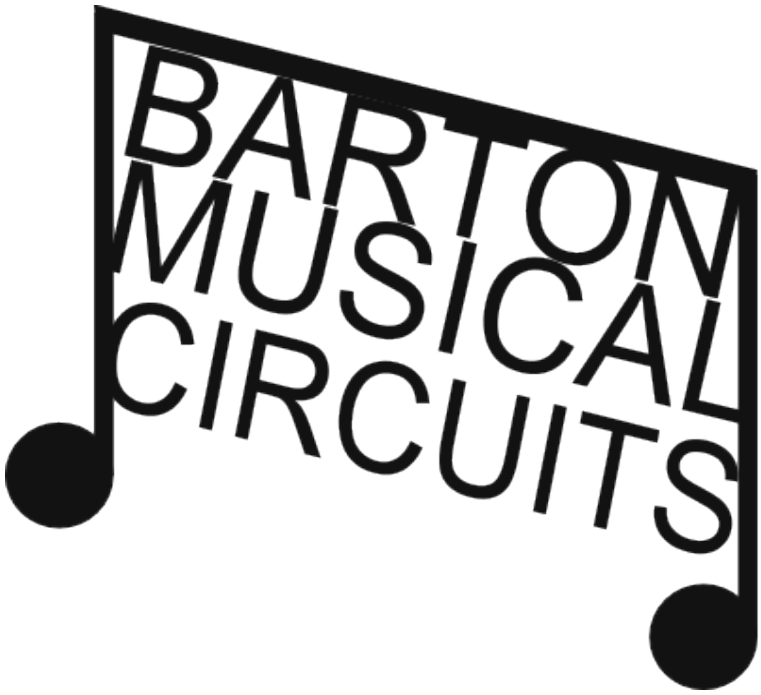


BMC051. Preset Rhythms.

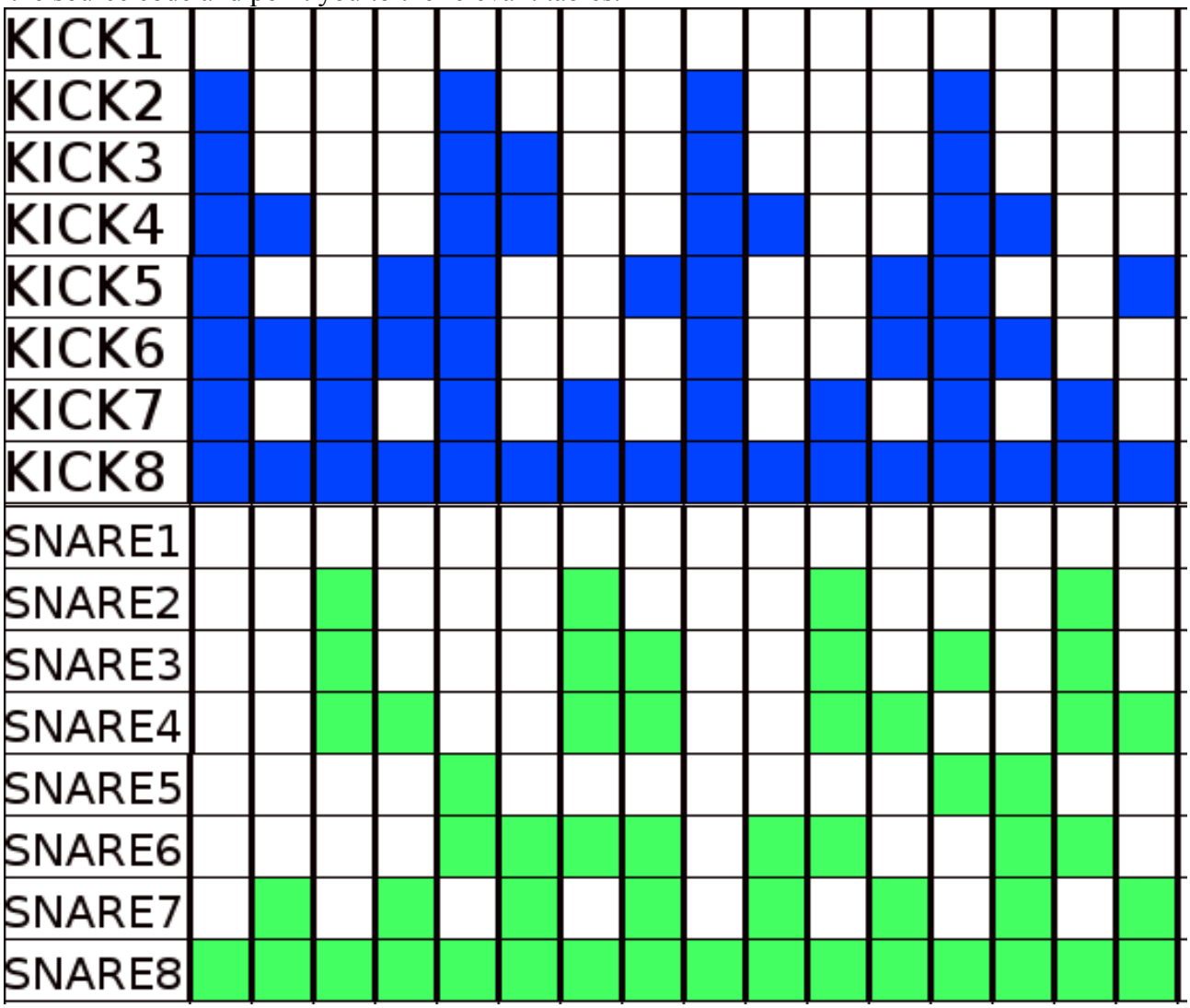
Last updated 6-12-17

I. Features

A.How it works

This module was initially inspired by preset rhythm patterns from cheap keyboards that I played with as a child. The design started with just single knob to select a rhythm pattern and evolved into the current version which has separate controls for selecting kick and snare as well as an internal clock generator.

The preset rhythm patterns are displayed on the graphs below. If you have access to a PIC programmer and would like to alter the patterns on your build, please email me and I will send you the source code and point you to the relevant tables.

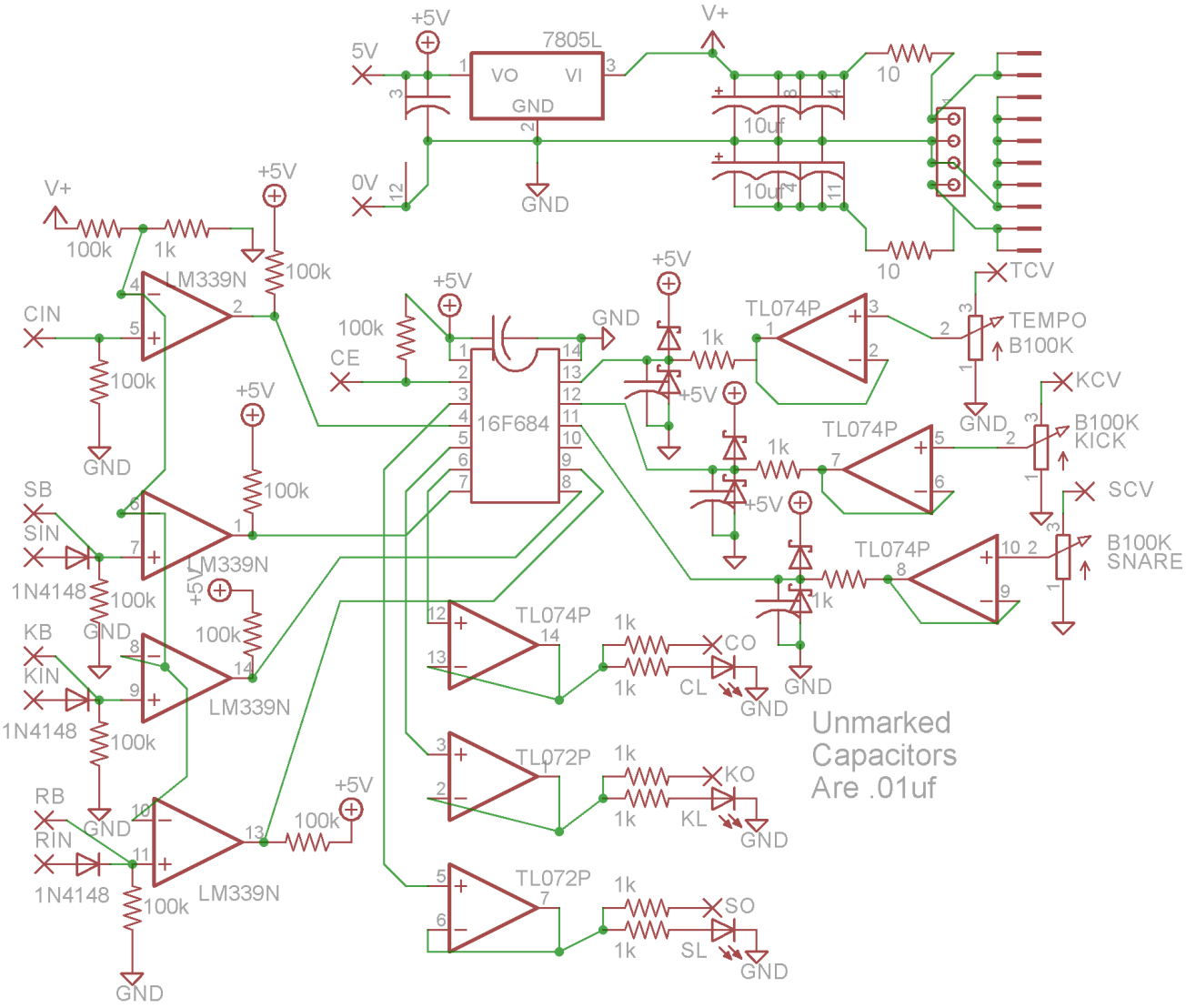


B.Controls/Inputs/Outputs

1.Tempo Knob – When using the internal clock, this sets the tempo and when using an external clock this controls a divider for the external clock. Set the tempo knob to the fastest position to have no division of the external clock.
2.Kick Select Knob – This knob selects which kick pattern is being outputted. The position of the knob is not registered until the Kick button is pressed or a trigger/gate goes high on the kick input.
3.Snare Select Knob – This selects the snare pattern with the same caveats about position as the kick knob.
4.Kick button – This button tells the PIC to read the position of the kick knob. This allows for more musical transitions in rhythm.
5.Snare button – This button tells the PIC to read the position of the snare knob.
6.Reset button – This button tells the PIC to go back the first beat of the pattern on the next clock

tick. The Reset button is also used in calibrating the trigger length.
7.Reset input – A positive voltage on this input will sent the pattern back to the first beat on the next clock tick.
8.Clock input – This is an external clock input. When using an external clock, the tempo knob will act as a divider.
9.Kick Input – This input works in parallel with the kick button. A positive voltage will cause the PIC to read the kick knob.
10.Snare Input – This input works in parallel with the snare button.
11.Tempo CV Input – This is a CV input for controlling the tempo/division. When something is plugged into this jack, the tempo knob will attenuate for the external voltage. The CV range is 0 to 5V for this and the other CV inputs.
12.Kick CV Input – This is a CV input for controlling the kick pattern. Inputting something causes the kick knob to attenuate the external voltage.
13.Snare CV Input – This is a CV input for controlling the snare pattern. Inputting something causes the snare knob to attenuate the external voltage.
14.Clock Output – This outputs triggers for the clock.
15.Kick Output – This outputs triggers for the kick.
16.Snare Output – This outputs triggers for the snare.

II. Schematic.



Above is the schematic for this project. The 16F684 is the heart of the module, it processes the input circuitry from the external voltages and gates and creates the triggers. Pin 2 of the PIC has a 100K pull up resistor and is attached to the "CE" or "Clock Enable" wirepad. This wirepad will

be connected to the ring connection of the clock input jack, which should be a stereo jack. Because mono plugs are used in modular systems, when a clock signal is plugged in, it will short pin 2 to ground, telling the PIC to switch to external clock mode.

On the left we see four comparators from an LM339 quad comparator chip. A 100K/1K voltage divider sets the threshold at 1/100 of the positive voltage rail. On the input of each comparator is a 100K pull down resistor, setting the input at 0V when the buttons are depressed and no gates are present. The gate input jacks all go through switching diodes and are in parallel with the buttons for the inputs. The output of each comparator has a 100K pull up resistor to 5V and is then sent the appropriate pin of the PIC.

To the right of the PIC, we see the potentiometers. The clockwise pin of each potentiometer is connected to a wirepad that will connect to the tip of the appropriate CV input jack. The switches of these jacks should be connected to +5V. The wiper of each potentiometer is buffered by an op-amp. The buffers output goes through a voltage limiting circuit formed by a 1K resistor and a pair of Schottky diodes which will clamp down the voltage when it exceeds the 0V-5V range of the PICs analog inputs. A .01 uf capacitor connected to ground is at the pin of each of the PIC's analog inputs to filter out high frequency noise.

Below the PIC are the output buffers. Each output goes through a 1K resistor and the display LED for each output's current is limited by a 1K resistor.

At the top of the schematic is the power supply. Connectors for Eurorack and MOTM systems are in parallel with each other. The positive and negative rails go through a 10ohm/10UF low pass filter. At the power pins for the op-amps are additional .01uf capacitors for high frequency filtering. The 5V supply is created by a 78L05 voltage regulator and this powers the PIC and the comparator which have .01 uf capacitors at their power pins as well.

III.Construction

A.Parts List

Semiconductors

Value	Qty	Notes
16F684	1	Provided with PCB
TL074	1	14 pin DIP packaging
TL072	1	8 pin DIP packagin
LM339	1	14 pin DIP package
78L05	1	TO-92 packaging
1N4148	3	Or other small signal switching diode.
BAT41	6	Or other schottky.
LED	3	3mm package

Resistors

Value	Qty	Notes
10 ohm	2	7.5mm lead spacing, 1/4W Metal film
1K ohm	10	" "
100K	10	" "
B100K Potentiometer	3	16mm pot, PCB mounted, Linear taper.

Capacitors

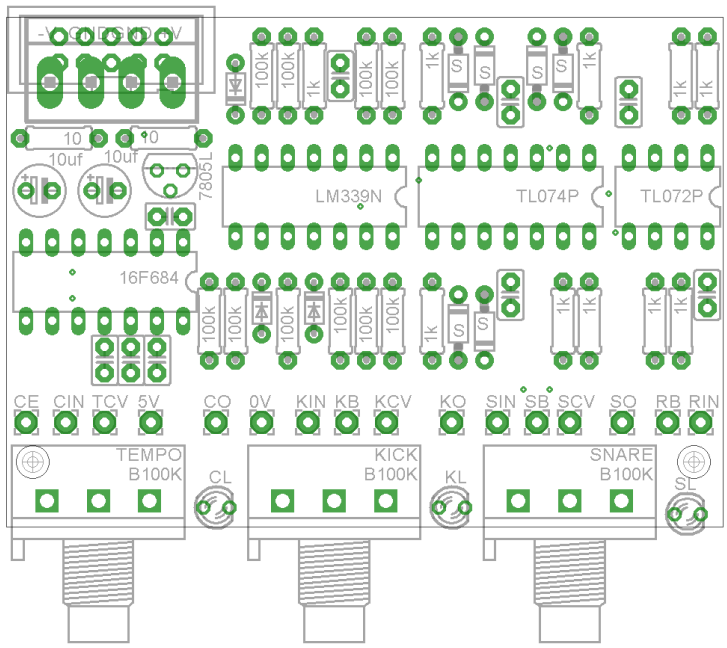
Value	Qty	Notes
.01uf	9	cheap ceramic 2.54mm, value not critical
10uf	2	Electrolytic

Other

Value	Qty	Notes
Power Connecter	1	Either Eurorack or MOTM
14pin DIP Socket	3	
8pin DIP socket	1	
Stereo jack	1	
Mono Jack	9	3 of these should be switching
Knobs	3	
Pushbutton	3	Panel mount, momentary normally disconnected.

B.The Board

To the right is an image of the PCB. It is 70mm x 50mm. The pots are spaced 0.9” apart. The mounting holes are 2.525” apart.



The wirepads should be connected as follows:
5V – To the switch connectors of the Tempo CV jack, Kick CV jack, Snare CV jack and to one connecter of the Kick button, Snare button and Reset button.
0V – To the sleeve connector of the Clock input jack. If using a non-conductive front panel, then connect the sleeve connectors of all jacks.
CE – Ring connector of Clock In Jack
CIN – Tip connector of Clock In Jack
TCV – Tip connector of Tempo CV Jack
CO – Tip connector of Clock Out Jack
KIN – Tip Connector of Kick In Jack
KB – Unconnected side of Kick Button
KCV – Tip Connector of Kick CV Jack
KO – Tip connector of Kick Out Jack
SIN – Tip Connector of Snare In Jack
SB – Unconnected side of Snare Button.
SCV – Tip connector of Snare CV Jack.
SO – Tip connector of Snare Output Jack.
RB – Unconnected side of Reset Button Jack.
RIN – Tip of Reset Input Jack.

D.Calibrating Trigger Lengths

1.Turn off your modular system.
2.Hold down the reset button as you power your system on, continue pressing the button as you adjust.
3.The Kick and Snare outputs will both be firing on each clock tick when in calibration mode.
4.Adjust the Snare knob to set trigger length.
5.Depress the reset knob. Your setting will be saved even after you turn your modular system off.
6.Press the Kick and Snare buttons to select your desired patterns.