Circuits Playground

DeetCode

A complete reference for the in-browser circuit simulator: every component, what each pin does, the values you can change, how to wire things up, and every worked example that ships with it.

Components	Categories	Worked examples
69	10	31

Everything runs in your browser. Nothing is sent to a server, and the simulation engine, the schematic editor and the instruments are all part of DeetCode.

1. Getting started

Pick a part from the palette on the left, then click the sheet to place it. Click one pin and then another to wire them together. Press Run to start the clock - the sheet opens paused so nothing has happened before you have looked at it.

Wiring

Wires are routed by hand, not guessed for you. Click a pin to start, then click empty space to drop each corner, then click the far pin to finish. Every segment is horizontal or vertical. Tab flips which way the current bend turns, Backspace removes the last corner, and Esc abandons the wire.

A wire's endpoints follow their pins, so dragging or rotating a component keeps the connection - only the corners you placed stay put.

Reading the sheet

Wire appearance	Meaning
Bright	Logic 1, or current is flowing
Dim	Logic 0 - connected, simply low
Red	Conflict: two outputs are fighting
Grey	Floating - nothing is driving it

Select a wire and use the Wire colour swatch to recolour just that one. With nothing selected, the swatch sets the default for every wire that has no colour of its own. Conflict and floating wires keep their warning colours whatever you choose - a colour picker must not be able to disguise a fault.

Components can be destroyed

Parts carry real ratings and they blow when you exceed them. A 9 V battery wired straight to a 2 V LED draws about 350 mA against a 20 mA rating, so the LED is destroyed and marked with a burst symbol - exactly as it would be on a bench. Add a series resistor to limit the current, then press Reset to fit fresh parts. Damage latches until you do.

Keyboard

Key	Action
`V / H`	Select tool / Pan tool
`R / Shift+R`	Rotate 90 degrees right / left
`T / Shift+T`	Tilt 45 degrees
`X / Y`	Flip horizontally / vertically
`Del`	Delete the selection
`Ctrl+A`	Select everything
`Ctrl+Z / Ctrl+Shift+Z`	Undo / Redo
`Ctrl + / Ctrl - / Ctrl 0`	Zoom in / out / reset to 100%
`Space + drag`	Pan from either tool
`Scroll`	Zoom about the pointer
`Tab`	While wiring: flip the bend
`Backspace`	While wiring: undo the last corner
`Esc`	Cancel the current action

Instruments

Double-click an oscilloscope or multimeter to open its panel. The scope plots up to four channels against time, with a selectable timebase and volts per division. The meter switches between DC volts, AC volts, current, resistance, continuity and diode test - and the range genuinely changes what the meter is, so volts go in parallel and current goes in series, just like the real instrument.

2. Component reference

Every part on the palette, grouped the way the palette groups them. Pins lists each terminal and what it is for. Values lists what you can change: select the part and press the Values button on the toolbar.

Power sources

DC voltage source

An ideal fixed DC voltage between + and −. Select it and press Values to set the volts.

Used in: Powering any circuit, biasing, setting a reference level.

Pins	plus (passive), minus (passive)
Values	Voltage (default 5 V)
Current path	plus - minus

AC voltage source

An alternating source that reverses polarity at its set frequency.

Used in: Rectifier and filter demos, mains-style input, transient studies.

Pins	plus (passive), minus (passive)
Values	Voltage (peak) (default 12 V); Frequency (default 50 Hz, min 0.01)
Current path	plus - minus

Battery

A DC voltage source drawn as a cell — the same idea as the DC supply.

Used in: Portable-circuit examples, simple powered loops.

Pins	plus (passive), minus (passive)
Values	Voltage (default 9 V)
Current path	plus - minus

DC current source

Forces a fixed current through its branch whatever the load resistance.

Used in: LED drivers, transistor biasing, current-mirror teaching.

Pins	out (passive), in (passive)
Values	Current (default 0.01 A)
Current path	in - out

Supply rail

A one-terminal supply rail — a shorthand for 'this node is at Vcc'.

Used in: Tidy schematics where a full source symbol would clutter the rail.

Pins	vcc (supply)
Values	Voltage (default 5 V)

Ground
The 0 V reference every voltage is measured against — node zero of the circuit.

Used in: Every circuit needs one: the return path for all current.

Pins	gnd (ground)

AC wave generator
A bench function generator: sine, cosine, square, triangle or sawtooth at a set amplitude, frequency and DC offset, evaluated continuously from simulated time.

Used in: Driving RC/RL/RLC circuits, testing filters, sweeping a frequency response, feeding a scope.

Select it and press Values to set amplitude, waveform and frequency.

Pins	out (output), gnd (ground)
Values	Amplitude (peak) (default 5 V); Waveform: Sine / Cosine / Square / Triangle / Sawtooth; Frequency (default 100 Hz, min 0.01); DC offset (default 0 V)
Current path	out - gnd

Inputs

Switch (SPST)
Single-pole single-throw switch — one on/off contact you click to open and close.

Used in: Power switches, manual enables, wiring one line to another.

Click it on the sheet to open and close it.

Pins	a (passive), b (passive)
Current path	a - b
Behaviour	click it on the sheet to operate it

Pushbutton
Momentary contact that conducts while held. Click to latch it here.

Used in: Reset lines, user input, clocking a counter by hand.

Click to latch it down, click again to release.

Pins	a (passive), b (passive)
Current path	a - b
Behaviour	click it on the sheet to operate it

Logic input
A clean logic-level source you flip between 0 and 1, with matching NO/NC taps.

Used in: Driving gate inputs, setting mode bits, truth-table exploration.

Click to flip between 0 and 1. NC is the inverse of NO.

Pins	com (passive), no (passive), nc (passive)
Behaviour	click it on the sheet to operate it

Clock source
A square wave at an editable frequency — select it and press Values to change the rate.

Used in: Driving counters and flip-flops, timing every sequential circuit.

Pins	out (output)
Values	Frequency (default 1 Hz, min 0.01)

Passives

Resistor
Limits current in proportion to voltage (Ohm's law). Select it and press Values to change it.

Used in: Current limiting, voltage dividers, pull-ups, biasing — everywhere.

Pins	a (passive), b (passive)
Values	Resistance (default 220 Ω, min 0)
Current path	a - b
Ratings	max power 0.25 W - exceed these and it is destroyed

Potentiometer
A resistor with a movable wiper tap, giving an adjustable divider.

Used in: Volume/brightness controls, adjustable references, sensor calibration.

Select it and press Values to move the wiper. The reading shows the divided voltage.

Pins	a (passive), b (passive), wiper (passive)
Values	Track resistance (default 10000 Ω, min 1); Wiper position (default 0.5 0–1, min 0, max 1)
Current path	a - b, a - wiper, wiper - b

Capacitor
Stores charge and blocks steady DC while passing changes. Open at DC here.

Used in: Decoupling, filters, timing (RC), coupling AC between stages.

Blocks steady DC but passes changes — charge and discharge happen over real time.

Pins	a (passive), b (passive)
Values	Capacitance (default 1e-06 F, min 0)
Current path	a - b
Behaviour	stores charge; blocks steady DC, passes changes

Electrolytic capacitor
A large-value electrolytic capacitor — mind the + terminal's polarity.

Used in: Power-supply smoothing, bulk decoupling, audio coupling.

Blocks DC. Mind the polarity marker — the + terminal must sit at the higher voltage.

Pins	plus (passive), minus (passive)
Values	Capacitance (default 0.0001 F, min 0)
Current path	plus - minus
Ratings	max voltage 25 V - exceed these and it is destroyed
Behaviour	stores charge; blocks steady DC, passes changes

Inductor
Opposes changes in current and stores energy in a magnetic field. A wire at DC.

Used in: Filters, switching regulators, RF tuning, transformers.

Passes DC like a wire, but opposes any *change* in current — that is where its reactance comes from.

Pins	a (passive), b (passive)
Values	Inductance (default 0.01 H, min 0)
Current path	a - b
Behaviour	stores energy in a magnetic field; opposes changes in current

Pull-up resistor
A resistor that weakly ties a line to Vcc so it idles high until pulled low.

Used in: Open-drain buses (I²C), button inputs, floating-input protection.

Pins	a (passive), b (passive)
Values	Resistance (default 4700 Ω, min 1)

Pull-down resistor
A resistor that weakly ties a line to ground so it idles low.

Used in: Defining a default-low input, discharging a node, enable lines.

Pins	a (passive), b (passive)
Values	Resistance (default 4700 Ω, min 1)

Transformer
Two coils on one core: steps AC voltage by the turns ratio and steps current the opposite way, so power in equals power out.

Used in: Mains power supplies, isolation, impedance matching, voltage step-up/step-down.

Steps AC voltage by the turns ratio. Above 1 steps up, below 1 steps down.

Pins	p1 (passive), p2 (passive), s1 (passive), s2 (passive)
Values	Turns ratio (sec/pri) (default 0.5 ×, min 0.01, max 100); Winding resistance (default 2 Ω, min 0.01)
Current path	p1 - p2, s1 - s2

Semiconductors

Diode
Lets current pass one way (anode→cathode) and blocks the reverse.

Used in: Rectifiers, reverse-polarity protection, freewheeling, logic ORing.

Pins	anode (passive), cathode (passive)
Values	Forward drop (default 0.7 V, min 0)
Current path	anode -> cathode
Ratings	max current 0.2 A - exceed these and it is destroyed

Zener diode
A diode that also conducts in reverse above its breakdown voltage, clamping it.

Used in: Voltage references, over-voltage clamps, simple regulators.

Pins	anode (passive), cathode (passive)
Values	Breakdown voltage (default 5.1 V, min 0.1)
Current path	anode -> cathode, cathode -> anode
Ratings	max current 0.1 A - exceed these and it is destroyed

NPN transistor
Bipolar transistor switched on by base current — collector-emitter conducts.

Used in: Low-side switches, amplifiers, driving relays and LEDs from logic.

Drive the base high to switch the collector-emitter path on.

Pins	base (passive), collector (passive), emitter (passive)
Current path	collector - emitter
Ratings	max current 0.5 A - exceed these and it is destroyed

PNP transistor
Bipolar transistor turned on by pulling the base below the emitter.

Used in: High-side switches, complementary output stages, current sources.

Pull the base low to switch it on — the opposite of an NPN.

Pins	base (passive), emitter (passive), collector (passive)
Current path	collector - emitter
Ratings	max current 0.5 A - exceed these and it is destroyed

N-channel MOSFET
Voltage-controlled switch — a gate voltage opens the drain-source channel, drawing no gate current.

Used in: Logic gates, power switching, the heart of every digital chip.

Voltage controlled — the gate draws no current at all.

Pins	gate (passive), drain (passive), source (passive)
Values	Gate threshold (default 2 V, min 0)
Current path	drain - source
Ratings	max current 1 A - exceed these and it is destroyed

Logic gates

AND
Output is high only when every input is high — logical multiplication.

Used in: Enable/gating logic, address decoders, combinational conditions.

Pins	a (input), b (input), y (output)

OR
Output is high when any input is high — logical addition.

Used in: Alarm/any-of conditions, bus merging, interrupt collectors.

Pins	a (input), b (input), y (output)

XOR
Output is high when the inputs differ. The building block of addition.

Used in: Half/full adders, parity generators, comparators, toggling.

Pins	a (input), b (input), y (output)

NAND
AND followed by an inversion — low only when all inputs are high.

Used in: The universal gate: any logic can be built from NANDs. SRAM, latches.

Pins	a (input), b (input), y (output)

NOR
OR followed by an inversion — high only when all inputs are low.

Used in: The other universal gate. SR latches, ring oscillators.

Pins	a (input), b (input), y (output)

XNOR
High when the inputs are equal — the inverse of XOR.

Used in: Equality comparators, parity checkers.

Pins	a (input), b (input), y (output)

NOT
Inverter — flips a single input from 0 to 1 and back.

Used in: Signal inversion, generating complements, buffering through pairs.

Pins	a (input), y (output)

Buffer
Passes its input straight through, restoring a clean, strong drive.

Used in: Fan-out boosting, restoring a weak signal, adding a delay stage.

Pins	a (input), y (output)

Tri-state buffer
A buffer that releases its output to high-Z when Output Enable is low.

Used in: Shared buses where many drivers take turns, memory data lines.

Pins	a (input), oe (input), y (output)

Schmitt inverter
Inverter with hysteresis — two switching thresholds clean up a noisy or slow edge.

Used in: Debouncing, squaring up slow sensor signals, RC relaxation oscillators.

Pins	a (input), y (output)

Sequential

D flip-flop
Captures the D input on each rising clock edge and holds it until the next.

Used in: Registers, shift registers, pipeline stages, clock dividers.

Pins	d (input), clk (clock), set (input), rst (input), q (output), qn (output)

JK flip-flop
Clocked flip-flop where J sets, K resets, and J=K=1 toggles the output.

Used in: Counters, frequency dividers, general state storage.

Pins	j (input), clk (clock), k (input), q (output), qn (output)

T flip-flop
Toggles its output on each clock edge while T is high — a divide-by-two.

Used in: Ripple counters, clock dividers.

Pins	t (input), clk (clock), q (output), qn (output)

SR latch
Level latch: Set forces 1, Reset forces 0, and it remembers in between.

Used in: Switch debouncing, simple memory, hold circuits.

Pins	s (input), r (input), q (output), qn (output)

Combinational

Half adder
Adds two single bits, producing a Sum and a Carry out.

Used in: The first stage of multi-bit adders and ALUs.

Pins	a (input), b (input), sum (output), carry (output)

Full adder
Adds two bits plus a carry-in, giving Sum and Carry-out.

Used in: Chaining into ripple-carry adders and arithmetic units.

Pins	a (input), b (input), cin (input), sum (output), cout (output)

2:1 multiplexer
Selects one of two inputs onto the output according to the select line.

Used in: Data routing, choosing between sources, building larger muxes.

Pins	a (input), b (input), sel (input), y (output)

2:4 decoder
Turns a 2-bit address into one of four active outputs.

Used in: Address decoding, chip-select generation, demultiplexing.

Pins	a0 (input), a1 (input), y0 (output), y1 (output), y2 (output), y3 (output)

ICs

7400 quad NAND
Four independent 2-input NAND gates in one 14-pin package.

Used in: The universal gate: any logic can be built from NANDs alone. Oscillators, latches.

Wire VCC high and GND to ground — the chip does nothing without power.

Pins	a1 (input), b1 (input), y1 (output), a2 (input), b2 (input), y2 (output), gnd (ground), vcc (supply), b4 (input), a4 (input), y4 (output), b3 (input), a3 (input), y3 (output)

7402 quad NOR
Four independent 2-input NOR gates.

Used in: SR latches, ring oscillators, the other universal gate.

Wire VCC high and GND to ground — the chip does nothing without power.

Pins	y1 (output), a1 (input), b1 (input), y2 (output), a2 (input), b2 (input), gnd (ground), vcc (supply), b4 (input), a4 (input), y4 (output), b3 (input), a3 (input), y3 (output)

7408 quad AND
Four 2-input AND gates.

Used in: Enable/gating logic, address decoding.

Wire VCC high and GND to ground — the chip does nothing without power.

Pins	a1 (input), b1 (input), y1 (output), a2 (input), b2 (input), y2 (output), gnd (ground), vcc (supply), b4 (input), a4 (input), y4 (output), b3 (input), a3 (input), y3 (output)

7432 quad OR
Four 2-input OR gates.

Used in: Any-of conditions, interrupt collection.

Wire VCC high and GND to ground — the chip does nothing without power.

Pins	a1 (input), b1 (input), y1 (output), a2 (input), b2 (input), y2 (output), gnd (ground), vcc (supply), b4 (input), a4 (input), y4 (output), b3 (input), a3 (input), y3 (output)

7486 quad XOR
Four 2-input XOR gates.

Used in: Adders, parity, comparators, controlled inverters.

Wire VCC high and GND to ground — the chip does nothing without power.

Pins	a1 (input), b1 (input), y1 (output), a2 (input), b2 (input), y2 (output), gnd (ground), vcc (supply), b4 (input), a4 (input), y4 (output), b3 (input), a3 (input), y3 (output)

7404 hex inverter
Six inverters — the workhorse for generating complements.

Used in: Signal inversion, clock buffering, ring oscillators.

Wire VCC high and GND to ground — the chip does nothing without power.

Pins	a1 (input), y1 (output), a2 (input), y2 (output), a3 (input), y3 (output), gnd (ground), vcc (supply), a6 (input), y6 (output), a5 (input), y5 (output), a4 (input), y4 (output)

7474 dual D flip-flop

Two D flip-flops with independent asynchronous preset and clear (both active LOW).

Used in: Registers, dividers, synchronising an async input.

PRE and CLR are active LOW and override the clock. Tie them high to use the D input.

Pins	clr1 (input), d1 (input), clk1 (clock), pre1 (input), q1 (output), qn1 (output), gnd (ground), vcc (supply), clr2 (input), d2 (input), clk2 (clock), pre2 (input), q2 (output), qn2 (output)

74138 3-to-8 decoder

Decodes a 3-bit address to one of eight active-LOW outputs, with three enable pins.

Used in: Memory chip select, address decoding, demultiplexing.

Outputs are active LOW. Enable needs G1 high and both G2 pins low.

Pins	a (input), b (input), c (input), g2a (input), g2b (input), g1 (input), y7 (output), gnd (ground), vcc (supply), y0 (output), y1 (output), y2 (output), y3 (output), y4 (output), y5 (output), y6 (output)

74151 8-to-1 multiplexer

Selects one of eight data inputs onto Y (and its complement onto W).

Used in: Data routing, implementing any 3-variable logic function.

W is the complement of Y. G is an active-low strobe — tie it low to enable.

Pins	d3 (input), d2 (input), d1 (input), d0 (input), y (output), w (output), g (input), gnd (ground), vcc (supply), d4 (input), d5 (input), d6 (input), d7 (input), a (input), b (input), c (input)

74161 4-bit counter

Synchronous 4-bit binary counter with parallel load, carry out and two enables.

Used in: Frequency division, timing chains, address generation.

Tie ENP and ENT high to count. CLR and LOAD are active LOW.

Pins	clr (input), clk (clock), pa (input), pb (input), pc (input), pd (input), enp (input), gnd (ground), vcc (supply), rco (output), qa (output), qb (output), qc (output), qd (output), ent (input), load (input)

7447 BCD to 7-segment

Converts a BCD digit into active-LOW drive for a common-anode seven-segment display.

Used in: Digital clocks, counters, any numeric readout.

Outputs are active LOW, for a common-anode display. LT and BI are active LOW too.

Pins	b (input), c (input), lt (input), bi (input), rbi (input), d (input), a (input), gnd (ground), vcc (supply), sf (output), sg (output), sa (output), sb (output), sc (output), sd (output), se (output)

4017 decade counter

Decade counter with ten decoded outputs: exactly one goes high at a time, walking 0 to 9, so no decoder is needed. Carry Out is the clock divided by ten.

Used in: LED chasers and sequencers, divide-by-N counters, step sequencers, traffic-light logic.

One output high at a time, walking 0-9. MR resets (active HIGH), CE high freezes it.

Pins	q5 (output), q1 (output), q0 (output), q2 (output), q6 (output), q7 (output), q3 (output), gnd (ground), vcc (supply), mr (input), cp (clock), ce (input), co (output), q9 (output), q4 (output), q8 (output)

4019 quad AND-OR select

Four AND-OR select gates sharing two select lines: each output is (A AND Ka) OR (B AND Kb).

Used in: Choosing between two data buses, merging two sources, gating a bus off entirely.

out = (A AND Ka) OR (B AND Kb). Raise one select to choose a bus, both to merge them.

Pins	gnd (ground), yd (output), db (input), da (input), ca (input), cb (input), yc (output), kb (input), vcc (supply), ka (input), ya (output), ab (input), aa (input), ba (input), bb (input), yb (output)

7495 4-bit shift register

Four-bit shift register that does both jobs: serial-in/parallel-out with MODE low, and parallel-in/serial-out with MODE high. Both clocks trigger on the falling edge.

Used in: Serial-to-parallel conversion, delay lines, data serialisers, ring and Johnson counters.

MODE low shifts on CP1, MODE high loads P0-P3 on CP2. Both clocks are FALLING edge.

Pins	ds (input), p0 (input), p1 (input), p2 (input), p3 (input), mode (input), gnd (ground), vcc (supply), q0 (output), q1 (output), q2 (output), q3 (output), cp1 (clock), cp2 (clock)

4511 BCD to 7-segment

Decodes BCD to seven-segment with active-HIGH outputs, for a common-cathode display, and can latch the digit it shows.

Used in: Counters and clocks driving a numeric display; the CMOS partner to the 7447.

Outputs are active HIGH, for a common-cathode display. LE high freezes the digit.

Pins	b (input), c (input), lt (input), bl (input), le (input), d (input), a (input), gnd (ground), vcc (supply), sf (output), sg (output), sa (output), sb (output), sc (output), sd (output), se (output)

74HC595 shift register

Serial-in, parallel-out shift register with a separate output latch, so outputs never glitch while data shifts in.

Used in: Driving many LEDs from three microcontroller pins.

Clock data in on SHCP, then pulse STCP to show it. OE is active LOW.

Pins	q1 (output), q2 (output), q3 (output), q4 (output), q5 (output), q6 (output), q7 (output), gnd (ground), vcc (supply), q0 (output), ds (input), oe (input), stcp (clock), shcp (clock), mr (input), q7s (output)

NE555 timer

Two comparators at 1/3 and 2/3 of VCC driving a latch — the classic timing chip.

Used in: Astable oscillators, monostable pulses, PWM, tone generation.

Trigger below ⅓ VCC sets the output high; threshold above ⅔ VCC resets it.

Pins	gnd (ground), trig (input), out (output), reset (input), vcc (supply), disch (bidirectional), thres (input), ctrl (input)
Current path	disch - gnd

Op-amp

Amplifies the difference between its two inputs by an enormous gain, clamped by the supply rails.

Used in: Comparators, amplifiers, filters, buffers.

Compares + against −. Output swings to whichever supply rail wins.

Pins	in_p (input), in_n (input), vcc (supply), vee (supply), out (output)
Values	Open-loop gain (default 100000 ×, min 1)

Outputs

LED
Lights when forward current flows — needs a return path to ground to glow.

Used in: Status indicators, seven-segment digits, opto-isolators.

Pins	anode (passive), cathode (passive)
Values	Colour (default #ff2d55); Forward drop (default 2 V, min 0)
Current path	anode -> cathode
Ratings	max current 0.02 A - exceed these and it is destroyed

Lamp
A resistive filament load that lights when current passes through it.

Used in: Indicator/output loads, showing that a switch or driver works.

Pins	a (passive), b (passive)
Values	Colour (default #ffd633); Filament resistance (default 100 Ω, min 1)
Current path	a - b
Ratings	max voltage 12 V - exceed these and it is destroyed

Buzzer
An audible output that sounds while it is driven.

Used in: Alarms, key-press feedback, timer alerts.

Sounds while it is driven and has a path to ground. Set the tone and volume in Values.

Pins	a (passive), b (passive)
Values	Tone (default 2400 Hz, min 40, max 12000); Volume (default 0.3 0–1, min 0, max 1); Coil resistance (default 100 Ω, min 1)
Current path	a - b
Ratings	max voltage 15 V - exceed these and it is destroyed

Logic probe
Reads a net without loading it, reporting 0, 1, X (conflict) or Z (floating).

Used in: Debugging logic, watching a signal, teaching the four logic states.

Reads a net without loading it. Shows 0, 1, X (conflict) or Z (floating).

Pins	in (input)

7-segment display
Seven bar segments (a–g) that light individually to form digits and letters.

Used in: Numeric displays: counters, clocks, meters.

Pins	a (input), b (input), c (input), d (input), e (input), f (input), g (input), dp (input), com (passive)

Instruments

Voltmeter
Measures the voltage between two points with a very high input impedance.

Used in: Checking divider taps, supply rails, drops across a component.

Wire it across the part you want to measure.

Pins	plus (passive), minus (passive)

Ammeter
Measures the current through its branch — wire it in series with the load.

Used in: Verifying LED current, confirming a load draws what you expect.

Break the circuit and wire it in series — never across a source.

Pins	in (passive), out (passive)
Current path	in - out

Oscilloscope
Plots voltage against time on four channels, so you can see a waveform rather than a single number.

Used in: Checking timing, watching a signal change, debugging oscillators and PWM.

Double-click to open the screen. Clip GND to your circuit's ground.

Pins	ch1 (input), ch2 (input), ch3 (input), ch4 (input), gnd (ground)
Values	Timebase (default 0.002 s/div, min 1e-06); Volts per division (default 2 V/div, min 0.001)
Behaviour	double-click to open its panel

Digital multimeter
Switchable meter: DC and AC volts, current, resistance, continuity and diode test.

Used in: Everyday measurement — the first instrument to reach for on any bench.

Double-click to change range. Volts go in parallel, amps in series.

Pins	probe_p (input), probe_n (input)
Values	Mode: DC volts / AC volts (RMS) / DC current / Resistance / Continuity / Diode test
Current path	probe_p - probe_n
Behaviour	double-click to open its panel

3. Example circuits

Open these from Info -> Examples on the toolbar. Each one loads onto the sheet ready to run, is wired to good practice - unused chip inputs tied, LEDs given series resistors - and none of them will destroy itself when you drive it.

Example	What it shows	Size
AND gate + LED	Logic input x2, AND, Resistor, LED, Ground	6 parts, 5 wires
Half adder	Logic input x2, XOR, AND, Resistor x2, LED x2	9 parts, 10 wires
Ring oscillator	NOT x3, Logic probe	4 parts, 4 wires
2-bit ripple counter	Clock source, Supply rail, T flip-flop x2, Resistor x2, LED x2	9 parts, 10 wires
Open-drain + pull-up	Pull-up resistor, Logic input, Logic probe, Resistor, LED	6 parts, 5 wires
D flip-flop	Logic input, Clock source, D flip-flop, Resistor x2, LED x2	8 parts, 10 wires
LED + resistor (Ohm's law)	DC voltage source, Resistor, Ammeter, LED, Ground	5 parts, 5 wires
Divider + voltmeter	DC voltage source, Resistor x2, Voltmeter, Ground	5 parts, 6 wires
Transistor switch	DC voltage source, Logic input, Resistor x2, LED, NPN transistor	7 parts, 7 wires
Bridge rectifier	AC voltage source, Transformer, Diode x4, Resistor, Voltmeter	9 parts, 13 wires
7400 quad NAND	Output is LOW only when both inputs are HIGH.	8 parts, 15 wires
7402 quad NOR	Output is HIGH only when both inputs are LOW.	8 parts, 15 wires
7404 hex inverter	One switch, two indicators: the input and its complement.	8 parts, 15 wires
7408 quad AND	Output is HIGH only when both inputs are HIGH.	8 parts, 15 wires
7432 quad OR	Output is HIGH when either input is HIGH.	8 parts, 15 wires
7486 quad XOR	Output is HIGH when the inputs differ.	8 parts, 15 wires
Half adder from 7486 + 7408	Two chips, one bit of arithmetic. XOR is the sum, AND is the carry.	10 parts, 27 wires
7474 divide-by-2 + scope	$\overline{Q}$ feeds D, so Q flips on every clock edge. CH1 is the clock, CH2 is Q.	7 parts, 16 wires
74138 3-to-8 decoder	Three switches pick one of eight outputs. Outputs are active LOW, so the selected probe reads 0.	14 parts, 17 wires
74151 8-to-1 multiplexer	Select lines A/B/C choose which data input reaches Y. D0 is tied low and D1 high, so toggling A switches the output.	9 parts, 19 wires
74161 counter + scope	A 4-bit binary counter. Watch QA halve the clock and QB halve QA again.	13 parts, 28 wires
7447 BCD to 7-segment	Set a BCD value on the four switches; the chip's readout shows the decoded digit. Segment outputs are active LOW, so a lit segment reads 0.	10 parts, 13 wires
74HC595 shift register	Data shifts in on SHCP; the outputs only change when STCP latches them. Four LEDs show the latched byte.	14 parts, 20 wires
555 comparators + DMM	Double-click the pot to move the wiper. Below ⅓ VCC the output sets; above ⅔ it resets. The meter reads the timing voltage.	8 parts, 15 wires
4017 LED chaser (10 outputs)	One output high at a time, walking 0 to 9. Carry Out is the clock divided by ten.	25 parts, 37 wires

Example	What it shows	Size
4017 divide-by-6	Q6 wired back to Master Reset makes the counter restart at six. No gate needed.	17 parts, 25 wires
4019 two-bit bus selector	Ka picks source 1, Kb picks source 2. Both high merges them; both low gates the outputs off.	13 parts, 19 wires
7495 shift register (SIPO + PISO)	MODE high loads P0-P3 in parallel; MODE low shifts them out serially. Both clocks trigger on the falling edge.	18 parts, 23 wires
0-9 counter on a 7-segment display	74161 counts, a NAND resets it at ten, and a 4511 decodes BCD into segments.	7 parts, 40 wires
RC low-pass filter + scope	1 k and 1 uF put the cutoff at 159 Hz. Change the generator frequency and watch the output shrink.	5 parts, 7 wires
Op-amp comparator + DMM	The pot sets the + input, a fixed divider sets − at 2.5 V. Cross it and the output swings rail to rail.	8 parts, 14 wires

Parts used by each example

Example	Components
AND gate + LED	Logic input x2, AND, Resistor, LED, Ground
Half adder	Logic input x2, XOR, AND, Resistor x2, LED x2, Ground
Ring oscillator	NOT x3, Logic probe
2-bit ripple counter	Clock source, Supply rail, T flip-flop x2, Resistor x2, LED x2, Ground
Open-drain + pull-up	Pull-up resistor, Logic input, Logic probe, Resistor, LED, Ground
D flip-flop	Logic input, Clock source, D flip-flop, Resistor x2, LED x2, Ground
LED + resistor (Ohm's law)	DC voltage source, Resistor, Ammeter, LED, Ground
Divider + voltmeter	DC voltage source, Resistor x2, Voltmeter, Ground
Transistor switch	DC voltage source, Logic input, Resistor x2, LED, NPN transistor, Ground
Bridge rectifier	AC voltage source, Transformer, Diode x4, Resistor, Voltmeter, Ground
7400 quad NAND	DC voltage source, Ground, Logic input x2, 7400 quad NAND, Logic probe, Resistor, LED
7402 quad NOR	DC voltage source, Ground, Logic input x2, 7402 quad NOR, Logic probe, Resistor, LED
7404 hex inverter	DC voltage source, Ground, Logic input, 7404 hex inverter, Resistor x2, LED x2
7408 quad AND	DC voltage source, Ground, Logic input x2, 7408 quad AND, Logic probe, Resistor, LED
7432 quad OR	DC voltage source, Ground, Logic input x2, 7432 quad OR, Logic probe, Resistor, LED
7486 quad XOR	DC voltage source, Ground, Logic input x2, 7486 quad XOR, Logic probe, Resistor, LED
Half adder from 7486 + 7408	DC voltage source, Ground, Logic input x2, 7486 quad XOR, 7408 quad AND, Resistor x2, LED x2
7474 divide-by-2 + scope	DC voltage source, Ground, Clock source, 7474 dual D flip-flop, Oscilloscope, Resistor, LED
74138 3-to-8 decoder	DC voltage source, Ground, Logic input x3, 74138 3-to-8 decoder, Logic probe x8
74151 8-to-1 multiplexer	DC voltage source, Ground, Logic input x3, 74151 8-to-1 multiplexer, Logic probe, Resistor, LED

Example	Components
74161 counter + scope	DC voltage source, Ground, Clock source, 74161 4-bit counter, Oscilloscope, Resistor x4, LED x4
7447 BCD to 7-segment	DC voltage source, Ground, Logic input x4, 7447 BCD to 7-segment, Logic probe x3
74HC595 shift register	DC voltage source, Ground, Logic input, Clock source x2, 74HC595 shift register, Resistor x4, LED x4
555 comparators + DMM	DC voltage source, Ground, Potentiometer, NE555 timer, Digital multimeter, Capacitor, Resistor, LED
4017 LED chaser (10 outputs)	DC voltage source, Ground, Clock source, 4017 decade counter, Logic probe, Resistor x10, LED x10
4017 divide-by-6	DC voltage source, Ground, Clock source, 4017 decade counter, Logic probe, Resistor x6, LED x6
4019 two-bit bus selector	DC voltage source, Ground, Logic input x6, 4019 quad AND-OR select, Resistor x2, LED x2
7495 shift register (SIPO + PISO)	DC voltage source, Ground, Clock source, Logic input x6, 7495 4-bit shift register, Resistor x4, LED x4
0-9 counter on a 7-segment display	DC voltage source, Ground, Clock source, 74161 4-bit counter, 7400 quad NAND, 4511 BCD to 7-segment, 7-segment display
RC low-pass filter + scope	AC wave generator, Resistor, Capacitor, Oscilloscope, Ground
Op-amp comparator + DMM	DC voltage source, Ground, Potentiometer, Resistor x2, Op-amp, Digital multimeter x2

4. How the simulation works

Two engines run side by side. An event-driven digital simulator answers "what logic level is this net?" - it only evaluates a component when one of its inputs actually changes, so an idle circuit costs nothing and gate delays are real, which is why a ring oscillator genuinely oscillates. Alongside it, a modified nodal analysis solver answers "how many volts, how many amps?", so instruments read real numbers and a 220 ohm resistor behaves differently from a 10 k one.

Four logic states

State	Meaning
0 / 1	A driven low or high level
X	Conflict - two outputs driving against each other
Z	Floating - nothing is driving the net

Time and reactance

When a capacitor, an inductor or an instrument is on the sheet, time is stepped in small increments and each step is solved as a genuine transient step. That is what makes RC and RL circuits charge on their real time constant, and what lets a scope show a waveform instead of an aliased mess. Without any of those parts the solver simply finds the steady operating point, which is faster and just as correct.

Honest limits

Transistors are modelled as switches rather than with small-signal gain, so the playground teaches switching rather than amplifier design. The transformer transforms the instantaneous primary voltage, which is right for an AC drive but means it does not show the way a real transformer passes no steady DC at all. These are stated here rather than left for you to discover.

Generated from the live component registry - if a part exists in the playground, it is in this document.