ELECTRONIC PROJECT KIT

Timing & Control

Series and parallel, a transistor as a switch, and capacitors that set the pace.

30 IN ONE

OHMSVILLE.COM/MANUALS/LEVEL-2

Contents

THE FIVE YOU ARE GRADED ON

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Timing & Control

Series and parallel, a transistor as a switch, and capacitors that set the pace.

Level 2 hands you the drawer: more resistors, more capacitors, a yellow LED and a knob that goes to a hundred thousand ohms. Every build in here needs exactly one of them and nothing else, so you can see what that one part bought you. Three of the four are about time — how long a capacitor takes to fill, and what happens to a note when you change the road the current takes to get there.

The Rate Knob

WHAT YOU SHOULD SEE

The lamp blinks, and the knob sets how fast — about twice a second at the top of its travel, about once every four at the bottom.

PARTS

9 V battery, 330 Ω, 1 kΩ, two 10 kΩ, 100 kΩ, two 100 µF, red LED, Q1, Q2, 100 kΩ pot

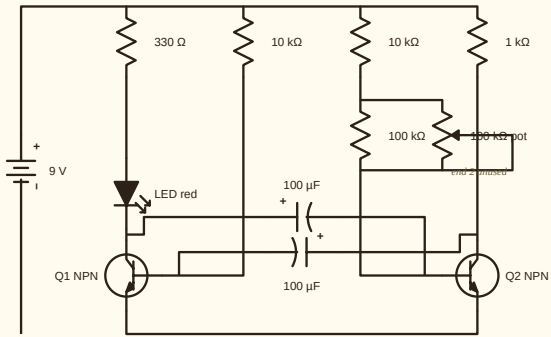
WHY IT WORKS

A 100 µF flasher again, but Q2's base feed is a 10 kΩ in series with a 100 kΩ, and the new pot is laid *across* that 100 kΩ rather than in line with it. Two resistances side by side always come to less than the smaller of them, so the pair is whatever the knob leaves it: wind the wiper to one stop and the pot section is near zero ohms, which shorts the 100 kΩ out and leaves the base with only the 10 kΩ, so the capacitor refills quickly and the lamp blinks fast. Wind it the other way and the pot offers its full 100 kΩ, which beside the fixed 100 kΩ gives 50 kΩ, and each blink takes four times as long. Putting the knob across a resistor instead of in line with it is also what keeps this honest: the base resistance can never run past about 60 kΩ, which is where a cross-coupled pair stops saturating and the maths behind the board stops converging.

WIRING

1. 1 → 5
2. 6 → 28
3. 29 → 32
10. 16 → 36
11. 15 → 46
12. 47 → 16

SCHEMATIC



The Slow Fuse

WHAT YOU SHOULD SEE

Nothing happens for about seven seconds. Then the lamp comes on, all at once, and stays on.

PARTS

9 V battery, 100 kΩ, 470 µF, 330 Ω, red LED, Q1, Q2

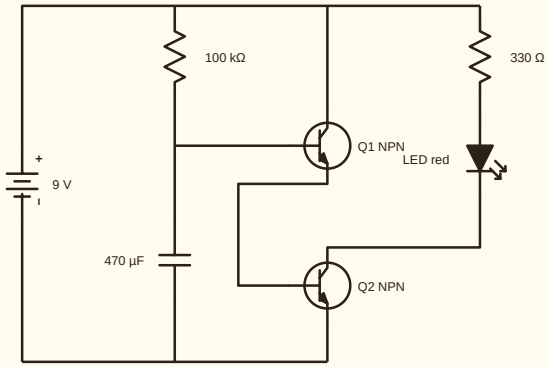
WHY IT WORKS

The 470 µF fills from the plus rail through a 100 kΩ, and a hundred thousand ohms into nearly half a millifarad is a forty-seven-second time constant, so the voltage on the capacitor crawls. That voltage is the input to two transistors wired nose to tail — Q1's emitter feeds Q2's base — which multiplies their two gains together. The pair needs about 1.4 V to start, and once it starts it needs almost no current to hold the lamp at full brightness. So a very slow ramp gets you a very sharp edge: nothing at all for six seconds, half a percent of brightness at six, seventy percent at seven and a half, full on by eight, and then it simply stays there, because the capacitor has nowhere to empty except into the base it is already holding up. One capacitor and one big resistor is a timer, and the delay is nothing but the product of those two numbers.

WIRING

1. 1 → 15
2. 16 → 46
3. 47 → 2
4. 16 → 33
6. 34 → 36
7. 1 → 5
8. 6 → 28
9. 29 → 35

SCHEMATIC



Two Buckets, Two Ways

WHAT YOU SHOULD SEE

Two 1 µF capacitors nose to tail give the higher note. Slide the switch to jump one of them out and the note drops by about a fifth.

PARTS

9 V battery, two 330 Ω, 1 kΩ, 10 kΩ, 0.1 µF, two 1 µF, Q1, Q2, speaker, slide switch

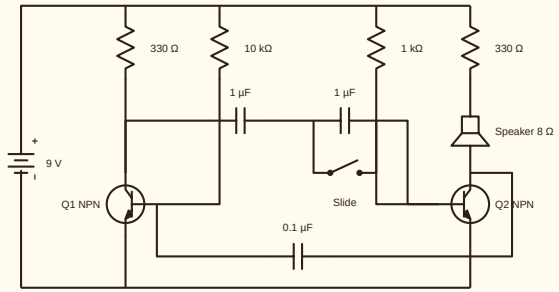
WHY IT WORKS

The two 1 µF capacitors sit nose to tail between Q1's collector and Q2's base, and that pair is the timing element for one half of the oscillator. In series the same charge has to push through both of them, so each takes only half the voltage and the two together behave as a single half-microfarad: half the bucket, half the time to fill, a higher note. The slide switch is laid across the second capacitor. Close it and that one is jumped out of the path, the first works alone at its full 1 µF, that half-cycle doubles, and the note falls. The other half of the oscillator never changes, which is why the note moves by about a fifth rather than by half. Capacitors in series *subtract* capability — the exact opposite of what resistors in series do — and this is the fastest way to hear that rather than take it on trust.

WIRING

1. 1 → 5
2. 6 → 32
3. 1 → 7
10. 32 → 46
11. 47 → 48
12. 49 → 36

SCHEMATIC



The Parallel Trick

WHAT YOU SHOULD SEE

Hold the key and the tone climbs by half. Let go and it drops straight back.

PARTS

9 V battery, two 330 Ω, two 10 kΩ, 4.7 kΩ, two 0.1 µF, Q1, Q2, speaker, pushbutton

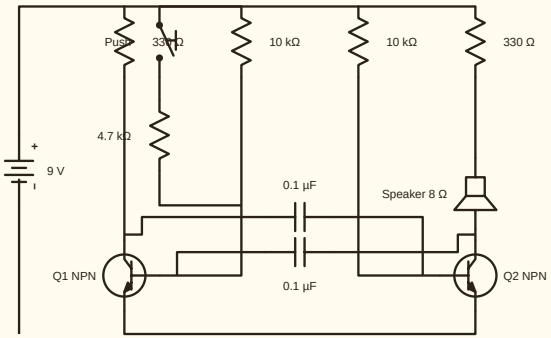
WHY IT WORKS

The usual pair, 10 kΩ feeding one base and 10 kΩ the other, with the 0.1 µF capacitors putting the note near seven hundred hertz. The key and the drawer's 4.7 kΩ are wired together as a second road from one end of the first 10 kΩ to the other. Hold the key and the current has two roads instead of one, and two resistances side by side always total less than either alone: 10 kΩ beside 4.7 kΩ comes to about 3.2 kΩ. That half of the cycle now refills three times as fast, the period shortens by a third, and the pitch climbs by half. Let go and it falls back to exactly where it was. Adding a resistor makes the resistance *smaller*, which is the whole lesson, and here you hear it instead of squinting at an LED.

WIRING

1. 1 → 5
2. 6 → 32
3. 1 → 7
4. 8 → 42
5. 43 → 35
6. 1 → 11
7. 12 → 33
10. 11 → 38
11. 39 → 46
12. 47 → 12
13. 32 → 24
14. 25 → 36
15. 35 → 26
16. 27 → 33

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.

HERITAGE

The Heritage builds in this booklet re-express ideas from vintage Radio Shack “Science Fair” kit manuals. Those manuals are the work of Tandy Corporation; the circuits, drawings and words here are ours. Read the originals:

- Science Fair 200-in-1 Electronic Project Kit (Cat. No. 28-249, 1981) — https://archive.org/details/science-fair-200-in-1-electronic-project-kit

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