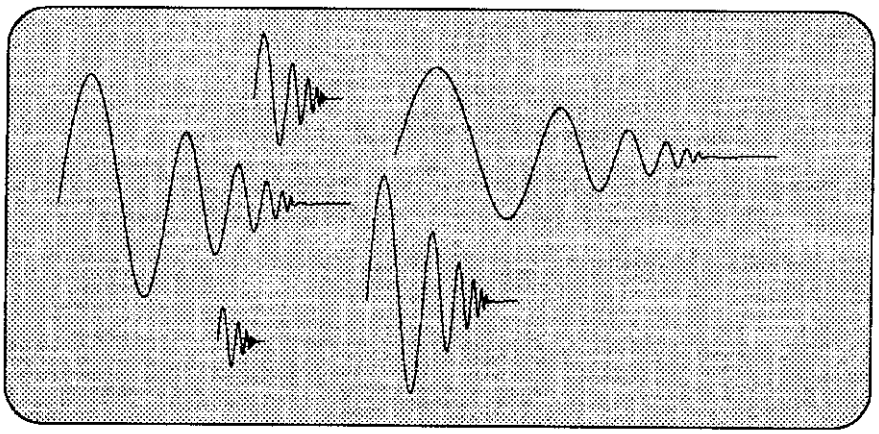
Drum Tone Board

Model 9302
Assembly and Using Manual



The Drum Tone Board provides analog circuitry for a drum kit with Bass, Tom-tom, Snare, Conga, Wood-Block, Clave and SynthDrum sounds. It uses ringing oscillators, a transistor noise source and diode tricks to get a classic (or at least retro) set of electronic drums that can plug right into guitar amps or hi-fis.

In the days before digital sampling, most electronic percussion units generated drum sounds with "ringing oscillator" designs like those used here. When sampling instruments became available, the absolute realism resulting from their being essentially a recording of a drum made these electronic sounds unfashionable. But, what goes around, comes around and now ringing oscillator sounds are regaining popularity because they AREN'T exactly like drums.

ASSEMBLING THE Drum Tone Board

Before beginning assembly, go through the manual. Look at the drawings. Feel the parts. You're naturally eager to plunge right in, but take a few deep breaths first.

Notice that each step in the manual is marked with a checkoff box like this:

DESIGNATION	VALUE	COLOR CODE
( ) R27	100 ohm	brown-black-brown

Checking off each step as you do it may seem silly and ritualistic, but it greatly decreases the chance of omitting a step and also provides some gratification and reward as each step is completed.

Numbered figures are printed in the Illustrations Supplement in the center of this manual. These pages may be removed for easy reference during assembly.

THE CIRCUIT BOARD

The Drum Tone Board is built on a single-sided circuit board. Before beginning assembly, clean oxidation from the copper side of the circuit board using scouring cleanser and water. The copper should be bright and shiny before beginning assembly.

Once you begin putting parts on the circuit board, it's a good idea to continue until all the parts are mounted. Stopping overnight may allow the copper to oxidize and make soldering more difficult.

TOOLS

You'll need a minimum of tools to assemble the kit - a small pair of diagonal wire cutters and pliers, screwdriver, sharp knife, ruler, soldering iron and solder.

Modern electronic components are small (in case you hadn't noticed) and values marked on the part are often difficult to see. Another handy tool for your bench will be a good magnifying glass. Also

use the magnifier to examine each solder joint as it is made to make sure that it doesn't have any of the problems described in the SOLDERING section which follows.

SOLDERING

Select a soldering iron with a small tip and a power rating not more than 35 watts. Soldering guns are completely unacceptable for assembling solid state equipment because the large magnetic field they generate can damage components.

Use only rosin core solder (acid core solder is for plumbing, not electronics work). A proper solder joint has just enough solder to cover the soldering pad and about 1/16-inch of lead passing through it. There are two improper connections to beware of: Using too little solder will sometimes result in a connection which appears to be soldered when actually there is a layer of flux insulating the component lead from the solder bead. This situation can be cured by reheating the joint and applying more solder. If too much solder is used on a joint there is the danger that a conducting bridge of excess solder will flow between adjacent circuit board conductors forming a short circuit. Accidental bridges can be cleaned off by holding the board upside down and flowing the excess solder off onto a clean, hot soldering iron.

Use care when mounting all components. Never force a component into place.

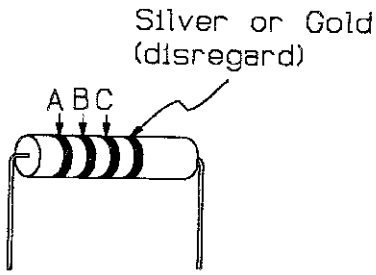
-*-

This product originated as a Do-It-Yourself article by John Simonton & Kent Clark *in the June & July 1993 issues of* Electronics Now *magazine. There may be differences between what appeared in the article and what is supplied with the kit. These differences, and any discussion of them, will be set aside with this italicized type. In some cases, notes packed with the parts will be used to call your attention to special situations.*

-*-

RESISTORS

Solder each resistor in place following the parts placement designators printed on the circuit board and the assembly drawing Fig 1. Note that resistors are nonpolarized and may be mounted with either lead in either of the holes provided. Before mounting each resistor, bend its leads so that they are at a right angle to the body of the part. Put the leads through the holes and then push the resistor firmly into place. Cinch the resistor in place by bending the leads on the solder side of the board out to an angle of about 45 degrees. Solder both ends of each resistor in place as you install it. Clip each lead flush with the solder joint as the joint is made. Save the clippings, we'll use them later as circuit board jumpers.

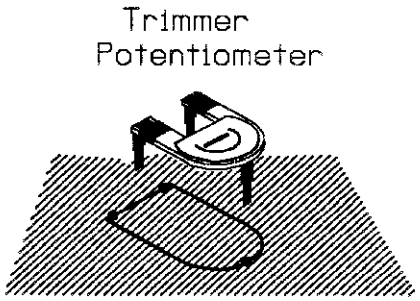


DESIGNATION	VALUE	COLOR CODE A-B-C	
( ) R1	1000 ohms	brown-black-red	
listed below:	10k	brown-black-orange	
( ) R2	( ) R5	( ) R9	( ) R16
( ) R23	( ) R31	( ) R40	( ) R41
( ) R42	( ) R46		
listed below:	2.2 megohm	red-red-green	
( ) R3	( ) R4	( ) R10	( ) R11
( ) R13	( ) R17	( ) R18	( ) R24
( ) R25	( ) R32	( ) R33	( ) R39
( ) R47	( ) R48	( ) R50	
listed below:	3.9 megohm	orange-white-green	
( ) R6	( ) R20	( ) R27	( ) R35

listed below:	330 ohms	orange-orange-brown	
( ) R8	( ) R15	( ) R45	( ) R60
( ) R12	15k	brown-green-orange	
( ) R19	68k	blue-grey-orange	
( ) R22	33k	orange-orange-orange	
listed below:	1 megohm	brown-black-green	
( ) R26	( ) R29	( ) R44	
( ) R30	33k	orange-orange-orange	
( ) R34	39k	orange-white-orange	
( ) R37	680k	blue-grey-yellow	
( ) R38	2200 ohms	red-red-red	
( ) R43	680k	blue-grey-yellow	
listed below:	47k	yellow-violet-orange	
( ) R49	( ) R52	( ) R53	( ) R54
( ) R55	( ) R56	( ) R57	
( ) R58	22k	red-red-orange	
( ) R59	22k	red-red-orange	

TRIMMER POTENTIOMETERS

Mount the 6 trimmer potentiometers by inserting their three pins into the holes provided. Press them down until the "shoulders" of the solder pins are resting on the surface of the board. Solder each part in place as it is installed.



DESIGNATION	VALUE	TYPE	
listed below:	100k	Trimmer Potentiometer	
( ) R7	( ) R14	( ) R21	( ) R28
( ) R36	( ) R51		

CAPACITORS

Ceramic Disk Capacitors

Some of the capacitors used in the Drum Tone Board are nonpolarized ceramic disks, either lead can go in either of the holes on the circuit board. Leads are already parallel to each other but still may need to be bent slightly to match the spacing of the circuit board holes. Like the resistors, push the leads through the holes in the board and push the part against the circuit board as far as it wants to go. Don't force it, it's OK if it sits a little off the board.

Disk Capacitors

Capacitors are often marked with obscure codes that indicate their values. The 3 digit number that specifies value may be preceded or followed by letters indicating such things as tolerance. If you get confused about which capacitors are which, it may help to group then by same type and check them against quantities on the packing list at the end of this manual.

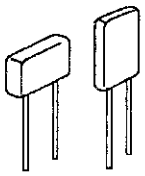
DESIGNATION	VALUE	MARKINGS	
listed below:	.01 uF	103	
( ) C1 ( ) C26	( ) C9	( ) C13	( ) C18
( ) C5	.05 uF	503	
( ) C30	.005 uF	502	

Mylar/Polystyrene Capacitors

Some of the capacitors are Mylar or Polystyrene types. These parts are not polarized. The Mylar Capacitors' leads are already parallel to each other, but like the Ceramic Disks, they may need to be formed to better fit the circuit board holes.

The leads of the Polystyrene Capacitors are bent down and may bend back under the part slightly when it is mounted on the circuit board. Too much heat on these leads can melt the plastic body of the part, be decisive while soldering. Like the disks, it's OK if these parts sit off the board slightly.

Mylar Capacitors



Polystyrene Capacitors

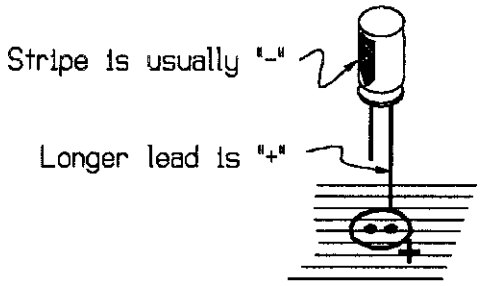
DESIGNATION	VALUE	MARKINGS	
listed below:	.01 uF	103	
( ) C2	( ) C6	( ) C10	( ) C14
( ) C19	( ) C22		
listed below:	.001 uF	102 or 1000	
( ) C3	( ) C4	( ) C11	( ) C12
( ) C15	( ) C16	( ) C20	( ) C21
( ) C7	4700 pF	472	
( ) C8	4700 pF	472	
( ) C17	.22 uF	224	
listed below:	560 pF	560	
( ) C23	( ) C24	( ) C27	( ) C28
( ) C29			
( ) C25	.1 uF	104	

Electrolytic Capacitors

One of the capacitors used in the Drum Tone Board is an electrolytic type. Unlike the previous components, electrolytic capacitors are polarized and the leads are not interchangeable. Leads are marked "+" and/or "-" and the "+" lead must go through the "+" hole in the circuit board. Frequently the positive lead of the capacitor is significantly longer than the negative lead.

Usually the Negative lead of the capacitor is marked rather than the positive. It naturally goes through the hole not marked "+".

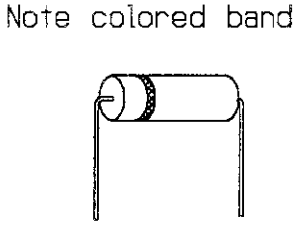
Capacitors supplied with specific kits may have a higher Voltage (V) rating than the minimum specified below.



DESIGNATION	VALUE
( ) C31	10 uF / 16V

DIODES

Diodes are polarized and must be installed so that the lead on the banded end of the part corresponds to the banded end of the designator on the circuit board. Bend the leads so they are at right angles to the body of the part and insert them through the holes provided in the circuit board.



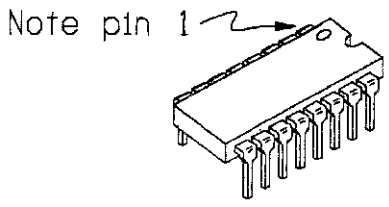
Diodes are also somewhat heat sensitive so the soldering operation should be done as quickly as possible.

DESIGNATION	TYPE
listed below:	1N914 or 1N4148 Silicon Diodes

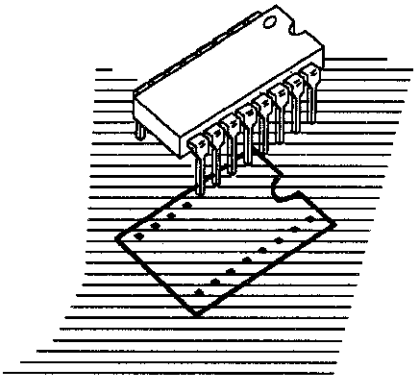
( ) D1 ( ) D2 ( ) D3 ( ) D4
( ) D5

INTEGRATED CIRCUITS

Of all the parts, the ICs are the most easily damaged and should be treated with some respect. In particular, they may be destroyed by discharges of static electricity. Modern ICs are not nearly as sensitive to this kind of damage as were earlier versions, but it is still good practice to handle

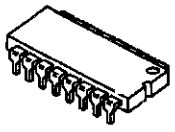


these parts as little as possible. Also good practice: don't wear nylon during assembly. Don't shuffle around on the carpet immediately before assembly (or if you do, touch a lamp or something to make sure you're discharged). Don't be intimidated. It's rare for parts to be damaged this way.



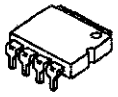
LM324

ICs are polarized in one or both of two ways; A dot formed into the case of the IC corresponding to pin 1 or a semicircular notch that indicates the end of the package with pin 1. Take care that this polarizing indicator corresponds to the similar indicator on the circuit board graphics.

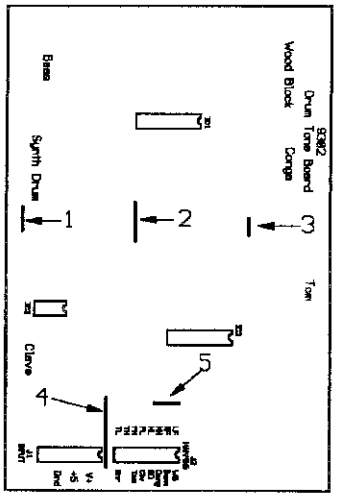


5532

The pins of the ICs may be splayed somewhat and not match up exactly with the holes in the circuit board. Carefully re-form the leads if necessary so that they are at right angles to the part. Solder each IC in place as it is installed by initially soldering two pins in diagonal corners of the pattern. Make sure that the part is seated firmly against the pc board by pressing it down while remelting the solder joint at first one corner, then the other. Finally, solder the remaining connections.



DESIGNATION	TYPE
( ) IC1	LM324 Quad Operational Amplifier
( ) IC2	LM324 " " "
( ) IC3	5532 Dual Low Noise OpAmp



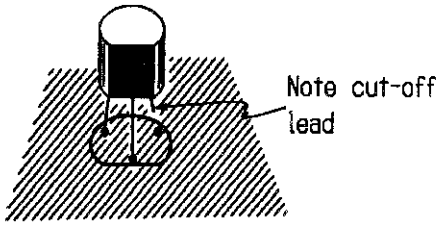
There are 5 wire jumpers on the circuit board

JUMPERS

( ) Using the excess lead clipped during component intstallation, form and install the 5 jumpers indicated on the circuit board by bold lines.

NOISE TRANSISTOR

The noise source used in the Tone Board is a transistor which has been selected for this purpose. You will notice that one of the leads was bent up when it was selected. Cut this lead off as shown in the illustration below. Install the transistor by inserting its remaining two leads through the holes in the circuit board as shown. Even if there is a hole provided for the missing lead, notice that the pad on the conductor side of the board is isolated.

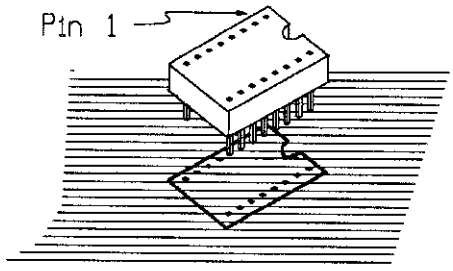


DESIGNATION	TYPE
( ) Q1	NPN Silicon Transistor

DIP SOCKETS

Two DIP Sockets are used on the Drum Tone Board. The 14-pin socket at J1 serves as a power and trigger input connector. The 16-pin socket at J2 is used to connect ("map") inputs to drum sounds.

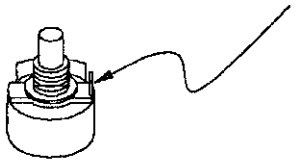
Sockets are polarized with a rectangular or semi-circular notch at one end of the part which corresponds to a similar indicator on the circuit board graphics. The socket would, of course, work just as well if it were inserted backward to the marked polarity, but this might lead to confusion when pin numbers are referenced in future instructions.

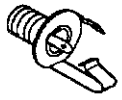


Insert the socket in the circuit board holes and initially solder two pins in diagonal corners of the pattern. Make sure that the socket is seated firmly against the pc board by pressing the socket against the board while remelting the solder joint at first one corner, then the other. Finally, solder the remaining connections.

DESIGNATION	TYPE
( ) J1	14 Pin DIP Socket
( ) J2	16 Pin DIP Socket

Bend or remove this tab so that the pot will seat flush against the panel.



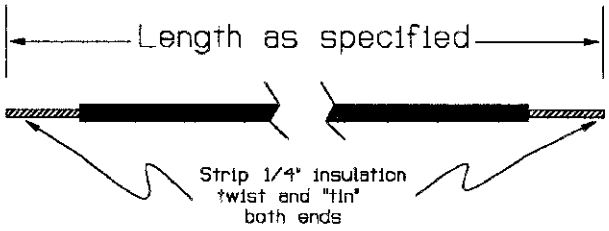


Open Circuit Jack

FLYING WIRES

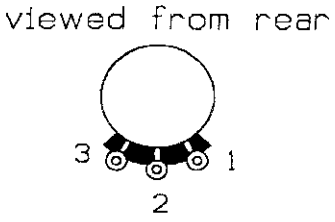
The Volume Control R61 and output jack J3 do not mount directly on the circuit board. Instead, they will mount on the case with "flying" wires back to the board.These connections will be made with the #22 stranded wire supplied.

At each step, cut a piece of wire to the specified length and strip 1/4" of the insulation from each end. Twist the exposed wire strands together and "tin" them by melting a small amount of solder into the strands. This will make soldering easier when the wires are installed and prevents fraying of the wire strands when they are pushed through the holes. Solder each connection as it is made and clip any excess wire from the solder side of the board.



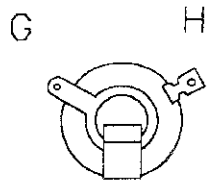
PC POINT / Length		PC POINT / Length	
( ) "A"	12"	( ) "G"	12"

Now we'll make the final connections between the circuit board, R61 and J3.



( ) Locate the 10k ohm potentiometer R61. Solder the free end of the wire originating at circuit board point "A" to lug #3 of the pot.

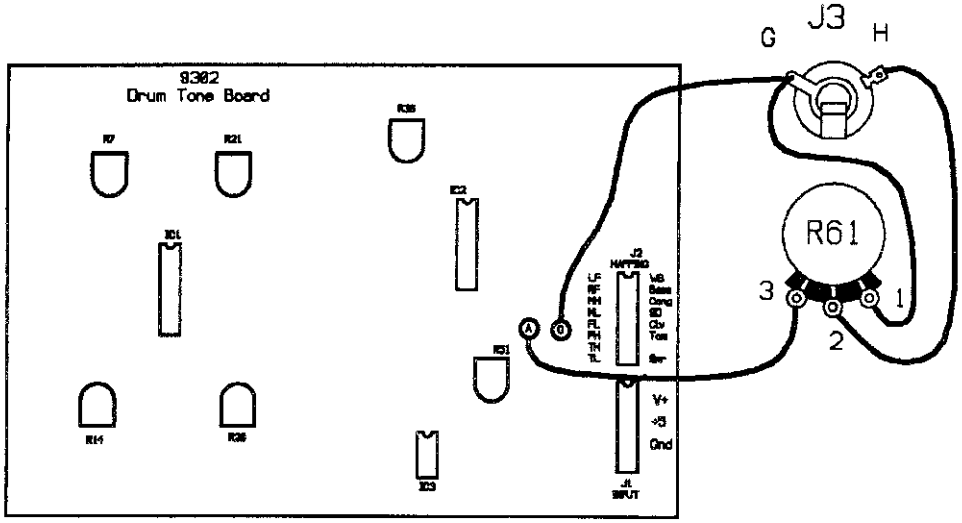
( ) Locate the Open Circuit 1/4" Phone Jack J3. Strip and Tin a 2" length of the #22 stranded wire and use it to connect lug #2 of R61 to the "H" lug of J3. Solder both of these connections as they are made.



Here's a tip on soldering to the lugs of the Jack: the nickel plating on the lugs will take a lot of heat before it begins to accept solder. Before connecting wires, "tin" the lugs by holding your soldering iron against them until solder flows onto the lug. Only a small tinned spot is needed because subsequently this spot will easily conduct heat to the lug.

( ) Strip and Tin a 2" length of #22 stranded wire and connect one end to Lug #1 of R61. Solder this connection. Connect the other end of this wire to the G lug of J3. In the next step another wire will be added to the lug, so do not solder yet.

( ) Connect the free end of the wire originating at circuit board point "G" to lug G of J3 and solder the two wires at this connection.

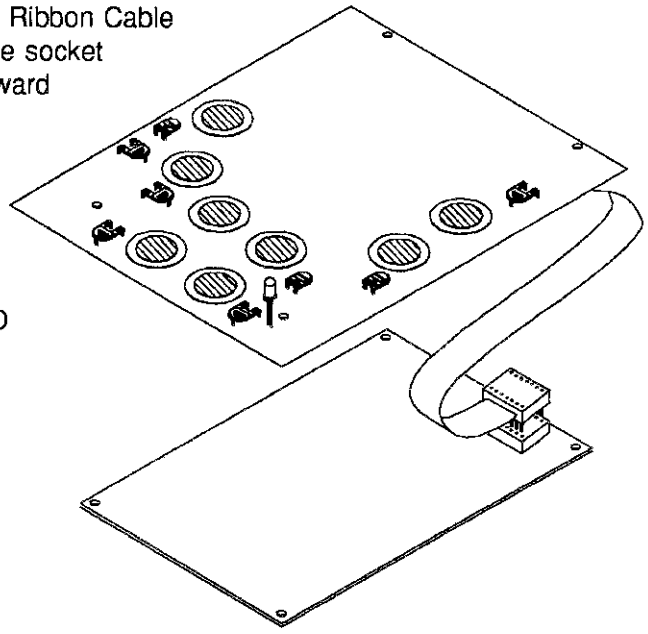


THIS COMPLETES THE ELECTRONIC ASSEMBLY of the Drum Tone Board. Before plugging the unit in and testing it, take a well earned break then come back and check your work completely. In particular, check your soldering. Make sure you have soldered all connections with bright, shiny joints. Remelt any connections that seem questionable. Watch for solder bridges and if you find any review the SOLDERING section on pg 3. Check polarity of the ICs, Diodes, Noise Transistor and the Electrolytic Capacitor.

POWER UP & TESTING

After rechecking your work, it's time for the all important smoke test. If anything unfortunate is going to happen, this is the most likely time.

Bring out the Sensor Board and plug its ribbon Cable into the socket at J1 on the Drum Tone Board. Note that when the Ribbon Cable Header is properly mated with the socket the ribbon will exit the header toward the center of the Tone Board as shown in the illustration. Plug the wall-mount transformer into a 120VAC outlet, slide the power switch to "ON" and make sure that the Sensor Board's POWER LED lights. If not, turn the power off immediately and find out why.

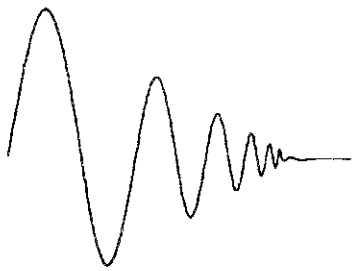


If there is a problem, localize it by disconnecting the Sensor Board from the Tone Board and turning the power on to see if the LED lights. If the LED now lights, the problem is almost certainly on the Drum Tone Board and is very likely a short circuit of some kind. Look carefully for solder bridges or reversed components on this board.

Once the LED lights, let the units idle for a few minutes while you check for any parts that might be getting overly warm. Anything too hot to hold your finger on is too hot. Find out why.

The final tests of the Tone Board involves listening to it, so either connect the audio output to an amplifier or plug in a pair of headphones (the output of the Tone Board is capable of driving high-efficiency headphones, such as those used with personal stereos). You will probably need a 1/4" mono to stereo adapter for the phones.

Begin by rotating the adjusting disks of all the trimmer resistors on the Tone Board fully CounterClockWise. At very high volume levels you may hear some slight noise from the output, but there should be no sustained tones audible. As you slowly advance the trimmers, you should hear a tone begin to swell and then stay constant. When you hear the tone, backoff on the trimmer and go on to the next one. No tone is trouble. Check for cold solder joints and incorrect parts, particularly among those that make up the sound that's not working.



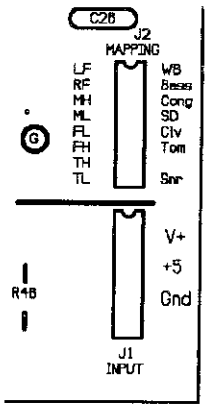
On an oscilloscope, the output of the drum oscillators will have this shape.

When you have verified that all of the Drum Tone oscillators are working it's time to make sure that the signals from the Sensor Board will trigger them. First, drum sounds must be assigned ("mapped") to finger pads by connecting the outputs of the Sensor Board (pins 1-8 of J2 on the Drum Tone Board) to the desired drum oscillators on pins 9 and 11-16 of J2. Notice that pin 10 of this connector has no drum sound assigned to it. A 16-pin header supplied with the kit makes these connections easier to make and change. For initial tests, use component lead clippings to wire the DIP header as shown below. Insert the header into socket J2.

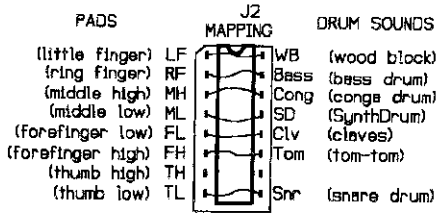
Hint: An 8-position DIP switch temporarily inserted in the socket at J2 makes it easy to test pads and oscillators one at a time. If you have small clip leads available, you may want to use one to temporarily map pads to sounds.

Set the sensitivity trimmer on the Sensor Board for the Piezo Disk that you're going to test fully ClockWise (maximum sensitivity). Hit a pad and adjust the trimmer on the Tone Board for the drum circuit connected to that pad. As you strike the pad while rotating the trimmer's adjusting disk in a CW direction you'll hear first a dull pop then a more drum-like tone and finally sustained oscillation. Back off (CCW) from the sustained oscillation point until you have a sound that most closely resembles the drum named.

Finger pads are connected to drum sounds by placing wire jumpers between pins of the "mapping" socket at connector J2.



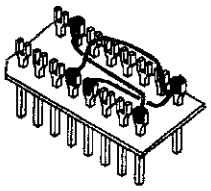
This mapping may be used for initial tests but will probably not be your final choice.

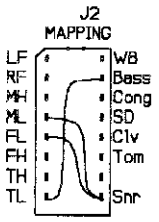


Pay close attention to the sound of the snare drum. There can be some variation in the level of noise produced by the Noise Transistor without affecting the sound of the snare. Particularly "hot" Noise Transistors may cause some noise to leak through the gate that is supposed to turn it on and off. The result is a constant, objectionable "hiss" even when the drum is not triggered. The best way to deal with this situation is to reduce the gain of the amplifier for the noise source by soldering a 680k resistor (blue-grey-yellow) in parallel with R39. Solder this resistor to the bottom of the board. Clip its leads off to a length of about 1/4" and bend them at right angles to the part. Solder the resistor's leads to the solder pads for R39.

Setting the sensitivity trimmers on the Sensor Board is not critical. Use them to adjust the relative audio mix of the drum sounds. If you hear the ghost of one sound (the clave, say) when you hit another pad it may mean that the sensitivity of the pad for the ghost drum (clave, in this example) is too high.

You will want to play with things some before committing to a permanent pad to drum mapping. There are eight pads and only seven drum sounds because it's so frequently useful to have two adjacent pads assigned to one drum (for doing rolls and other difficult parts). The most likely candidate for having two pads is the Snare Drum. In the partially wired mapping header shown to the right, the Snare Drum is assigned to both the Middlefinger Low and Forefinger Low pads on the Sensor Board. This partial example also shows the Bass Drum assigned to the Thumb Low pad.





This map assigns Snare Drum to forefinger and middlefinger and Bass to the thumb.

NOTES

HOW IT WORKS

While real drums (like all "natural" instruments) generate a complex spectrum of subtle overtones, these drum circuits generate a fairly pure tone. They "sound like" drums because they capture what is the essence of all percussion instruments, an envelope that rises rapidly to some peak when the instrument is first struck and then logarithmically decays back to nothing.

Even through the schematic for the drum circuits shown in the schematic is imposing at first, you'll soon notice that there is one basic circuit duplicated 6 times. This building block is typified by the Wood Block circuitry built up around one of the four operational amplifier stages in IC1.

This circuit is primarily a "twin-T" notch filter (R3, C2 and R4 for one "T"; C3, R5 and C4 for the other) in the inverting feedback loop of the amplifier. DC gain of the stage is set by R6 and R7 and when the gain is high, it overcomes the losses in the filter section and the circuit oscillates at the frequency set by the filter components. As gain is reduced, the circuit will stop spontaneously oscillating, and at that point it's a very resonant bandbass filter. It's not a very "good" bandpass filter because of its transient response. If you hit it with a pulse input, it temporarily breaks into oscillation and rings like crazy. What's not good for a bandpass filter is great for producing drum sounds. Input pulses are coupled into the circuit by C1 and R1.

The snare drum sound starts with a burst of white noise to simulate the rattle of the snares when the drum is hit. The noise source used is an avalanching base-emitter junction of the NPN transistor Q1. The low level noise from the transistor is boosted in level by the amplifier stage IC2:B.

The high level noise is gated by IC2:C, the trigger pulse biases the OpAmp out of saturation into a linear operating range. C25 and R44 serve to stretch the relatively short pulse from the drum sensor to hold the noise burst on a little longer than the sensor pulse alone would do.

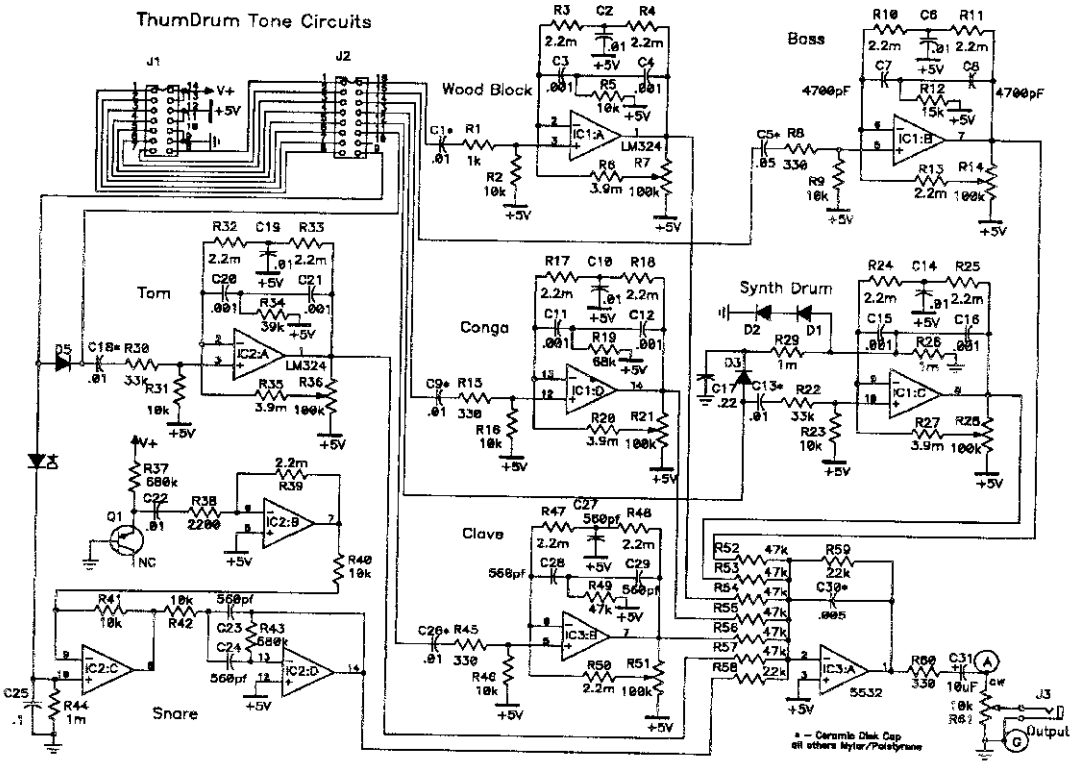
This technique is not universally applicable to switching audio because the change in DC level at the output of the IC2:C as it goes into its linear range generates a large pop. We can get away with it here, though, for two reasons; the first is that the output of the gate drives a high pass voicing filter (IC2:D, C23, C24, R42 and R43), which has the primary function of brightening the noise so it more closely simulates the sound of snares, also dissipates much of the energy in the level shift. Secondly, what little "pop" might get through the filter is acoustically masked by the noise that's being gated in the first place.

Just the noise burst alone would do a credible job of simulating a snare sound, but we already have a "Tom-(tom)" sound built around IC2:A and of course a snare drum is nothing but a tom-tom with snares, so diode D5 couples the Tom oscillator to the snare trigger so that it rings when the snare pad is hit. D5 also prevents the snare from sounding when only the Tom trigger is hit.

Whereas all the other drum circuits operate at a constant pitch, the SynthDrum built around IC1:C is a little different. It slides down in pitch as it decays. This circuit is a ringing oscillator like the others but here the frequency is adjustable by varying the current flow through diodes D1 and D2. It's not typical to see diodes used in this way, but as current flow through them increases, their equivalent impedance goes down. D1 and D2 are "controlled by" the current flow through R29 which is a trigger pulse stretched by D3 and C17. They "control" the notch frequency of the filter network (R24-R26, C14-C16). A trigger pulse raises the frequency which then glides down as the charge on C17 drains away and the equivalent impedance of the diodes increases.

Just like the other drum circuits, the trigger pulses coupled by C13 and R22 kick the SynthDrum into oscillation and provide a percussive edge to the sound. But unlike the others, this one would oscillate spontaneously just because of the change in impedance of the diodes. As a result, this drum is capable of much longer sustain times than the others.

Finally, the audio outputs of all the drum circuits are mixed by the summing amp built from IC3:A and R52-R59, then AC coupled by C31 to the level pot R61 to appear at the audio output jack J3. The 5532 dual low noise amp used for this stage can drive high-efficiency headphone with as little as 8 ohm impedance directly.



ThumbDrum Tone Board

Packing List

8	.001 uF	Mylar or Polystyrene Capacitors
2	4700 pF	" " "
6	.01 uF	" " "
1	.1 uF	" " "
1	.22 uF	" " "
5	560 pF	" " "
5	.01 uF	Ceramic Disk Capacitor
1	.05 uF	" "
1	.005 uF	" "
1	10uF/15V	Electrolytic Capacitor
5	1N914 or 1N4148	Silicon Diodes
2	LM324	Quad Opamp
1	5532	Dual Low Noise Opamp
1	NPN	Noise Transistor
6	100k	Horizontal Trimmer Potentiometers
1	10k	Panel Mount Potentiometer

10	10k	All Resistors
1	15k	1/4W 5%
1	1k	
3	1 megohm	
15	2.2 megohm	
1	2200 ohms	
2	22k	
4	3.9 megohm	
4	330 ohms	
2	33k	
1	39k	
7	47k	
2	680k	
1	68k	
1	Open Circuit Phone Jack	
1	14 Pin Socket	
1	16 Pin Socket	
1	16 Pin Header	
1	Push-On Knob	
36"	#22 Stranded Wire	
1	9302 Printed Circuit Board	

PAiA Electronics, Inc.
phn (405) 340-6300

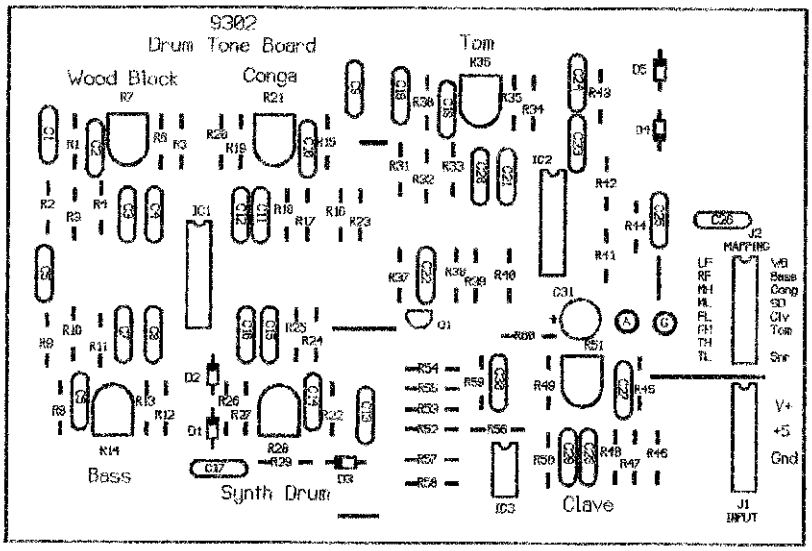


Fig 1a. Parts are placed on the circuit board as shown above.

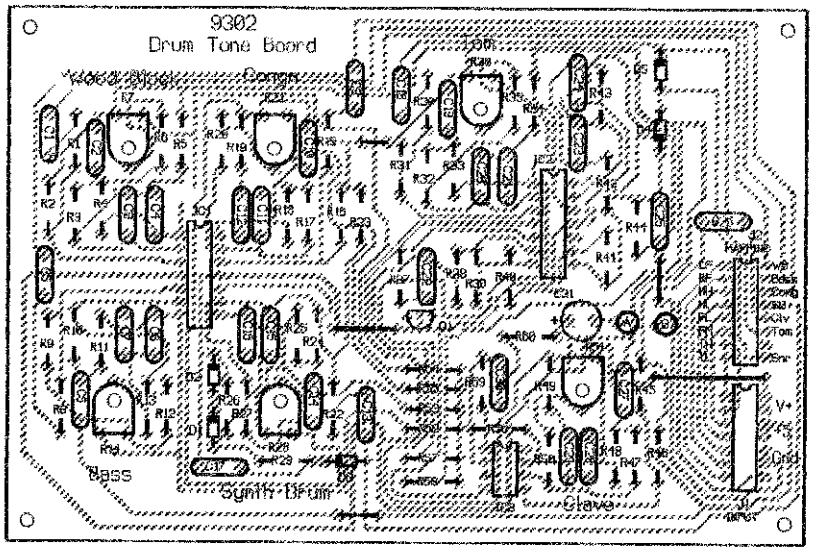
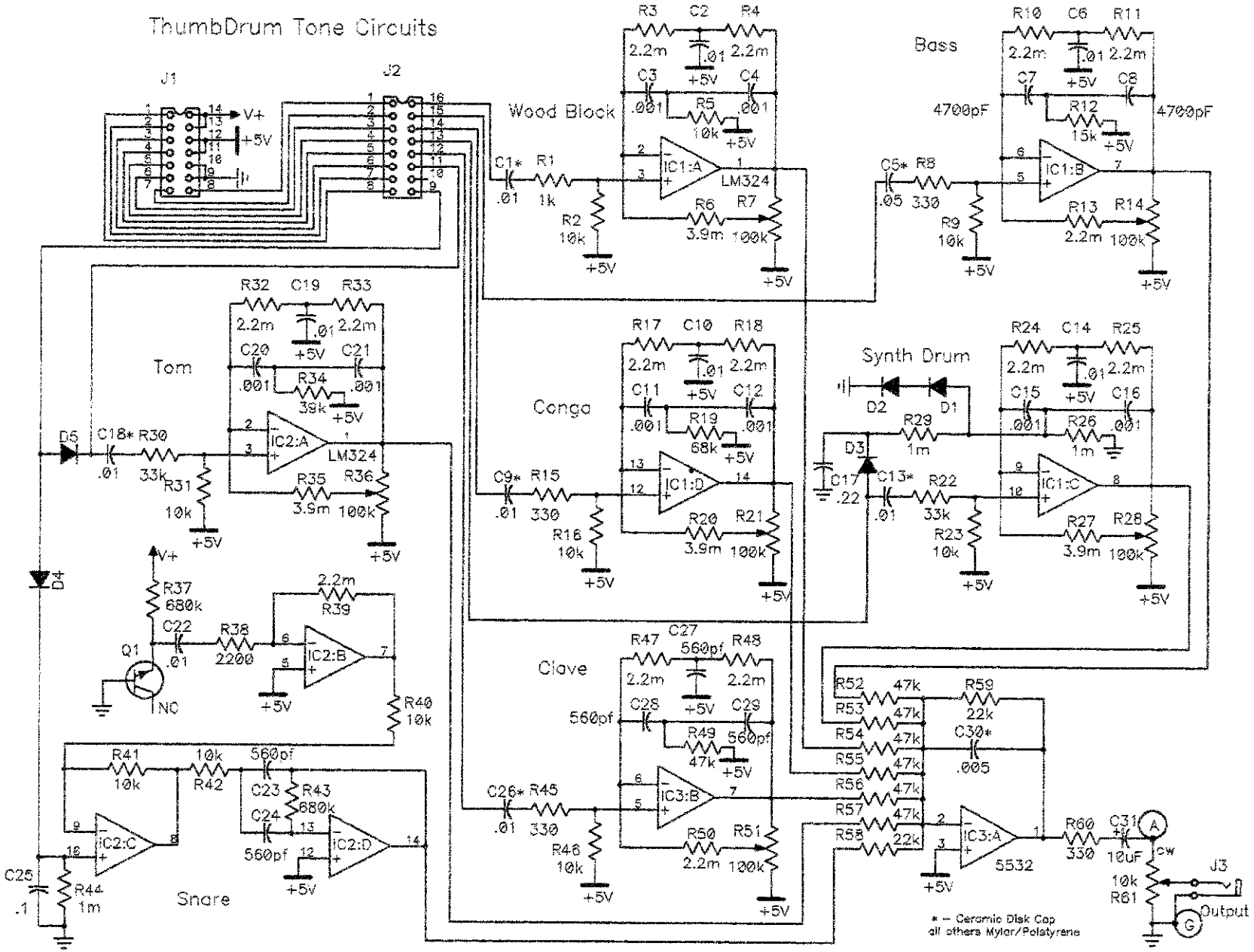


Fig 1b. This phantom view of the copper conductors will be useful if you have to trouble shoot the circuit.


ThumbDrum Tone Circuits
J1
J2
V+
+5V
Wood Block
R3
C2
R4
2.2m
.01
C3
C4
.001
R5
10k
C1*
R1
1k
R2
10k
IC1:A
LM324
R6
3.9m
R7
100k
Bass
R10
C6
R11
C7
C8
4700pF
R12
15k
C5*
R8
.05
330
R9
IC1:B
R13
R14
Tom
R32
C19
R33
C20
C21
R34
39k
D5
C18*
R30
33k
R31
IC2:A
R35
R36
Conga
R17
C10
R18
C11
C12
R19
68k
C9*
R15
R16
IC1:D
R20
R21
Synth Drum
R24
C14
R25
C15
C16
R26
D2
D1
D3
R29
1m
C17
.22
C13*
R22
R23
IC1:C
R27
R28
D4
R37
680k
C22
R38
2200
Q1
NC
R39
IC2:B
R40
10k
Clave
R47
C27
560pf
R48
C28
C29
R49
C26*
R45
R46
IC3:B
R50
R51
R52
47k
R53
R54
R55
R56
R57
R58
22k
R59
C30*
.005
IC3:A
5532
R60
330
C31
10uF
R61
J3
Output
cw
Snare
R41
R42
C23
R43
680k
C24
IC2:C
IC2:D
C25
.1
R44
1m
* = Ceramic Disk Cap
all others Mylar/Polystyrene