TICOTRONICS

001

Cascading Square-Waves, Part 1

VAUXFLORES

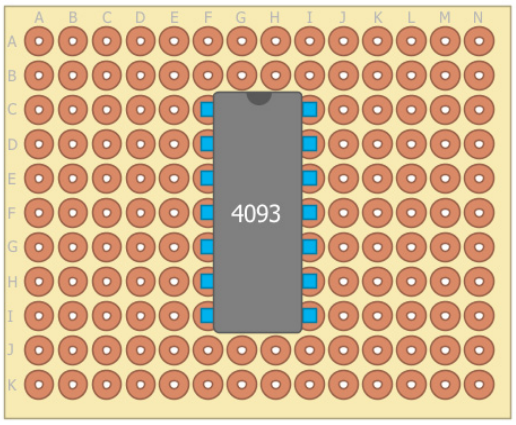
Workshop 1a: Cascading Squarewaves Circuit Assembly

Objectives: Explore the potential of a standard CMOS chip as an oscillator, design and build a functioning cascading square-wave synthesizer, based on schematics found in Nicolas Collins' *Handmade Electronic Music*.

Materials Needed:

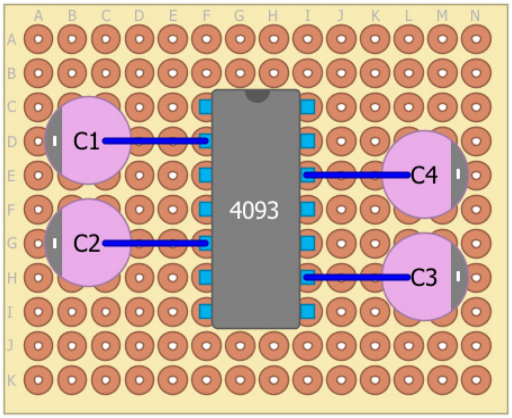
- Soldering Iron/Solder
- 4093 CMOS chip (Mouser Part Number 595-CD4093BE)
- 2x 1/4" Audio Jacks (Can be substituted with 1/8" if you desire)
- Power Supply (2.1 mm)
- Wire (ideally thin and solid)
- 4x Capacitors (can range from .1 to 100 uF)
- Wire Cutters/Needle Nose Pliers/Wire Strippers
- 4x Potentiometers (either 100K or 1M)
- 2x Photoresistors
- 4x SPDT switches
- Perfboard
- Optional: 3mm Acrylic panel, 10 cm x 20 cm

Let's begin, shall we?



Step One:

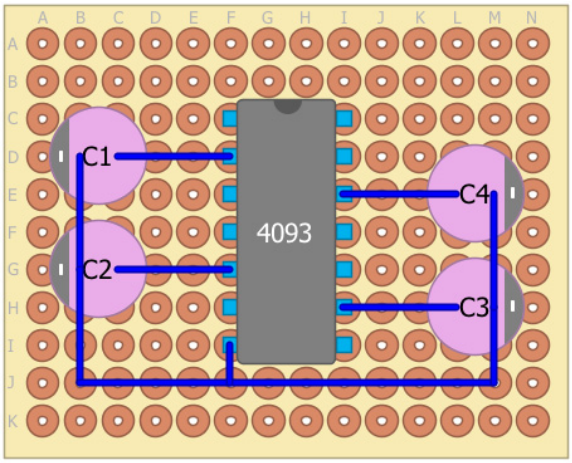
Place the **4093 IC** in the center of your perf-board, allowing space on every side for wiring and components. The indentation of the IC should be facing upwards. Note: pin numbers go counter-clockwise from the indentation, so pin number 1 will be to the direct left of the indentation. Pin 8 is at the bottom right-hand side of the IC and pin 14 is at the upper right.



Step Two:

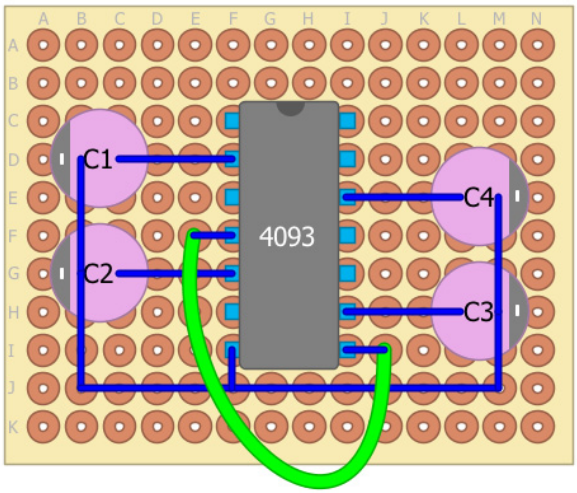
Solder one lead of four **Capacitors** to **Pins 2, 5, 9 and 12**. Any capacitor can be used, however, smaller-valued capacitiors (nanofarads, picofarads) will produce higher frequency ranges than lower valued ones (microfarads, etc.). In general anything larger than 100 microfarads will produce sub-audio frequencies. If electrolytic/polarized capacitors are used, make sure the negative lead is pointing away from the IC. This will be the side with a large stripe on the side and a shorter lead. Other capacitors (ceramic, poly, etc.) can be arranged in any direction.

Be sure to leave at least three to four spaces between the capacitors and your IC to allow for wiring. This will make wiring much easier in later steps



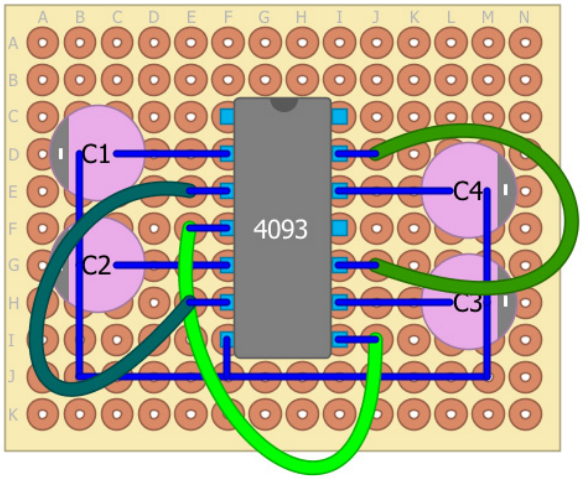
Step 3:

Solder the **negative leads** from the four capacitors, as well as **Pin 7** together. This will connect the grounds of the capacitors as well as the 4093 IC, forming a ground bus for your synth.



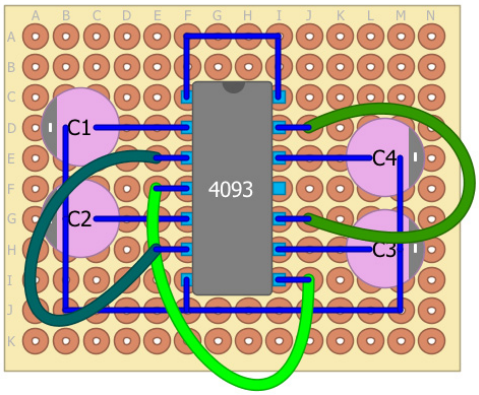
Step 4:

Using a short piece of **Wire**, Connect **Pins 4 and 8**.



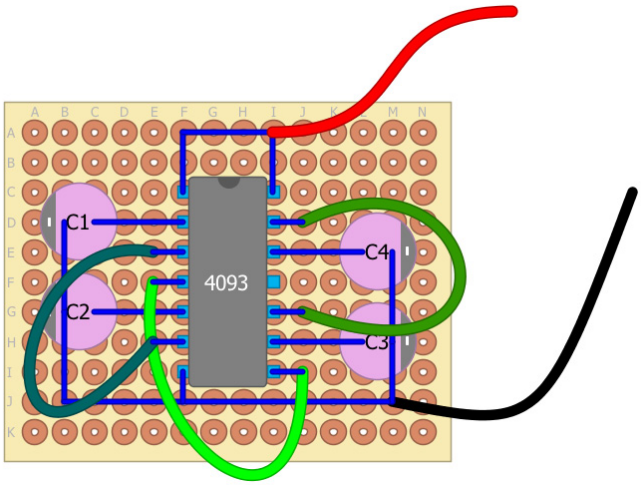
Step 5:

Similar to Step 4, use Wire to connect **Pins 3 and 6**, as well as **10 and 13**.



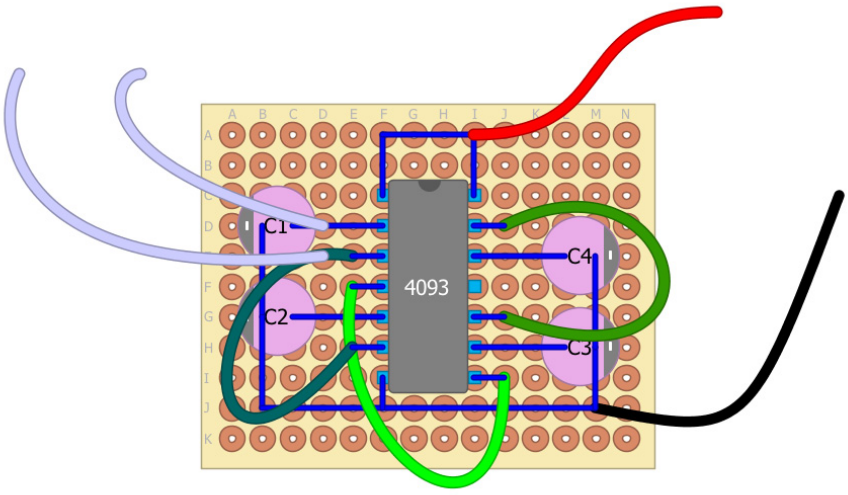
Step 6:

Connect **Pins 1 and 14**. This will carry voltage from the 9v input on the IC (Pin 14) to our oscillator array.



Step 7:

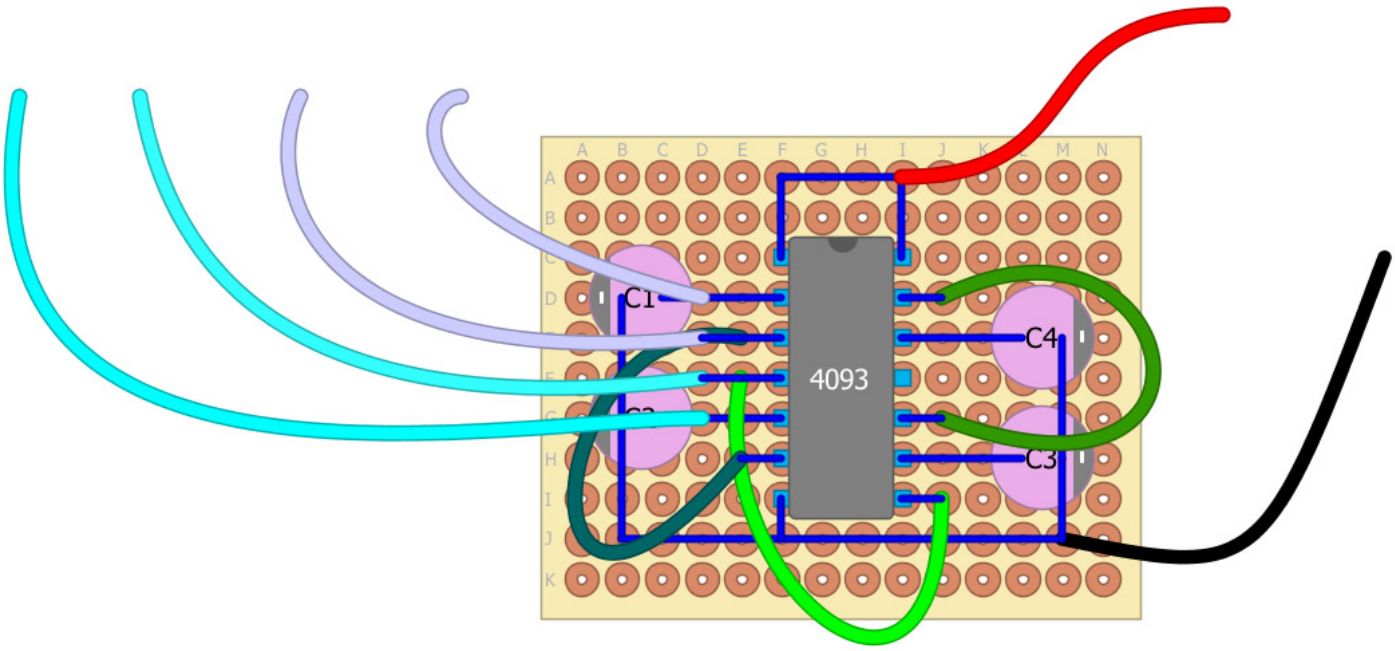
Connect a **Red Wire** to the circuit's **9v Input** (that we created in Step 6) and a **Black Wire** to the circuit's **Ground** (created in Step 3). These will eventually be connected to the circuit's master power supply. Red (positive) and Black (negative) are international electrical standards when it comes to wiring/power/electricity, etc. While not especially required for this build, adhering to these standards will simplify things if you decide to expand this build or integrate it into other systems.



Step 8:

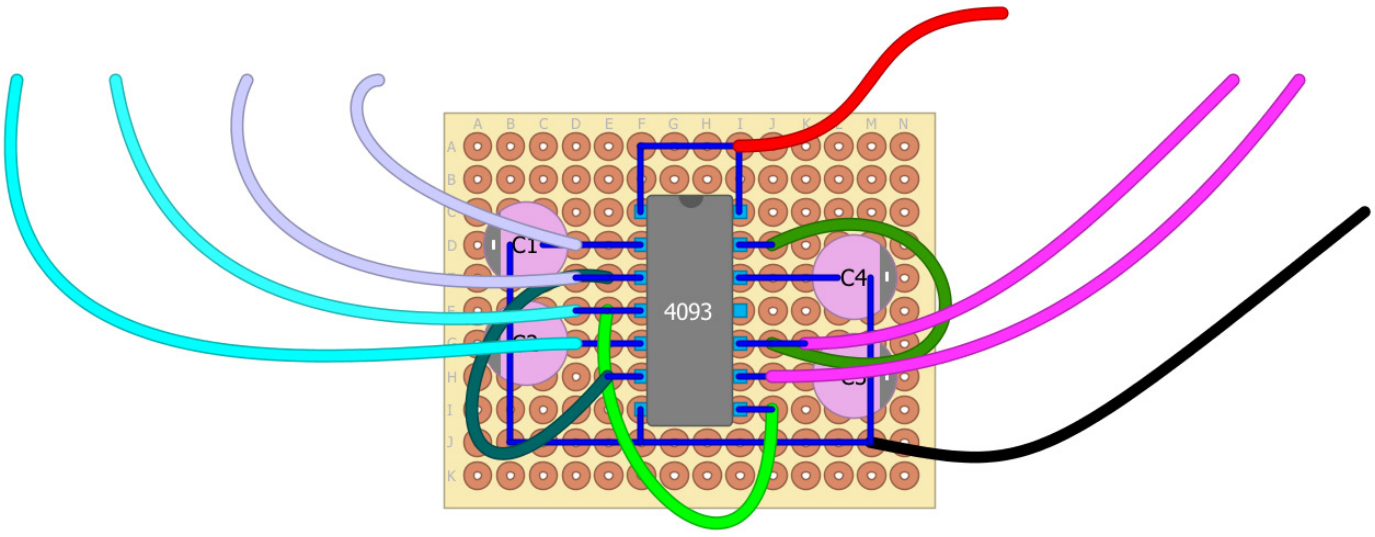
Solder one **20 cm** piece of wire to **Pin 2** and another to **Pin 3**. These will eventually be connected to the potentiometer controlling the frequency of the first oscillator.

Step 9:



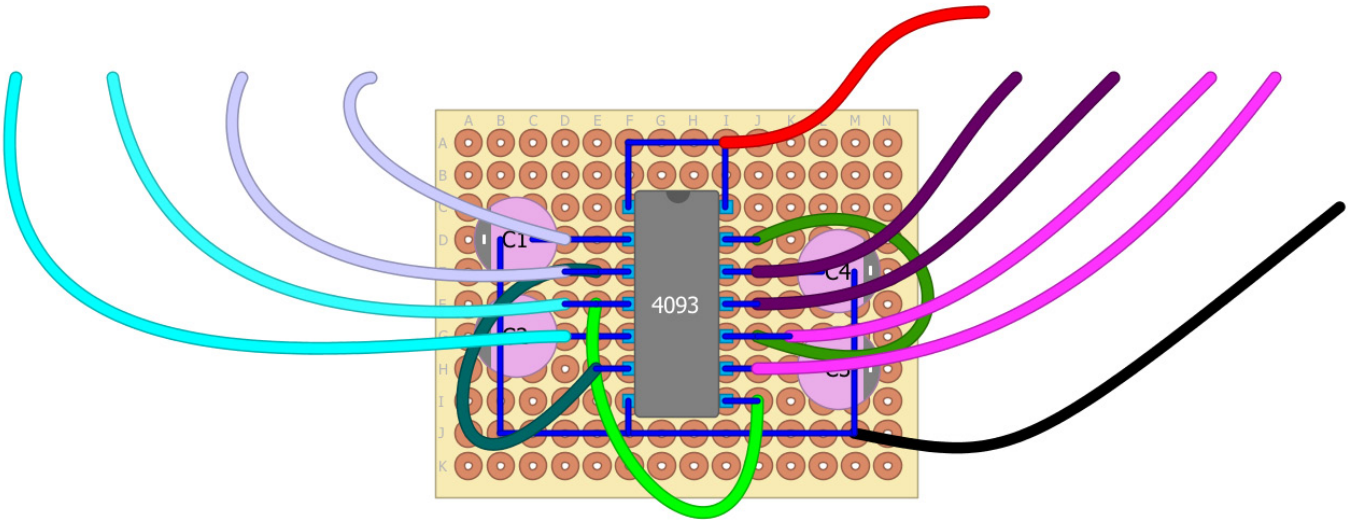
Solder one **20 cm** piece of wire to **Pin 4** and another to **Pin 5**. These will eventually be connected to the potentiometer controlling the frequency of the second oscillator.

Step 10:



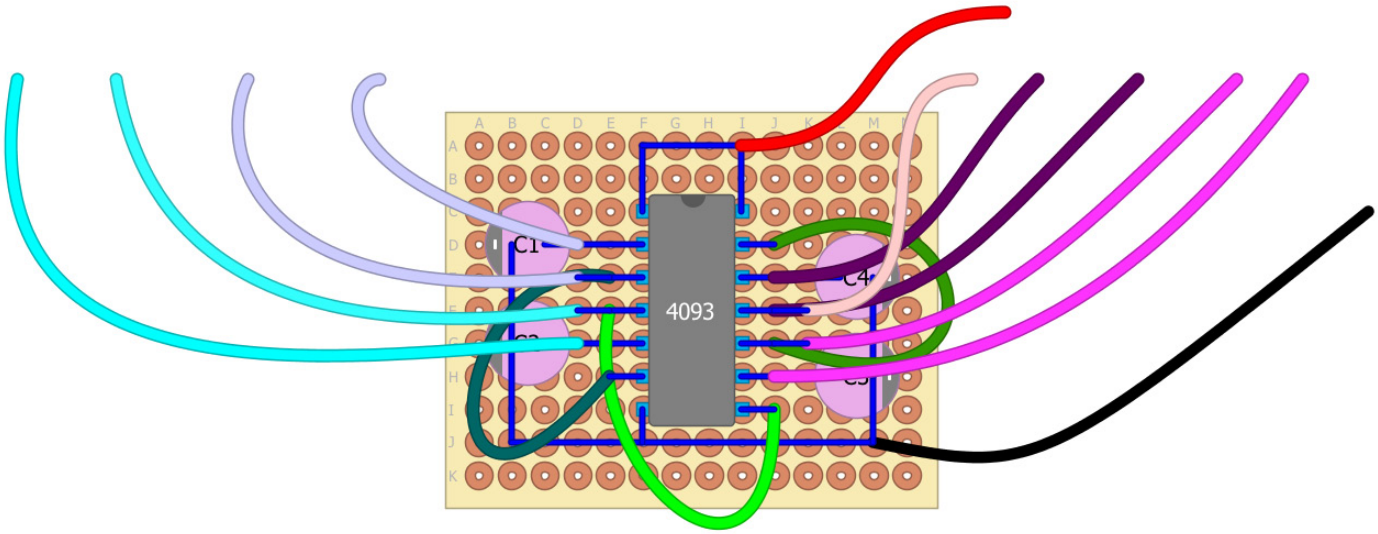
Solder one **20 cm** piece of wire to **Pin 9** and another to **Pin 10**. These will eventually be connected to the potentiometer controlling the frequency for the third oscillator.

Step 11:



Solder one **20 cm** piece of wire to **Pin 11** and another to **Pin 12**. These will eventually be connected to the potentiometer controlling the frequency for the fourth oscillator.

Step 12:



Solder a final wire to **Pin 11**. This will serve as the master audio output for the synthesizer.

And with that you've just completed the core of this circuit. If you're thinking about using the front panel we designed for this circuit, take a break and read on. If you're thinking about using an alternative interface, similarly take a break, take a glimpse at the next document and adjust accordingly. Either way, props on the wiring.