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ELECTRONICS

BUILD DOCUMENT

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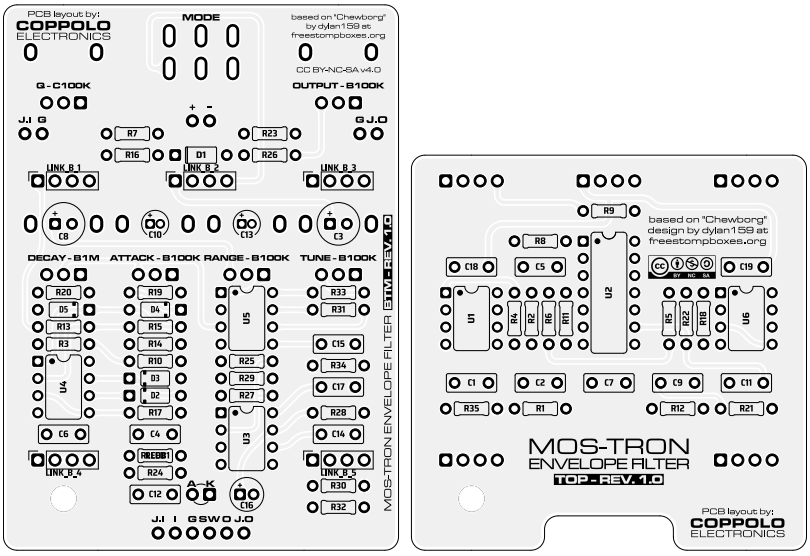
MOS-TRON

ENVELOPE FILTER

REV. 1.0.0



Bottom Board Size: 3.175" x 2.30"
Top Board Size: 2.30" x 2.30"

DETAILS

Based on the Chewborg Envelope Filter by Dylan159 at freestomboxes.org. According to Dylan159, the Chewborg is designed around the familiar sounds of the most popular envelope filters of all time, but instead of being designed with LDRs, Vactrols, or JFETs, his design is based around using the CD4007's matched CMOS FETs to form the state-variable filter. We've taken Dylan159's clever design work and packaged it up into a 125B.

*see Non-Affiliation Disclaimer for more details.

TABLE OF CONTENTS

BEFORE YOU BEGIN...

Please consider reading this document in its entirety before switching on the soldering iron. Doing so will give you a better understanding of this project, and increases the likelihood of a smooth and successful building experience. This project is **not** intended for beginners, and as such, we assume that you already have the appropriate tools, supplies, and experience needed to build this project.

If additional steps are required to set trim pots or otherwise, we've mentioned them in the project notes section of this document.

If you are having trouble with your build, check the troubleshooting section of this document for a few tips on how to resolve common mistakes.

We hope that you enjoy building this project as much as we have! We hope to see your build reports on the forums!

BILL OF MATERIALS

REF DES	QTY	VALUE	COMPONENT TYPE
R11, R14, R17, R19, R22, R25, R26, R27, R29, R31	10	10K	1/4W Resistor
R3, R9, R10, R20, R30, R33	6	100K	1/4W Resistor
R1, R8, R12, R18, R21	5	1M	1/4W Resistor
R2, R5, R6, R24	4	2K2	1/4W Resistor
R4, R23	2	22K	1/4W Resistor
R7	1	3K3	1/4W Resistor
R13	1	20K	1/4W Resistor
R15	1	330K	1/4W Resistor
R16	1	15K	1/4W Resistor
R28	1	220K	1/4W Resistor
R32	1	1K	1/4W Resistor
R34	1	150K	1/4W Resistor
R35	1	RPD*	1/4W Resistor, ***see project notes**
RLED1	1	4K7	1/4W Resistor, *sets LED brightness (min. 2K4 recommended)
C1, C4, C7, C11, C15, C17, C18, C19	8	100n	Film Capacitor - L7.2mm x W2.50mm x LS5.00mm
C2, C12	2	6n8	Film Capacitor - L7.2mm x W2.50mm x LS5.00mm
C5, C9	2	10n	Film Capacitor - L7.2mm x W2.50mm x LS5.00mm
C6, C14	2	22p	Film Capacitor - L7.2mm x W2.50mm x LS5.00mm
C10, C13	2	1µ	Polarized Electrolytic Capacitor - D4.00mm x P1.50mm, LP, ***see project notes** ***Recommended Part number: ESS105M050AB2AA***
C3	1	100µ	Polarized Electrolytic Capacitor - D6.30mm x P2.50mm, LP, ***see project notes** ***Recommended Part number: ESS107M025AE2AA***
C8	1	47µ	Polarized Electrolytic Capacitor - D6.30mm x P2.50mm, LP, ***see project notes** ***Recommended Part number: ESS476M025AE2EA***
C16	1	10µ	Polarized Electrolytic Capacitor - D5.00mm x P2.00mm, LP, ***see project notes** ***Recommended Part number: ESS106M035AC2AA***
Q (VR1)	1	C100K	9mm Alpha RD901F-* Potentiometer, Right Angle PCB
ATTACK (VR2)	1	B100K	9mm Alpha RD901F-* Potentiometer, Right Angle PCB
DECAY (VR3)	1	B1M	9mm Alpha RD901F-* Potentiometer, Right Angle PCB
RANGE (VR4)	1	B100K	9mm Alpha RD901F-* Potentiometer, Right Angle PCB
TUNE (VR5)	1	B100K	9mm Alpha RD901F-* Potentiometer, Right Angle PCB
OUPUT (VR6)	1	B100K	9mm Alpha RD901F-* Potentiometer, Right Angle PCB
MODE (SW.1)	1	ON-ON-ON	Miniature Toggle Switch, Solder Lug, ***TYPE 2, see project notes***

REF DES	QTY	VALUE	COMPONENT TYPE
D1	1	1N5817	Schottky diode, DO-41
D2, D3	2	1N4148	Silicon Standard Switching Diode, DO-35
D4, D5	2	BAT41	Small Signal Schottky diode, DO-35
U1, U3, U6	3	TL072	Dual Operational Amplifier, DIP-8
U4, U5	2	LM358	Dual Operational Amplifier, DIP-8
U2	1	CD4007UBE	CMOS Dual Complementary Pair, DIP-14
LEDB1	1	3-5mm	LED
LINK_B_1, LINK_B_2, LINK_B_3, LINK_B_4, LINK_B_5	5	01X04_2.54_FEMALE	4-pin Single Row Female Pin Header, P2.54mm, Vertical, ***see project notes**
LINK_T_1, LINK_T_2, LINK_T_3, LINK_T_4, LINK_T_5	5	01X04_2.54_MALE	4-pin Single Row Male Pin Header, P2.54mm, Vertical, ***see project notes**
M3 Screw	2	M3x6mm	M3 Steel Screw Cross Round Head M3x6mm, ***see project notes**
M3 Washer	4	3.3mm	Washer 3.3mm for Screw M3, ***see project notes**
M3 Spacer	1	M3x10mm	Brass Standoff Spacer Golden Screw Hex Female, ***see project notes**

OFF-BOARD COMPONENTS

COMPONENT	QTY	VALUE	COMPONENT TYPE
Footswitch	1	3PDT	Latching 3PDT Footswitch
Audio Jack	2	1/4”	1/4” Instrument Jack
Power Jack	1	2.1mm	2.1mm DC Panel Jack Positive Center
Knobs	6	~	~
Enclosure	1	125B	125B or equivalent

ABOUT COMPONENT VALUE SHORTHAND:

It’s easy to miss a decimal place on the finished project board when the silkscreen printed value must be both small enough to fit within the bounds of a component outline and remain legible. For this reason, component values are often abbreviated. This typically applies to passive components like resistors, capacitors, inductors more so than active components. When a resistor is listed using shorthand, such as 4K7, the full length value of the part is 4.7KΩ. When a capacitor is listed as 4µ7, the full length value of the part is 4.7µF.

PROJECT NOTES

RPD (R35):

The pull-down resistor at the circuit input is not part of the original circuit created by Dylan159. This project includes this resistor in the event that the circuit pops when activated/deactivated. If this resistor is necessary to mitigate switch pop, choose a value of 2M2 or above.

ELECTROLYTIC CAPACITORS (E-CAPS):

This project uses stacked boards in order to fit the entire circuit into a 125B-sized enclosure. Common e-caps are 11mm in height, which is too tall to fit between the boards when stacked. We recommend using low-profile e-caps that have a maximum height of 7mm. See the BOM for recommended part numbers.

MODE SWITCH (ON-ON-ON):

This project requires a **Type 2** DPDT ON-ON-ON miniature toggle for the mode selection. Make sure that Type 2 is specified when purchasing. The switch must adhere to the following switching pattern:

SWITCH POSITION		
ON	**ON**	**ON**
2-3, 5-6	2-3, 5-4	2-1, 5-4

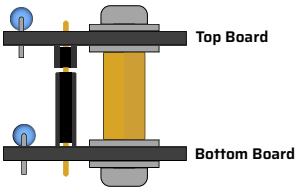


Figure 1: Board Mounting

PIN HEADERS:

The top and bottom boards are electrically connected through socketed pin headers. The bottom board requires five (5) 2.54mm pitched single-row female 4-pin headers (minimum height 8.5mm). The top board requires five (5) 2.54mm pitched single-row male 4-pin headers. See Figure 1 for placement guide.

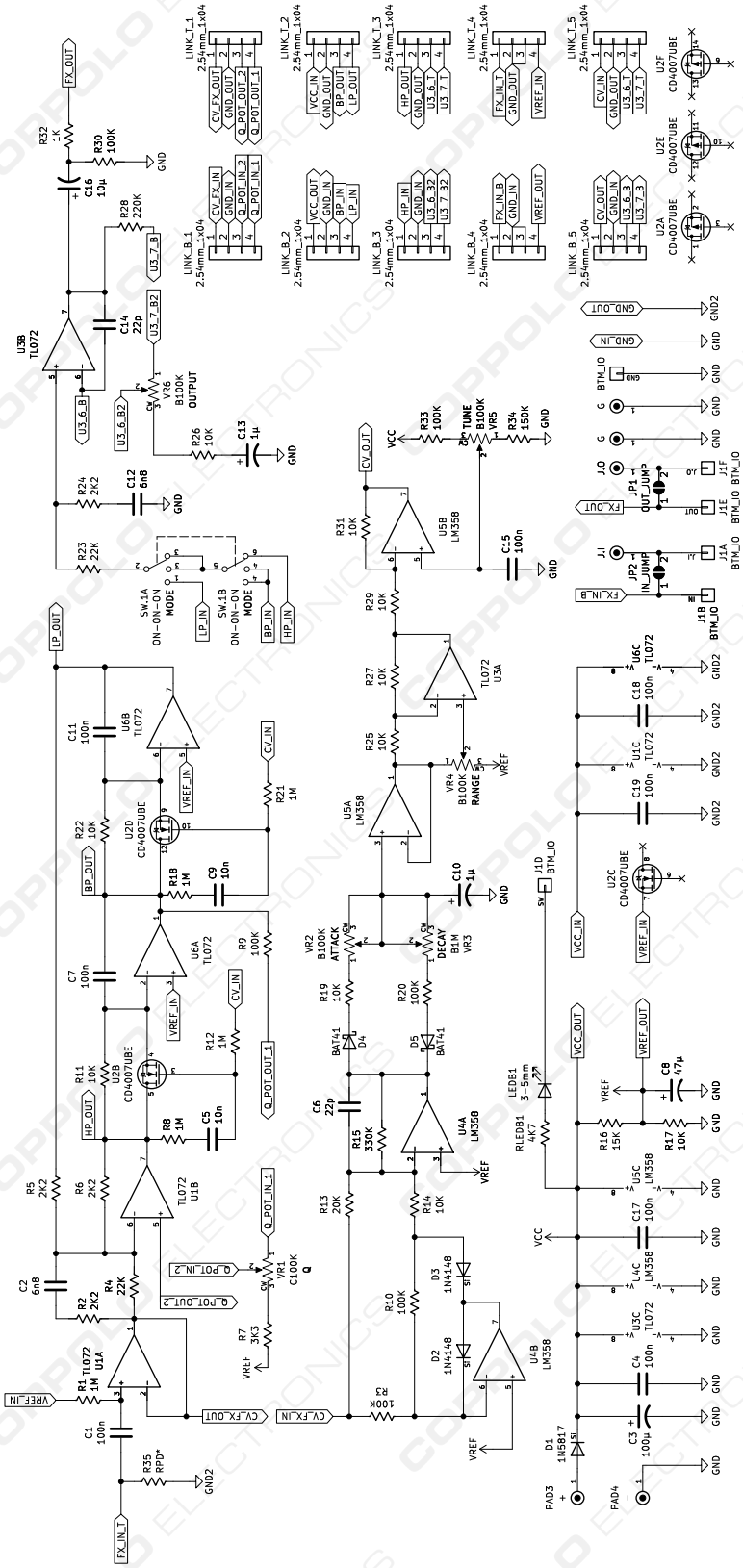
M3 FASTENERS (SCREWS, WASHERS, SPACER):

The top and bottom boards are electrically connected through socketed pin headers, but mechanically secured together using a fastener. The assembly stack is as follows (listed from bottom to top): M3 machine screw, M3 washer, bottom board, M3 washer, M3 spacer, M3 washer, top board, M3 washer, M3 machine screw. See Figure 1 for an assembly order example.

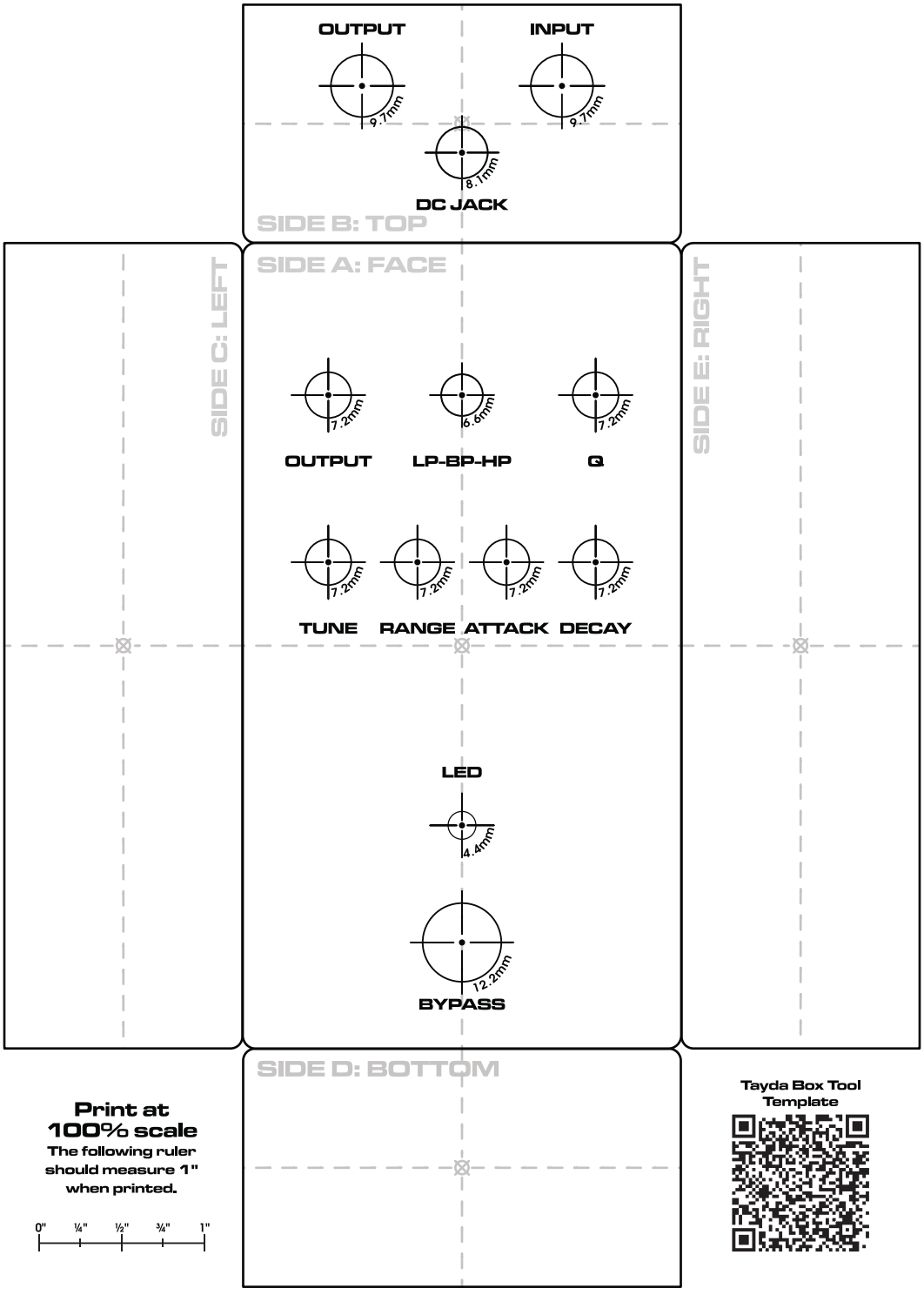
JUMPERS FOR TOP BYPASS:

When assembling this project, you may notice that there are jumper pads on the back of the board. If you're using a CE Soft-Touch Relay Bypass I/O board with your project or you wish to have always-on operation (with no bypass switch), bridge these jumper pads with solder. Otherwise, leave these jumpers open. Jumpers on the input side bridge the JACK IN (J.I) and circuit IN. Jumpers on the output side bridge the JACK OUT (J.O) and circuit OUT.

SCHEMATIC



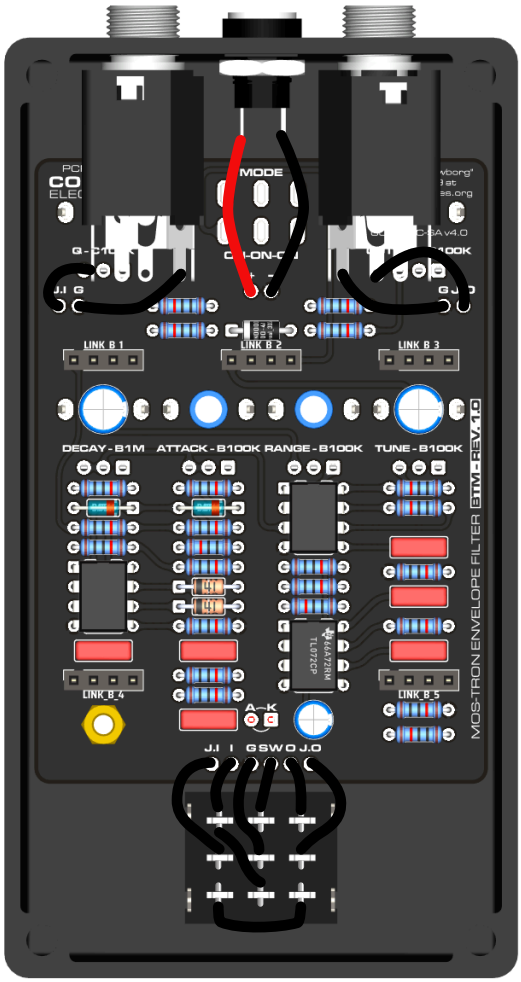
DRILL TEMPLATE



125B ENCLOSURE

WIRING GUIDE

A generalized wiring example is shown below. It's recommended to keep wire lengths to a minimum to avoid potential for oscillation. The image shown may not reflect this specific project or the most recent iteration of this project.



CONTROLS

CONTROL	DESCRIPTION
OUTPUT	Adjusts the overall output level of the circuit.
LP-BP-HP	Toggles between low pass, band pass, and high pass modes of the two-pole state-variable envelope controlled filter.
Q	Adjusts resonance of the filter.
TUNE	Adjusts the variable offset of the envelope output. There may be a small amount of deadzone in the very beginning and end of this control due to tolerances and the full range of the envelope detector. This control, together with the Range control, gives a wide range of adjustability over the envelope detector sidechain.
RANGE	Adjusts the envelope polarity, the width of the sweep, and the range of the sweep (in conjunction with the Tune control). With Range at 12 o'clock, there's no envelope modulation. Turning clockwise increases the amount of positive modulation (sweeps upwards). Turning counterclockwise increases negative modulation (sweeps downwards).
ATTACK	Adjusts the attack of the sidechain envelope detector circuit.
DECAY	Adjusts the decay of the sidechain envelope detector circuit.

ACKNOWLEDGEMENTS

Thank you to Dylan159 from freestompboxes.org for providing this circuit to the community. The original circuit can be found at the following:
Chewborg Envelope Filter

TROUBLESHOOTING

Unless you find a serious defect with the circuit board or this documentation, we do not provide direct support for issues faced when building this project. This project is not intended for first time builders. There are other sources for guitar pedal projects that may be better suited for beginners.

Although they are far from comprehensive, following the steps below may be helpful in diagnosing common mistakes when building projects like this one:

1. Verify that all components are installed, fully seated, and match the value(s) listed in the Bill of Materials. If you deviated from these values, it may be difficult to diagnose problems.
2. Verify that off-board wiring is connected properly to the corresponding pads on the board.
3. Check your workmanship:
    - Evaluate solder joints and reflow them as needed.
    - Ensure that component leads are tidy and trimmed to an appropriate length.
    - If any component shows signs of overheating during the soldering process AND the problem could be related to the part in question, it may be appropriate to replace it.

If your project still isn't working after following the steps above, PedalPCB has an awesome community of fellow builders that can be very helpful. Consider opening a new thread at PedalPCB's troubleshooting forum.
Troubleshooting

**Be sure to include a thorough description of the problem along with detailed pictures of the front and back of your circuit board.*

NON-AFFILIATION DISCLAIMER

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DOCUMENT REVISIONS

VERSION	DATE	COMMENT
1.0.1	3/18/24	Updated drill template to correct toggle drill size.
1.0.0	3/13/24	Initial release.