ELECTRONIC PROJECT KIT

Logic Lane

A chip that keeps time, gates that decide, and a digit the room can read.

63 IN ONE

OHMSVILLE.COM/MANUALS/LEVEL-5

Contents

THE FIVE YOU ARE GRADED ON

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A chip that keeps time, gates that decide, and a digit the room can read.

Chips. A 555 that keeps time better than any pair of transistors will, gates that decide, a counter that remembers how many and a display that says so. These are the builds that used to fill the back half of a 200-in-1 manual, and they are the ones that look most like the inside of something you own.

One shot

WHAT YOU SHOULD SEE

Tap the button and the lamp comes on and stays on for about a second, then goes out by itself. Tapping again during the second changes nothing.

PARTS

9 V battery, NE555 from the drawer, 100 kΩ, 10 µF from the drawer, 1 kΩ, pushbutton, 330 Ω, red LED

THE SHOP TEACHER'S NOTE

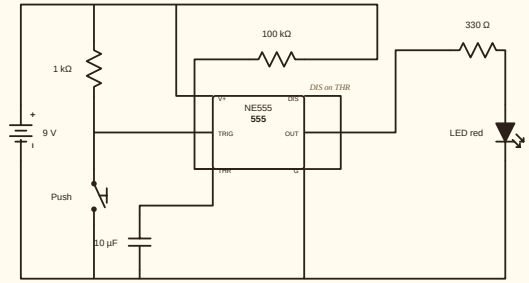
Wired as a monostable the 555 waits: DIS holds the capacitor empty until TRIG is pulled below a third of the supply, then the latch sets, DIS lets go, and the cap charges through the 100 kΩ until THR passes two thirds. That takes R × C × 1.1, about 1.1 s here. One pulse of a length you choose, from a push of any length: that is a timer.

WIRING

1. 1 → 46
2. 49 → 2
3. 1 → 15
4. 16 → 48
5. 48 → 50
6. 48 → 52
7. 53 → 2
8. 1 → 9
9. 10 → 47
10. 47 → 38
11. 39 → 2
12. 51 → 5
13. 6 → 28
14. 29 → 2

Open it on the bench: ohmsville.com/bench#a=one-shot

SCHEMATIC



NOT, from a NAND

WHAT YOU SHOULD SEE

The lamp is lit at rest and goes dark while you hold the button. That is NOT.

PARTS

9 V battery, NAND gate from the drawer, pushbutton, 10 kΩ, 330 Ω, red LED

THE SHOP TEACHER'S NOTE

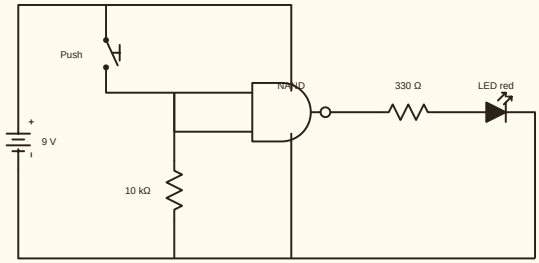
A NAND gives a low only when both inputs are high. Tie its two inputs together and there is only one input left, so it gives a low whenever that input is high and a high whenever it is low. One gate, wired one way, is an inverter — and an inverter after a NAND is an AND.

WIRING

1. 1 → 49
2. 50 → 2
3. 1 → 38
4. 39 → 46
5. 46 → 47
6. 46 → 11
7. 12 → 2
8. 48 → 5
9. 6 → 28
10. 29 → 2

Open it on the bench: ohmsville.com/bench#a=inverter

SCHEMATIC



Count by hand

WHAT YOU SHOULD SEE

Tap the button and the digit goes up by one: 0, 1, 2 … 9, and then round to 0 again.

PARTS

9 V battery, decade counter (up) from the drawer, 7-segment display, pushbutton, 10 kΩ

THE SHOP TEACHER'S NOTE

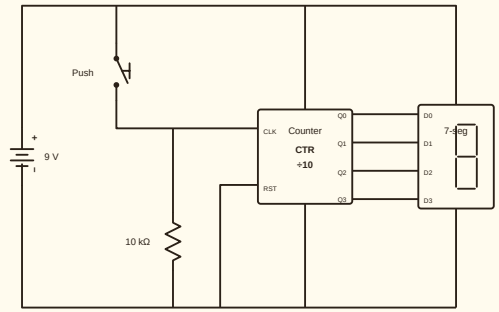
The counter changes its number every time CLK goes from low to high, and the four wires to the display carry that number in binary. Your finger is the clock here; in experiment 25 a 555 does the tapping. RST is tied to ground so the count is never held.

WIRING

1. 1 → 48
2. 49 → 2
3. 1 → 58
4. 59 → 2
5. 1 → 38
6. 39 → 46
7. 46 → 11
8. 12 → 2
9. 47 → 2
10. 50 → 54
11. 51 → 55
12. 52 → 56
13. 53 → 57

Open it on the bench: ohmsville.com/bench#a=count-by-hand

SCHEMATIC



Flickering candle

WHAT YOU SHOULD SEE

A yellow LED that never sits still: two clocks running at once, and the brightness is their sum.

PARTS

9 V battery, 2 × NE555 from the drawer, 10 kΩ, 100 kΩ, 4.7 kΩ and 22 kΩ from the drawer, 2 × 10 µF from the drawer, 2 × 330 Ω, yellow LED from the drawer

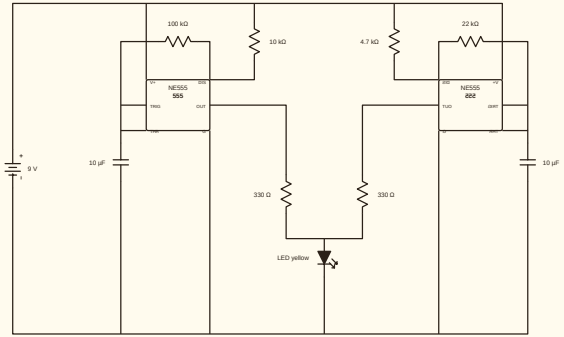
THE SHOP TEACHER'S NOTE

One 555 blinks about four fifths of a second, the other three times a second, and each drives the same LED through its own 330 Ω. Both low and it is out; one high and it is half lit; both high and it is full. Because the two rates do not divide into each other the pattern only comes back round every five seconds, which is longer than anyone watches a candle. Put the slide switch in the rail and you have a jack-o'-lantern with a lid.

WIRING

1. 1 → 46
2. 49 → 2
3. 1 → 11
4. 12 → 50
5. 50 → 15
6. 16 → 48
7. 47 → 48
13. 63 → 56
14. 56 → 64
15. 65 → 54
16. 53 → 54
17. 54 → 60
18. 61 → 2
19. 51 → 5

SCHEMATIC



Eyes in the bushes

WHAT YOU SHOULD SEE

Two red LEDs blinking the opposite way round: when one is lit the other is out, about three times every two seconds.

PARTS

9 V battery, NE555 from the drawer, 10 kΩ, 47 kΩ from the drawer, 10 µF from the drawer, 2 × 330 Ω, red LED, red LED from the drawer

THE SHOP TEACHER'S NOTE

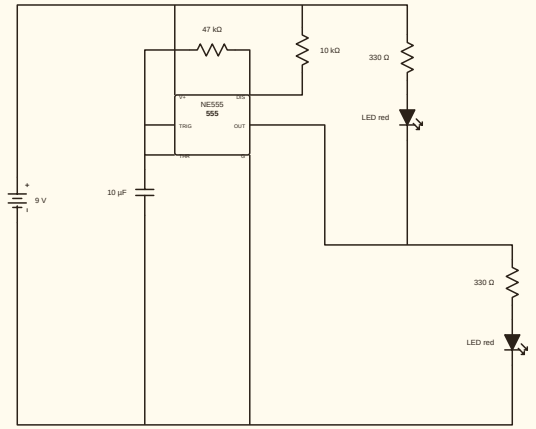
One output, two LEDs, hung opposite ways. The board's red LED comes down from +9 to OUT, so it lights when the chip pulls OUT low. The drawer's red LED goes from OUT down to ground, so it lights when the chip pushes OUT high. A 555's output is push-pull — it drives both ways — which is why one pin can run two lamps that are never lit together. The upper eye never goes fully black: there is still about a volt across it when OUT is high, and that is the ember.

WIRING

1. 1 → 46
2. 49 → 2
3. 1 → 11
4. 12 → 50
5. 50 → 54
6. 55 → 48
7. 47 → 48
8. 48 → 52
9. 53 → 2
10. 1 → 5
11. 6 → 28
12. 29 → 51
13. 51 → 7
14. 8 → 56
15. 57 → 2

Open it on the bench: ohmsville.com/bench#a=eyes-in-the-bushes

SCHEMATIC



Lightning

WHAT YOU SHOULD SEE

A rattling burst of flashes for about three quarters of a second, then nothing for about the same, over and over.

PARTS

9 V battery, 2 × NE555 from the drawer, 10 kΩ, 100 kΩ, 2 × 4.7 kΩ from the drawer, 2 × 10 µF from the drawer, 330 Ω, 1 kΩ, red LED, speaker

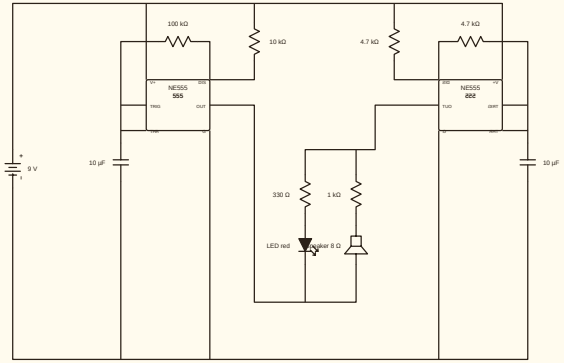
THE SHOP TEACHER'S NOTE

The lamp is not between an output and a rail — it is between two outputs. It can only light when the fast chip is high AND the slow chip is low, so the fast chip's flicker is switched on and off by the slow one. That is a burst and a pause with no extra parts. The speaker hangs across the same pair through 1 kΩ, so it rattles with the flashes. The kit has no white LED; in a dark room the red one reads as lightning anyway.

WIRING

1. 1 → 46
2. 49 → 2
3. 1 → 11
4. 12 → 50
5. 50 → 15
6. 16 → 48
7. 47 → 48
13. 63 → 56
14. 56 → 64
15. 65 → 54
16. 53 → 54
17. 54 → 60
18. 61 → 2
19. 57 → 5

SCHEMATIC



Creaky door

WHAT YOU SHOULD SEE

Hold the button to wind it up. Let go and the tone groans downward for ten seconds, slower and slower, until the door is shut.

PARTS

9 V battery, pushbutton, 470 µF from the drawer, 22 kΩ from the drawer, NE555 from the drawer, 10 kΩ, 0.1 µF, 330 Ω, speaker

THE SHOP TEACHER'S NOTE

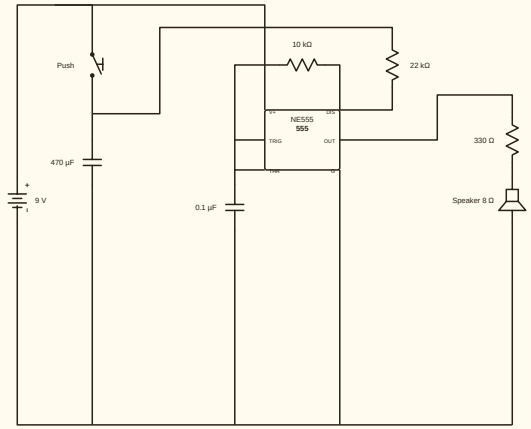
The chip's thresholds are a third and two thirds of the 9 V rail and they do not move. What moves is where the charging current comes from: the 470 µF, and nothing else, feeds the timing network through 22 kΩ. As the capacitor empties, each charge takes longer, so the pitch falls — 340 Hz, 300, 250, 170 — and when the capacitor reaches two thirds of the supply the chip can never trip again and it stops dead. Compare experiment 22, where the pitch is yours to set; here it is the capacitor's.

WIRING

1. 1 → 46
2. 49 → 2
3. 1 → 38
4. 39 → 54
5. 55 → 2
6. 54 → 52
7. 53 → 50
8. 50 → 11
9. 12 → 48
10. 47 → 48
11. 48 → 24
12. 25 → 2
13. 51 → 7
14. 8 → 42
15. 43 → 2

Open it on the bench: ohmsville.com/bench#a=creaky-door

SCHEMATIC



Tripwire scream

WHAT YOU SHOULD SEE

Keep a light on the cell and the shop is quiet. Break the beam — slide the light toward the moon, or cover the camera — and it screams.

PARTS

9 V battery, 100 kΩ, CdS cell, Q1, Q2, relay and 1N4001 from the drawer, NE555 from the drawer, 1 kΩ, 10 kΩ, 0.1 µF, 330 Ω, speaker

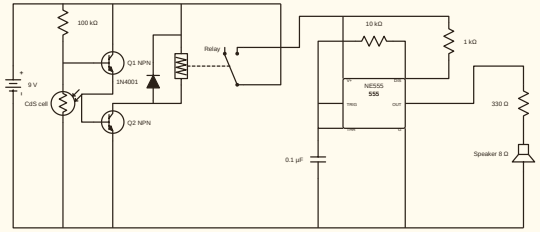
THE SHOP TEACHER'S NOTE

This is experiment 18's dark alarm with something better than a buzzer on the end of it. The 100 kΩ and the CdS cell make a divider, the two transistors together have a gain of about ten thousand, and the relay pulls in when the cell goes dark. Its contact does not carry the sound: it carries the 555's supply. No light, no relay, no 9 V on the chip, no scream — and the moment the beam breaks, the chip wakes up already oscillating at about 660 Hz. A relay is how a tiny sensor switches a whole circuit on.

WIRING

1. 1 → 15
2. 16 → 33
3. 33 → 44
4. 45 → 2
5. 32 → 1
6. 34 → 36
13. 49 → 53
14. 56 → 2
15. 49 → 9
16. 10 → 57
17. 57 → 11
18. 12 → 55

SCHEMATIC



The siren that knows it is hot

WHAT YOU SHOULD SEE

Turn the speaker on and drag the heat: 207 Hz at freezing, 663 Hz in the room, 1 667 Hz on a 50 °C day.

PARTS

thermistor from the drawer, 1 kΩ resistor, 555 timer from the drawer, speaker

THE SHOP TEACHER'S NOTE

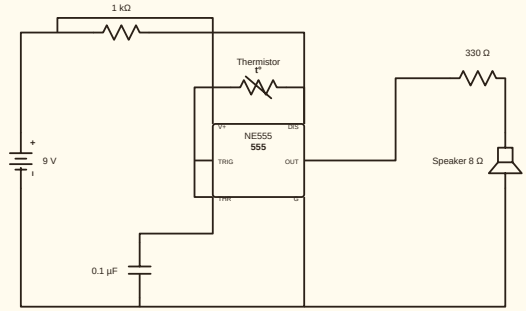
The thermistor stands in for the tone circuit's own timing resistor (as the photocell does in experiment 5): hotter means fewer ohms, faster charging, a higher pitch. A sensor plus a 555 is a whole automatic instrument, here reporting temperature as a sound.

WIRING

1. 1 → 48
2. 51 → 2
3. 1 → 9
4. 10 → 52
5. 52 → 46
6. 47 → 50
7. 49 → 50
8. 50 → 24
9. 25 → 2
10. 53 → 5
11. 6 → 42
12. 43 → 2

Open it on the bench: ohmsville.com/bench#a=heat-siren

SCHEMATIC



The lie detector

WHAT YOU SHOULD SEE

Hold the plates and it hums at about 70 Hz. Slide toward damp — nervous hands — and the hum climbs to a 670 Hz whine. Let go and it stops.

PARTS

touch plates from the drawer, 10 kΩ resistor, 555 timer from the drawer, 0.01 µF capacitor from the drawer, speaker

THE SHOP TEACHER'S NOTE

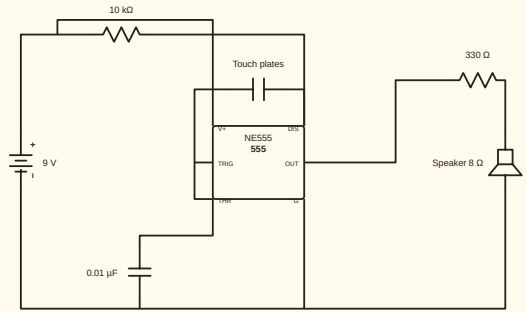
The plates stand in for the 555's own timing resistor: dry skin is close to a megohm and charges the capacitor slowly, a sweaty grip is closer to a hundred kilohms and charges it fast, so the pitch climbs with how nervous the hands are. This measures sweat, not truth, which is the whole history of the polygraph.

WIRING

1. 1 → 48
2. 51 → 2
3. 1 → 11
4. 12 → 52
5. 52 → 46
6. 47 → 50
7. 49 → 50
8. 50 → 54
9. 55 → 2
10. 53 → 5
11. 6 → 42
12. 43 → 2

Open it on the bench: ohmsville.com/bench#a=lie-detector

SCHEMATIC



Colophon

Generated from the modules the bench runs on: every circuit in this booklet is the circuit the simulator solves, and every word beside it is the word the manual panel prints.

Built 2026-09-15 from commit 953a47e.