

## **BMC098. Toggle Router**

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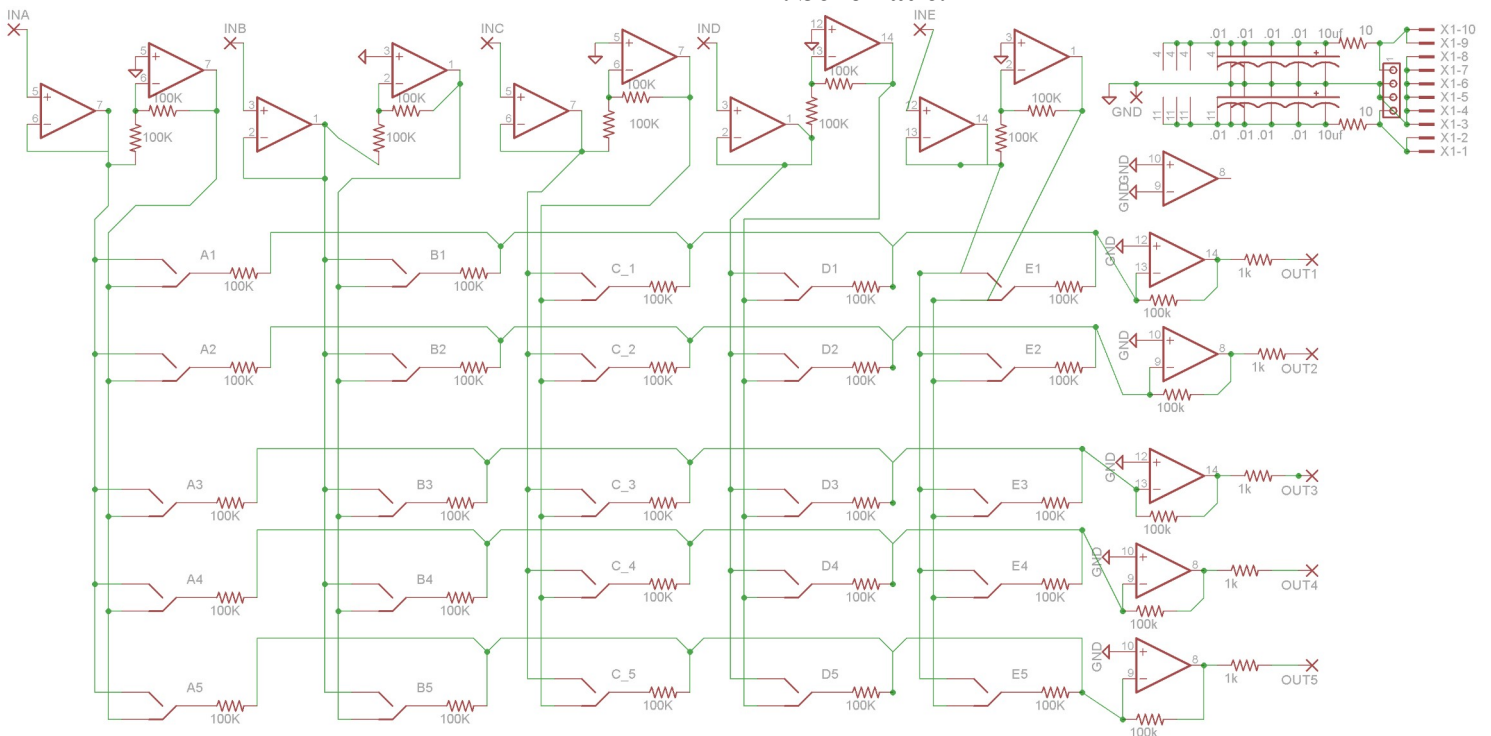
## I. Overview

This module controls the routing of signals from five inputs (A, B, C, D, E) to five outputs (1, 2, 3, 4, 5) by manipulating toggle switches. Every input has inverted and non-inverted versions of the signal available and every output is a unity gain mixer. This allows the module to be used as a buffer, inverter, mixer or differential amplifier.

Each combination of input and output has a toggle switch associated with it (25 total). Each toggle is 3-position, when in the center position no signal is passed to the output, when the toggle points down the non-inverted signal is passed and when toggle is pointing up, the inverted signal is passed.

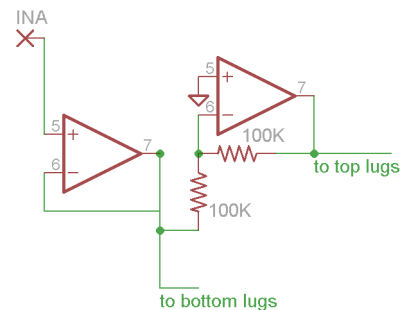
This module will work on 15V systems without modification.

## II. Schematic.

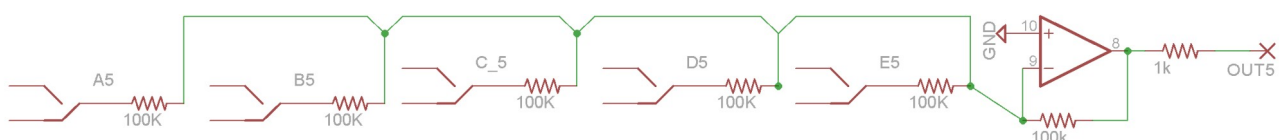


Above is the schematic for this module. The module is composed of five input sections, five output sections, the toggles that make the connections and some power connections.

To the right is an input section isolated. Input signal comes from the IN wirepad to the input of an op-amp wired as a unity buffer. The output of this is sent to the bottom lugs of the toggles. The buffer's output is then inverted by a second op-amp wired as an inverting amplifier stage with a gain of -1. The output of this section goes to the top lugs of the toggles.



Below is an output section isolated. The center lug of each toggle connects to a 100K resistor that leads to the negative input of an op-amp wired as inverting mixer. When the toggles connect to the top lug, they receive an inverted version of the input which is then sent to the inverting output section and the result is a non-inverting output. When the bottom lug is connected, the output becomes inverted by connecting it to non-inverting inputs. The 100K feedback resistor on the output op-amps sets the gain at -1, and a 1K resistor protects the op-amps output from short circuits.



### III. Construction

#### A. Parts List

##### Semiconductors

Name	Quantity	Notes
TL064	4	14pin DIP. Any quad-op with this pinout should be fine

##### Resistors

Name/Value	Quantity	Notes
10 ohm	2	1/4w metal Film for all resistors unless otherwise noted
1K ohm	5	
100K ohm	40	

##### Capacitors

Name/Value	Quantity	Notes
10nf / .01uf	8	Ceramic disc type, value not critical
10uf	2	Electrolytic rated at least 16V

##### Other

Name/Value	Quantity	Notes
Power connector	1	Eurorack or MOTM
Jacks	10	
14 pin DIP socket	4	
Sub Mini SPDT on-off-on PCB mount toggles	25	<a href="#">I used these in my build.</a>

#### B. The PCB

The PCB is 82mm x 56mm. The toggles are spaced 12.7mm apart horizontally and 18.41mm apart vertically.

The wirepad labeled “GD” is ground and should be wired to the sleeve of a jack. All other wirepads should be connected to the tip of the corresponding jack. Inputs are labeled “INA” through “INE” and outputs are labeled “OUT1” through “OUT5.”

Renderings of the PCB and photos of my build are on the next pages.

When populating the PCB, I suggest installing the toggles last, and only soldering one pin of the toggle before mounting the PCB to the panel. This will allow for a little more flexibility when mounting to the panel. Solder the rest of the pins after mounting.





