Samodular 258s Build Guide

Version 1.1 - June 2022

Table of Contents

Preparation & Expectations

The 258s PCB is a relatively quick build, but the PCB is densely populated with components. Because of the dense population of components, it is important you pay special attention to the amount of solder you use and your soldering tip. Keeping your soldering tip clean is especially important in this build so that you do not accidentally fill through holes or bridge components. With this in mind, it is important that you allocate enough time to build the module correctly and resist the temptation to rush through the build process. It's understandable that what you really want is a working module to play with, but a successful build requires careful attention to detail.

Paying careful attention to detail takes time, however paying careful attention to detail throughout the build process takes much less time overall than the hours/days it may take to find and correct a mistake that could have been avoided in the first place.

This guide provides a general build sequence and detailed information on areas that are non-obvious or require extra attention to detail, as such, this guide assumes that you have the necessary tools and general DIY skills to complete a build by following a bill of materials and referencing component maps.

Bug Fixes and Modifications

The Samodular 258s PCBs have been updated to include fixes that were necessary with earlier DIY kits. No bug fixes are necessary to complete the 258s build. Additionally, the Samodular full kits are delivered with correctly selected critical components where necessary.

NOTE: Due to the nature of the 258s, even with correctly selected components and all bug fixes, you may choose to implement some resistor modifications to achieve your desired operation.

Build Overview

The build sequence is broken down into five main steps with additional build breakdown under each step. Steps 2-4 can be performed in any order that works, though the sequence here is intended to have the panel finished first so that when the PCB is finished the last steps are final assembly and calibration.

1. **Verify Kit**
2. **Panel, Power, and Hookup Prep**
3. **PCB Build**
4. **PCB + Panel Assembly**
5. **Calibration**

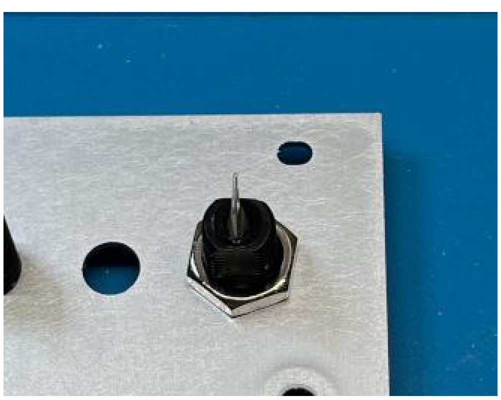
Step 1: Verify Kit Against BOM

Samodular complete kits ship with all required components needed to complete a module. While great care is taken to ensure that kits ship with all the correct components, occasional component errors do happen. It's worth taking the time to verify components against the bill of materials to ensure that your kit is complete.

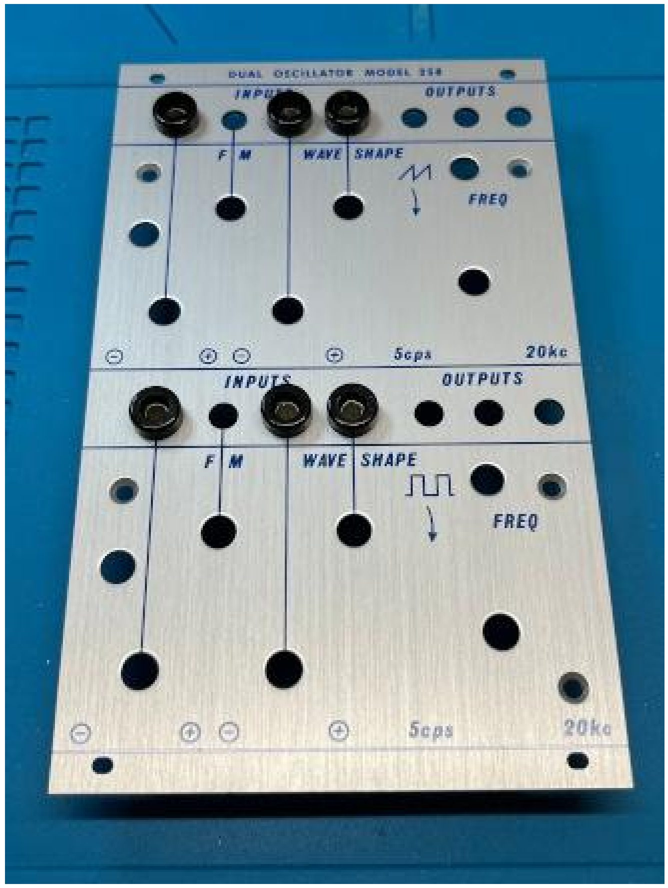
Step 2: Panel, Jacks, and Power Prep

1. **Mount Banana Jacks**: make sure to adequately tighten the banana jack nuts, but not so tightly that you strip the nylon threading on the jack. You don't want a jack coming loose after final assembly.

Black Banana Jack	CV Input	Quantity 6

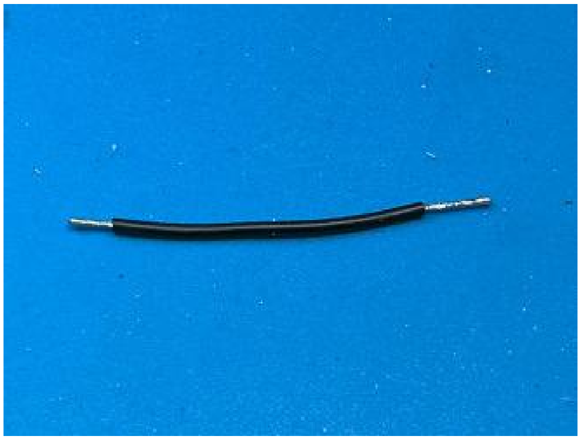
NOTE: There is enough space between banana jacks to use the Samdodular 3D printed nut tightening tool.

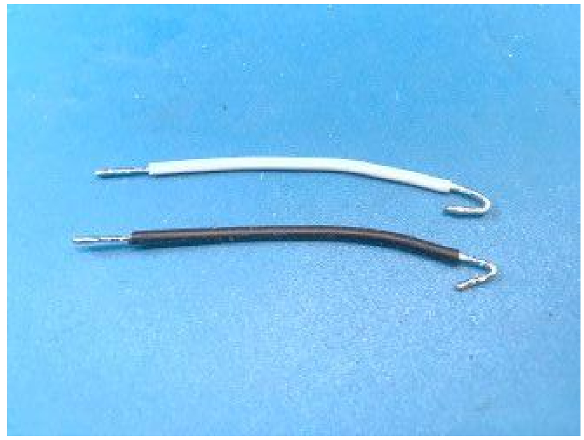


2. **Cut and Prep Hook Up Wire**: cutting, stripping, tinning (if you use stranded hook up wire), and crimping all of the necessary hookup wire takes a considerable amount of time. No-clean solder is used to tin the ends. Most builders use color coded hookup wire for banana jacks that follows the color scheme for voltage: black for CV input. Tinijax have signal (S) and ground (G) connections. White is used for signal (S) and black is used for (G).

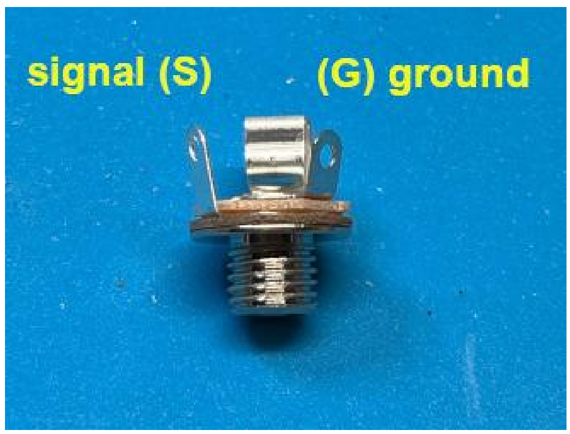
Black hook up wire	CV Input	Quantity 6
White hookup wire	Audio signal (S)	Quantity 8
Black hook up wire	Audio ground (G)	Quantity 4

NOTE: 3” is a good minimum length for banana jack and Tinijax hook up wire. The previous table lists the necessary hookup wire for the 258s. Banana jack hook up wire can be kept straight, and Tinijax hook up wire can be crimped on one end for physical connection to Tinijax eyelets.

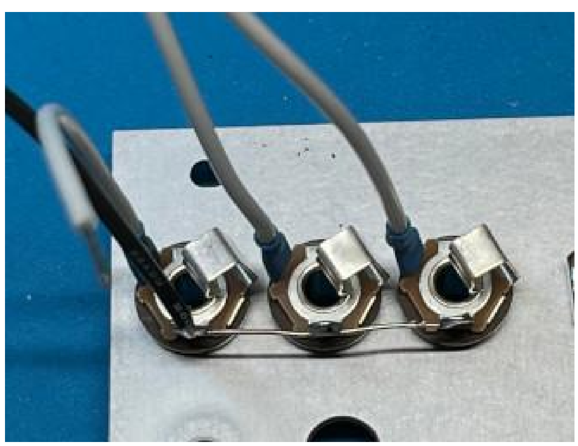




3. **Tinijax Prep**: Model 41 Tinijax have two connections. The longer eyelet is the signal (S) connection and the shorter eyelet is the ground (G) connection. The 258s PCB denotes signal and ground on the silkscreen as (S) and (G).

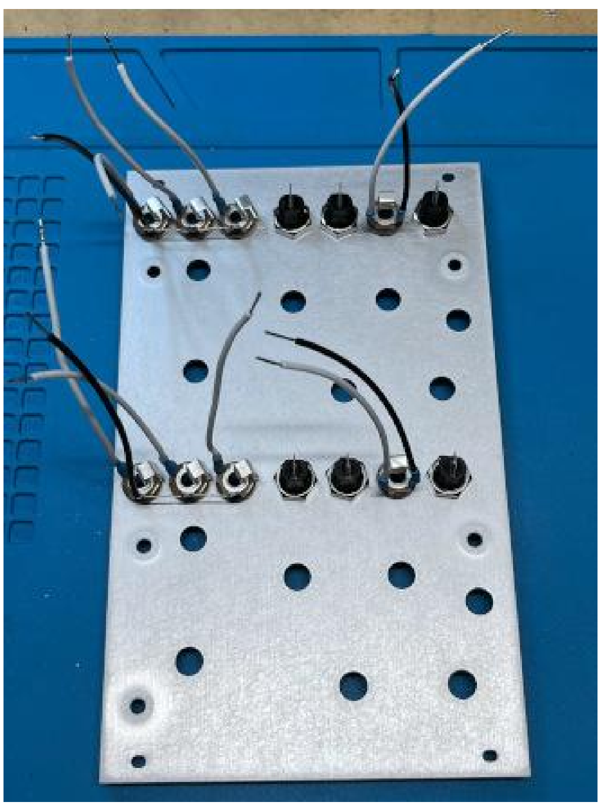


Tinijax Prep: the 258s layout allows for ground bussing the three output Tinijax to simplify the amount of hook up wire.



Because of the ground bus, only the FM input and two of the audio output Tinijax will have both white (S) and black (G) hook up wire attached. The remaining Tinijax will only have white (S) hook up wire attached.   Shrink tubing is optional.

Completed Tinijax and completed panel prep shown below. **NOTE**: the black banana jack hookup wire is first soldered to the PCB and then attached to the banana jacks after assembly.



4. **Power Cable and EDAC Prep**: the 258s power cable requires three connections: +15V (red), -15V (white), Quiet Ground (black). The colors listed are the standard colors for 4U power connections.

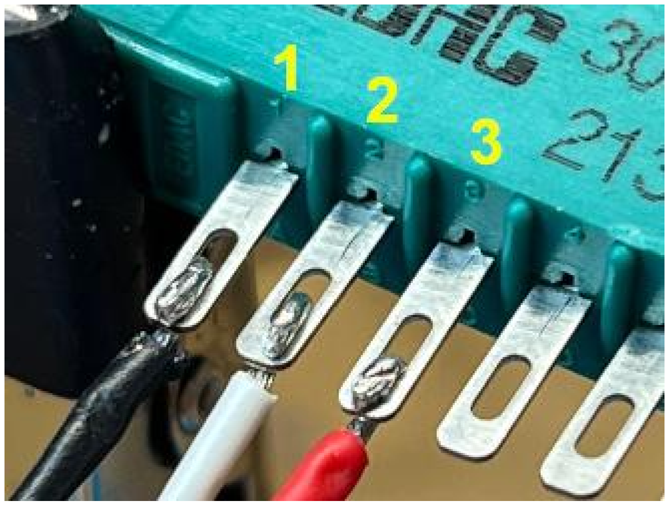
   Cut and Prep Power Hookup Wire: 18” is a good minimum length for the power cable.

Black Hookup Wire 18”	Quiet Ground, EDAC pin 1	Quantity 1
White Hookup Wire 18”	-15V, EDAC pin 2	Quantity 1
Red Hookup Wire 18”	+15V, EDAC pin 3	Quantity 1

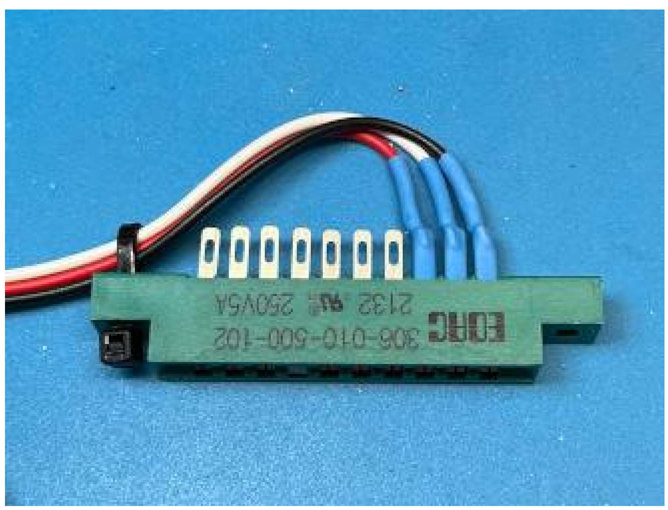
   I use stranded wire so it can flex, as such I also strip and tin both ends. No-clean solder is used to tin the ends. I also prefer shrink tubing the cable with two sections of shrink tubing allowing each wire to follow its natural coil. Some builders like using zip ties to keep the power cable together. Either method is fine.

5. **EDAC Prep**: crimp the tinned wire ends before soldering to form a good physical connection to the EDAC eyelets. The pin numbers and colors adhere to the power connection standards for 4U. No-clean solder is used here.

    - **Pin 1 Black**: Quiet Ground
    - **Pin 2 White**: -15V
    - **Pin 3 Red**: +15V



Adding shrink tubing to the eyelet connections and using a zip tie to secure the power cable to the EDAC is optional; though a good practice.



Preventing Reverse Power: if available, insert a polarizing key into EDAC pin 7. The polarizing key ensures that the power cannot be reverse connected. See Mouser part number [587-338-240-328](587-338-240-328). If you do not have a polarizing key, a solder bridge at pin 7 can also be used.

Step 3: PCB Build

The 258s PCB build consists of both Wet Build and Dry Build phases. Wet Build uses water soluble flux solder (Kester 331) and covers all of the components that can be washed in water. Dry Build uses no-clean solder (Kester 245).

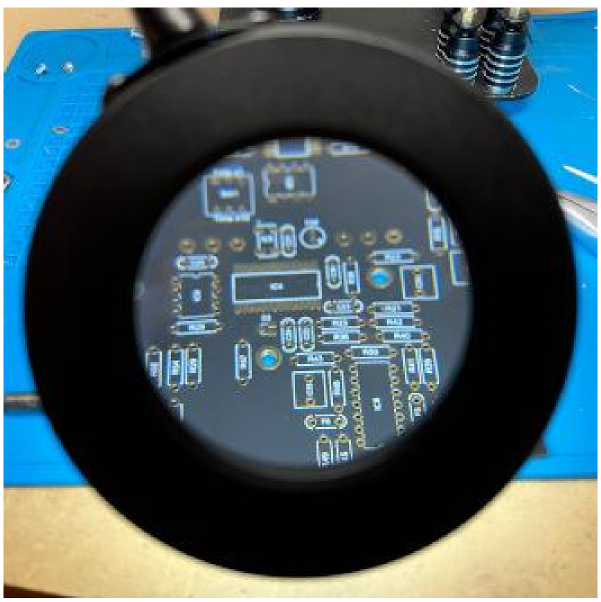
NOTE: the 258s silkscreen denotes parts by number. Parts numbers correlate to the BOM. It is highly recommended that builders make use of the BOM and component maps available here.

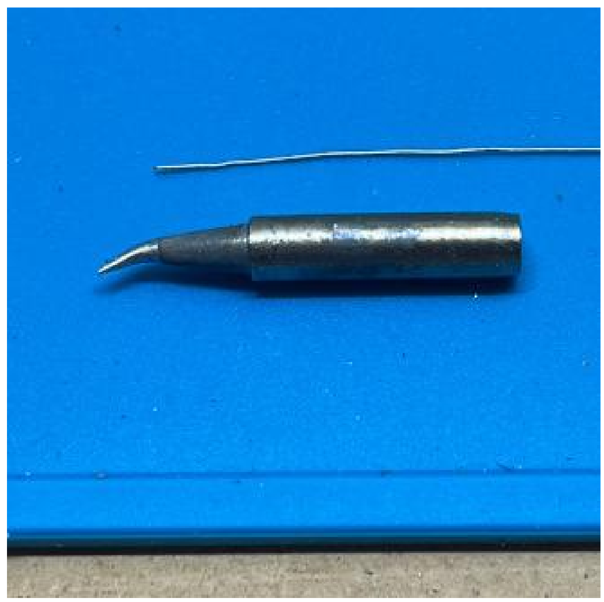
1. **0.1uF SMD Capacitors**: The 258s PCB requires eight SMD capacitors. Install the SMD capacitors first.

0.1uF Ceramic SMD 0805	F1, F2, F3, F4, F5, F6, F7, F8	Quantity 8

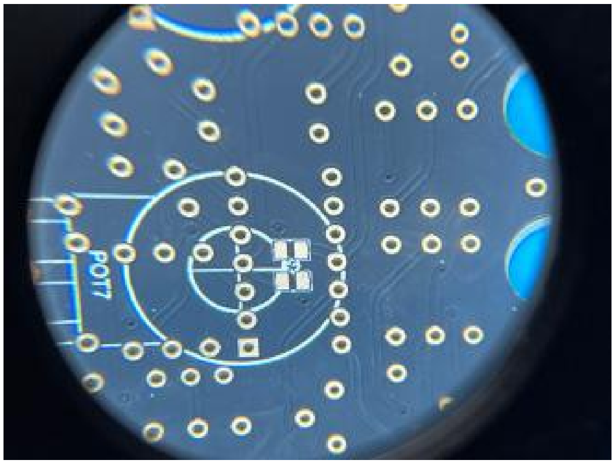
NOTE: Hand soldering the SMD capacitors is fairly easy provided you have the correct tools and a good method. At minimum, you should have lighted magnification, the correct soldering tip for SMD work, tweezers, solder braid, and thin solder.

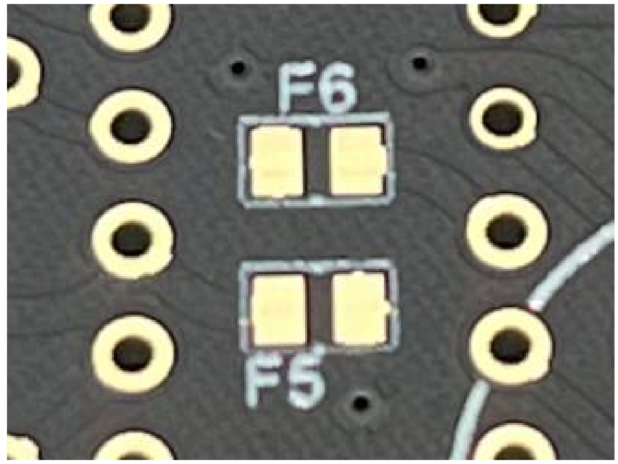
I use a magnified light ring, standard SMD tip for my iron, and thread thin .015” water soluble flux solder.





NOTE: SMD capacitors F1 and F2 are inside the footprint for POT7. There are no labels on the silkscreen for F1 and F2. Capacitors F3-F8 are clearly labeled on the silkscreen as shown in the image of F5 and F6.

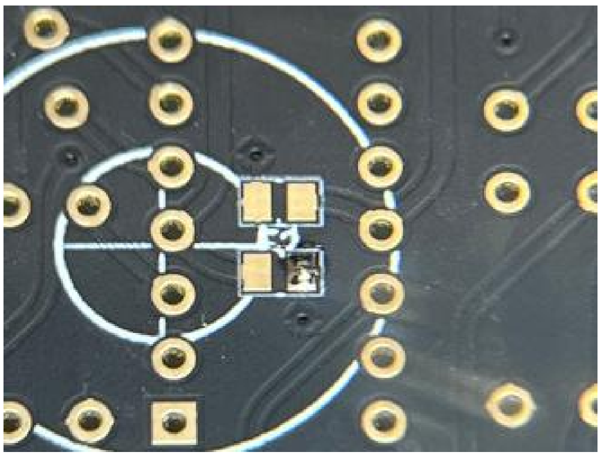
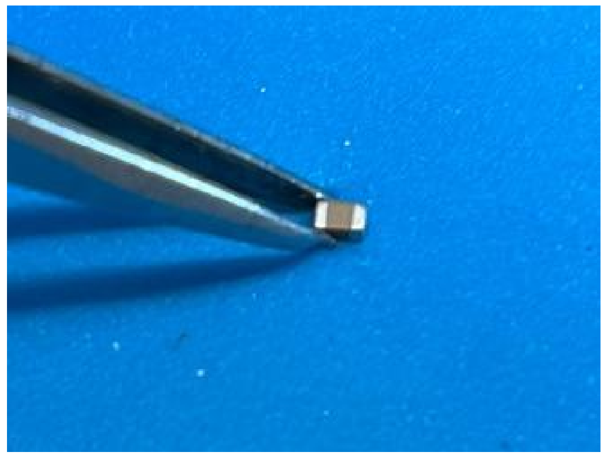
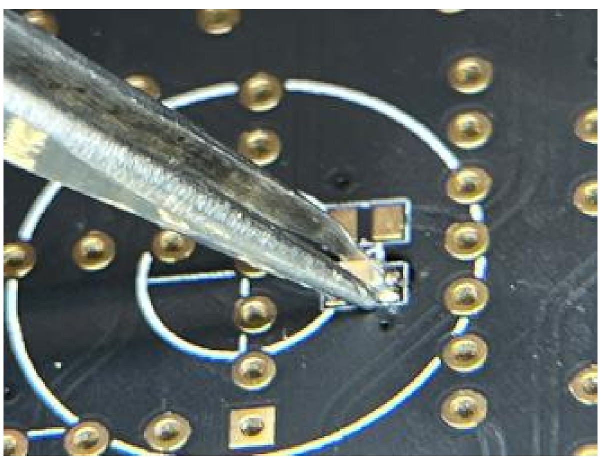
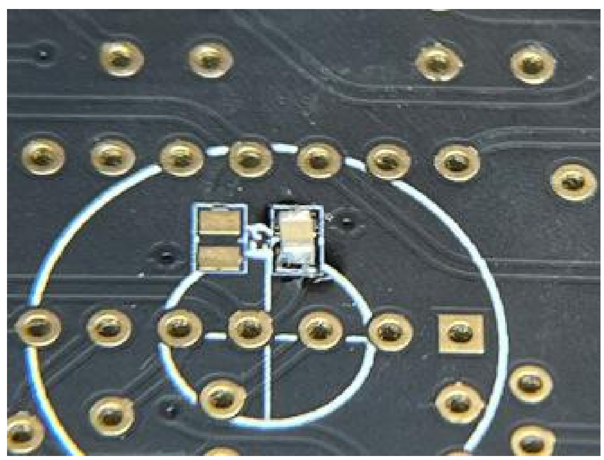




Unpack the SMD capacitors carefully. Use the component receptacles on your solder mat if you have them. Keep the SMD capacitors organized.

NOTE: The SMD ceramic capacitors are not polarized, so orientation does not matter. The following method seems to work well.

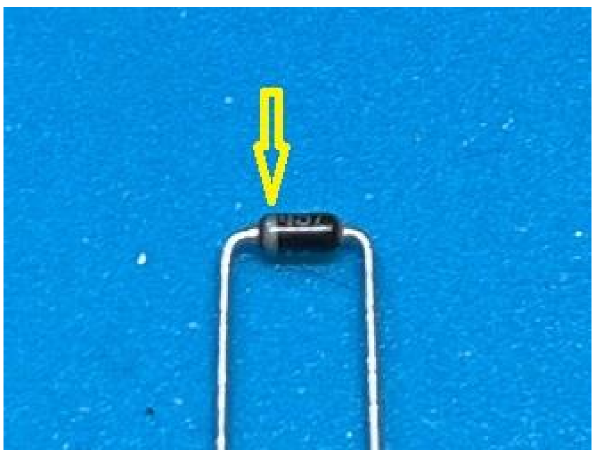
1. Tin one pad of the capacitor footprint
2. Move the component into place with tweezers, note orientation of terminals
3. Reflow the tinned pad while holding the capacitor in place
4. Solder the other terminal
5. Touch up the first terminal if needed

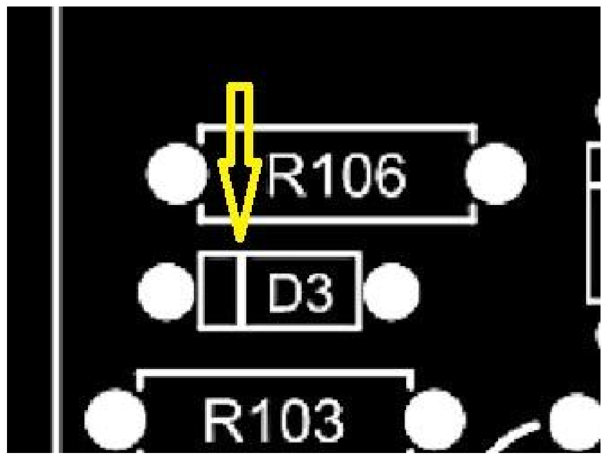





1. **Wet Build Diodes:** Diode installation on the 258s PCB is straightforward. There are 1N457 and 1N5233 Zener only diodes. Lead spacing is consistent. Diodes can be soldered on the top side of the PCB which makes stuffing and soldering very quick. Refer to the BOM and component maps for diode locations.

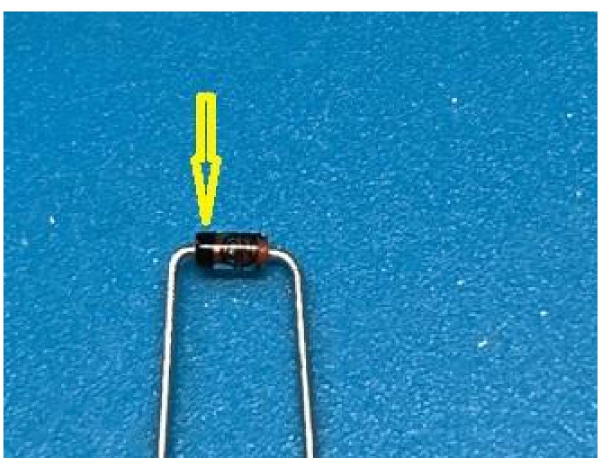
Diodes (component maps)		
1N457	D1, D2, D3, D4	Quantity 4
1N5233 Zener	Z1, Z2	Quantity 2

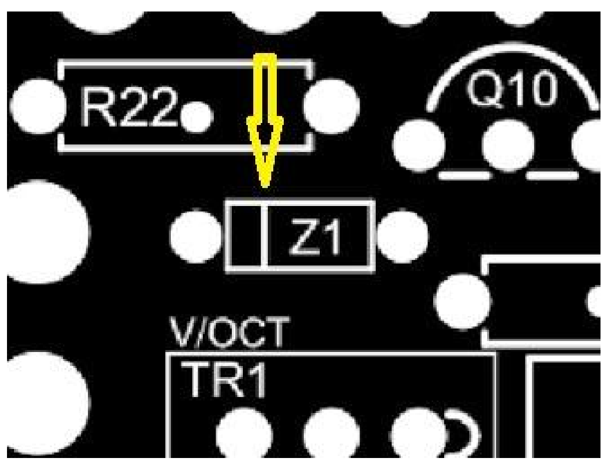
NOTE: 1N457 diodes are marked with a silver band to indicate the cathode. Orient diodes so that the silver band aligns with the stripe on the silk screen.





NOTE: 1N5233 Zener Diodes are marked with a black band to indicate cathode. Orient Zener diodes so that the black band aligns with the stripe on the silkscreen.





2. **Wet Build Resistors**: Resistor installation on the 258s PCB is straightforward with no special considerations. There are too many resistors to list here, refer to the BOM and component maps for all resistor locations.

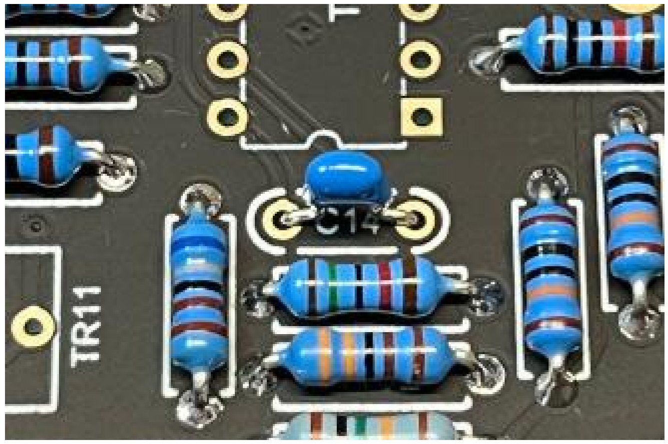
   All resistors are through-hole with consistent lead spacing. Resistors can be soldered on the top side of the PCB which makes stuffing and soldering very quick.


3. **Wet Build Capacitors:** the 258s PCB has ceramic, film, styrene, and electrolytic capacitors.   Refer to the BOM and component maps for all resistor locations.

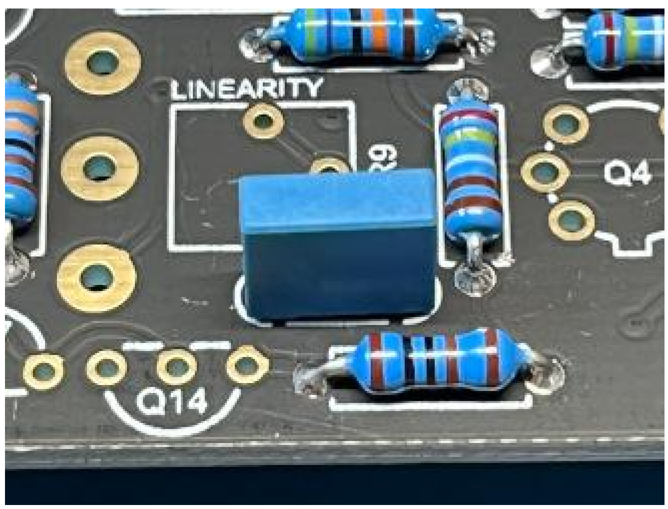
   NOTE: styrene and electrolytic capacitors have special notes below.

Capacitors (component maps)		
22pF Ceramic 5mm	C6, C14	Quantity 2
4.7nF Styrene	C2, C10	Quantity 2
10nF Ceramic 5mm	C7, C16	Quantity 2
47nF Film 5mm	C1, C9	Quantity 2
0.1uF Ceramic 5mm	C17, C18, C19, C20, C21, C22	Quantity 6
15uF	C3, C4, C5, C8, C11, C12, C13, C15	Quantity 8

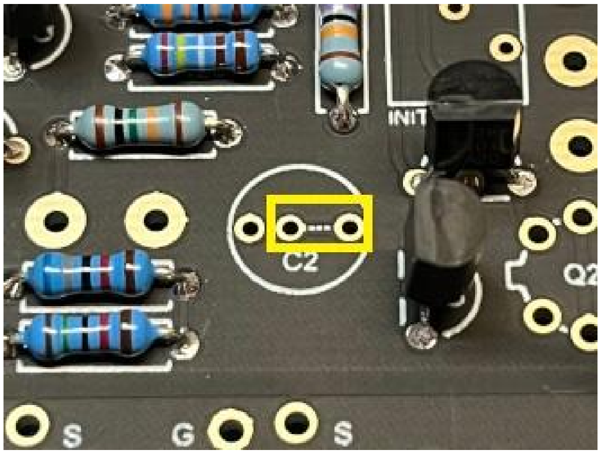
Ceramic Capacitors: lead spacing and footprints for ceramic capacitors are consistent. Ceramic capacitors can be soldered on the topside of the 258s PCB which makes stuffing and soldering very quick.



Film Capacitors: there are two film capacitors on the 258s PCB. Film caps are inserted on the top side of the PCB and soldered on the opposite side of the PCB.

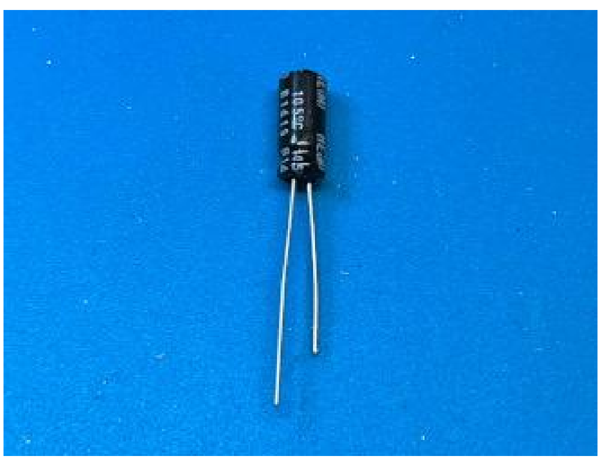
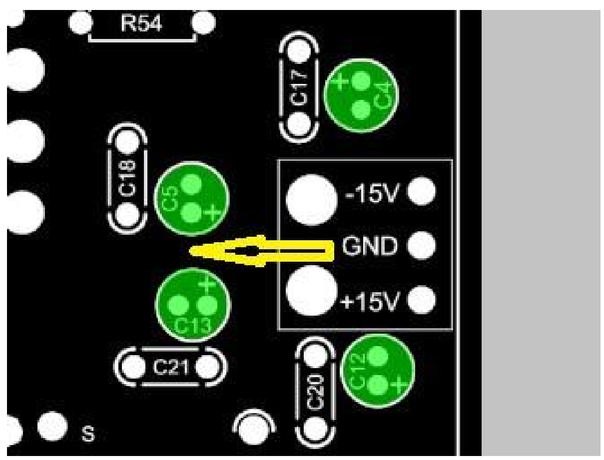


Styrene Capacitors: the styrene capacitor footprint is designed to accept both axial and radial lead packages. The dashed line between the two pads indicates the same electrical connection. Here the radial leads are close together. Additionally, the leads on this particular package are very thin. The package has been mounted lying down to restrict its movement so the leads do not eventually snap from flexing.



Electrolytic Capacitors: electrolytic capacitors are polarized. The shorter leg is the negative terminal. Insert the longer leg in the + terminal on the footprint.

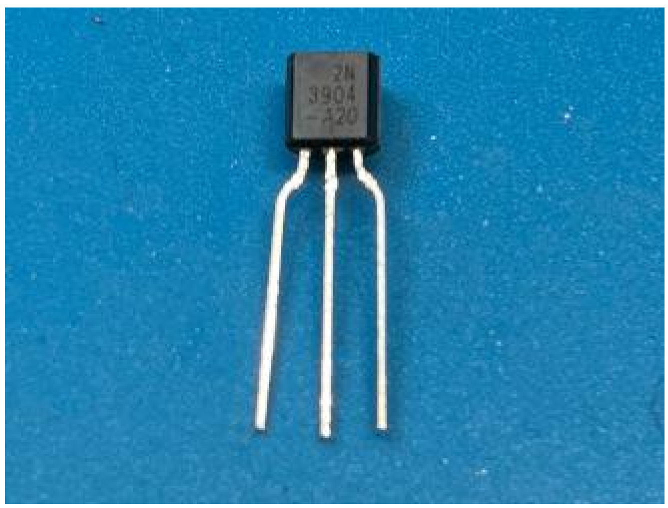
Planning Ahead Tip: because of the orientation of the power connection and zip tie mount points, the power cable will place stress on C5 and C13. One solution is using the space on the PCB to mount C5 and C13 lying down.

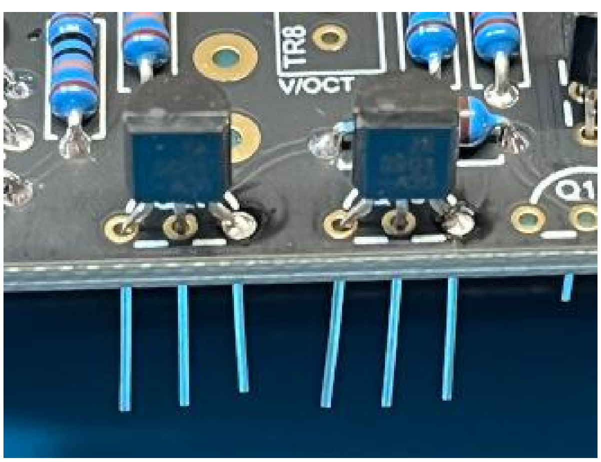



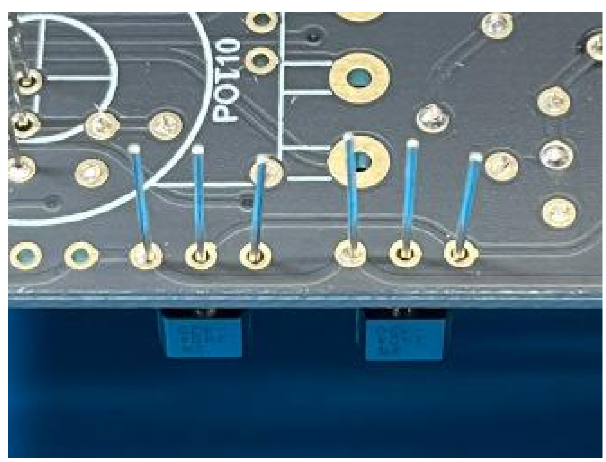
4. **Wet Build Transistors**: the 258s PCB has 2N3904, 2N3906, 2N4339, J201, and 2N3806 transistors. **NOTE**: the metal can 2N3806 transistors are installed after washing the PCB. Refer to the BOM and component maps for all resistor locations.

Transistors (component maps)		
2N3904	Q5, Q6, Q7, Q8, Q9, Q11, Q16, Q17, Q18,Q19, Q20, Q22	Quantity 12
2N3906	Q1, Q10, Q14, Q21	Quantity 4
2N4339 *selected*	Q12, Q23	Quantity 2
J201	Q3, Q13, Q15, Q24	Quantity 4

293904, 2N3906, J201: the silkscreen denotes the correct orientation for each transistor. A quick approach is mounting each transistor, tacking one leg into place on the top of the PCB, then flipping the PCB over to complete the soldering.

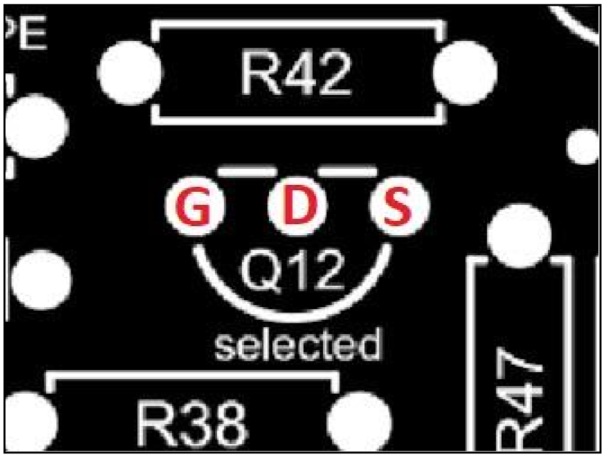


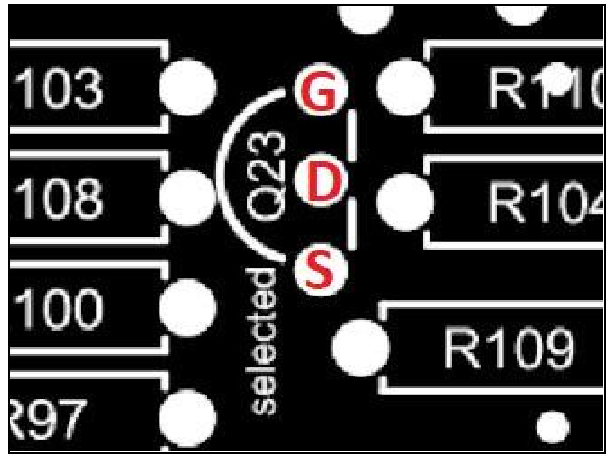




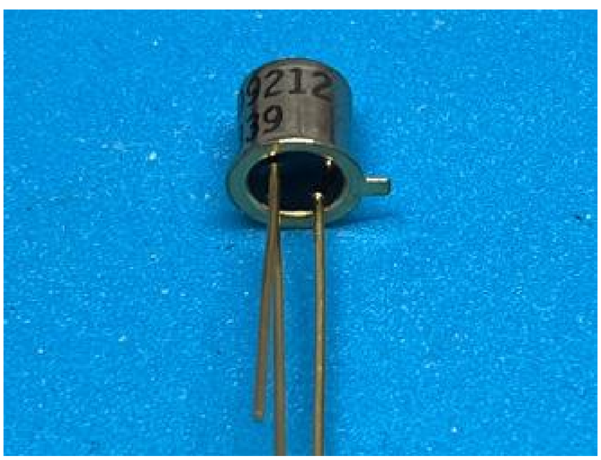
2N4339: The Samodular 258s full kit includes a correctly selected 2N4339. The Idss must be between .7mA and 1.2mA. If the Idss is outside this range, it will have a cascading effect on the sine shape/purity, and then the saw/square shapes will be off.

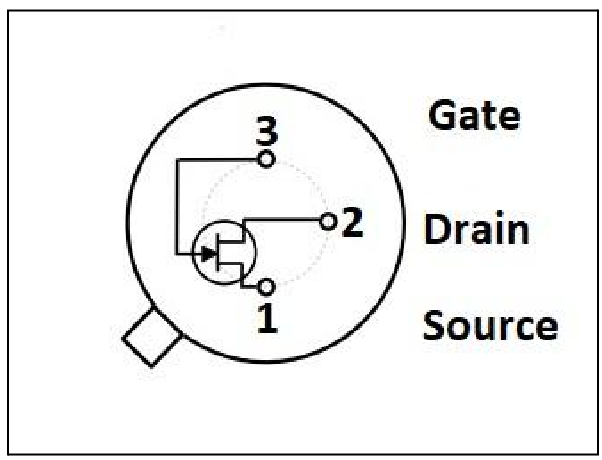
NOTE: The footprint on the PCB is designed for the TO-92 package, however, the 258s kit ships with 2N4339 metal can TO-18 package. Make sure you correctly orient (G)ate, (D)rain, and (S)ource of the 2N4339 TO-18 package to the footprint.





The tab on the package helps determine the orientation of the pins. The image below shows the top down view of the 2N4339 metal can TO-18 package.

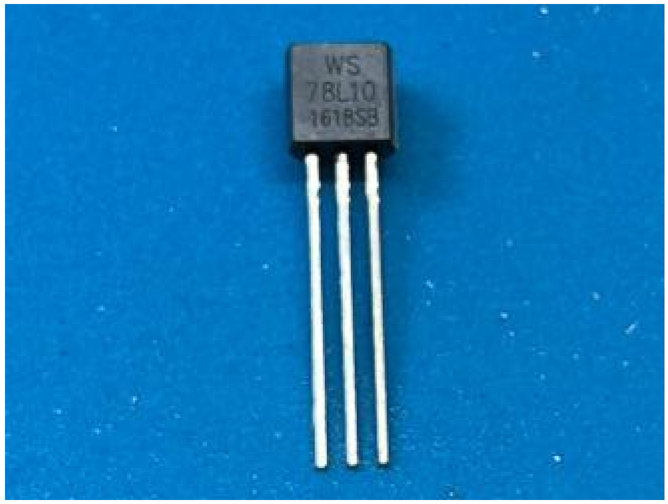




Planning Ahead Tip: If you have a component tester, it is worth checking the Idss of both 2N4339's before soldering them to the 258s PCB. Knowing the Idss of each 2N4339 will help later during calibration if there are any issues.

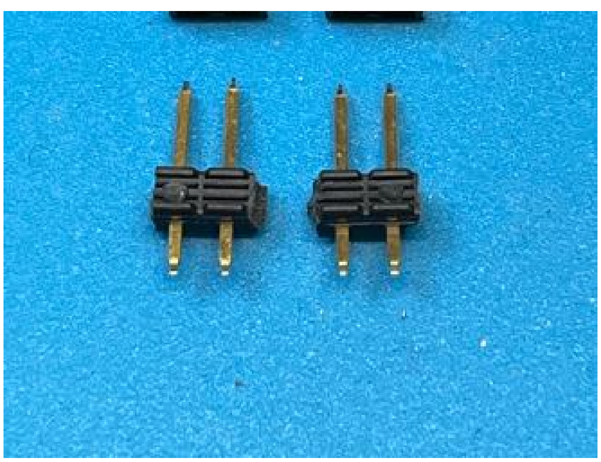
5. **Wet Build 78L10 Voltage Regulator**: There are two 78L10 linear voltage regulators. The 78L10 is provided in a TO-92 package that resembles a transistor. There are no special instructions for the 78L10.

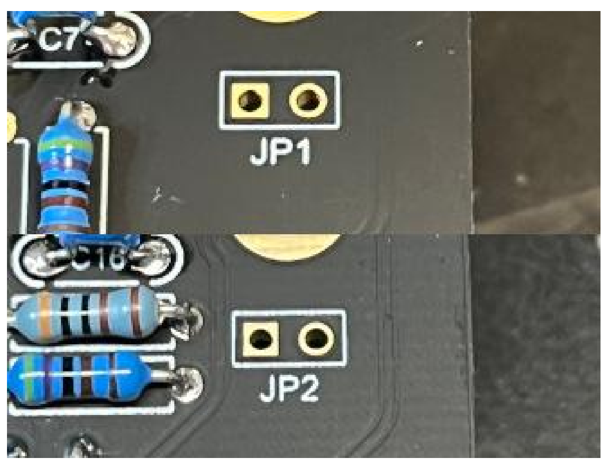
78L10 Linear Voltage Regulator 10V	IC4, IC3	Quantity 2



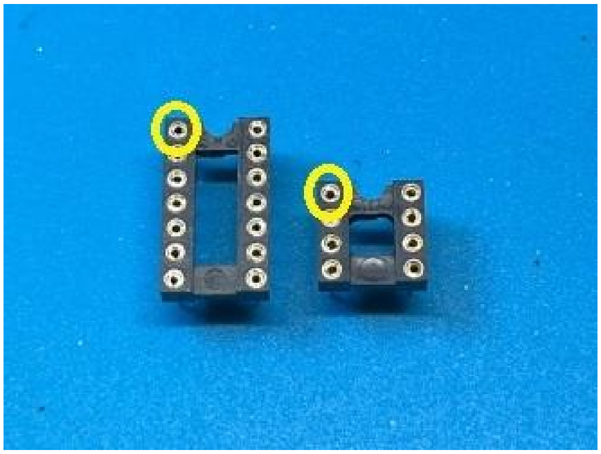
6. **Wet Build Jumpers:** there are two jumpers on the PCB. Attach the shunt to the jumpers after installation.

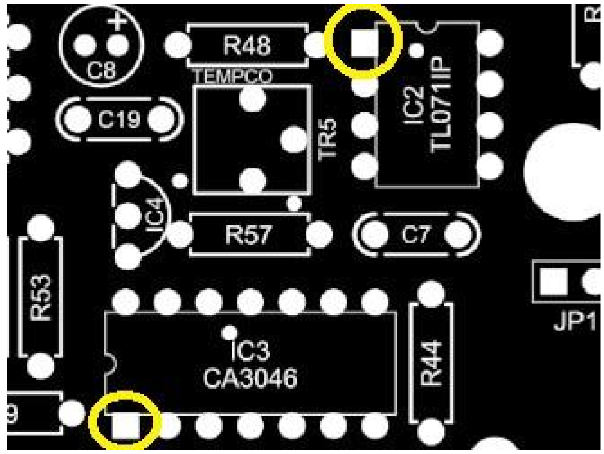
Jumper 1 pin	JP1, JP2	Quantity 2





7. **Wet Build IC Sockets:** PCB2 uses 8 pin and 14 pin IC sockets. Installation is straightforward. Location is obvious. Pay attention to the silkscreen and the socket to ensure that you align the indentations so that pin1 is obvious when installing ICs. Pin 1 is marked in the photos below.



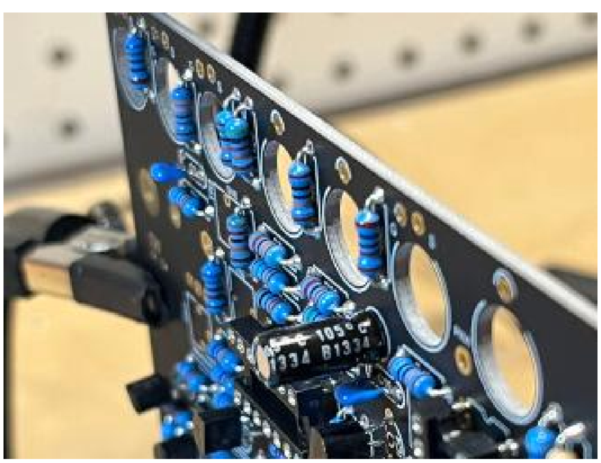


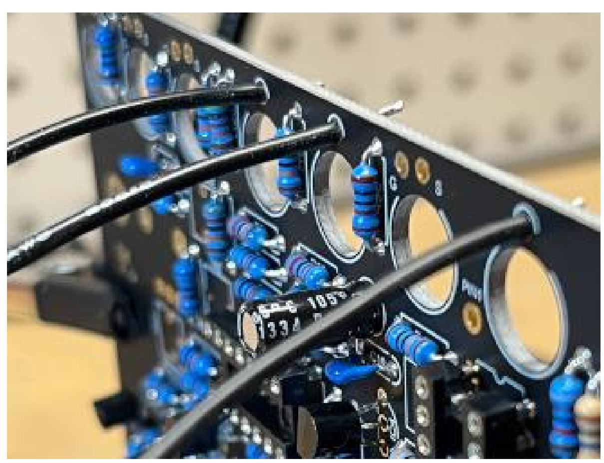
8. **Wet Build Banana Jack Hookup Wire**: Installation of the banana jack hookup wire is optional at this point, though installing banana jack hook wire now allows using solder with water soluble flux for a cleaner final PCB. Use the black hookup wire prepped in the earlier step.

Black hookup wire - CV Input	B1, B2, B3, B4, B5, B6	Quantity 6

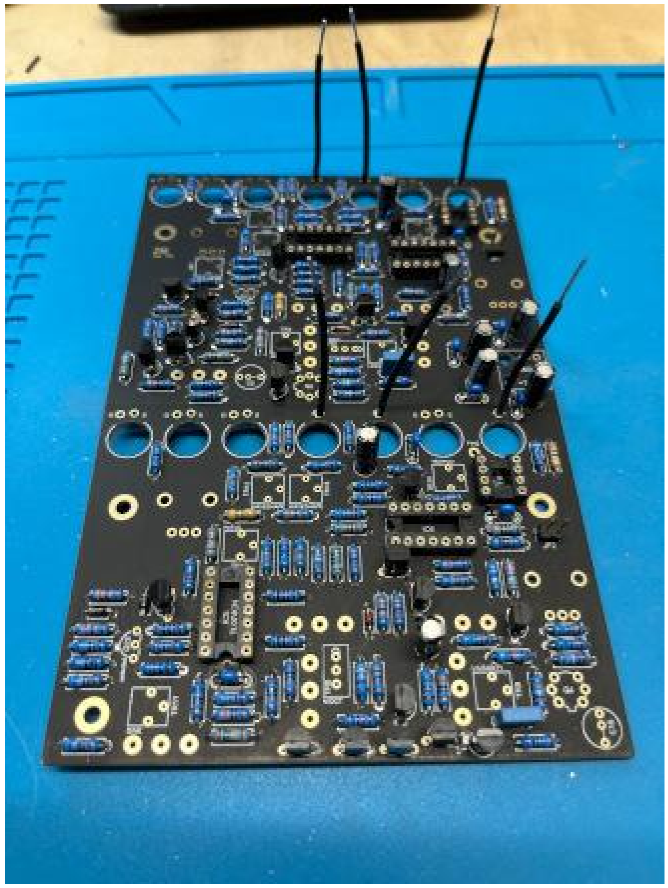
NOTE: It is marginally easier to first solder the banana jack hookup wire to the PCB then solder to the banana jack after MB assembly.

Banana jack hookup wire is mounted on the rear of the PCB and soldered on the front. Standing the PCB allows for the quickest installation of the banana jack hookup wire. Here the mount points for the black banana jack hook up wire are easily accessible.





Finalize the soldering of the hook up wire to the banana jacks after PCB & Panel assembly. 3” hookup wire lengths are used here. Space is not an issue, and having extra length helps if you ever need to disassemble the module for service.



9. **Wash MB in hot water**: scrub lightly with a soft toothbrush under running hot water (120 to 140 degree F). Water soluble flux (Kester 331) will lather up and help clean the PCB leaving a nice, flux-free finish.

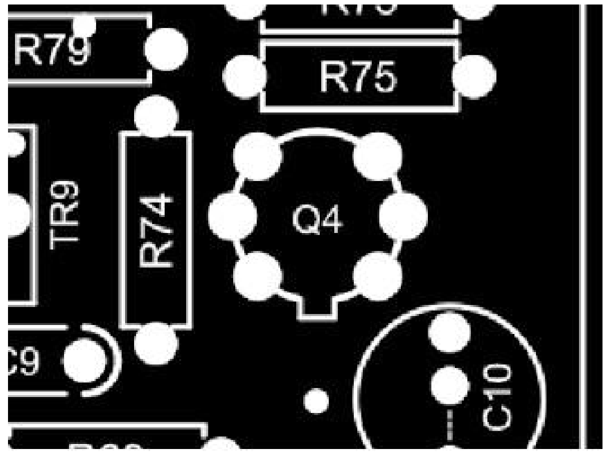
   NOTE: The Kester 331 Flux Cored Wire Technical Bulletin recommends cleaning within 48 hours. Most builders clean every hour or so. See kestor.com for details.

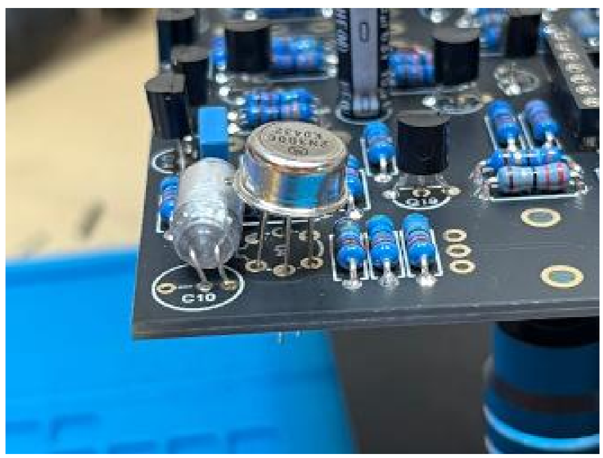
   NOTE: Dry PCBs thoroughly after washing before beginning the Dry Build. Let the PCB dry overnight if possible.

   After the PCB has dried completely, switch to no-clean solder for the remainder of the MB build.

10. **Dry Build 2N3806 transistor**: the metal can 2N3806 is a dual matched Bipolar (BJT) Transistor Array (PNP). Install the 2N3806 transistor aligning the small tab on the metal can to the tab on the silkscreen. You can angle Q4 backwards slightly for clearance from C10. Use non-clean solder here. Q2 has enough clearance already.

2N3806 Bipolar (BJT) Transistor (PNP)	Q2, Q4	Quantity 2



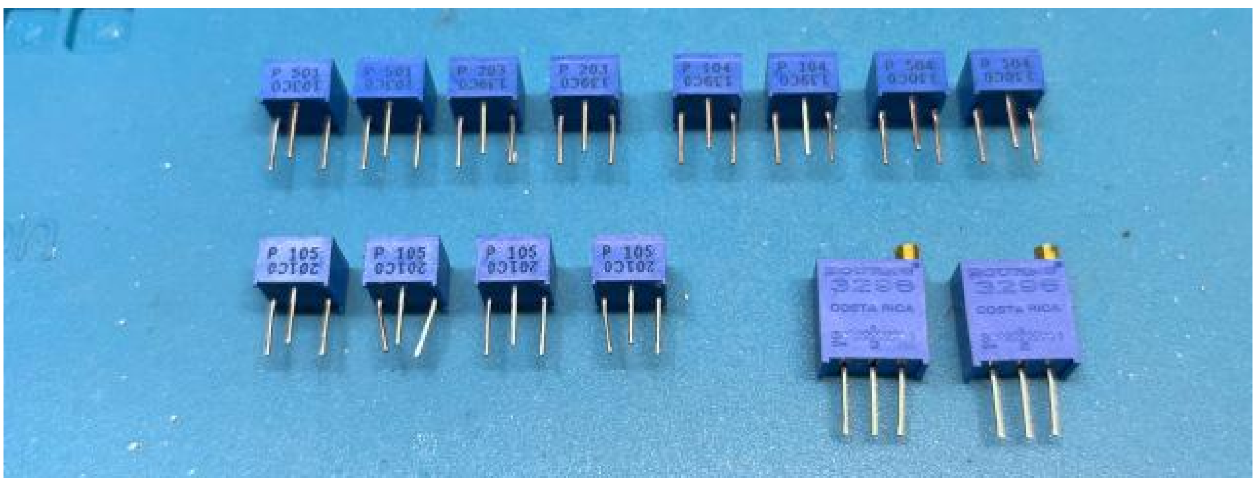


11. **Dry Build Trimmers**: the 258s has 14 trimmers of various values. Each section has 7 trimmers. The PCB silkscreen clearly marks the location of each trimmer.

500R single turn - CA3046 tempco	TR5, TR14	Quantity 2
20K single turn - sine shape adjust	TR4, TR11	Quantity 2
20K multi-turn - v/oct adjust	TR1, TR8	Quantity 2
100K single turn - initial frequency	TR3, TR10	Quantity 2
500K single turn - saw/square adjust	TR7, TR13	Quantity 2
1M single turn - waveshape CV depth	TR76, TR12	Quantity 2
1M single turn - linearity adjust	TR2, TR9	Quantity 2

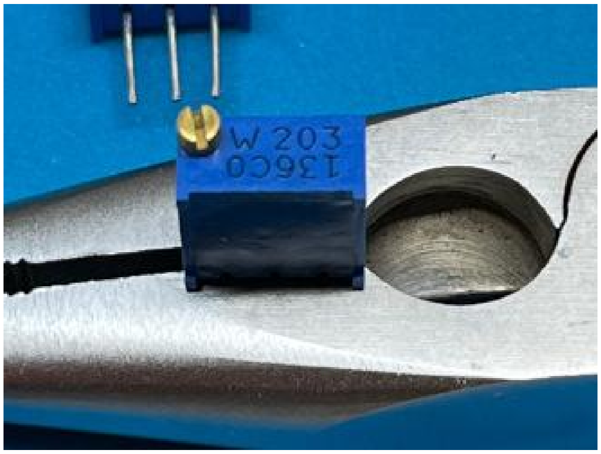
NOTE: numeric codes on the trimmer case indicate their values:

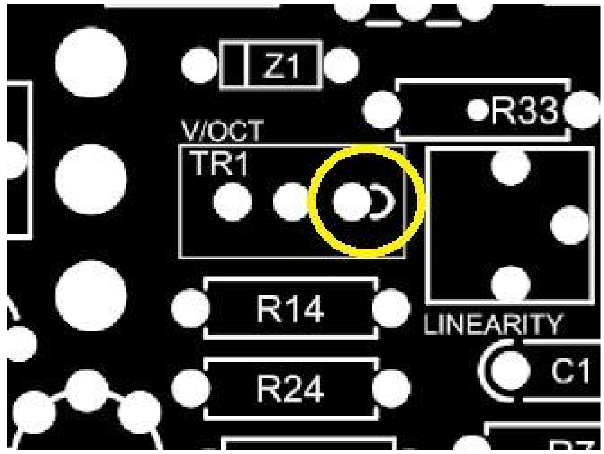
- 501 = 500R
- 203 = 20K
- 104 = 100K
- 504 = 500K
- 105 = 1M



Orientation of the single turn trimmers should be obvious.

NOTE: The value of the multi-turn trimmer is located on the top of the package (203 = 20K). The silkscreen denotes the correct orientation of the multi-turn trimmer with the small half-circle. Align the adjustment screw with the marking on the silkscreen.



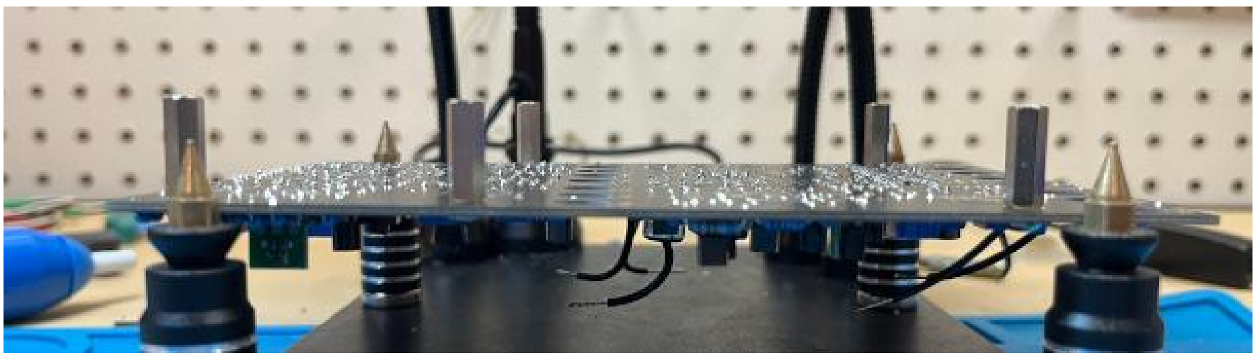


Step 4: PCB & Panel Assembly

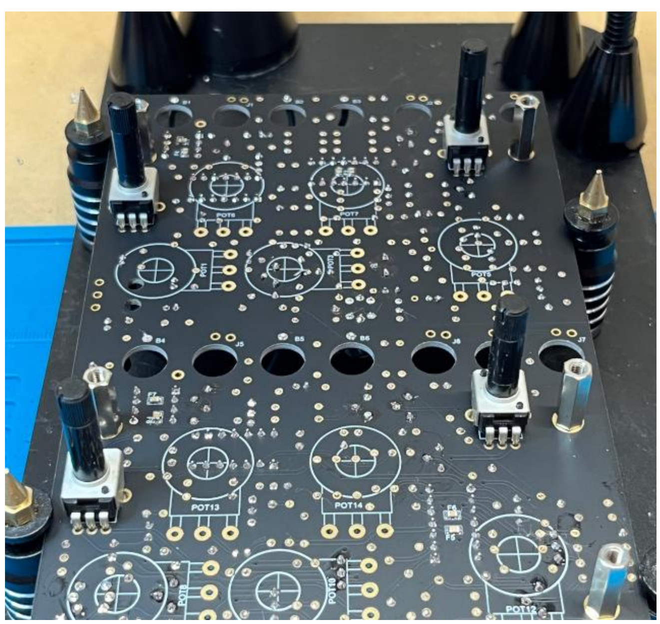
Finalizing the assembly of the PCB to the Panel is best accomplished by mounting the stand offs to the PCB, placing the PCB on its back with the pots and standoffs facing upwards. Lower the panel down onto the PCB and then fastening the panel to the PCB using the flathead screws. I find that trapping the 16mm angled pots between the PCB and panel, attaching the nuts, then soldering the pots produces the best results placing the least amount of strain on the pots.

1. **Stand Offs:** the 258s build includes five 15mm. The 15mm standards sit between the panel and PCB.

Standoff	15mm	Quantity 5



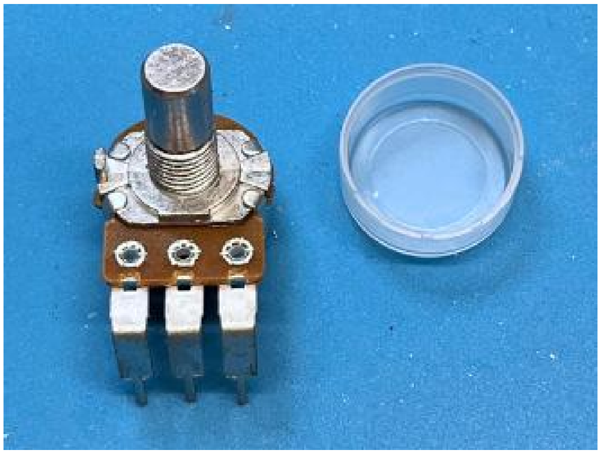
2. **Dry Build 9mm Linear Potentiometer:** There are four 9mm linear potentiometers that snap into place on the PCB and are not mounted to the panel. The 9mm pots can be soldered now or after attaching the panel.

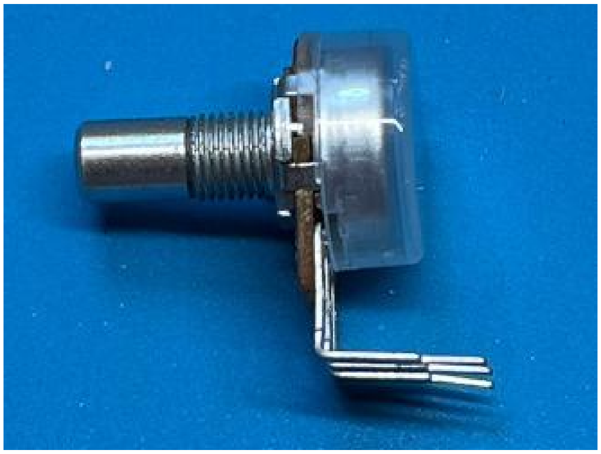


3. **Dry Build 100K Potentiometers**: There are both linear taper and audio taper 16mm angled potentiometers in the 258s build. The audio taper (A100K) pots are for the FM input. The linear taper (B100K) are for the CV inputs, Waveshape input, and Course Frequency.

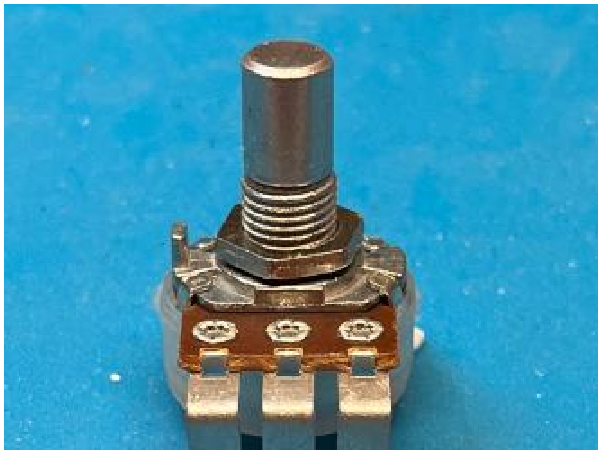
100K Audio Taper Pot. 16mm (A100K)	POT6, POT13	Quantity 2
100K Linear Taper Pot. 16mm (B100K)	POT1, POT3, POT5, POT7, POT8, POT10,POT12, POT14	Quantity 8

Some kits ship with dust caps attached to the potentiometer and some kits ship with the dust caps loose. Should the dust caps arrive loose, simply attach to the potentiometers.

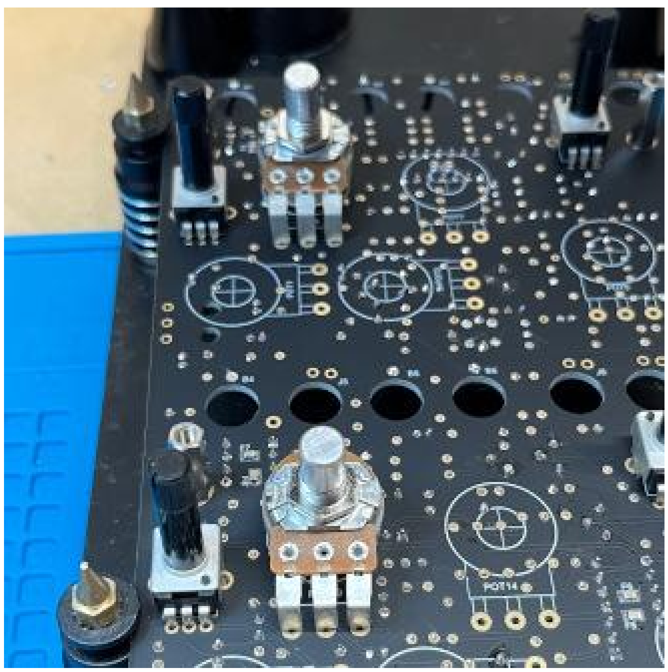




All potentiometers in the 258s kit include two nuts and a washer. Attach one nut to the shaft as shown to stabilize the pot against the panel.

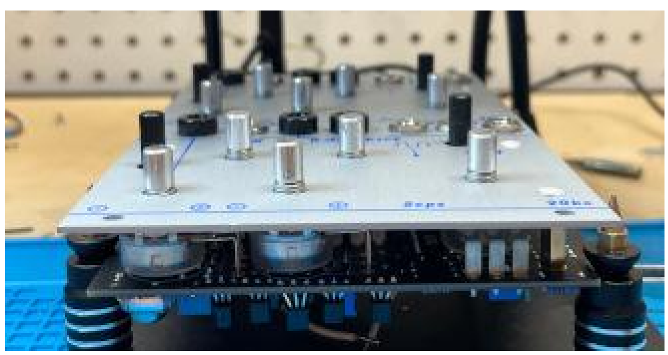


Place the audio taper pots (A100K) first at footprints POT6 and P13. Then place the remaining pots.



4. **Panel Installation**: with the PCB, potentiometers, and standoffs facing upward, lower the panel onto the PCB.

Adjust the potentiometer shafts so that the panel falls easily into place.



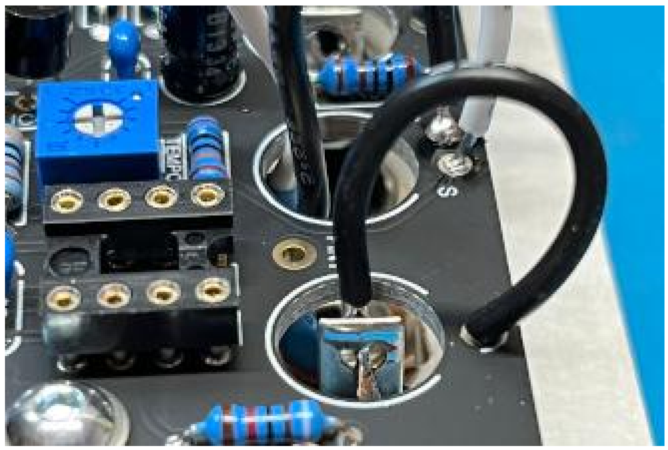
Once the panel is seated, install the flat head screws into the countersunk holes for securing the panel to the standoffs.

Install the potentiometer washers, pull the potentiometer shaft through the panel and attach the potentiometer nuts. Use the 3D printed nut tool to protect against scratching the panel.

5. **Dry Build MB Final Soldering**: solder the remaining components using no-clean solder:

    a. 9mm potentiometers
    b. 16mm potentiometers
    c. Banana jack hook up wire
    d. Tinijax hookup wire

    NOTE: when soldering the Tinijax hook up wire on the top side of the board pay attention to (S) and (G) markings.



6. **Power Cable:** As noted earlier, the electrolytic caps are a potential problem for the power cable. Additionally, the position of POT1 blocks one of the zip tie mount holes.

    An alternative approach to mounting the power cable is provided below that does not depend on the position of the electrolytic caps. Simply feed the power cable through the open zip tie mounting hole.

    - **Red** = +15V
    - **Black** = Quiet Ground (Q)
    - **White** = -15V


7. **Install IC's:** the silkscreen denotes IC location by both part number on the BOM and the part value. Location of the IC's should be obvious. Refer to the BOM for parts values.

CA3046 NPN Transistor Array	IC3, IC6	Quantity 2
TL071 Op Amp	IC2, IC7	Quantity 2
TL074 Quad Op Amp	IC1, IC5	Quantity 2

8. **Install knobs**: There are 10 knobs that are mounted on the 16mm potentiometer shafts. There are large knobs for the course frequency adjustment and small knobs for the CV inputs, FM inputs, and Waveshape inputs. Knob installation is straightforward.

   Regardless if you use Davies or Rogan knobs, the potentiometer nuts provide a good spacer when attaching potentiometers.

With the panel attached and all knobs installed, the 258s build is complete.

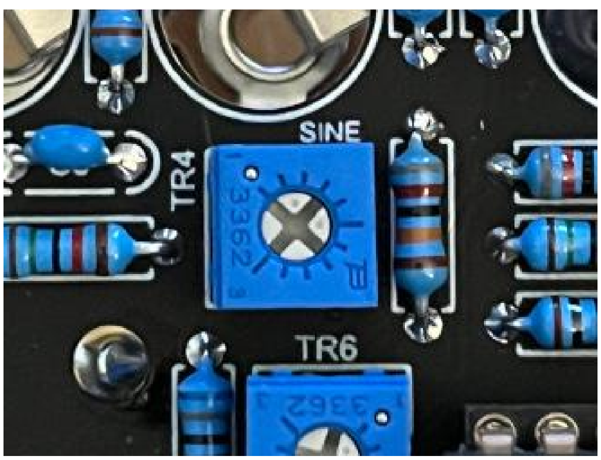
Step 5: Calibration

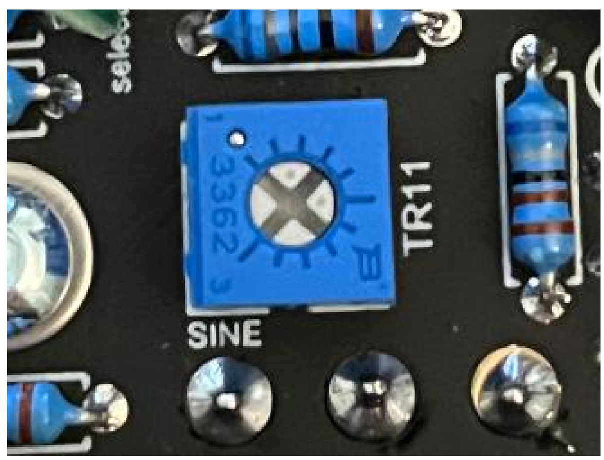
Calibration instructions are partially based on the calibration instructions for the DIY 258 modules posted on Dave Brown's excellent DIY website modularsynthesis.com.

Calibration consists of six steps:

1. **Sine Shaper Adjust**: adjust TR4 and TR11 for optimal sine wave shape.
2. **Saw Wave Adjust**: adjust TR6 and TR7 for optimal saw shape and CV response.
3. **Square Wave Adjust**: adjust TR12 and TR13 for optimal square wave shape and CV response.
4. **Initial Frequency Adjust**: adjust TR3 and TR10 for 5Hz operation with coarse frequency knob fully CCW.
5. **CA3046 Tempco Adjust**: adjust exponential pair temperature compensation.
6. **1.2v/oct Tracking**: adjust V/OCT scaling for reliable tracking across multiple octaves.

1. **Sine Shaper Adjust**: TR4 and TR11 adjust the sine wave purity. TR4 adjusts the sine shape for the top section and TR11 adjusts the sine shape for the bottom section. View the 258s output on an oscilloscope.

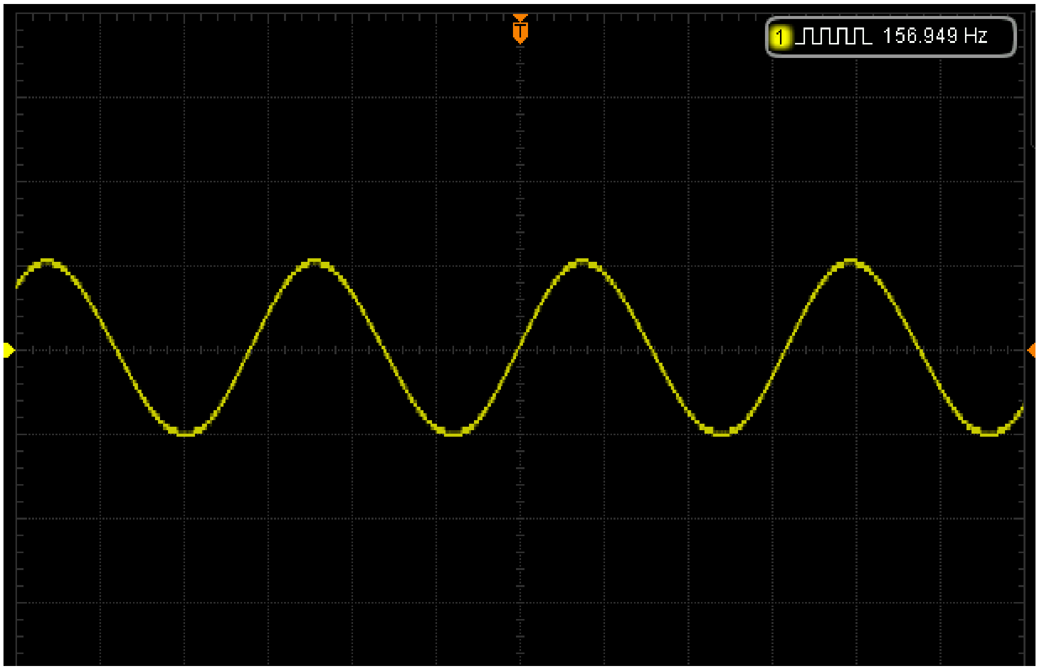




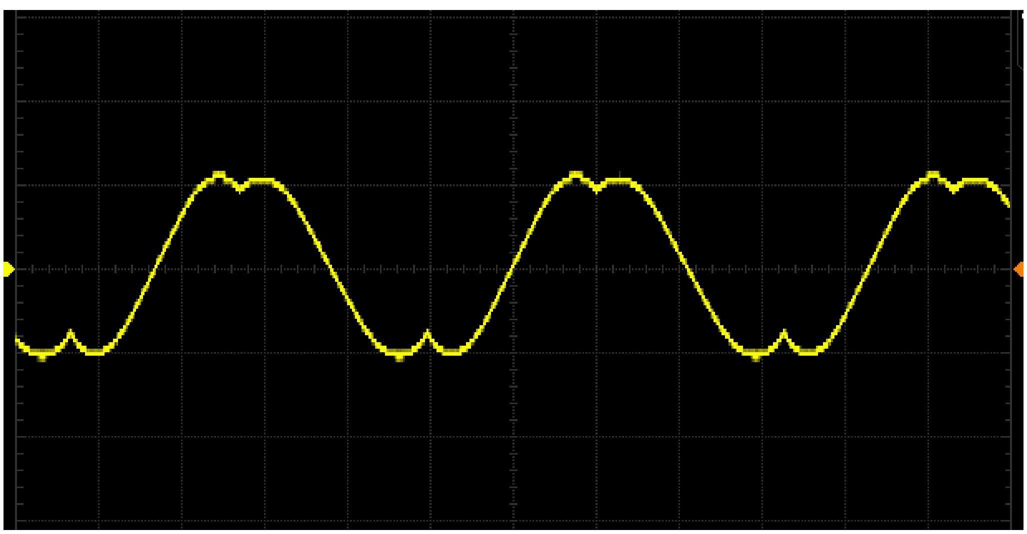
Generally, the 2N4339 transistor provided with the Samodule full kit is within the selection criteria (Idss between .7mA and 1.2maA). As such, the sine shape should need minimal adjustments.

- Turn Waveshape knobs full CCW
- Set coarse frequency knob to 12:00
- View 258s output on and oscilloscope

When the 2N4339's are in spec, the sine shapes should already be quite pure and will need minimal adjustments at TR4 and TR11.

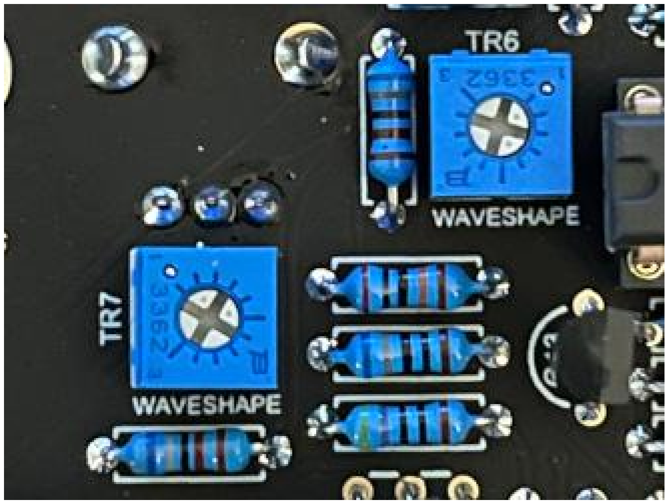


The most common problem with sine purity is a "double hump" waveform. This occurs when transistors Q12/Q23 are out-of-spec and fall below the minimum Idss of .7mA. Trimmers TR4/TR11 reach their maximum, but do not trim out all harmonics. This problem primarily occurs when using a J201 instead of a 2N4339 for Q12/Q23. J201 transistors that meet the selection criteria are exceedingly rare. **NOTE**: under normal circumstances, if you purchased the full kit with selected 2N4339's you should not experience this problem.



Fixing a "double hump" waveform is fairly simple. Reduce the resistance of R39 and R101. R39 and R101 are 6K8 resistors by default. See the component maps for 6K8 resistors.

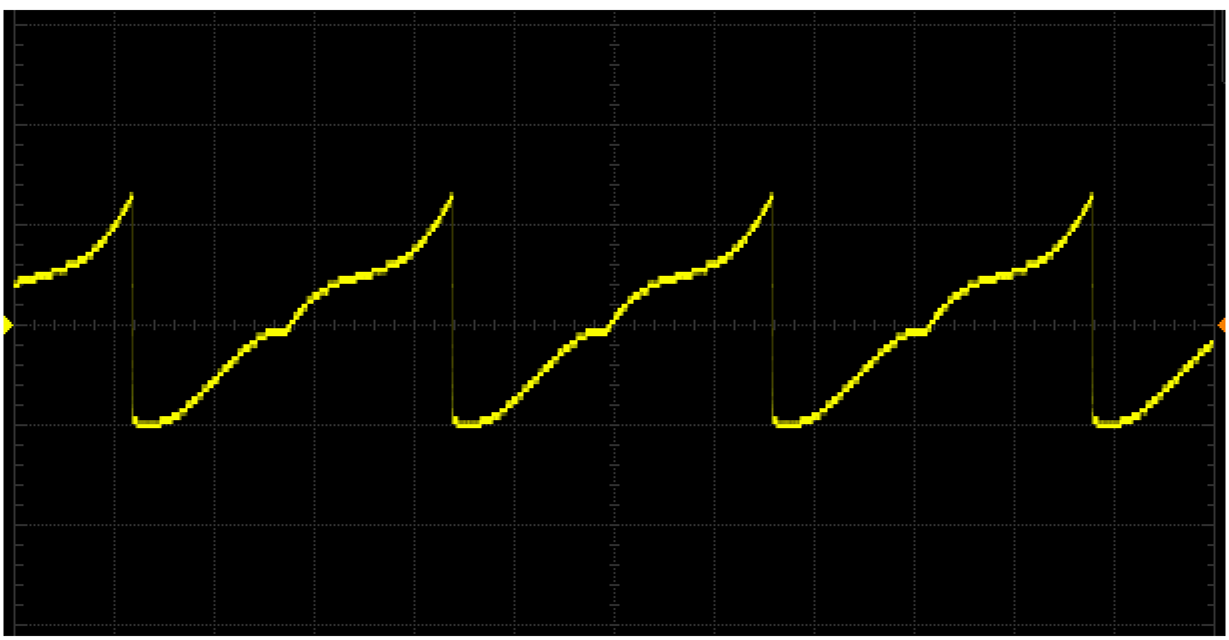
2. **Saw Wave Adjust**: TR7 adjusts the overall saw shape and TR6 adjusts the *WAVESHAPE* offset.



When the 2N4339 transistor is in spec, and there is a good sine shape, it should take minimal adjustments of TR7 to produce an optimal saw shape as shown below.

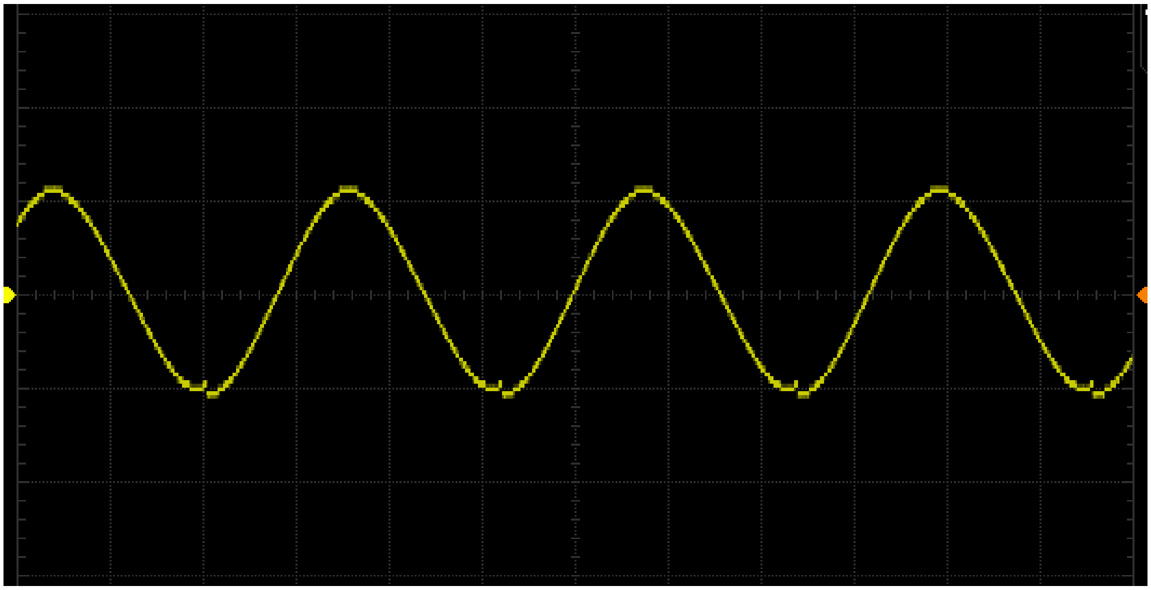
NOTE: the 258s, by design, produces an imperfect saw wave. The waveshape shown below is true to an original 258.

Turn the *WAVESHAPE* knob fully CW and adjust TR7 for the shape below.

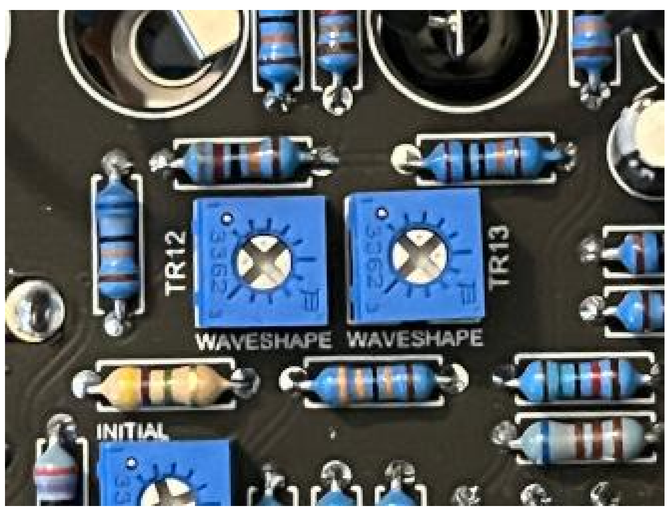


Once you have adjusted TR7 for optimal saw shape, turn the *WAVESHAPE* knob fully CCW then fully CW. If the WAVESHAPE knob does not affect waveshape for the entire travel of the knob, then make minor adjustments to TR6 turning it CCW until the

WAVESHAPE knob affects the waveshape for the full travel of the knob. If you adjust too far, the sine may develop a glitch as shown below. Adjust TR6 slightly CW to remove the glitch.



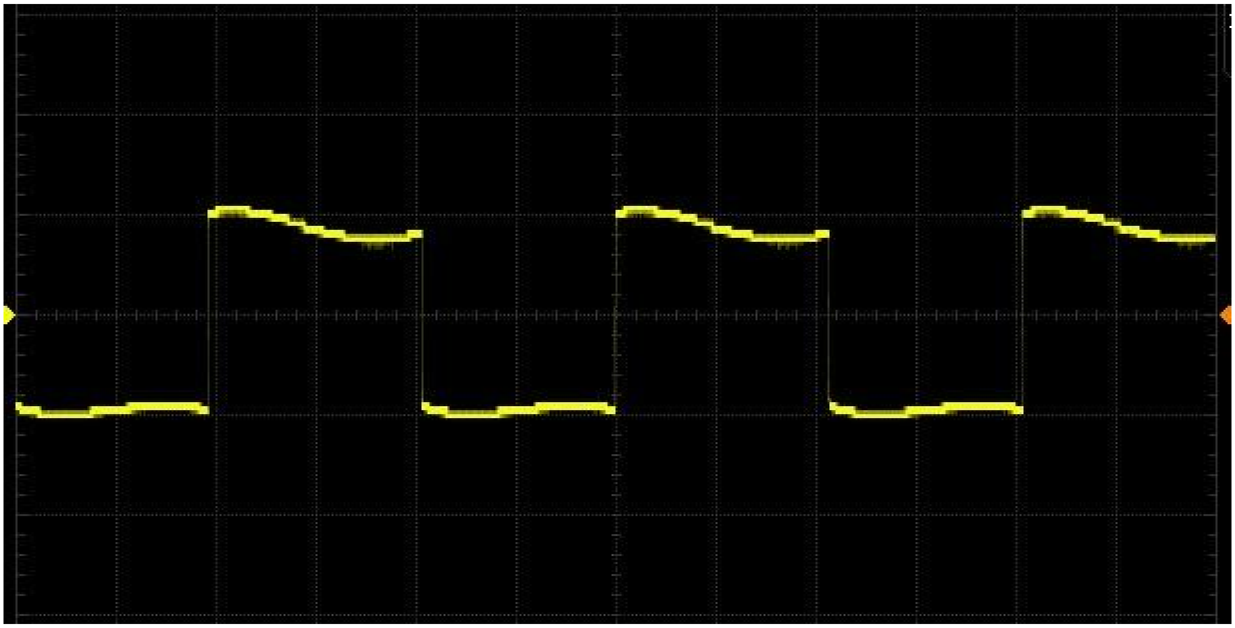
3. **Square Wave Adjust**: TR13 adjusts the overall square shape and TR12 adjusts the *WAVESHAPE* offset.



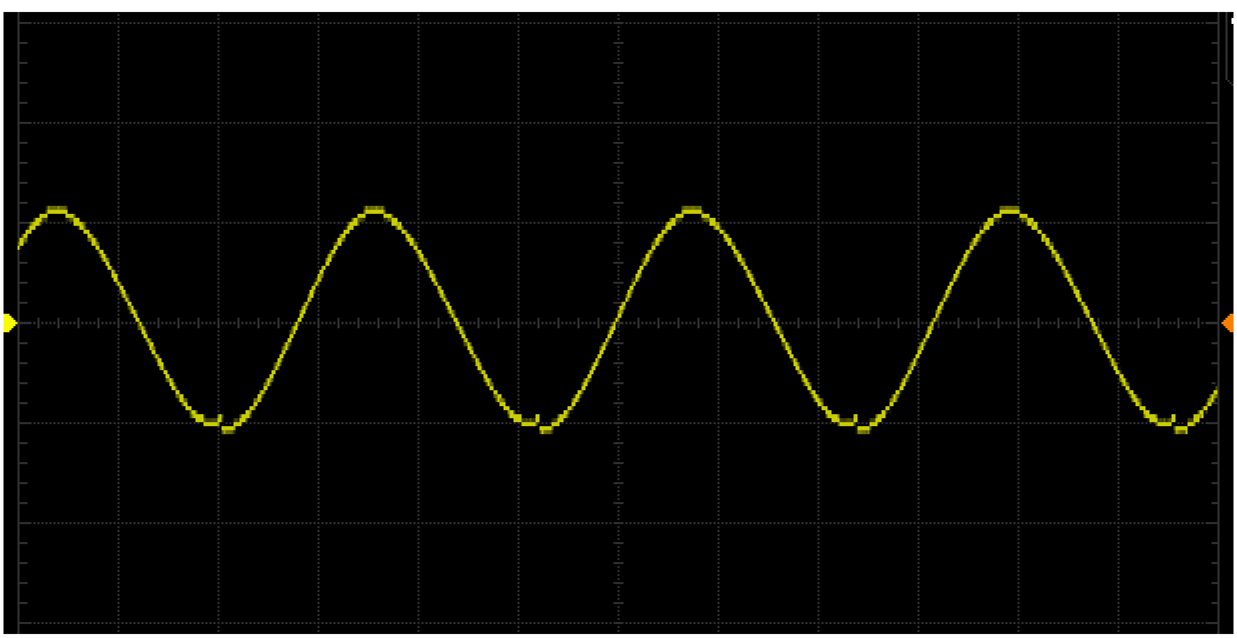
When the 2N4339 transistor is in spec, and there is a good sine shape, it should take minimal adjustments of TR13 to produce an optimal square wave shape as shown below.

NOTE: the 258s, by design, produces an imperfect square wave. The waveshape shown below is true to an original 258.

Turn the *WAVESHAPE* knob fully CW and adjust TR13 for the shape below.

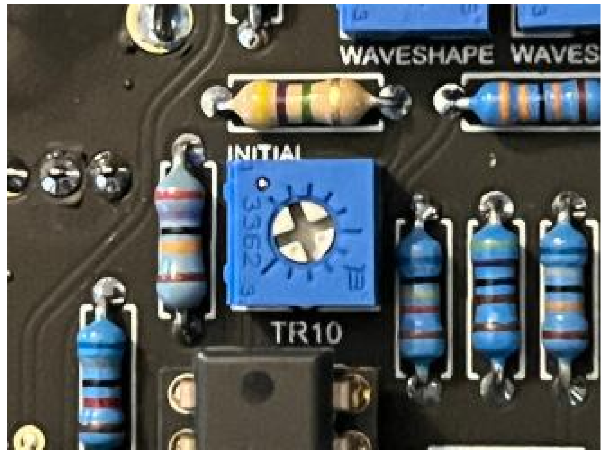


Once you have adjusted TR13 for optimal square shape, turn the *WAVESHAPE* knob fully CCW then fully CW. If the WAVESHAPE knob does not affect waveshape for the entire travel of the knob, then make minor adjustments to TR12 turning it CCW until the WAVESHAPE knob affects the waveshape for the full travel of the knob. If you adjust too far, the sine may develop a glitch as shown below. Adjust TR12 slightly CW to remove the glitch.



4. **Initial Frequency Adjust**: TR3 adjusts initial frequency for the top oscillator. TR10 adjusts initial frequency for the bottom oscillator.

   - Turn both coarse frequency knobs fully CCW so they are point at 5Hz
   - Adjust TR3/TR10 for 5Hz operation



5. **CA3046 Temperature Adjustment**: These instructions are taken directly from Dave Brown's excellent DIY website modularsynthesis.com.

Temperature Adjustment

1. Open (e.g. off, not shorted) JP1 (or JP2) and adjust TR5 (or TR14) CCW and operate for about 10 minutes to allow 3046 to reach room temperature.

2. Measure $V_{be(cold)}$ at Pin1 (or Pin2)

3. Subtract the room temperature in °C from 55°C to determine the temperature rise Δ T to the desired operating junction temperature of 55°C.

4. Determine the desired operating $V_{be(op)}$ by the following formula:

$$V_{be(op)} = V_{be(cold)} - (\, 0.002 \text{ X } \Delta \text{ T})$$

For example, if $V_{be(cold)} = 0.605\text{V}$ and the room temperature is 23°C,

then $V_{be(op)} = 0.541\text{V}$.

5. Close (e.g. on, shorted) JP1 (or JP2) and adjust TR5 (or TR14) until IC2 pin 2 (or IC7 pin 2) measures $V_{be(op)}$.

6. Measure Pin1 (or Pin2) and verify the voltage is $V_{be(op)}$. Note the chip has to heat to this operating temperature so you have to wait and incrementally adjust to meet this value.

The chip operating temperature is now set to 55°C.

Additional Notes: The following notes help clarify the temperature adjustment procedure.

- **For step 1** remove the shunts from JP1 and JP2

- **For Step 2** PIN1 and PIN2 are test points on the 258s PCB next to the TL071's

- **Step 3:** if you measure your room temperature in ℃, no conversion is necessary. If you measure your room temperature in ℉, convert to ℃ using the following formula to find ΔT

  RTF = room temperature in ℉
  RTC = room temperature in ℃

  Conversion equation: RTC = (RTF - 32) / 1.8

  If your room is 77℉: RTC = (77 - 32) / 1.8

  RTC = 25℃

  ΔT = 55℃ - 25℃

  ΔT = 30℃

- **Step 4**: Calculating $V_{be(op)}$

  $V_{be(cold)}$ measured at PIN1 and PIN2 = .677V

  NOTE: .677V is what I measured on my build, your measured value will likely be different. Use whatever $V_{be(cold)}$ value you measure in this equation.

  $V_{be(op)} = V_{be(cold)} - (.002 \times \Delta T)$

  $V_{be(op)} = .677 - (.002 \times 30)$

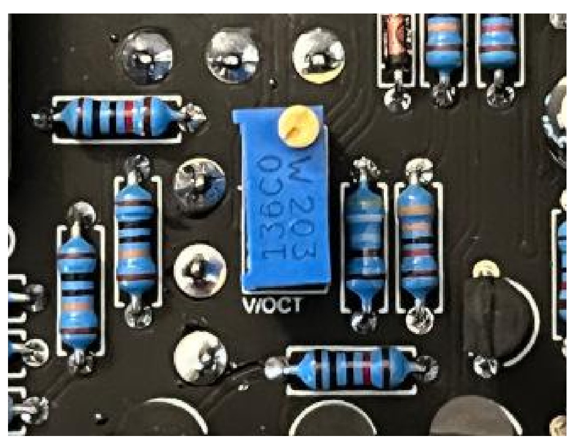
  $V_{be(op)} = .617V$

- **Step 5**: follow instructions above and adjust TR5/TR14 for .617V

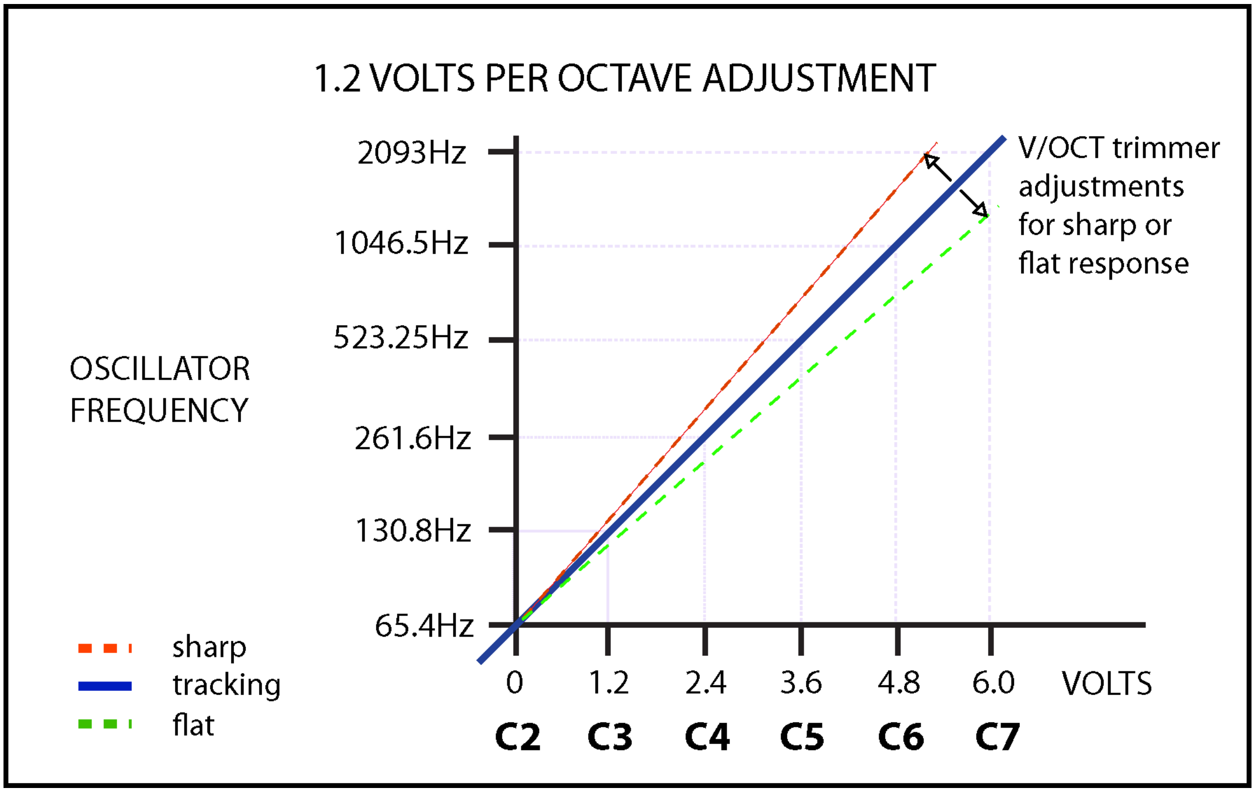
  NOTE: it takes time for the CA3046 to heat, so wait 10-20 minutes after replacing the shunts before adjusting for $V_{be(op)}$ and then wait after making adjustments for the temp to catch up.

6. **1.2v/oct Tracking**: Calibrating the 258s for 1.2v tracking is not difficult, but it does require some patience and attention to detail. The second CV input is calibrated for 1.2V/OCT response. Each half of the 258s (top and bottom) is calibrated independently. Set the first CV knob to center, the FM knob fully CCW, the WAVESHAPE knob fully CCW, the second CV knob fully CCW, and the fine frequency knob to its midpoint. Use a reliable frequency counter or tuner to measure the output of the 258s.

Tuning the 258s requires the frequency of the oscillator to exactly double for each 1.2V applied to the second CV input. The V/OCT trimmers located on the rear of the module adjust the CV input scale of each oscillator for this response.



For example, when the 258s is tuned initially to 65.4Hz (C2), patch the 218 keyboard (or similar voltage source) into the 258s. With the lowest ‘C’ key on the 218e keyboard triggered in the lowest octave, 0V is applied to the oscillator, then with the highest ‘C’ key triggered on the 218e keyboard 5 octaves up, 6V is applied to the oscillator resulting in a frequency of 2093Hz (C7). When the oscillator is sharp or flat relative to the target frequency of 2093Hz (C7), adjust the V/OCT trimmer to bring the upper frequency closer to the desired tracking frequency.



The calibration process is quite simple. Calibration involves setting the base frequency using the large frequency on the front with 0V applied, applying a multiple of 1.2V, checking the tracking, adjusting the V/OCT trimmer if the response is sharp or flat, then repeating the process until 0V and the applied voltage result in correct tracking.

NOTE: Remember that the coarse frequency knob on the front sets the base frequency, and the V/OCT trimmer on the back adjusts the tracking at the upper frequency.

NOTE: When adjusting the frequency with 6V applied, if you cannot fully increase or fully decrease the frequency with the V/OCT trimmer to meet the target frequency, adjust Linearity by making minor adjustments to TR2 or TR9 (depending on which oscillator you are calibrating) to increase or decrease the frequency spread as needed.