Dead-Bug Cicada

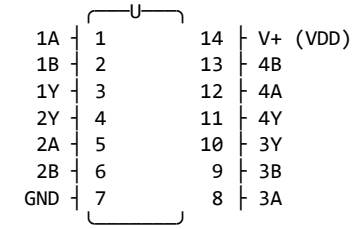
A GATED FOUR-OSCILLATOR CD4093 SYNTH, POINT-TO-POINT // DEAD-BUG BUILD WORKSHEET // MESS O' PEDALS

Turn a CD4093 quad NAND Schmitt trigger into a four-voice gated synth, built dead-bug with no breadboard and no PCB. Parts list, pinout, a pin-by-pin netlist, and how to make the voices gate each other into rhythms.

Parts

☐	1× CD4093 (a.k.a. CD4093B / HEF4093 / MC14093) quad 2-input NAND Schmitt trigger, 14-pin DIP - spot it: 4093 printed on top; a notch marks pin 1. Do not confuse it with the 4011 (plain quad NAND, no Schmitt - it won't oscillate cleanly).
☐	4× 100K-1M pots for playable pitch, one per voice. Spot it: pots are marked B = linear taper (use these), value after.
☐	4× Ceramic capacitors , one value per voice - run the ladder: 101 (100pF, highest whistle), 102 , 103 , 104 , up to 105 / 106 (1 µF+, slow ticking). Four voices want four values; the spread is what stops it sounding like one fat buzz. Spot it: the printed code is the value - 103 = 10nF, and they don't have to match each other to work.
☐	1× 0.1 µF ceramic - supply decoupling (printed 104).
☐	4× Mixing resistors , ~ 10K , one per voice - bands brown-black-orange, or meter them; non-polar.
☐	4× Mixing capacitors , one per voice - 1 µF non-polarised (NP / bipolar) . Audio swings both ways, so a cap that doesn't care about direction is the safe choice. Spot it: NP caps are usually printed NP or BP on the body.
☐	4× 1K resistors - one per pot, in series with it, and not optional (Step 1 explains why). Spot it: bands read brown-black-red-gold = 1, 0, ×100, so 1000 ohms ±5%
☐	1× 10 µF electrolytic - output DC-blocker. Spot it: a little can; the stripe marks the minus leg , longer leg is +.
☐	Optional: 2-4 patch points, switches, or body-contact bolts for the enable inputs - this is where the gating lives (see Step 6 and Going further).
☐	1× Output: a small speaker + an LM386 amp for real volume (that's the Dead-Bug Hornet), OR a jack to an amplifier - see Step 7.
☐	1× SPST toggle for on/off - a 2-lug switch.
☐	1× Power source - at least two vape cells in series (7.4V; three gives you 11.1V), or a 9V battery .
☐	1× LED + a series resistor (~ 1K-10K) as a power indicator. Spot it: the longer leg is + (anode); the flat spot on the rim marks the negative side.
☐	1× Enclosure preferably grounded; if not, copper tape for grounding.
☐	Solid-core hookup wire, soldering iron, cutters, multimeter.

The chip, from above



"A" and "B" are the two inputs, "Y" is the output. Notch marks pin 1. Keep the chip label-up and this map reads exactly as you see it. Watch the outputs: unlike the 40106's neat pairs, each 4093 output sits between the next gate's inputs - gate 2's output (pin 4) is right above gate 2's inputs, not after them.

Build

STEP 1 - PRESOLDER EVERYTHING, THEN POPULATE THE PANEL

Do this before the chip ever comes out of its bag.

One pitch pot - three joints, times four

	CONNECT	TO	PART
	Pot outer lug	1K resistor	Tin both, join in one touch
	1K far end	Wire out	Pick a color and keep it
	Pot wiper (middle lug)	Wire out	The other color
	Pot third lug	nothing	Left empty - do not bridge it

STEP 2 - FLATTEN THE LEGS - AND LEAVE IT LABEL-UP

Bend all fourteen legs out flat, so they splay sideways instead of pointing down.

STEP 3 - POWER - AND THE CMOS RULE

Hook up the two power pins - a red V+ lead and a black ground lead , soldered straight to the legs - and drop the decoupling cap across the chip.

Power & housekeeping

	CONNECT	TO	WHY
	Pin 14	V+	Supply positive (VDD)
	Pin 7	Ground	Supply negative (VSS)
	0.1 µF	Pin 14 -> Pin 7	Decoupling, right at the chip
	Both inputs of any unused gate	Ground	No floating CMOS inputs - ever

STEP 4 - BUILD ONE VOICE

Here's the whole oscillator, on gate 1.

Voice 1 (gate 1) - one row per joint

	CONNECT	TO	PART
	Pin 3 (out)	Pot wiper (middle lug)	Wiper wire
	Pot outer lug	1K resistor	Already joined in Step 1
	1K far end	Pin 1 (in A)	Resistor wire
	Pot third lug	nothing	Left empty
	Pin 1 (in A)	Ground	Range cap (e.g. 0.01 µF)
	Pin 2 (in B, enable)	V+	High = run (later: a gate source)
	Pin 3 (out)	-> to mixer (Step 5)	Signal tap

STEP 5 - ADD THE REST OF THE SWARM

Every voice is the same connections, just on a different gate.

All four gates - out -> R -> in A, in A -> C -> ground, in B -> V+

	VOICE	IN A (R + C)	IN B (ENABLE)	OUTPUT	SUGGESTED CAP
	1	Pin 1	Pin 2	Pin 3	0.01 µF - mid
	2	Pin 5	Pin 6	Pin 4	0.1 µF - low growl
	3	Pin 8	Pin 9	Pin 10	0.001 µF - high whistle
	4	Pin 12	Pin 13	Pin 11	1 µF - slow tick / LFO

STEP 6 - NOW MAKE THEM GATE EACH OTHER

This is the move the 40106 can't make.

- A slow voice gating a fast one. Take the output of your 1 µF voice (a slow tick, below hearing) and run it - through a ~ 100K resistor to be safe - into a fast voice's enable input. The fast voice now switches on and off in time with the slow one: rhythmic pulsing , the cicada chirp.
- A switch on the enable. An SPDT toggle that flips the enable between V+ (run) and ground (mute) gives you a per-voice on/off you can play by hand.
- Body contacts. Bring an enable input out to two bolts with a big pull-up resistor (~1M to V+). Bridge them with a wet finger and your skin drags the gate around.

STEP 7 - MIX THEM DOWN, AND GET IT OUT OF THE BOX

You can't just tie the outputs together - they'd fight.

Resistor mixer & output

	CONNECT	TO	PART
☐	Each voice output	10K resistor -> 1 µF NP cap	resistor first, then cap
☐	All caps	Mix bus	the shared node
☐	Mix bus	10 µF (+ to bus) -> output	DC blocker
☐	Output	LM386 + speaker, or jack to an amp	logic outputs are quiet on their own

STEP 8 - POWER UP

Wire your SPST toggle in the V+ line, flip it, and start sweeping pitch knobs with every enable tied high - you should hear four independent tones.

STEP 9 - IF IT WON'T SING

- A voice is dead silent? First check its enable input (B) is actually high - a floating or grounded enable means the output is jammed high and the voice can't run. Then check the feedback resistor really goes output->input A, and the cap goes input A->ground.
- One voice dies as you turn it down, and comes back as you turn it up? That voice is missing its 1K, or the 1K is bridged past. At 0 ohms the gate's output is tied straight to its timing input and there is nothing left to charge the cap through. Check that voice's outer lug. Note this is a different symptom from a dead enable, which kills the voice at every knob position rather than just at one end.
- A pot does nothing at one end of its travel? That is the 1K doing its job - it stops the range there on purpose. Nothing at all , anywhere in the sweep? You are on the wrong two lugs: it wants the wiper and one outer lug , not the two outer lugs.
- Mixed up which pin is the output? On gates 2 and 4 the output is the lower pin number (4 and 11), sitting above the inputs. Easy to swap.
- Whole chip buzzy or hot? A floating input. Every input of every gate goes somewhere - timing network, enable source, or ground.
- No sound at all? Confirm pin 14 at V+ and pin 7 at ground, and that you didn't skip the 0.1 µF decoupling cap.
- Gating sounds like clicks, not rhythm? That's the enable switching too fast, or a fast voice gating a slow one instead of the other way round. Slow voice gates fast voice.