Breadboard Hive

A SIX-OSCILLATOR CD40106 DRONE BOX, ON A BREADBOARD // BREADBOARD BUILD SHEET // MESS O' PEDALS

Build the six-voice CD40106 drone box on a solderless breadboard, so you can swap a range cap in two seconds instead of two minutes. Row-by-row recipe, pinout, and a troubleshooting table. Built a part at a time, all six voices together. About forty minutes.

Parts

	1x CD40106 hex Schmitt-trigger inverter, 14-pin DIP. Also sold as CD40106B or MC14106 . Spot it: the part number is printed on top and a notch marks pin 1
	6x 1M pots, linear - pitch, one per voice. Spot it: marked B for linear taper, with the value after, so B1M
	6x 1K resistors - one per pot, soldered to the wiper. Anything 1K to 10K works; see the note under the build. Spot it: bands read brown-black-red-gold = 1, 0, x100, so 1000 ohms
	6x 10K resistors - mixer, one per voice. Spot it: bands read brown-black-orange
	6x 1 uF non-polar - mixer, one per voice. Reach for film here: radial film sits on 0.2" pitch, which is exactly two breadboard rows. Spot it: marked NP or BP if electrolytic
	1x 0.1 uF ceramic - supply decoupling. Spot it: printed 104
	Range caps , one per voice, a decade apart, and the whole point of building it here: 1x 100pF (printed 101, the highest whistle, voice 1), 1x 1nF (printed 102, high, voice 2), 1x 10nF (printed 103, mid, voice 3), 1x 0.1 uF (printed 104, low growl, voice 4), 1x 1 uF (printed 105, sub-bass throb, voice 5), 1x 10 uF (printed 106, slow LFO clicks, voice 6 - the ceramic, not the polarised electrolytic)
	1x 10 uF electrolytic - output DC blocker. Spot it: the stripe marks the minus leg ; the longer leg is +
	1x 100 uF electrolytic - supply smoothing
	Breadboard, 5-9V supply, output jack, jumper wire. The chip is happy anywhere from 3V to 18V , so a 5V breadboard module is fine. 9V is livelier

Before you start

The CMOS rule: never leave an input floating. An unused 40106 input will pick up whatever is in the air, switch at random, and heat the chip up. Every input either has a voice hung on it or a jumper to the - rail. There is no third option, and this is the single most common way to kill one of these. Built in order, every input has its voice before power arrives at step 45 - but if you power up part-way through to test, every input that doesn't have its voice yet needs a jumper to the - rail first.

Check your power rails aren't split at the middle of the board , and check that both the top and bottom pairs are live - this build uses both. Jumper across any break, and jumper top to bottom if only one pair is fed.

The only soldering here is the six pot leads. Everything else pushes into the board.

The chip, from above

```
col10 col11 col12 col13 col14 col15 col16
F: V+ 6A 6Y 5A 5Y 4A 4Y
14 13 12 11 10 9 8
 ┌──┬──┬──┬──┬──┬──┬──┐
notch│ CD40106 │
 └──┴──┴──┴──┴──┴──┴──┘
1 2 3 4 5 6 7
E: 1A 1Y 2A 2Y 3A 3Y GND
```

"A" = input, "Y" = output. Keep the chip label-up with the notch to the left, put pin 1 in E10 , and every pin lands on the hole shown. Voices 1 to 3 live entirely in the bottom bank, voices 4 to 6 up top.

Build

Steps 1-4 Prep the pots, seat the chip

All six pots get the same treatment before anything goes near the board, then the chip and its two power jumpers. Pin 1 in E10 - put it anywhere else and every hole below shifts with it.

	STEP	DO	NOTES
	1	Solder a 1K resistor to the wiper of all six pots, and a wire to each end of the pair	The three joints below, six times
	2	CD40106 across the center channel	Notch to the left: pin 1 in E10 , pin 7 in E16, pin 8 in F16, pin 14 in F10
	3	Jumper: J10 -> top + rail	pin 14
	4	Jumper: A16 -> - rail	pin 7

Steps 5-9 The bus jumpers

Five jumpers turn rows 22, 26 and 30 on both sides into one node. Do them now, while the board is still empty enough to see what you are doing.

	STEP	DO	NOTES
	5	B22 -> B26	-
	6	C26 -> C30	-
	7	I22 -> I26	-
	8	H26 -> H30	-
	9	D30 -> G30	The one that links the two halves

Steps 10-15 The six mixer resistors

Six identical 10K resistors, one per voice, each from that voice's output row to its mixer row. Same part six times, so this goes quickly.

	STEP	DO	NOTES
	10	10K: B11 -> B20	Mixer resistor
	11	10K: B13 -> B24	Mixer
	12	10K: B15 -> B28	Mixer
	13	10K: I16 -> I28	Mixer
	14	10K: I14 -> I24	Mixer
	15	10K: I12 -> I20	Mixer

Steps 16-22 The ceramics

The six range caps are the only parts on this board that differ from each other, and they are what makes six voices instead of six copies of one. Check each value against the card above as you go. The decoupling cap goes in with them.

	STEP	DO	NOTES
	16	100pF (101): B10 -> - rail	Voice 1 range cap
	17	1nF (102): B12 -> - rail	Voice 2 range cap
	18	10nF (103): B14 -> - rail	Voice 3 range cap
	19	0.1 uF (104): I15 -> top - rail	Voice 4 range cap
	20	1 uF (105): I13 -> top - rail	Voice 5 range cap
	21	10 uF (106): I11 -> top - rail	Voice 6 range cap
	22	0.1 uF: G10 -> top - rail	Decoupling - it wants to be right at the chip

Steps 23-30 The mixing caps and the two cans

Six 1 uF non-polarised caps carry each voice onto the bus. Then the two polarised ones: the supply smoother across the rails and the DC block on the way out. Both cans have a stripe, and the stripe is minus.

	STEP	DO	NOTES
	23	1 uF NP: C20 -> C22	Mixing cap, onto the bus
	24	1 uF NP: C24 -> D26	Onto the bus
	25	1 uF NP: C28 -> B30	Onto the bus
	26	1 uF NP: H28 -> I30	Onto the bus
	27	1 uF NP: H24 -> G26	Onto the bus
	28	1 uF NP: H20 -> H22	Onto the bus
	29	100 uF: + leg in + rail, other leg in - rail	Supply smoothing
	30	10 uF: + leg in E30, other leg in B32	DC blocker, + toward the bus

Steps 31-42 The six pots

Two wires each, and nothing else goes into the breadboard after this. The 1K on every wiper is the one from step 1 - without it a pot at zero shorts the inverter's output straight to its own input.

	STEP	DO	NOTES
	31	The free end of pot 1's 1K -> A11	Resistor goes to the output
	32	Either outer lug of pot 1 -> A10	Lug goes to the input
	33	The free end of pot 2's 1K -> A13	Resistor goes to the output
	34	Either outer lug of pot 2 -> A12	Lug goes to the input
	35	The free end of pot 3's 1K -> A15	Resistor goes to the output
	36	Either outer lug of pot 3 -> A14	Lug goes to the input
	37	The free end of pot 4's 1K -> J16	Resistor goes to the output
	38	Either outer lug of pot 4 -> J15	Lug goes to the input
	39	The free end of pot 5's 1K -> J14	Resistor goes to the output
	40	Either outer lug of pot 5 -> J13	Lug goes to the input
	41	The free end of pot 6's 1K -> J12	Resistor goes to the output
	42	Either outer lug of pot 6 -> J11	Lug goes to the input

Steps 43-45 Out, and power up

Turn every pot down before you power up. Six voices arriving at once is louder than you think.

	STEP	DO	NOTES
	43	Wire: A32 -> output jack tip	-
	44	Wire: output jack sleeve -> - rail	Shared ground is mandatory
	45	Power: positive to + rail, negative to - rail, both rail pairs fed - bridge them at the free end if your supply lands on one pair	-

Note About that 1K on the wiper

It stops the pot ever reaching zero ohms . At zero the inverter's output is tied straight back to its own input with the range cap sitting directly across the output pin, and every edge dumps that cap through the output transistor with nothing limiting it. The chip runs warm and can eventually lose that inverter.

It also sets where the top of the pitch sweep lands , which is why a pot that seems to do nothing at its fast end isn't broken. Go higher than 1K to pull the ceiling down - 4.7K is worth trying on voice 5 , where the top of the range is supersonic anyway.

If it doesn't work

SYMPTOM	CHECK
Nothing at all, and the chip is warm	A floating input. All six inverters need their voice - if you left one out, jumper that input row to the - rail.
Nothing at all, and the chip is cool	Steps 3 and 4. Pin 14 to the + rail, pin 7 to the - rail, and confirm the rail you jumpered to is actually live.
One voice silent, the rest fine	Its two pot wires are swapped. The 1K's free end goes to the output row, the outer lug to the input row. On voices 4 to 6 remember the output is the lower pin number.
Two voices silent together	A missed jumper in steps 5 to 9. They fail in pairs because each bus segment carries two.
All six there but very quiet	That's the raw mix. A 40106 output is a logic gate, not a driver - it's line level at best and it will not push a speaker. Into an amp, or into an LM386 .
A pot does nothing at one end	The 1K doing its job. Nothing at either end means you're on the wrong two lugs - use the wiper plus one outer .
Voices 5 and 6 click instead of droning	That's 1 uF and 10 uF behaving correctly. Below about 20Hz you stop hearing a pitch and start hearing the individual edges.
Everything drifts and wobbles as you touch the board	Also correct, and it's most of the charm. Six free-running oscillators sharing a supply will pull on each other.

Things to try

- Cross-modulate. A 100K resistor from any output row to another voice's input row. Voice 6 into voice 5's input is the one to do first - slow clicking that gates the whistle.
- Swap range caps. This is the entire reason to breadboard it. Run the whole 101 to 106 ladder through one voice and you'll learn more in five minutes than from any amount of reading.
- Pull a pot and drop in an LDR across the same two rows. Light-controlled pitch, and it's a two-second change here. That is the Optical Theremin , more or less.
- Body contacts. A wire from any input row to a bare wire you can touch. Your skin resistance is in the megohms, which is exactly the range this circuit cares about.
- Run the mix into the Bazz Fuss instead of straight to the jack. Gating a drone with a gated fuzz does something ugly and good.
- Drop the supply. The 40106 runs down to 3V. Everything gets slower and sicker on the way down.