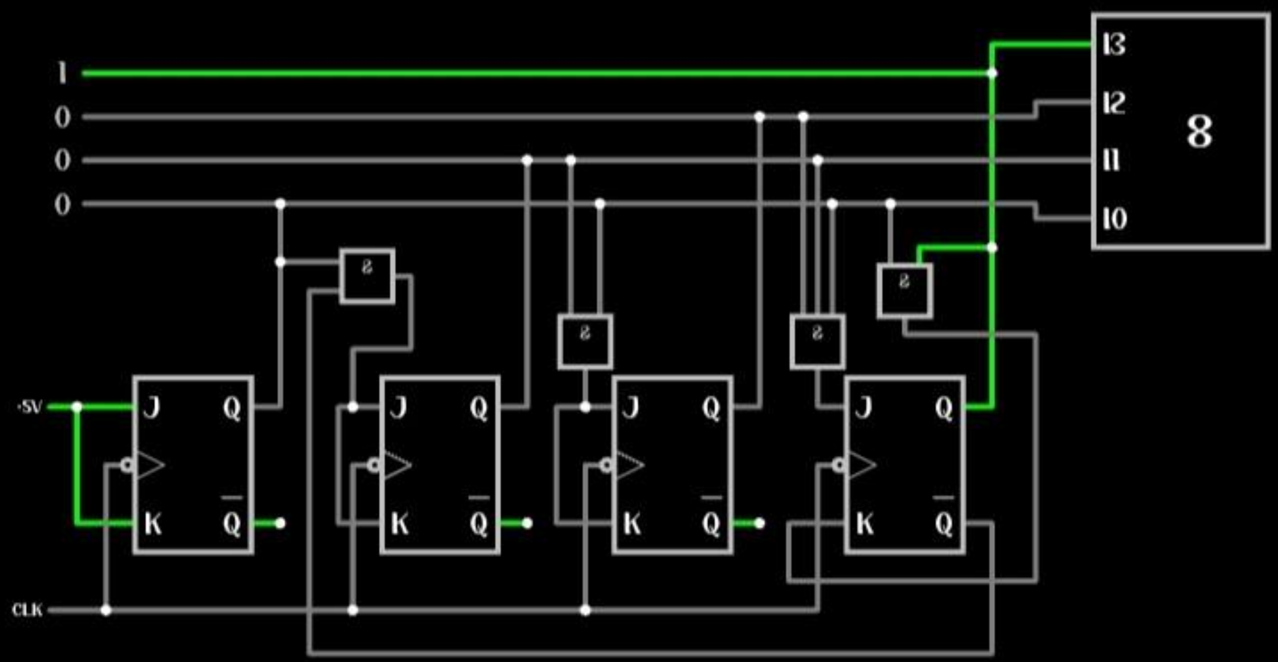


◆ A counter that increments or decrements based on a control input (up/down).

◆ The counter counts up or down with each clock pulse, depending on the control signal.

◆ Used in systems requiring bidirectional counting, such as digital clocks and position encoders.

Decimal counter

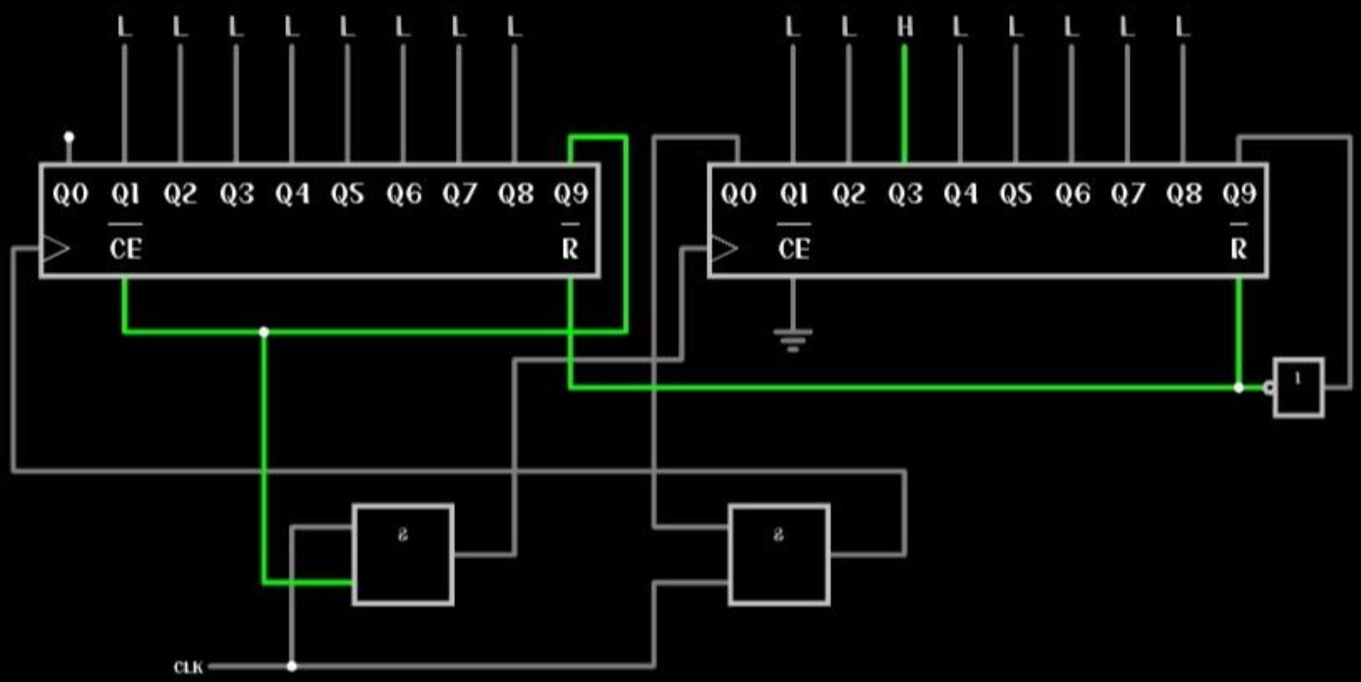


◆ A counter that counts from 0 to 9, representing decimal digits in binary.

◆ The counter increments with each clock pulse and resets to 0 after reaching 9.

◆ Used in applications requiring decimal digit counting, such as digital clocks, calculators, and frequency counters.

Ring counter

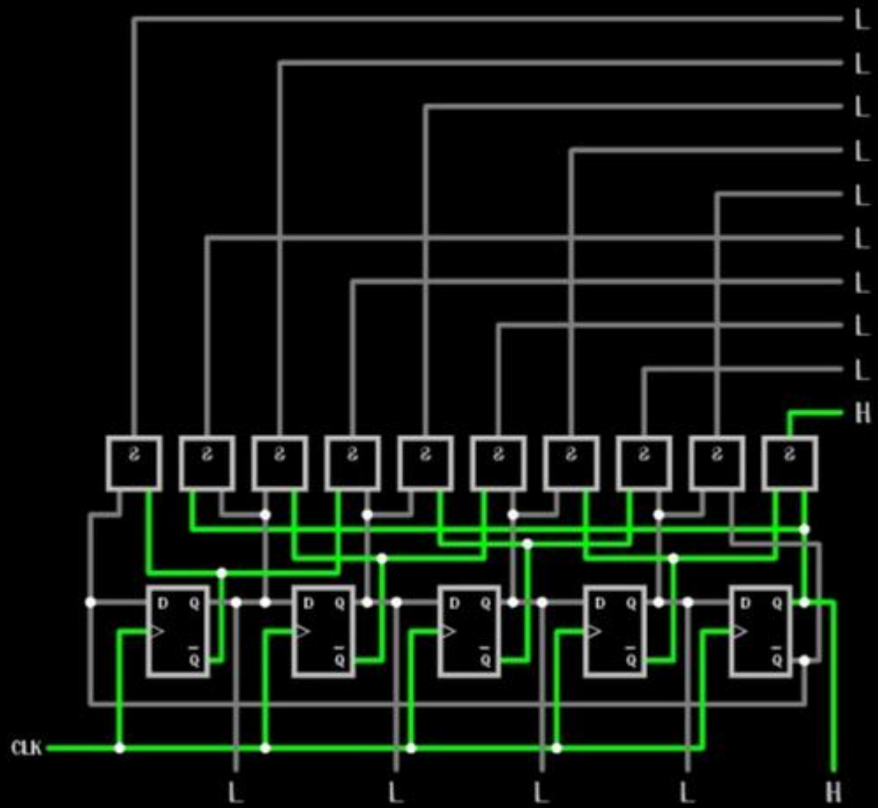


◆ A counter where only one bit is "high" at any time, and it circulates through a sequence of states, returning to the initial state after completing the cycle.

◆ The counter shifts the "high" bit around the register with each clock pulse, creating a continuous loop of states.

◆ Used in sequence generation, digital control systems, and in applications where cyclic counting or rotation is required.

Johnson counter

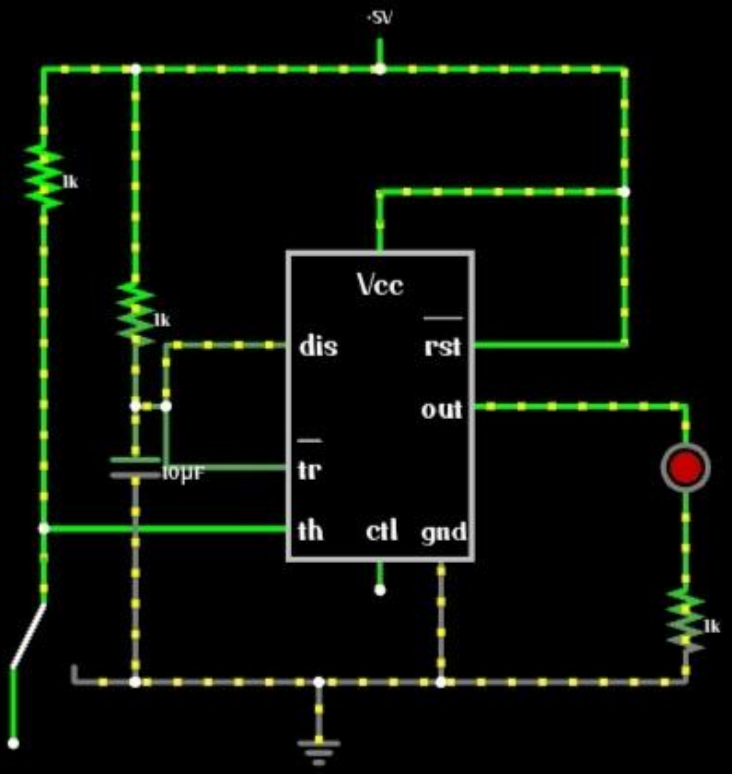


🔶 A counter that generates a unique sequence by feeding back the inverted output of the last flip-flop into the first.

🔶 Shifts bits through flip-flops to produce a sequence that cycles through 2n states.

🔶 Used in sequence generation, PWM, and LED control.

555 Timer delay circuit

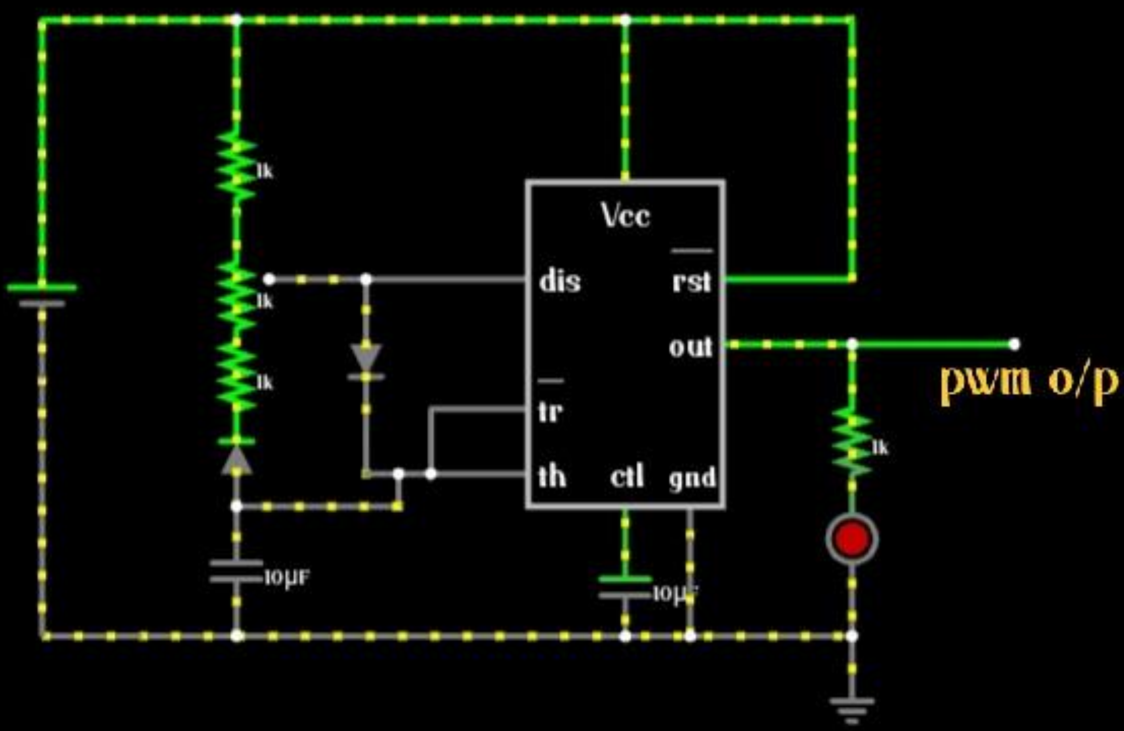


◆ Generates a precise time delay based on external resistor and capacitor values.

◆ The 555 timer operates in monostable mode, producing a single pulse of desired duration when triggered.

◆ Used in timing applications like delay circuits, pulse generation, and triggering systems.

SSS Timer pulse width modulation

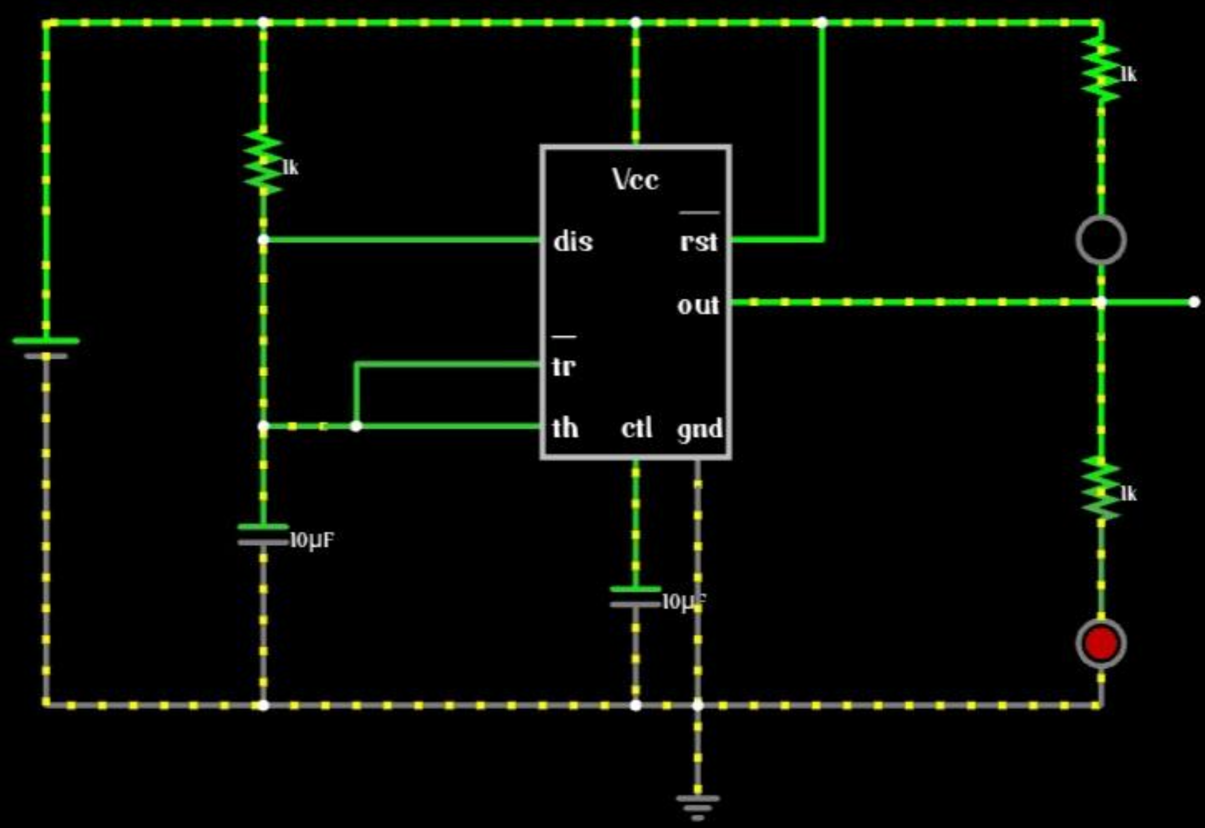


◆ Generates a pulse-width modulated (PWM) signal to control the duty cycle of an output waveform.

◆ Operates in astable mode, where the duty cycle is adjusted by varying the resistors or a control voltage.

◆ Used in motor speed control, LED dimming, and signal modulation.

Sequential timer circuit

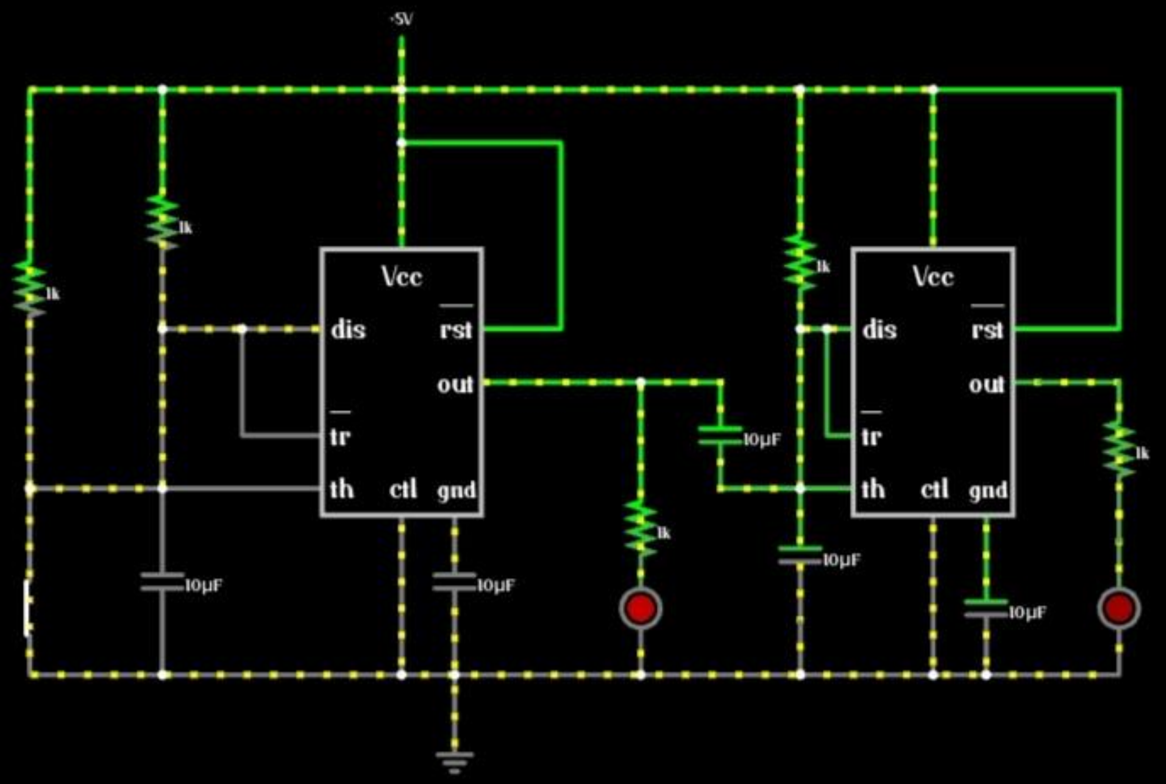


◆ Activates multiple outputs sequentially, each for a set time interval, based on a clock or trigger signal.

◆ Uses a series of 555 timers or counters to control the timing and order of activation for connected outputs.

◆ Used in automation systems, lighting control, and process sequencing.

Dual timer circuit

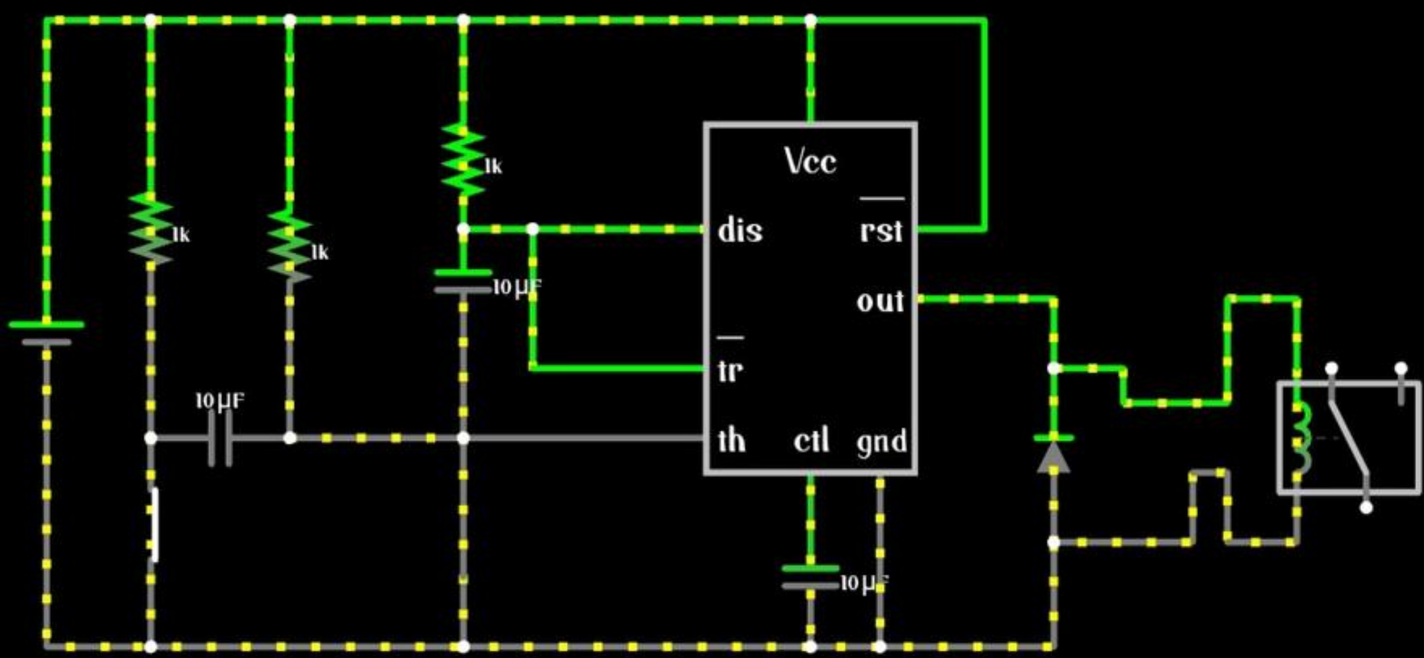


🔶 Combines two independent timers in a single circuit to generate two different time delays or intervals.

🔶 Typically uses a dual 555 timer (e.g., NE556) to operate in monostable or astable modes for separate timing functions.

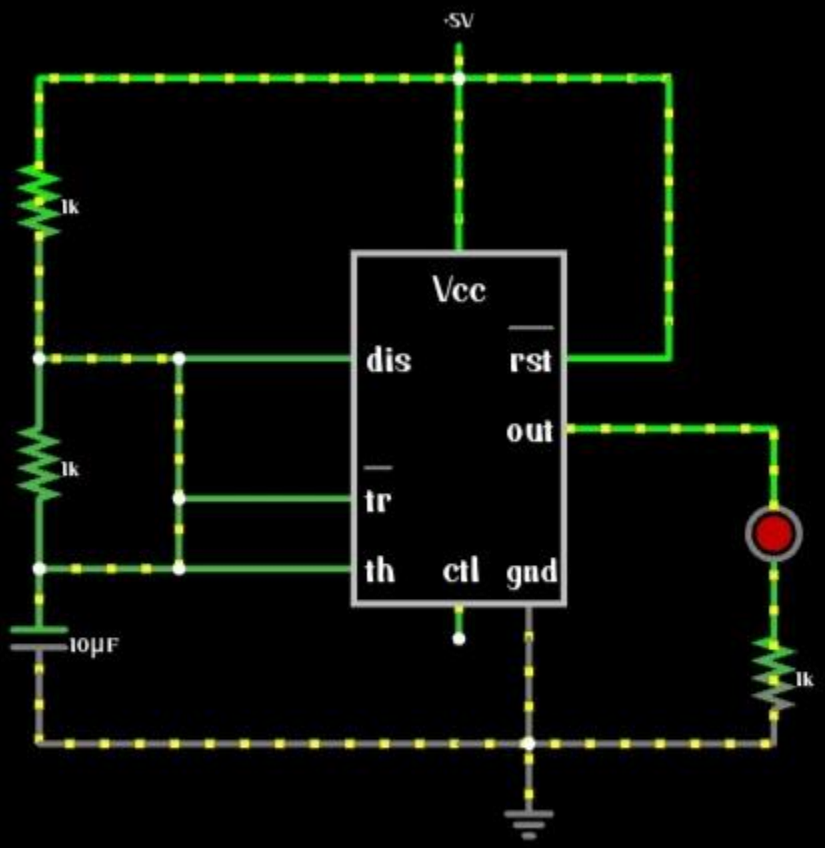
🔶 Used in multi-stage timing, pulse generation, and sequential operations in automation systems.

One shot timer



- Produces a single output pulse of a fixed duration when triggered.
- Operates in monostable mode, where the pulse width is determined by external resistor and capacitor values.
- Used in pulse generation, debouncing switches, and triggering events in digital circuits.

SSS Timer LED blinking circuit

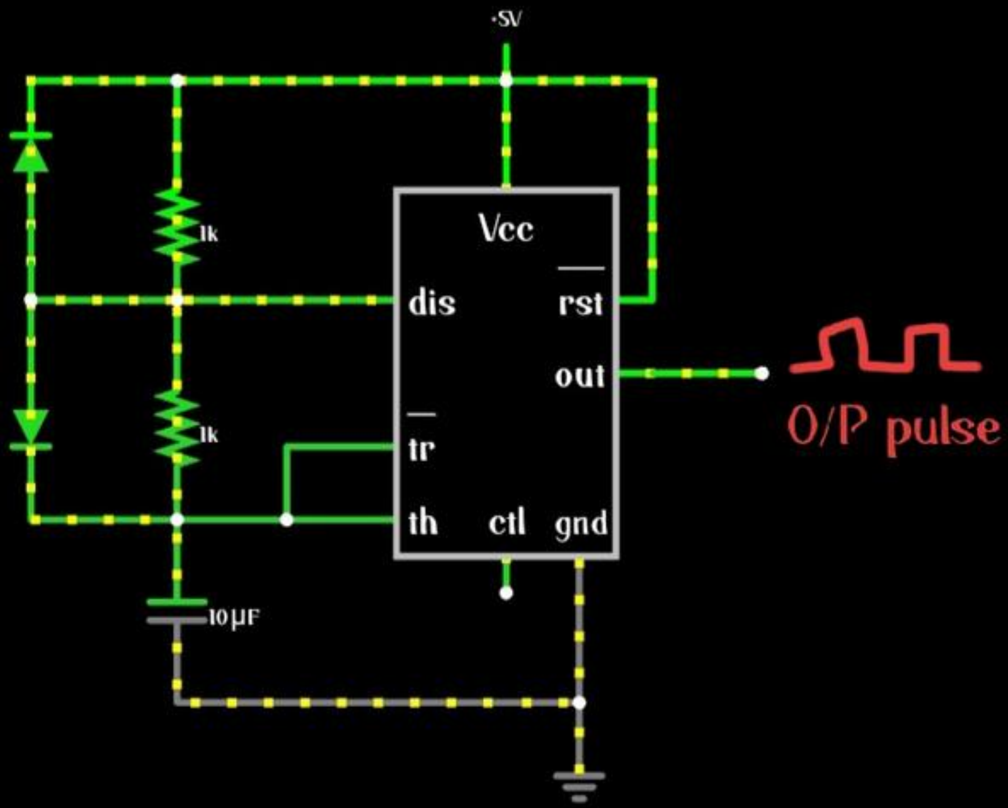


🔶 Blinks an LED at a regular interval by generating a square wave.

🔶 The 555 timer operates in astable mode, with the blinking rate controlled by external resistors and a capacitor.

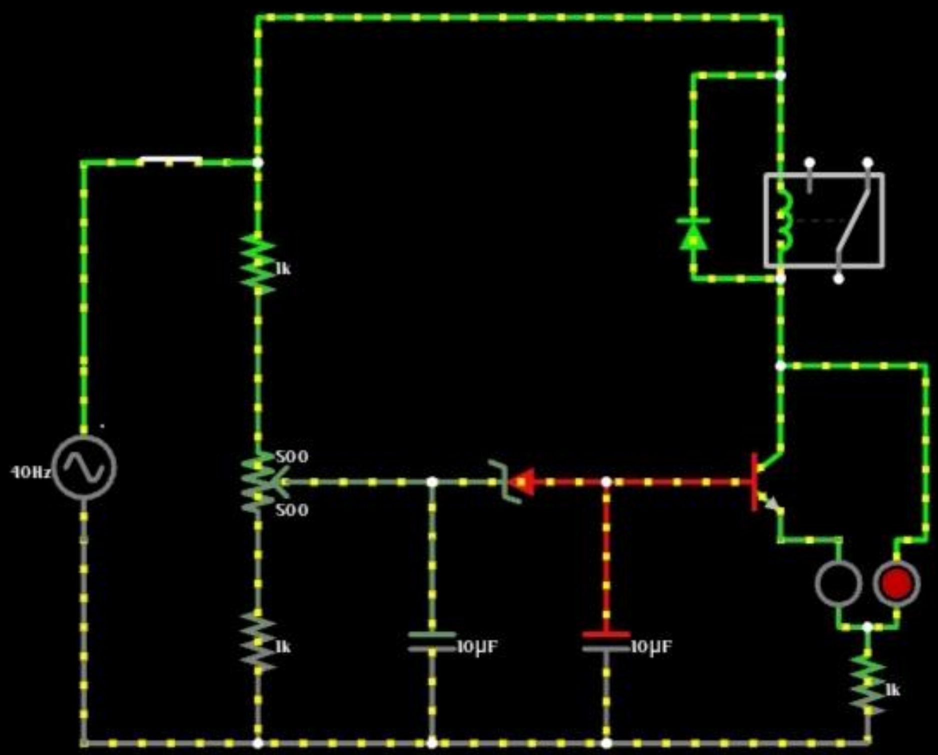
🔶 Used in basic LED indicators, signal testing, and timing demonstrations.

Pulse generator



- Generates periodic pulses of a specific width and frequency.
- Often built using a 555 timer in astable mode, with pulse characteristics controlled by external components.
- Used in clock signal generation, testing digital circuits, and triggering applications.

Time delay relay circuit

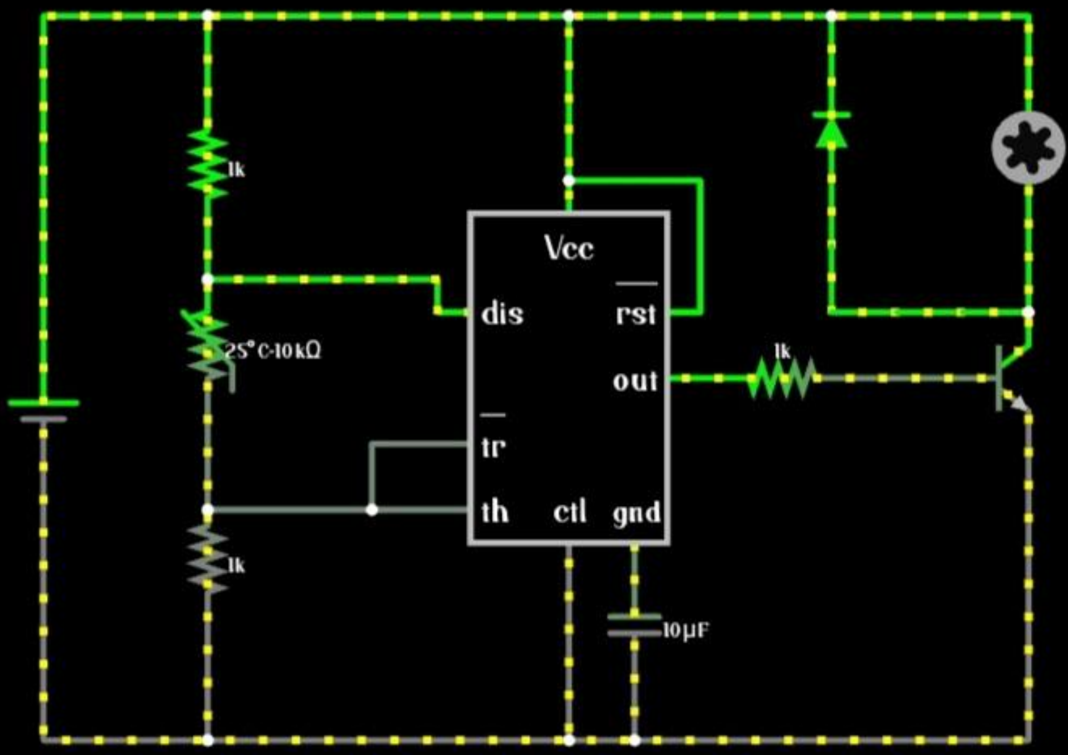


◆ Activates a relay after a preset time delay.

◆ Uses a 555 timer or similar device to generate a delay based on resistor and capacitor values, triggering the relay once the delay elapses.

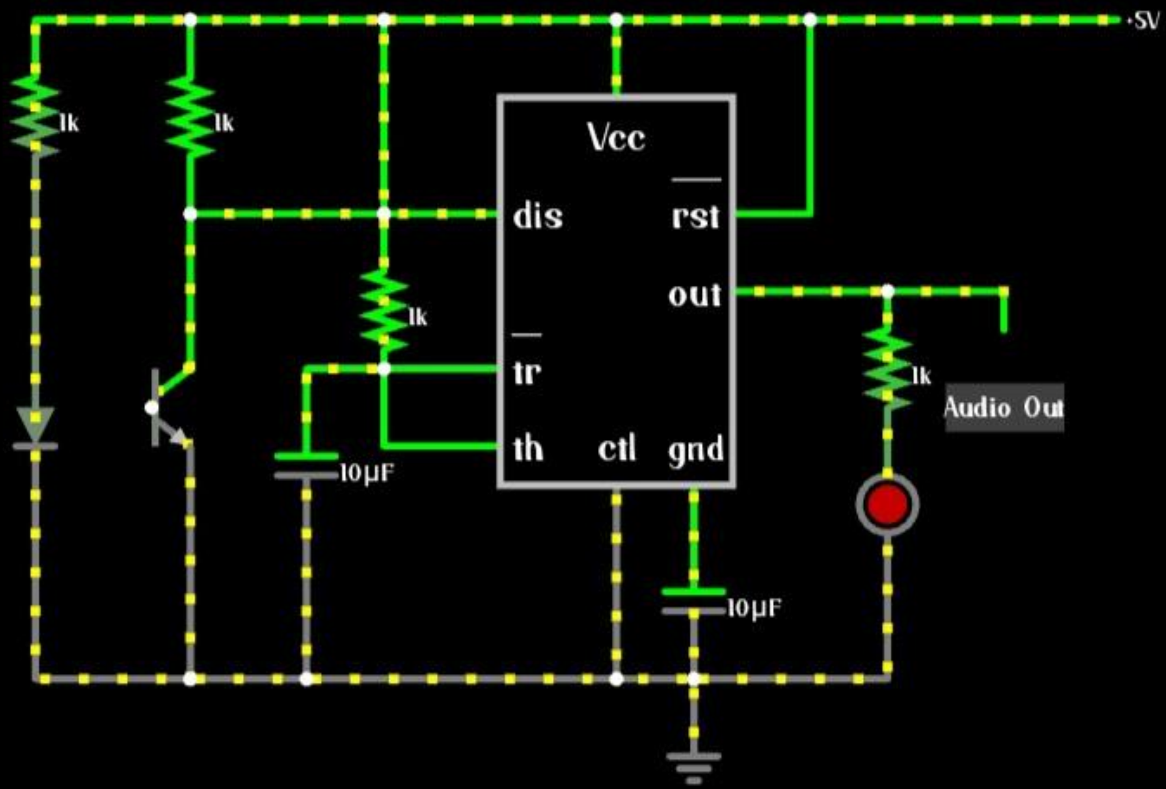
◆ Used in automation systems, motor control, and delayed power-on circuits.

Temparature controlled fan



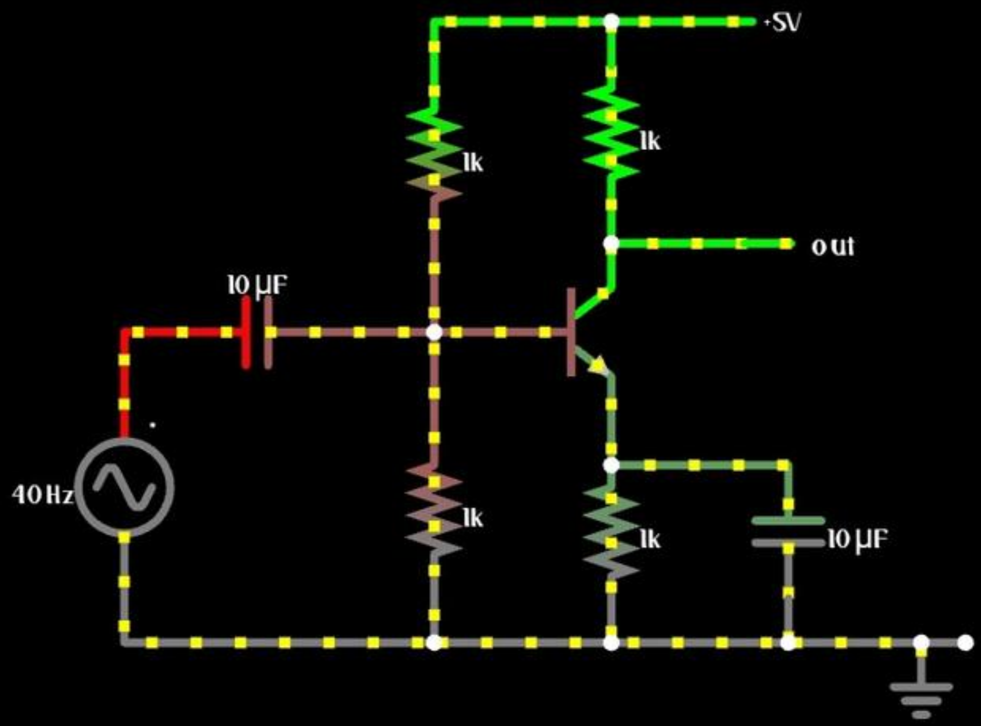
- Automatically adjusts the fan speed based on temperature changes.
- Uses a temperature sensor (e.g., thermistor or LM35) to detect heat levels and control the fan through a transistor or PWM signal.
- Used in cooling systems for electronics, HVAC systems, and appliances.

Motion detector alarm



- Detects motion and triggers an alarm or alert system.
- Uses a motion sensor to detect infrared radiation from moving objects, activating a buzzer or LED when motion is detected.
- Used in security systems, automated lighting, and intrusion detection.

Class A amplifier

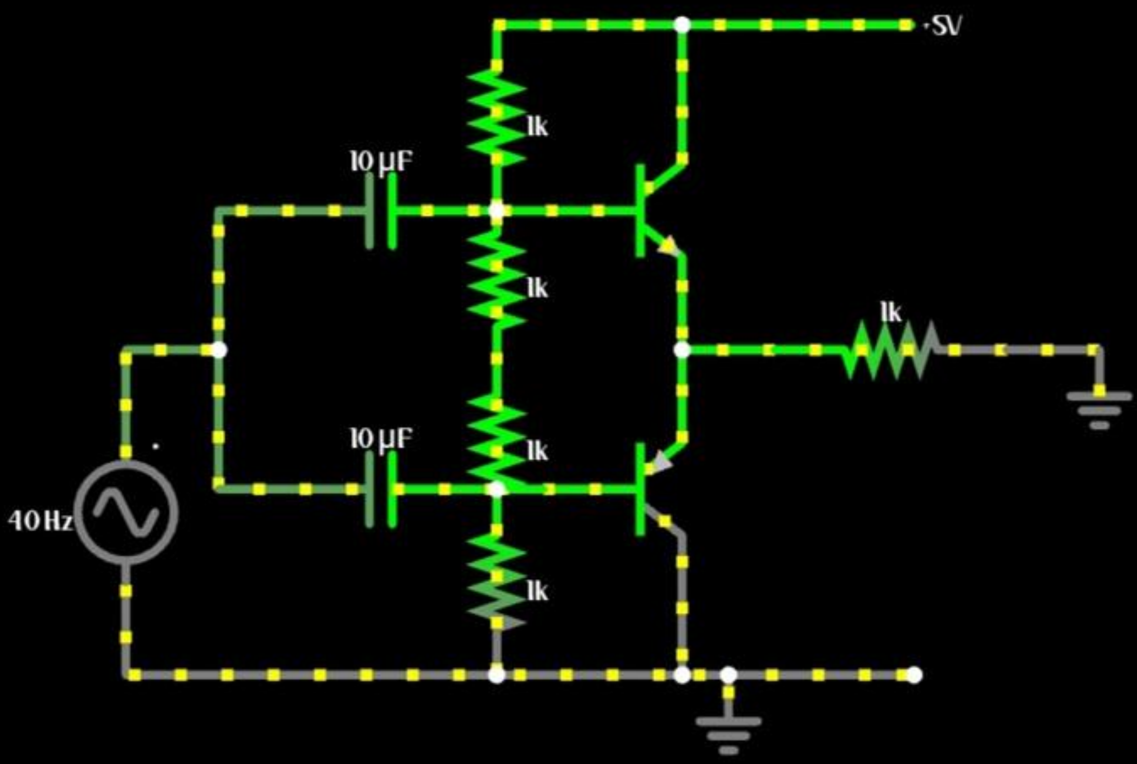


◆ Provides continuous amplification by operating in the linear region of the transistor for the entire input signal cycle.

◆ The transistor conducts throughout the signal cycle, resulting in high fidelity but low efficiency.

◆ Used in high-quality audio amplifiers, signal processing, and precision applications where linearity is crucial.

Class B amplifier

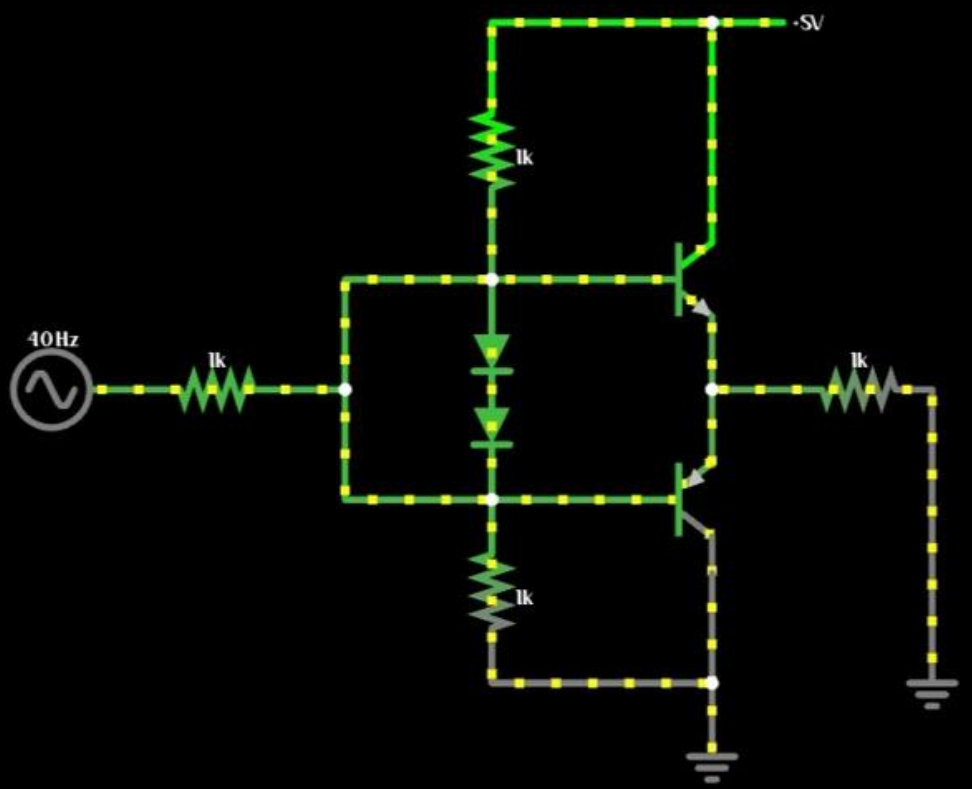


◆ Amplifies the input signal by using two active devices, each amplifying one half of the signal waveform.

◆ Each transistor or device conducts for 180° of the signal cycle, reducing power loss compared to Class A but introducing crossover distortion.

◆ Used in power amplifiers for audio systems, radio transmitters, and other applications.

Class AB amplifier

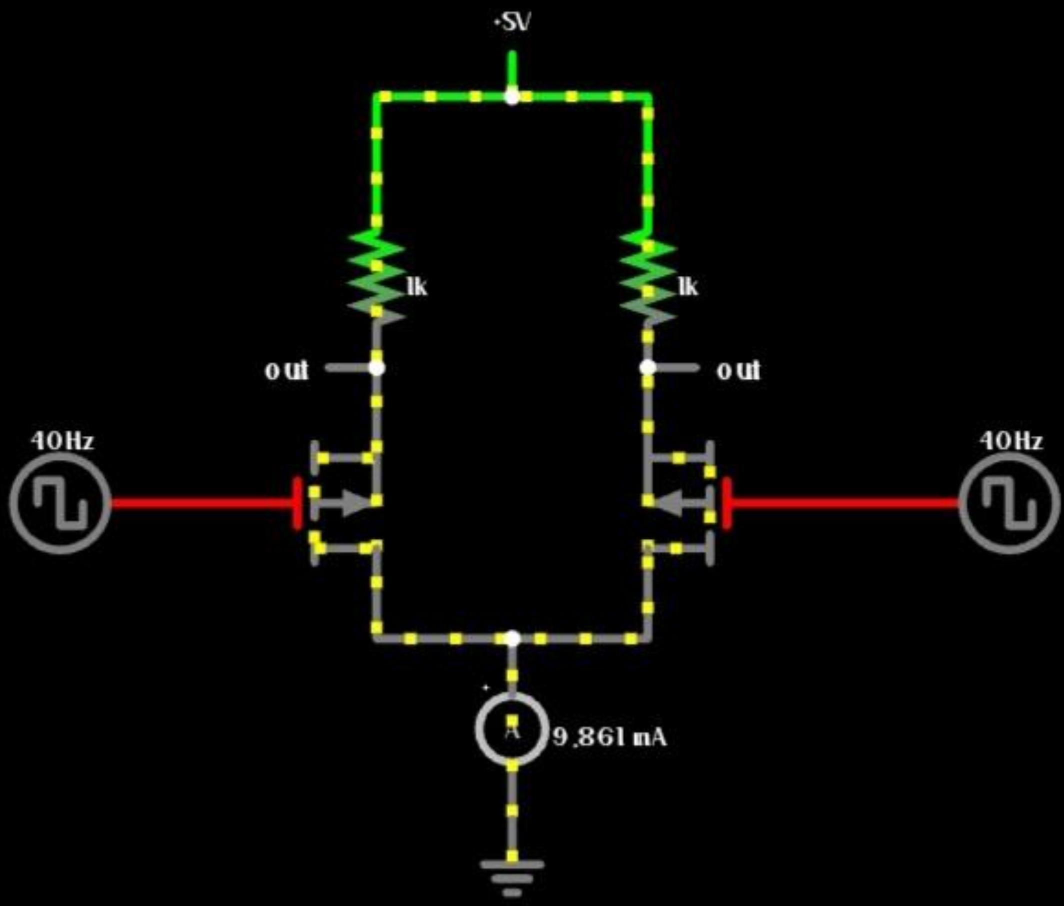


◆ Combines the advantages of Class A and Class B amplifiers, providing high linearity with improved efficiency.

◆ Each transistor conducts for more than half of the input signal cycle, reducing crossover distortion while maintaining better efficiency than Class A.

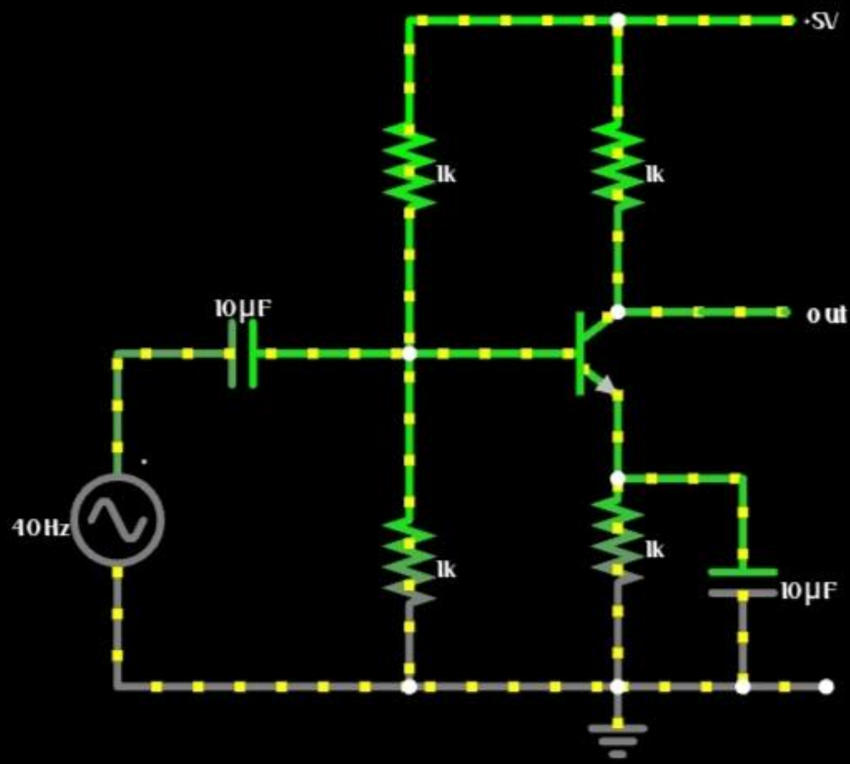
◆ Commonly used in audio amplifiers, home theater systems, and high-fidelity sound equipment.

Differential pair amplifier



- Amplifies the voltage difference between two input signals.
- Uses two transistors to amplify the difference while rejecting common-mode noise.
- Used in operational amplifiers, audio systems, and instrumentation for noise rejection.

Common Emitter amplifier

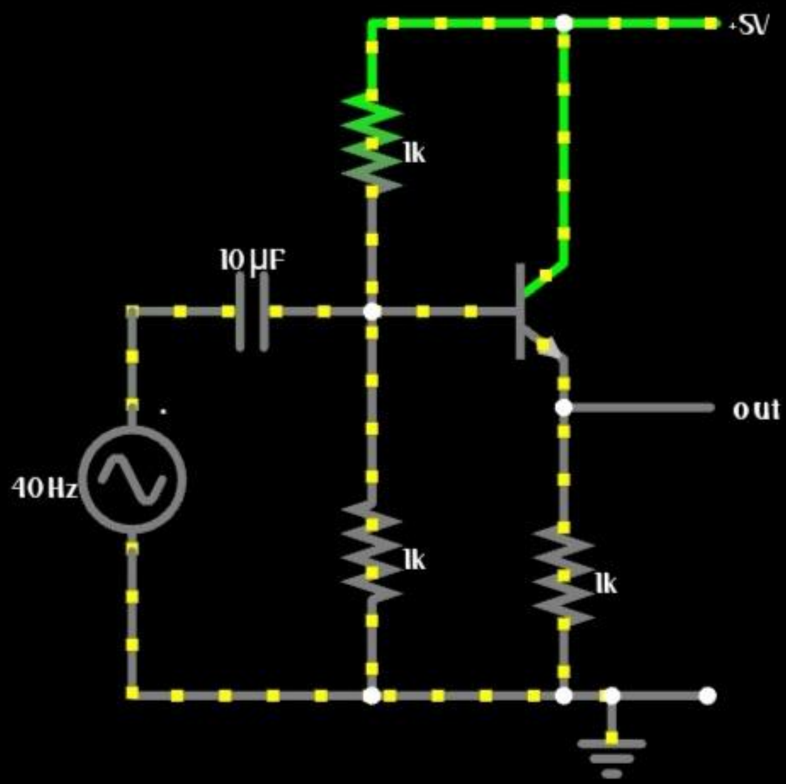


◆ Provides voltage amplification with moderate gain and phase inversion.

◆ The input signal is applied to the base, and the amplified output is taken from the collector, with the emitter typically grounded.

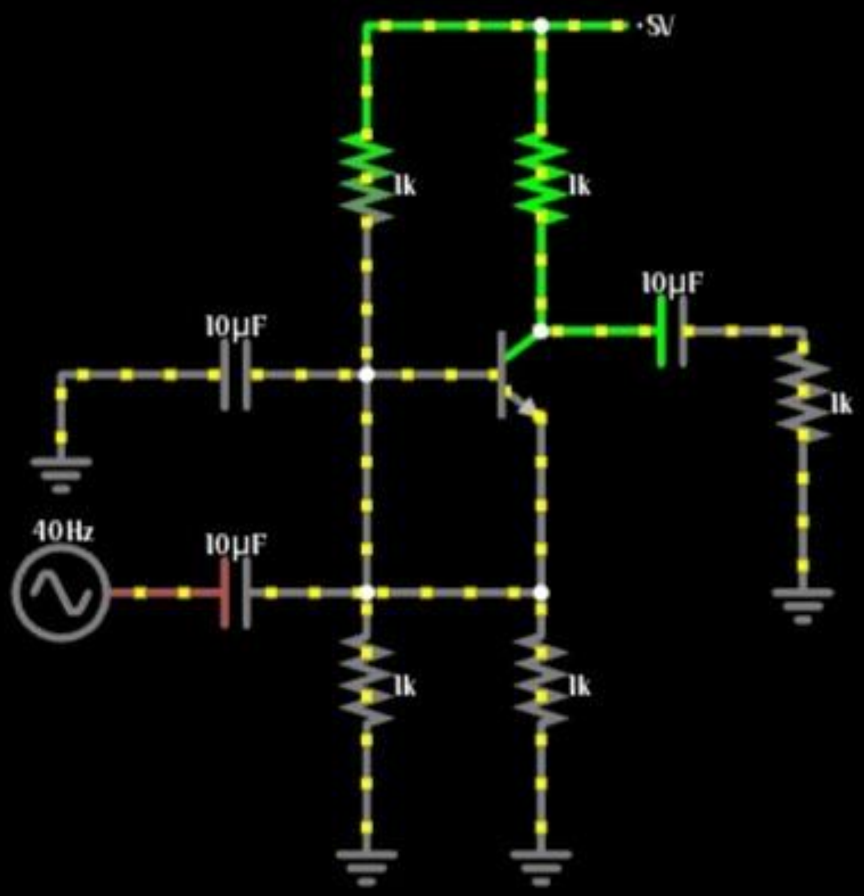
◆ Used in signal amplification for audio and RF circuits, as well as in analog signal processing.

Common collector amplifier



- Provides voltage gain with high input impedance and low output impedance, acting as a buffer.
- The input signal is applied to the base, with the output taken from the emitter, resulting in no phase inversion.
- Used in impedance matching, signal buffering, and as a voltage follower in various electronic circuits.

Common base amplifier

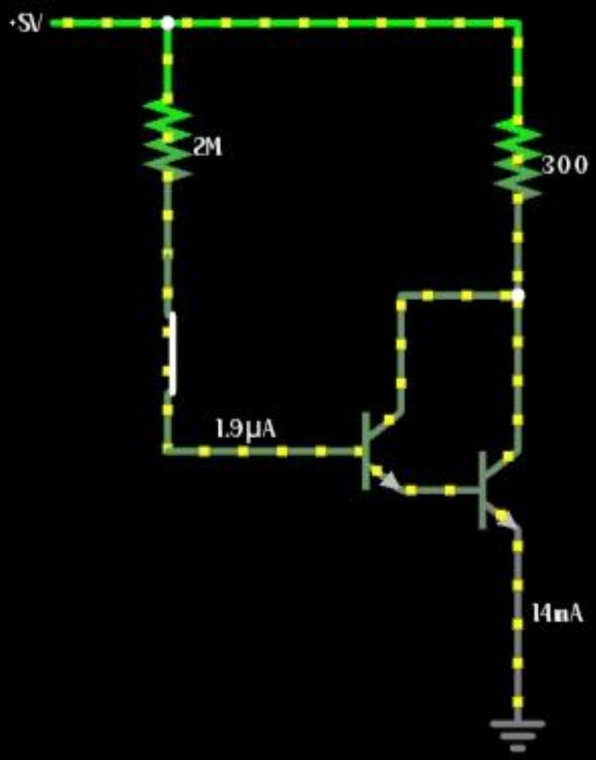


◆ Provides voltage amplification with low input impedance and high output impedance.

◆ The input signal is applied to the emitter, with the output taken from the collector, resulting in no phase inversion.

◆ Used in high-frequency applications, such as RF amplifiers and impedance matching in communication systems.

Darlington pair amplifier

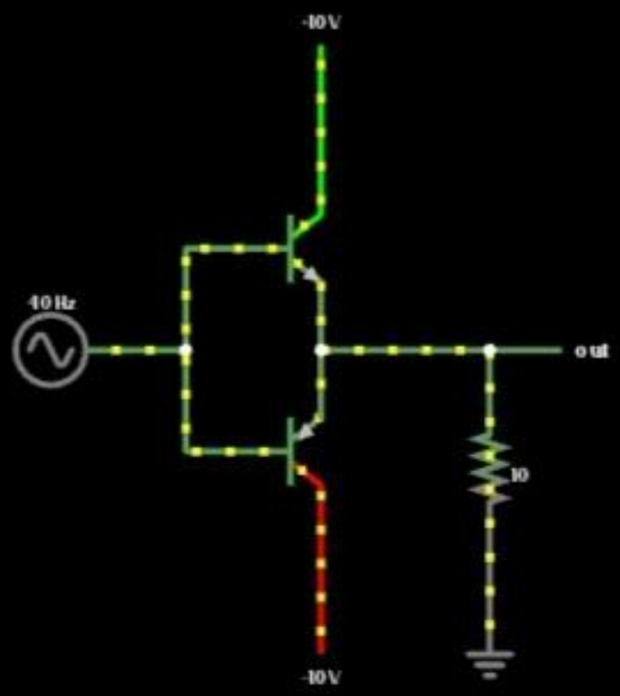


🔶 Provides high current gain by combining two transistors in a way that amplifies current more efficiently.

🔶 The output of the first transistor is connected to the base of the second, resulting in a combined current gain while maintaining the voltage gain characteristics.

🔶 Used in power amplifiers, audio amplifiers, and driver circuits where high current gain is required.

Push - pull follower

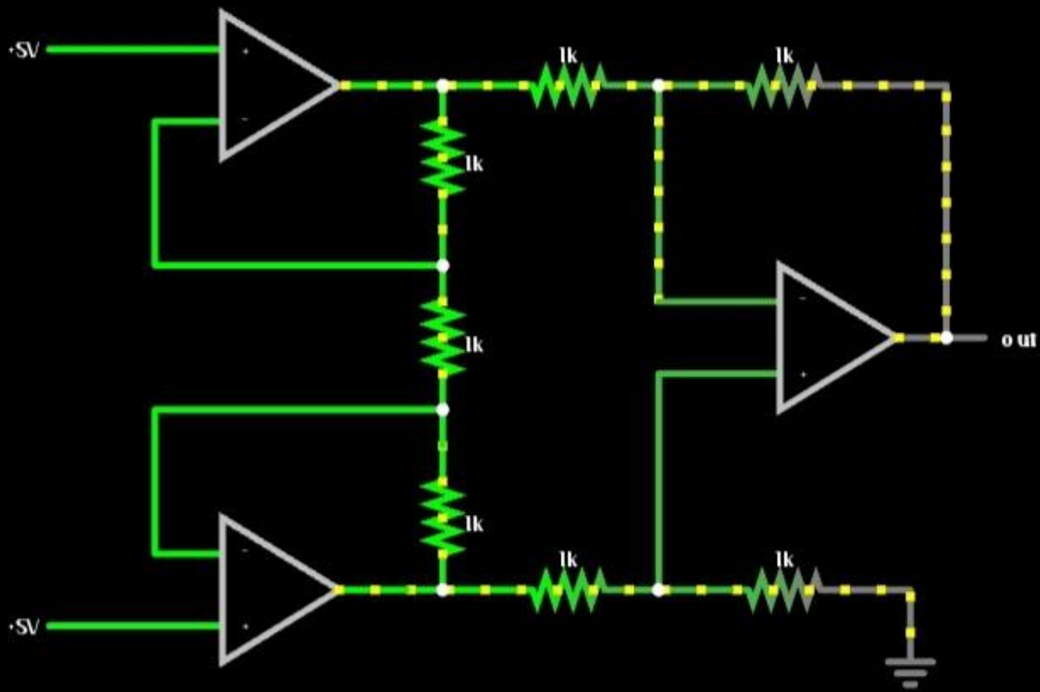


◆ Provides efficient amplification by using two transistors to handle both positive and negative halves of the signal.

◆ One transistor amplifies the positive half of the signal, while the other amplifies the negative half, improving efficiency and reducing distortion.

◆ Used in power amplifiers, audio systems, and signal amplification where high efficiency and low distortion are essential.

Op amps instrumentation amplifier

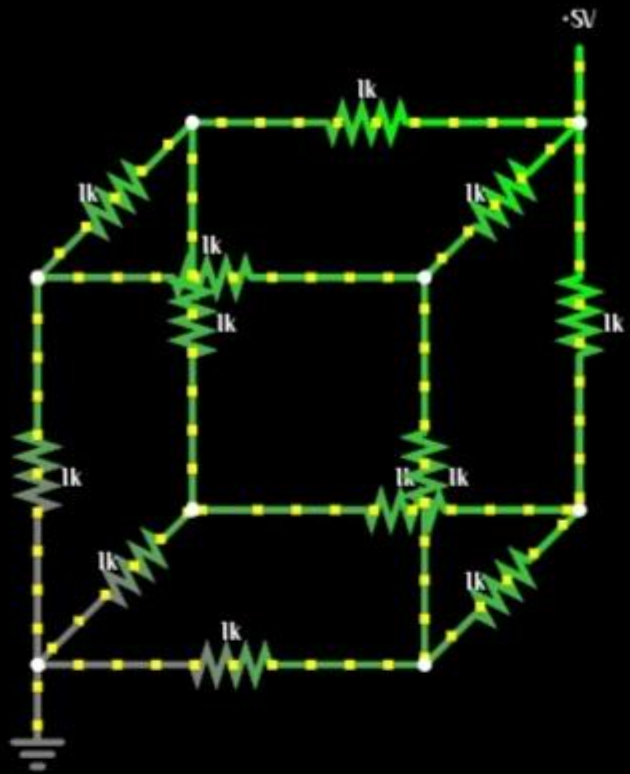


◆ Amplifies the difference between two input signals while rejecting common-mode noise.

◆ Consists of three op-amps, with two forming a differential amplifier and the third providing gain control, ensuring high input impedance and precise output.

◆ Used in applications requiring high accuracy and noise rejection, such as sensor signal amplification.

Resistor cube



◆ A symmetrical network of resistors arranged in a cube structure to analyze equivalent resistance between any two points.

◆ Uses symmetry and network analysis techniques to calculate the total resistance based on series and parallel combinations.

◆ Commonly used in circuit theory problems and for teaching network analysis concepts.

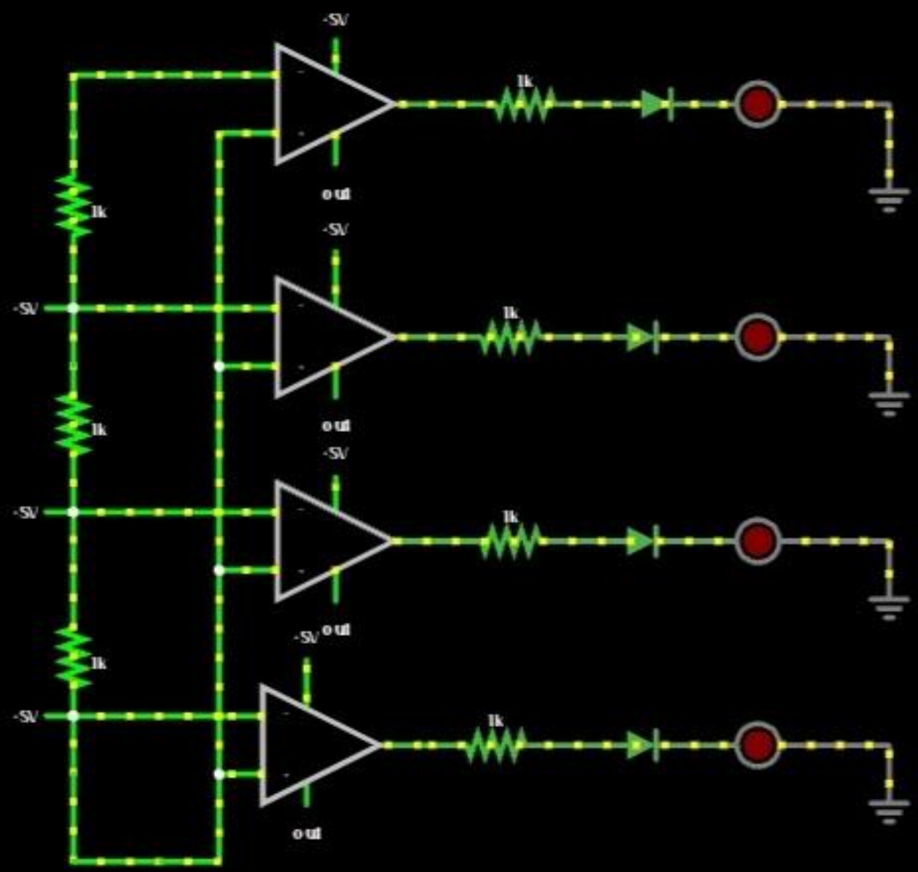
Resistor grid

◆ A network of resistors arranged in a grid pattern to calculate equivalent resistance between two nodes.

◆ Uses series-parallel reduction and symmetry, or advanced techniques like Kirchhoff's laws for complex grids.

◆ Used in teaching network analysis, circuit theory problems, and resistance measurement studies.

Voltage level detector

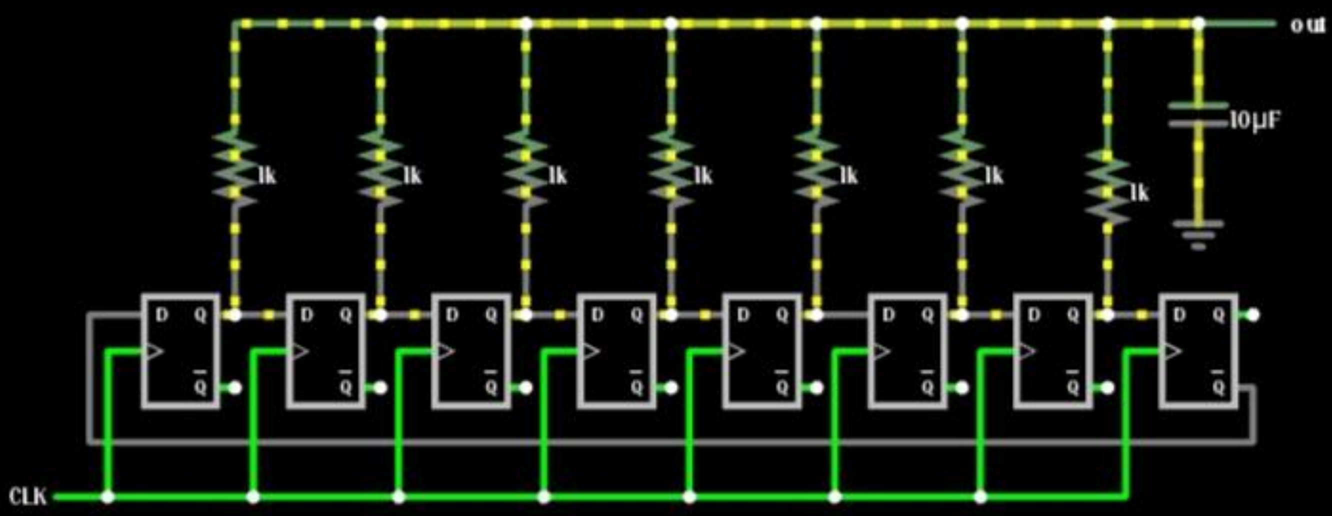


◆ Detects and compares input voltage against a reference voltage to indicate specific voltage levels.

◆ Uses a comparator or operational amplifier to output a high or low signal based on the input voltage relative to the reference.

◆ Used in battery level indicators, power supply monitoring, and threshold detection systems.

Digital sine wave

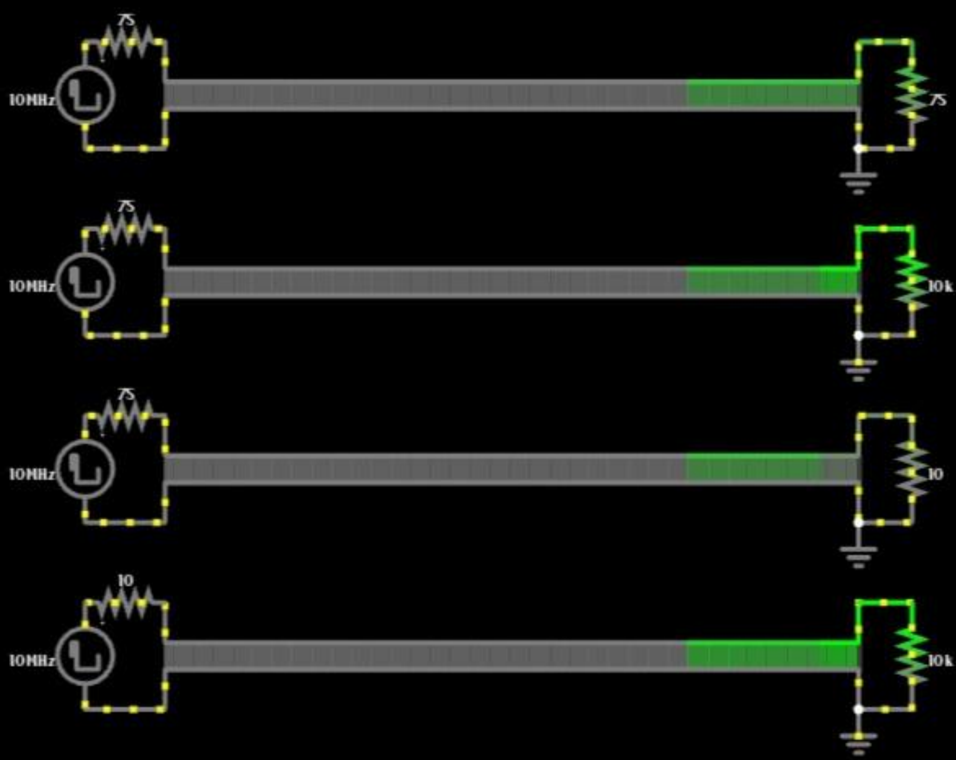


◆ Generates a sine wave signal using digital techniques, often for testing or modulation purposes.

◆ Utilizes a microcontroller, DAC, or digital logic to create a sine wave through waveform synthesis methods like lookup tables or PWM.

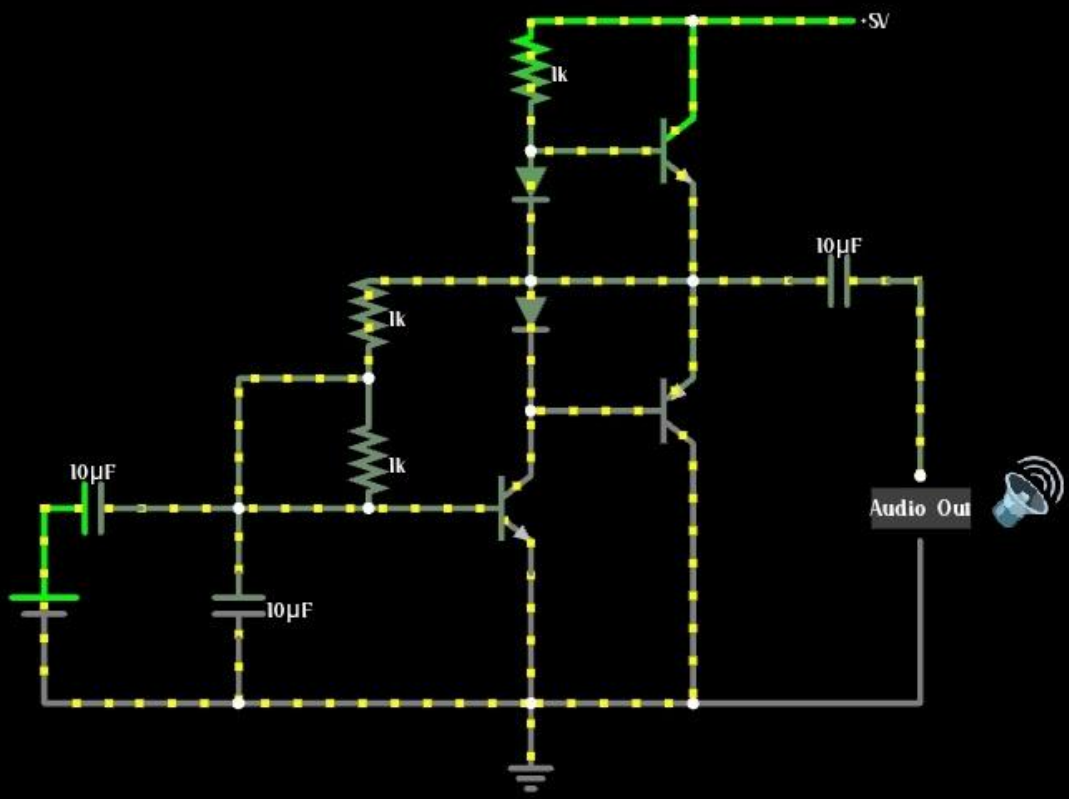
◆ Used in signal processing, communication systems, and waveform testing.

Transmission line termination



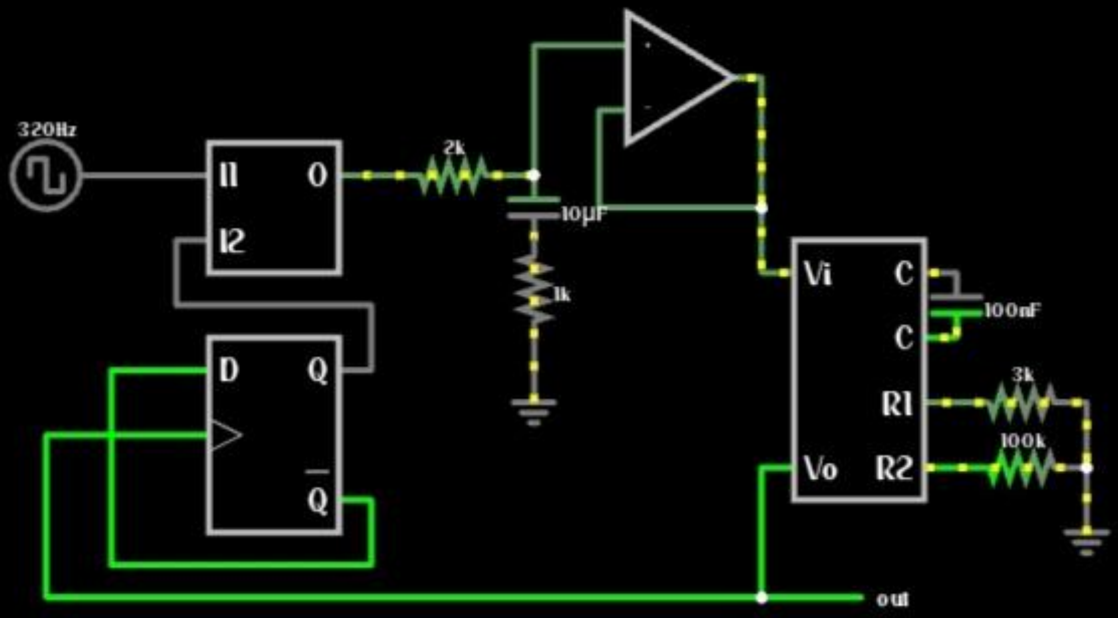
- Reduces signal reflections by matching the line's impedance.
- Demonstrates the effect of proper and improper terminations on signal integrity.
- Used in RF systems and high-speed communication to ensure signal fidelity.

Audio power amplifier



- Amplifies low-power audio signals to drive speakers or headphones.
- Boosts the signal's power using transistors or ICs while maintaining audio quality.
- Used in sound systems, home theaters, and portable audio devices.

Frequency doubler

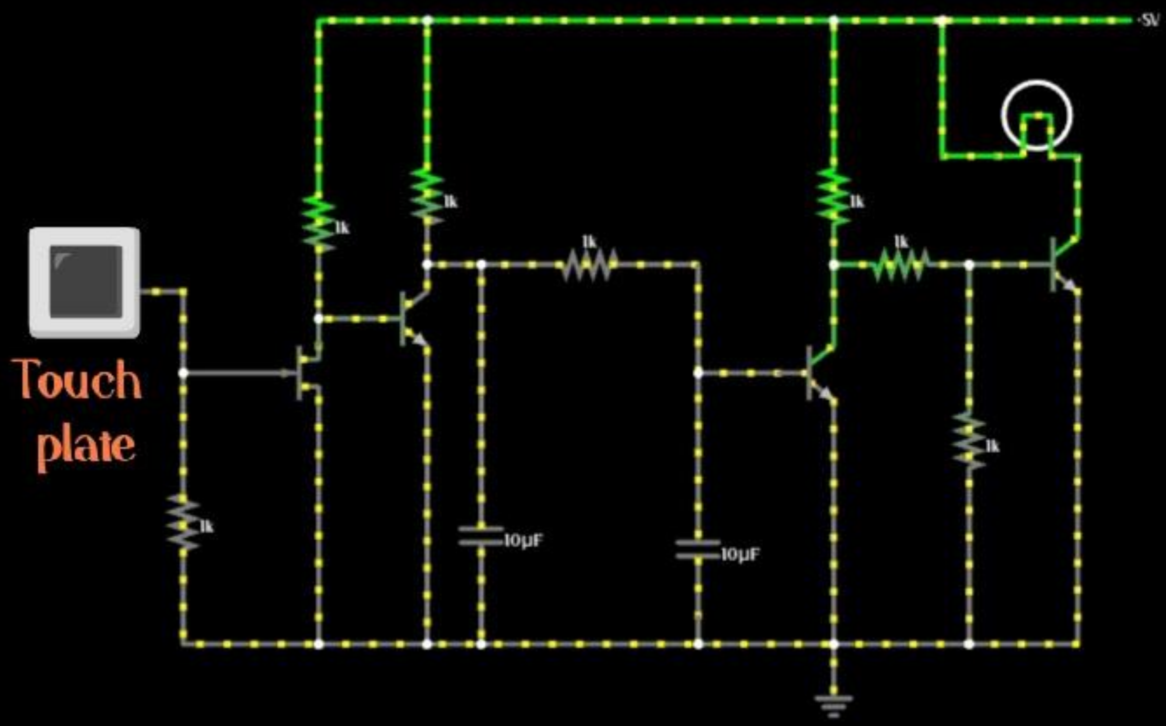


◆ Generates an output signal with double the frequency of the input signal.

◆ Uses nonlinear components like diodes or op-amps to create harmonics, extracting the second harmonic as the output.

◆ Used in RF communication, signal processing, and waveform generation.

Touch swich

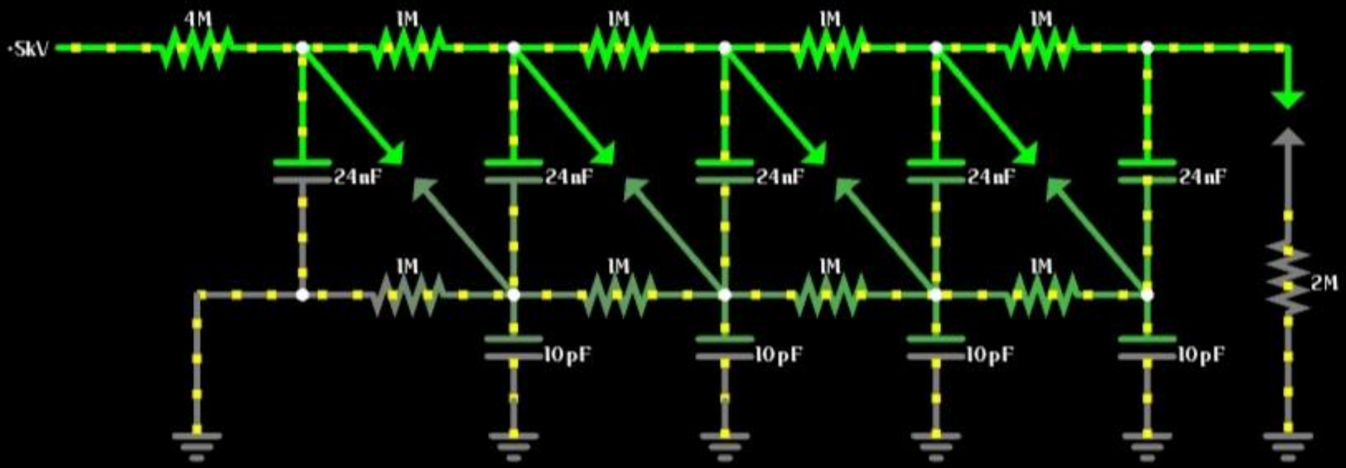


◆ Activates a circuit or device by detecting a user's touch, usually through capacitive or resistive sensing.

◆ Detects changes in capacitance or resistance when a finger touches the sensor, triggering an action like turning on or off.

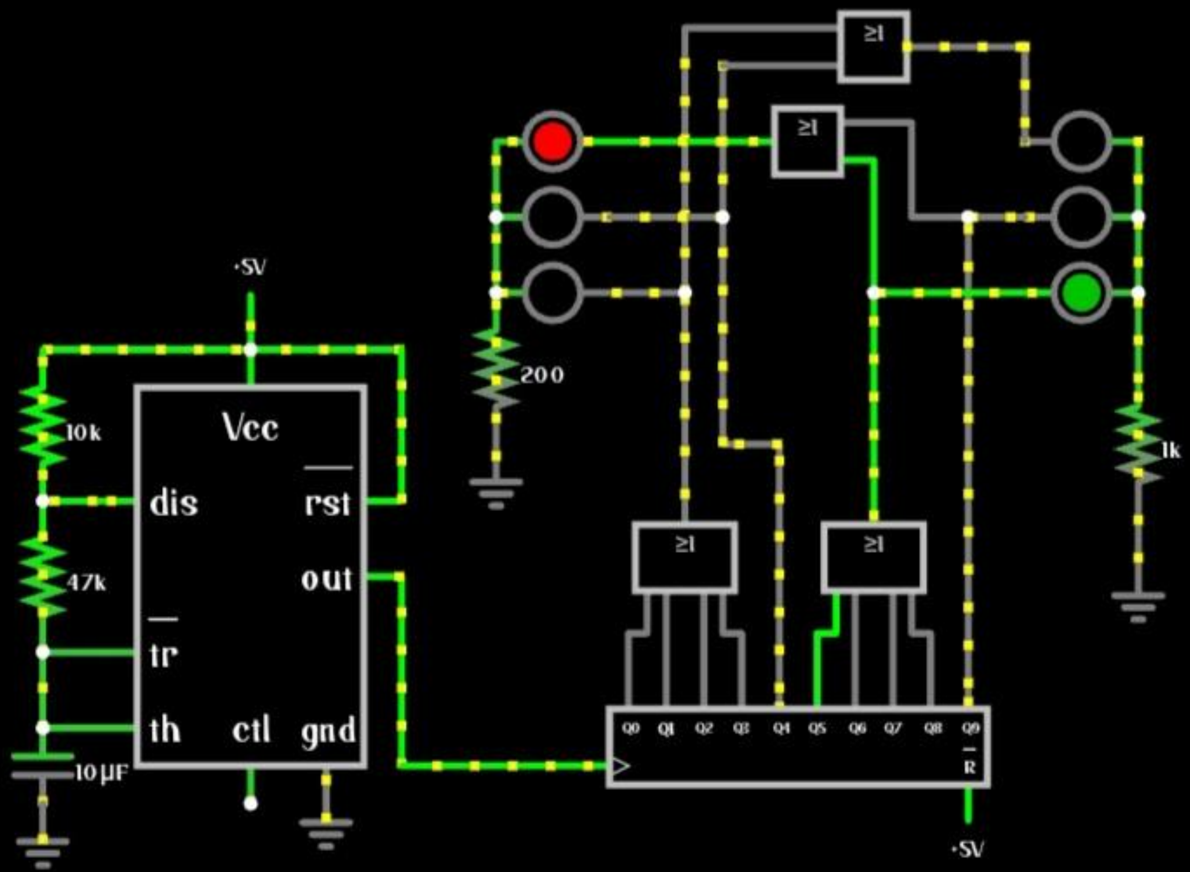
◆ Common in consumer electronics, home automation, touchscreens, appliances, automotive systems, and security devices.

Marx generator



- Produces high-voltage pulses by charging capacitors in parallel and discharging them in series.
- Capacitors charge and discharge through spark gaps to create a high-voltage output.
- Used in high-voltage testing, pulsed power systems, and particle accelerators.

Traffic light



◆ Controls the flow of traffic by using colored lights (red, yellow, green) to indicate stop, caution, or go.

◆ A timer system switches the lights in a cycle to manage vehicle and pedestrian movement.

◆ Found at road intersections, pedestrian crossings, and busy traffic areas to ensure safety and efficient traffic management.