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LOOPHOLE

FX TYPE: LOOPER

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Traditionally, loopers have been a bit beyond the reach of analog DIY. While there are plenty of commercial digital (and probably some DIY designs) the choices for pedal hobbiest with no programming experience have been limited. The **Loophole** is one project that attempts to bridge that gap. It is a low fidelity looper based off the ISD1020AP voice recorder chip. The ISD offers 20 sec. of digital recording at a sample rate of about 6.4kHz. All the A/D conversion is done within the chip, so designing an analog wrapper around it is a straight-forward task.

The Loophole originates from the Mobius Trip Looper designed by Dean Hazelwanter which has been available at General Guitar Gadgets for some time. Several modifications have been made to this design and features have been added to attempt to make this a more versatile project for all levels of DIY'ers. These include changes to the different gain stages in the analog path, noise reduction, a tone control for the loop and a hack that allows continuous detuning on playback.

It's important to know that this design cannot compete with commercially available digital loopers. It has significantly less fidelity and features than a Boss RC-3, for example. But, it does have its own character and definitely fits the mold of a worthy DIY build.

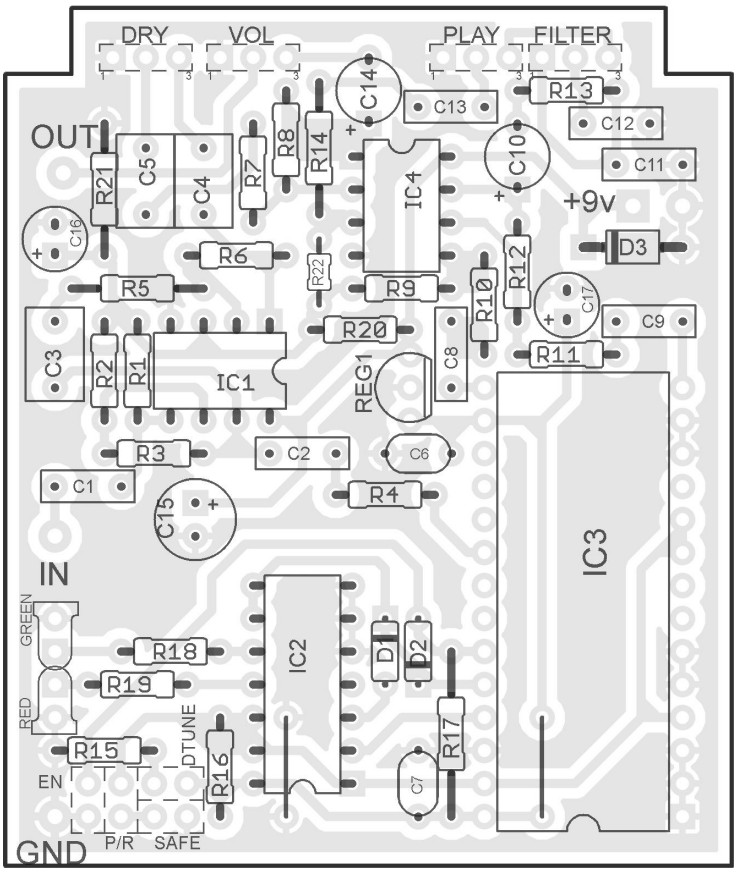
Controls

DRY: Sets the dry signal volume of the guitar.
VOL: The overall output of the **DRY** and **PLAY** signal paths.
PLAY: Sets the volume of the playback loop.
FILTER: This is a "cut" type filter. Turning it clockwise reduces treble content.
DTUNE: This optional mod lets you apply continuous detuning to the playback via a momentary switch.

This project requires a specific voice recorder IC. The ISD1020AP is available from Smallbear, and it is the only source that I know of for purchasing. You may be able to find them on eBay, but this has not been researched.

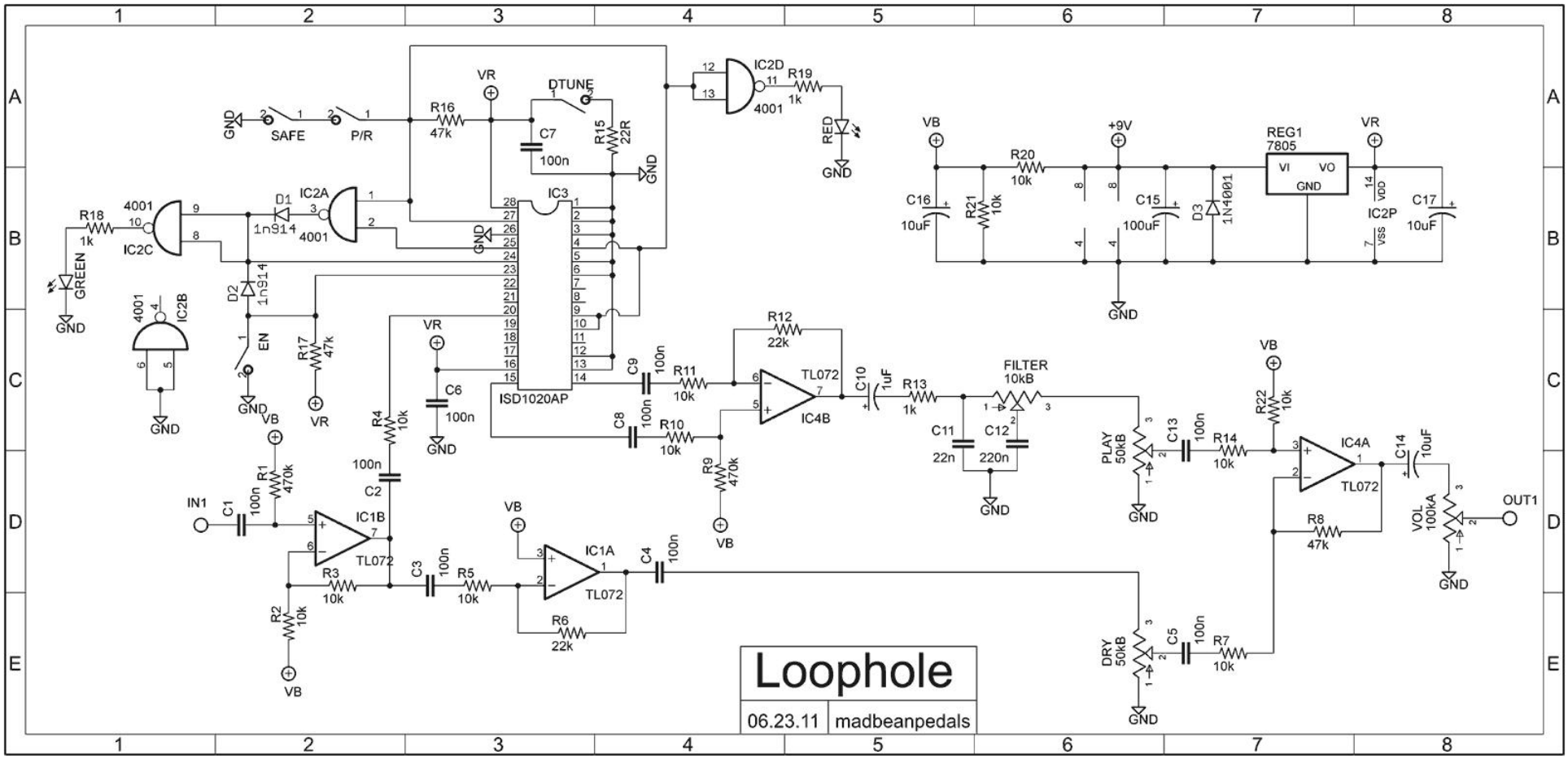
ISD1020AP: http://www.smallbearelec.com/Detail.bok?no=451

Layout Diagram



Bill of Materials

Resistors		Caps		Diodes	
R1	470k	C1	100n	D1, D2	1n914
R2	10k	C2	100n	D3	1N4001
R3	10k	C3	100n	RED	LED
R4	10k	C4	100n	GREEN	LED
R5	10k	C5	100n	**IC**	
R6	22k	C6	100n	IC1	TL072
R7	10k	C7	100n	IC2	CD4001
R8	47k	C8	100n	IC3	ISD1020AP
R9	470k	C9	100n	IC4	TL072
R10	10k	C10	1uF	REG1	7805
R11	10k	C11	22n	**Switch**	
R12	22k	C12	220n	DTUNE	SPST
R13	1k	C13	100n	**Pots**	
R14	10k	C14	10uF	DRY	50kB
R15	22R	C15	100uF	FILTER	10kB
R16	47k	C16	10uF	PLAY	50kB
R17	47k	C17	10uF	VOL	100kA
R18	1k				
R19	1k				
R20	10k				
R21	10k				
R22	10k				


Loophole
06.23.11
madbeanpedals
SAFE
P/R
DTUNE
FILTER
10kB
PLAY
50kB
DRY
50kB
VOL
100kA
ISD1020AP
TL072
4001
1n914
1N4001
7805
REG1
GREEN
RED
IN1
OUT1
GND
VB
VR
+9V

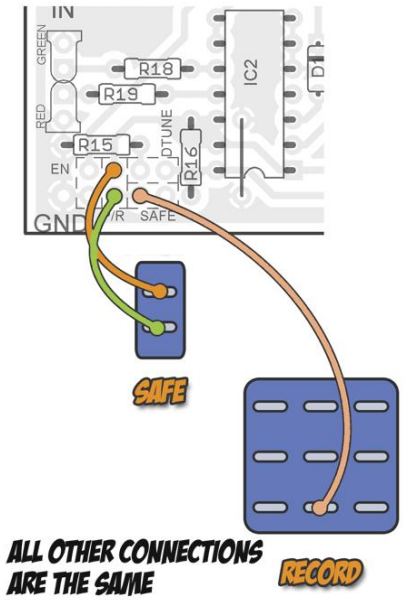
Notes

- The **Loophole** is not true bypass. The input of the effect is always connected to the input jack, even when a loop is not recording. There are advantages and disadvantages to this approach. The biggest advantage is that looping can be done “on the fly” simply by toggling the **Record** switch without first having to disengage a bypass. The disadvantage is that there is a possibility of small signal loss. My own testing on the circuit seems to indicate that signal loss is at a minimum, and nothing on the level of say, an old Crybaby Wah.

- It is possible to make the **Loophole** true bypass by adding a third switch. This precludes any possible signal loss due to tone suckage. Note that if you do this, you will have to engage two switches to record a pass rather than one. Then toggle the **Record** switch off and the **Playback** switch on to enable the loop playback. This is a lot to remember and execute while actually playing your instrument. True bypass wiring has been omitted from this document.

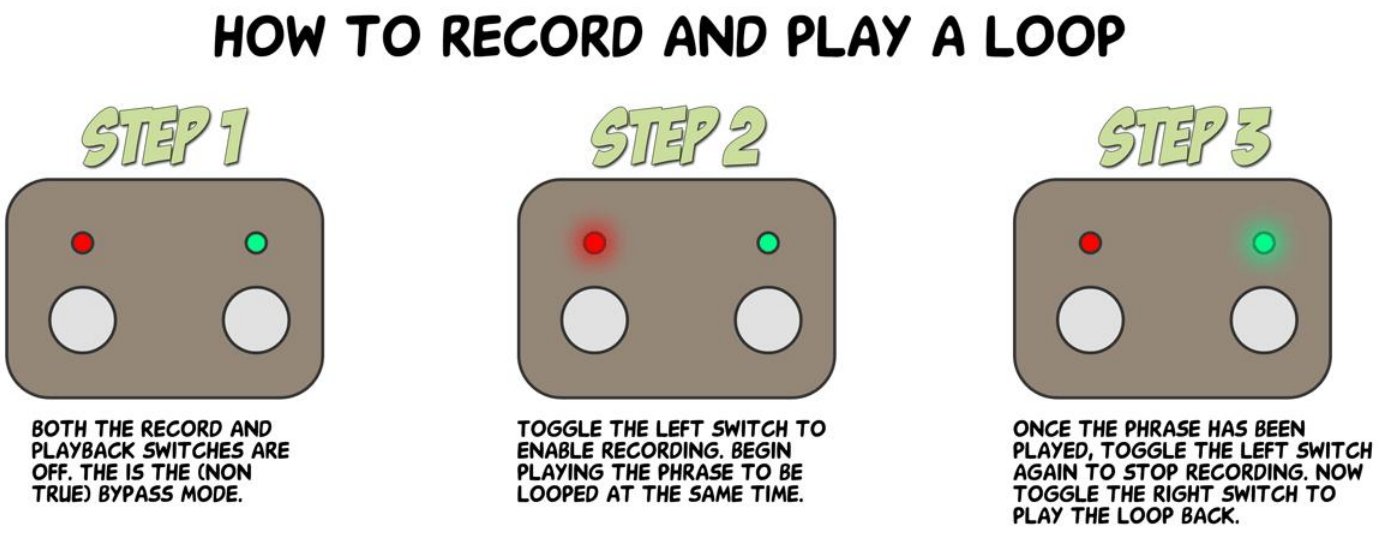
- The **DETUNE** function allows continual playback detuning so long as the switch is engaged. You can use either a latching or momentary switch. The small switch pictured in the build below (between the two 3PDTs) was purchased from Tayda Electronics and is a momentary. If you plan on using a larger enclosure, such as a 1590BB, a momentary footswitch would be a great addition. Note that you can also apply the **DETUNE** when recording a loop. When playing a de-tuned loop in playback, the pitch will increase continuously. This momentary footswitch is about the same size as a 3PDT and will work well for foot control: http://www.smallbearelec.com/Detail.bok?no=672

- Pads are included for a “Safe” switch on the PCB. The Safe switch disables recording by the voice recorder chip and will prevent accidental erasing of a loop you wish to save. Note that the **Loophole** will store any recorded loop until it is over-written, even when the power is disconnected. The Safe switch adds one more layer of protection by making it to impossible to record anything into the chip. To add a Safe switch, refer to the following diagram:

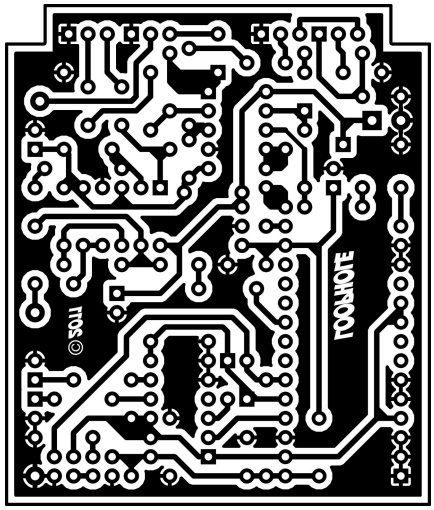


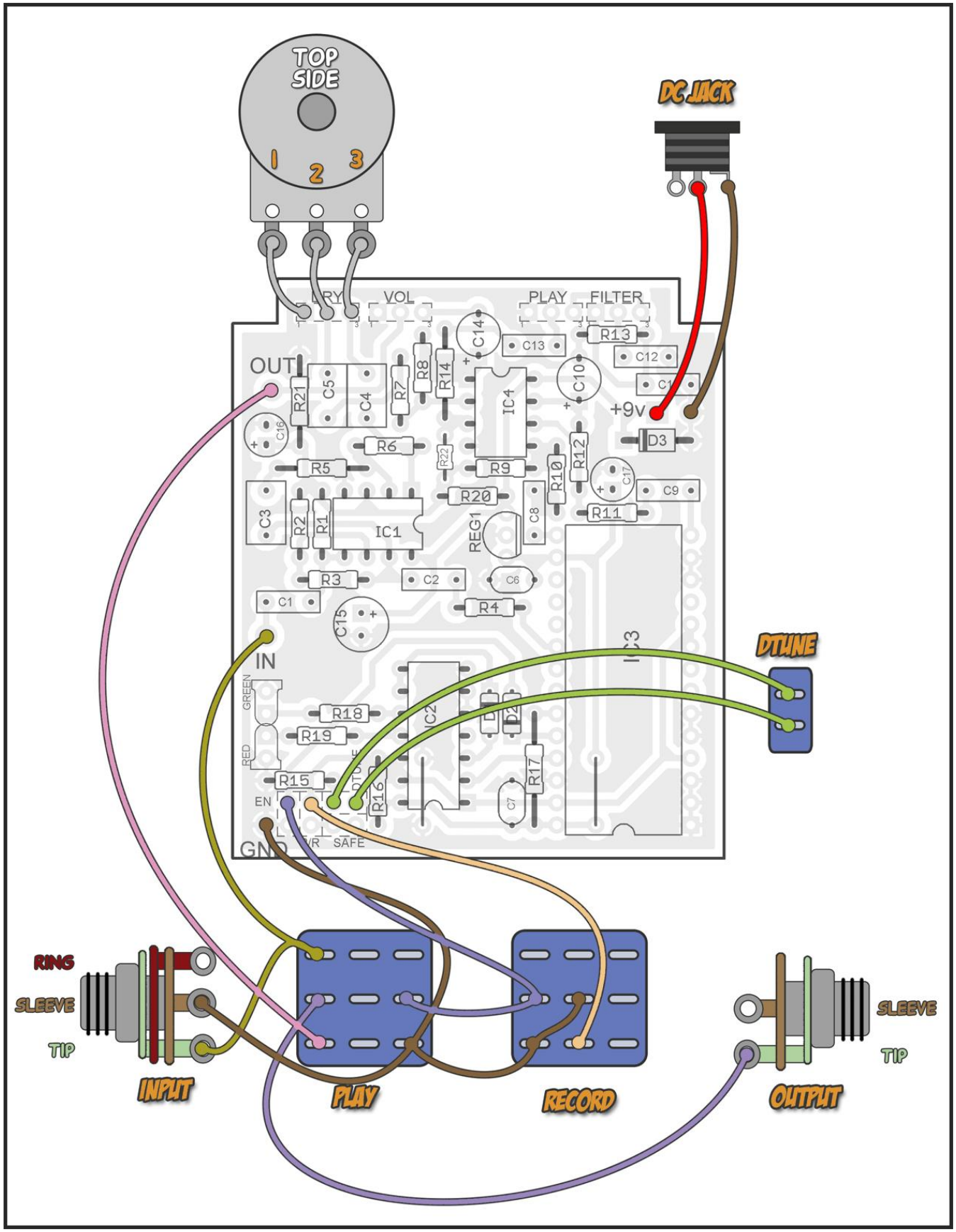
- You can experiment with adding an effects loop to the Loophole with a simple modification. R4 sets the record level into the ISD chip. Remove this resistor and use the two free pads for a send and return. By doing this, the **Loophole** will record the effected signal into the looper, and the output of the inserted effect sets the record level. Note that this has not been verified.

- This type of DC jack has a smaller profile and is a snap-in rather than using a nut. I recommend this if you are building the **Loophole** into a 1550B or 1590B. It does not have a ring for battery operation, but will allow you to place the jack very close to the top of the enclosure. See the pictures at the end of this document to get an idea.
  http://www.mouser.com/ProductDetail/163-1000-EX/?qs=sGAEpiMZZMtiLeikjuthVh%2f8HnDmxZQr

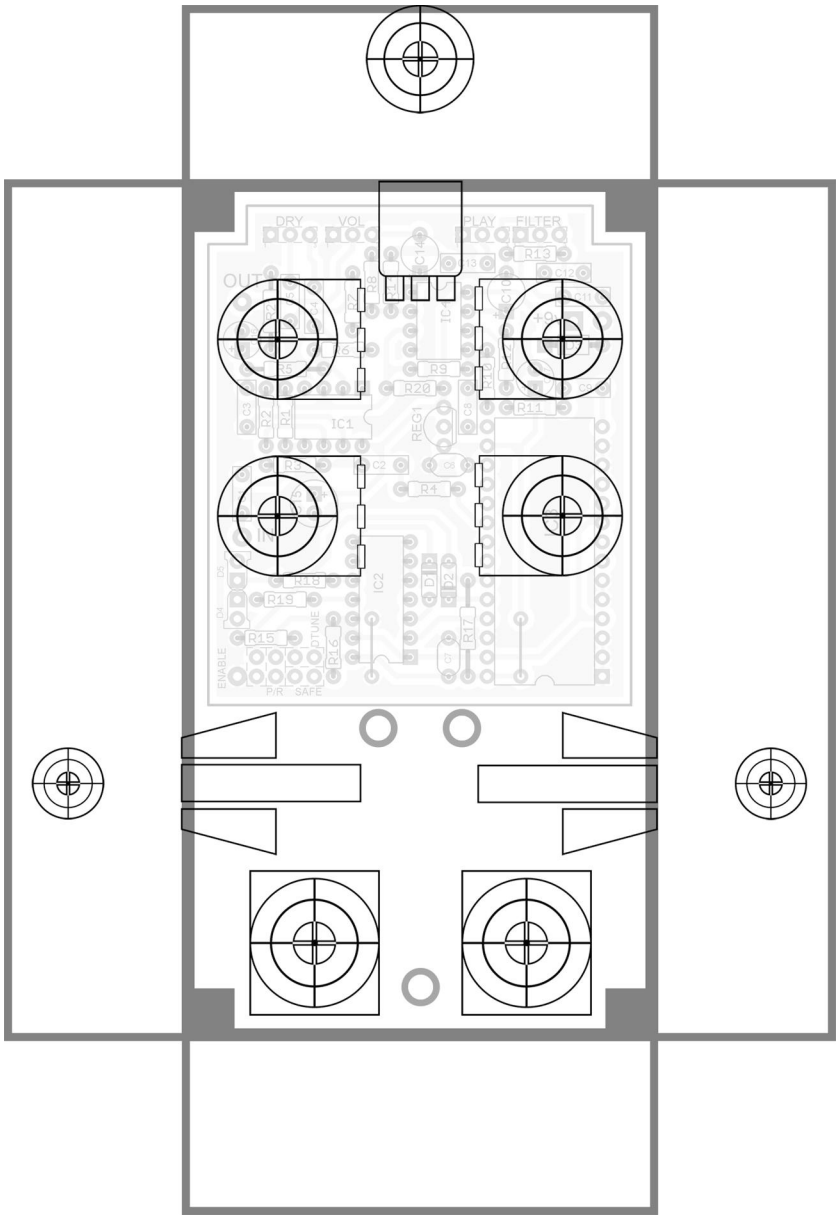


2.21”W x 2.61”H




TOP SIDE
1
2
3
DC JACK
DRY
VOL
PLAY
FILTER
OUT
IN
+9v
GND
IC1
IC2
IC3
IC4
REG1
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
D1
D2
D3
GREEN
RED
EN
DTUNE
SAFE
DTUNE
RING
SLEEVE
TIP
INPUT
PLAY
RECORD
SLEEVE
TIP
OUTPUT

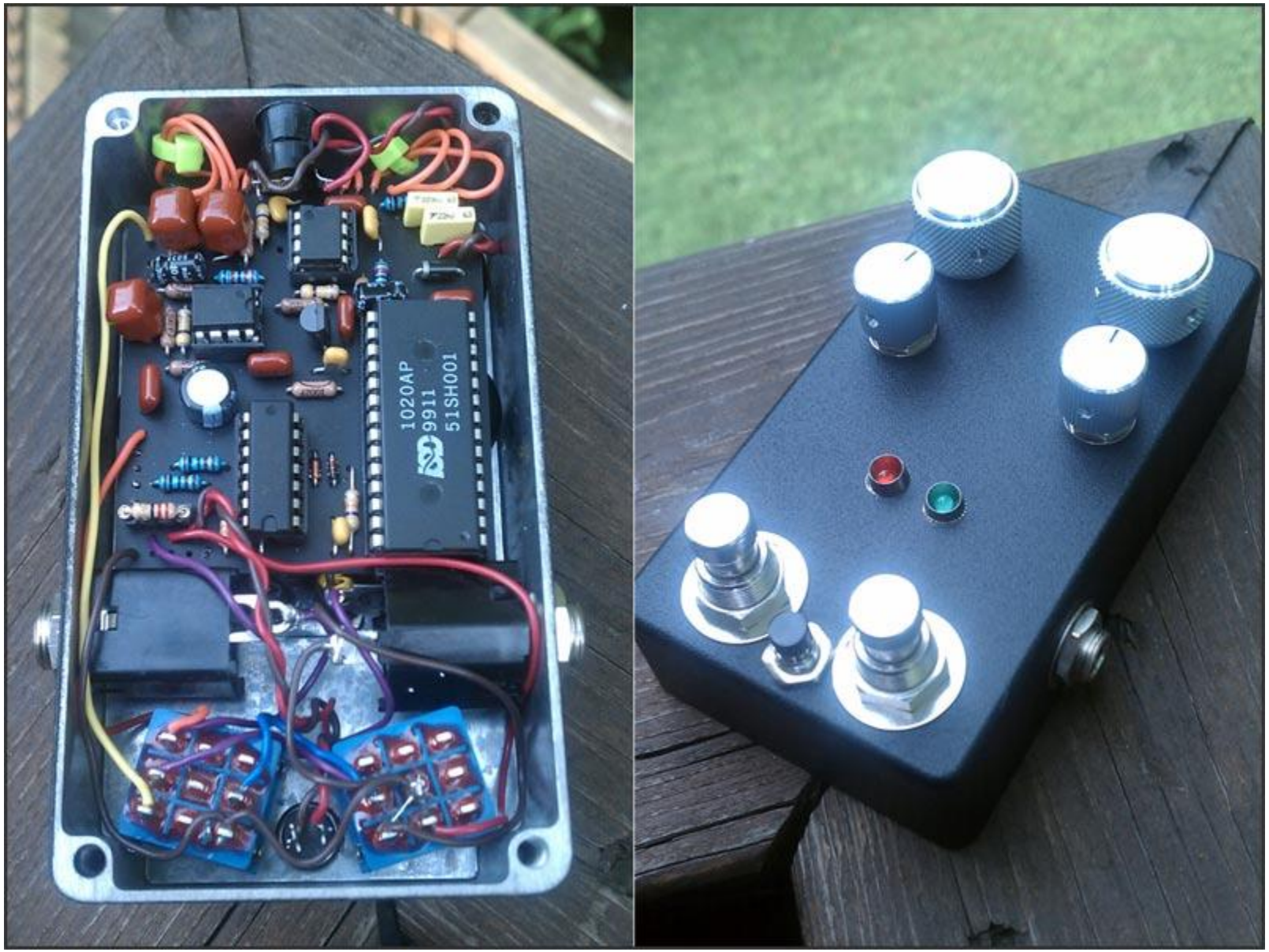
4.33” x 6.3”
1550B



The Hammond 1550B is slightly wider and longer than the 1590B and is what I used for my build. I highly recommend this enclosure over the 1590B if you want to do a two switch layout.

The 1550 can be ordered from Mouser in either black powder coated or unfinished.

http://www.mouser.com/Search/Refine.aspx?Keyword=hammond+1550b


1020AP
9911
51SH001

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