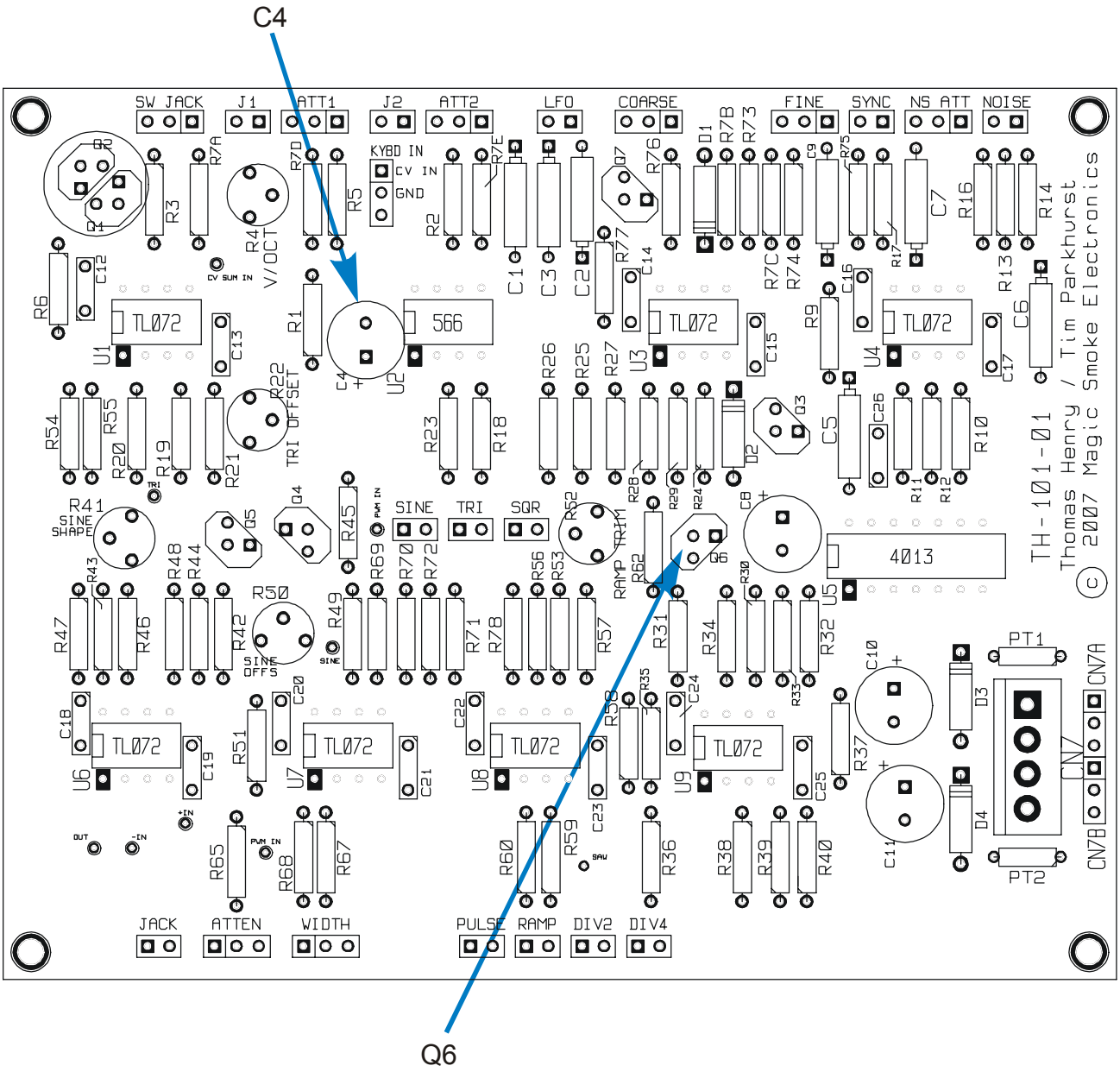
TH-101 “Sheboygan” 566 VCO Build Notes

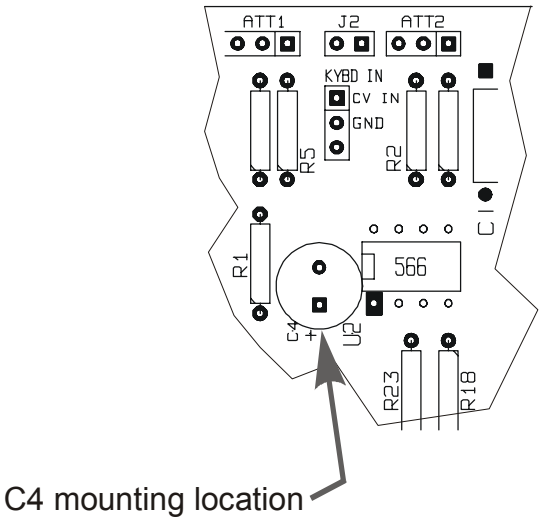
Build Notes / Corrections

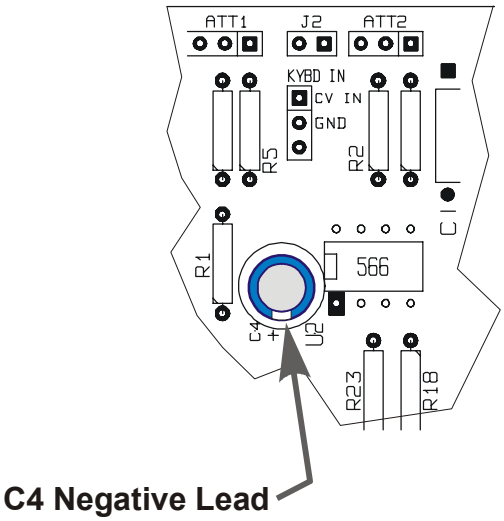
Q1, Q2 and R3 form the “Exponential Converter” on the TH-101. To get the best performance, Q1 and Q2 should be matched, and R3 should be a 2k “Tempco” resistor. Modern manufacturing techniques produce transistors that are very stable and repeatable, so you may get useful results without bothering to match Q1 and Q2, but if you want to match those transistors, there are circuits on the Internet that aid in matching and will describe the process. The transistors should be glued together, face to face, to maximize the thermal contact between them. The tempco resistor should also be in contact with Q1 and Q2, and a small dab of silicone heat sink compound can be used to eliminate any air gap between the tempco and the transistors. 2k tempco resistors are available from Magic Smoke Electronics

The silkscreen on the board is wrong for C4 and Q6. C4 is installed backwards from the polarity indication on the board, and Q6 is rotated 90° counterclockwise. Locate C4 and Q6 as shown below –

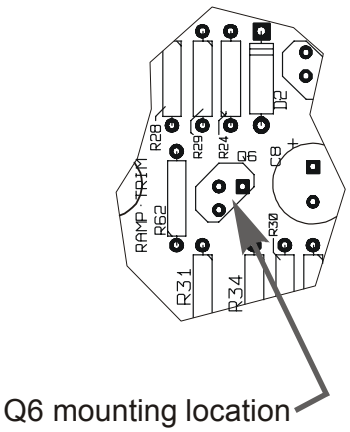


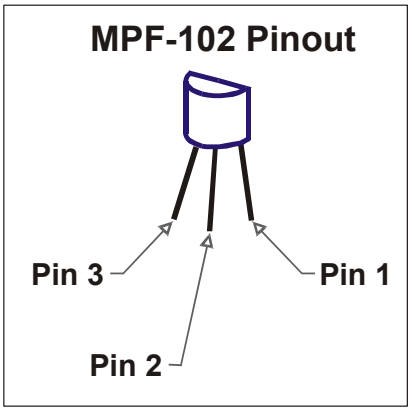
C4 should be mounted opposite to the polarity shown on the silkscreen

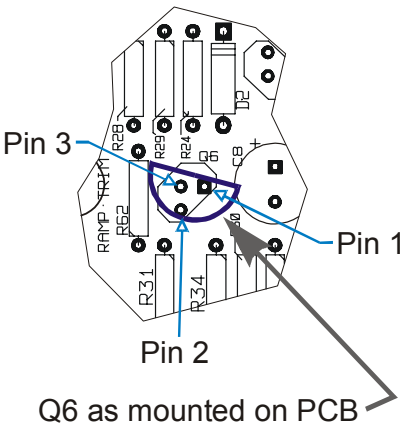




Q6 is mounted 90° counter-clockwise to the orientation shown on the board.







On the Noise Output, a small amount of the VCO can be heard. When using the noise source as a modulation source for “tuned noise” effects, this bleedthrough is not a problem. If you want to use the noise output as a separate noise source however, you may want to eliminate this bleedthrough. Dave Brown has an excellent page about his TH-101 build, and has detailed a mod for the noise source. Dave’s site is definitely worth checking out at http://www.modularsynthesis.com/magicsmoke/566/566.htm

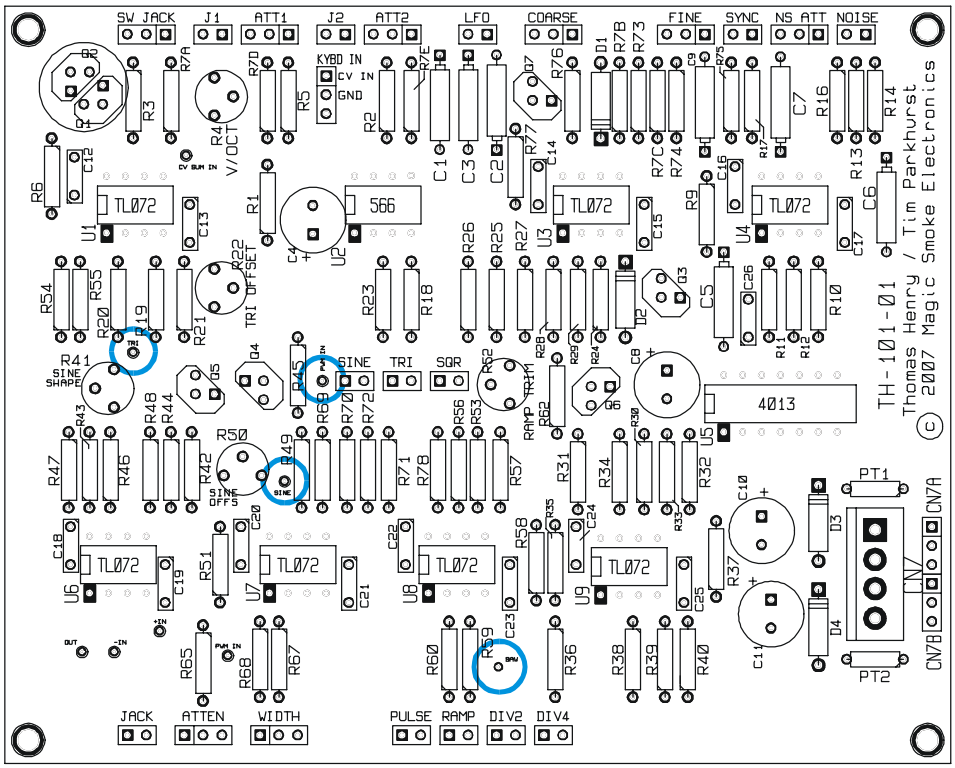
Waveform Adjustment

All waveform adjustments should be done using an oscilloscope, with the TH-101 at a medium frequency setting (around 1kHz should work well). The 566 waveforms will distort at the extreme ends of its range, so you should stick to a medium frequency for the initial setup. If you don't have a scope, you should set the waveform pots to their middle position, and then adjust the waveforms for the best sound. Some things like the Triangle Offset will be a little tricky by ear, but you should at least be able to hear any large misadjustments. Still, even an older low-bandwidth oscilloscope is an extremely handy tool for DIY, so you'll be doing yourself a huge favor by getting one.

The first waveform to adjust is the Triangle. Luckily, it is also the simplest. Looking at the Triangle Output on a scope, simply adjust R22 to center the wave about 0 Volts. When set correctly, the Triangle should be 10V p-p (+5V to -5V). The Sine, Saw and Pulse waves are based on the Triangle, so getting this one right makes the others easier. Note that the R22 adjustment is not listed in the 566 book, but this is a very simple arrangement where we are simply adding a DC offset to center the wave instead of using a capacitor to remove any DC offset as shown in the book. This method responds better to a wide range of frequencies, especially if you use the TH-101 as an LFO.

Next up is the Sine wave. Following the instructions in Thomas' 566 book, adjust R50 for the waveform symmetry (again, symmetrical around 0 Volts) and R41 for the sine shape. The two adjustments interact slightly, so you will probably have to go back and forth between them a few times to get a properly shaped and centered sine wave.

The Saw "Ramp Trim" is another simple adjustment. Looking at the Saw Output on a scope, adjust R52 to get the cleanest Ramp shape. The Saw wave is created by switching between inverted and non-inverted versions of the Triangle wave, and the Ramp Trim will allow you to get rid of the "reset" that occurs in the middle of the ramp. The Saw wave circuit is another departure from Thomas' 566 book. This circuit is from Thomas' "An Analog Synthesizer for the 21st Century" and is used in several other Thomas Henry VCOs. This waveshaper works better than the one shown in the 566 book, and allows us to simultaneously use the Triangle and Square waves.



A comparator is used to create the Pulse wave, and you need to add a jumper to select which waveform is used as the input to the Pulse comparator. As shown above, there are pads for the Triangle, Sine, and Saw waves, and the pad just above R69 is the input to the comparator. Using the Tri or Sine waves will result in a Pulse wave where both the rising and falling edges move about a center point, while using the Saw wave will give you a Pulse where only the rising edge moves. In the audio range, both types of Pulse waves sound the same, but you may

notice more of a difference when using the TH-101 as an LFO and using the Pulse output. You may also choose to add a switch to select between which wave is fed to the Pulse comparator, although the audible difference is very subtle. One more note: Using the Tri or Sine waves as the comparator input and setting the Pulse wave to a width of 50% will give you a square wave that is 90° out of phase from the Square Output, as noted in the 566 book.

On the divider used to create the “DIV4” suboctave, you may notice a capacitor (C26) has been added. This cap creates a slight phase delay on the second suboctave, keeping it from being phase locked with the Square and “DIV2” suboctave waves. This has a subtle (but nice) effect when mixing the waves in the audio range. If you’re using the TH-101 as an LFO or a clock, you may want to remove C26 (or add a switch) if you DO want all of the various square waves kept in phase lock.

All of the waveforms on the TH-101 should be symmetrical about 0 Volts, and are roughly 10 V p-p in amplitude. The Square, -1 Suboctave (DIV2) and -2 Suboctave (DIV4) don’t require any tweaking or calibration.

Calibration

The only other adjustment on the TH-101 is the “Tracking” or V/Octave adjustment. This adjustment is relatively simple in that you just adjust R4 to get the most accurate response to a control voltage input. You are adjusting so that the output frequency doubles when the control voltage increases by 1 Volt (hence the term “1V/Octave” used to describe the response of the VCO). A properly built TH-101 will track well over four or five octaves, and while this is not the eight octaves or so you might expect from a MOTM oscillator, it is very musically useful and a VCO with a lot of warmth and character.