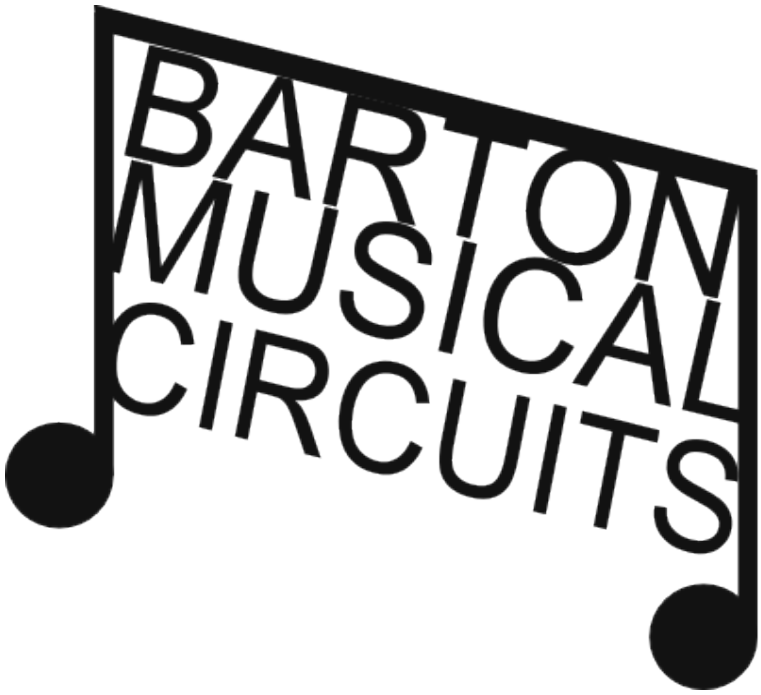


BMC048. Single Rhythm

Last updated 2-13-17

I. Features

A.How it works

This module is based on BMC27. Random Rhythms. Like that module, it is microcontroller based and uses a pseudo-random number generator to create rhythmic patterns. While that module provided four channels of random rhythm generation, this only provides one or two (depending on the mode selected), but adds the ability to save a randomly generated beat to EEPROM memory so it can be loaded later, even after powering the module off. The module is compatible with +/-12V or +/-15V systems without needing to substitute any parts.

B.Controls/Inputs/Outputs

CONTROLS

1.Length – This knob controls the length of the pattern. Length is measured by incoming clock beats. When the knob is fully counter clockwise the pattern will be 2 clock inputs long, and when fully clockwise it will be 256 clock beats long.
2.Divide – This knob controls the way in which the clock input is divided or multiplied when outputting beats. Adjusting this control will not affect length. When the knob is fully counter clockwise it will multiply the beat by 4 and when fully clockwise it will divide by 64.
3.New – This button will generate a new rhythmic pattern.
4.Reset – This button will reset the rhythmic pattern, so that on the next clock input it will return to the first beat.
5.Save – This button saves the current rhythm to the selected bank.
6.Load – This button loads the rhythm saved to the current bank.
7.Bank Select – This toggle selects which bank the save/load buttons will use. There are three banks available, depending on if the toggle is up, down or center.

INPUTS

1.Clock – An LFO or clock source should be input to this jack to control the tempo of the rhythms.
2.New – This input is in parallel with the New button, a gate signal on this input will create a new pattern.
3.Reset – Like the New input, it works parallel to the Reset button.

OUTPUTS

1.Gate – In normal mode, this outputs the gate. Both outputs alternate between 0 and +5V. It will turn on at the start of an on beat and stay on until an off beat.
2.Trigger – In normal mode, this outputs the trigger. It will turn on at the start of an on beat and stays on for about 1ms.

C. Alternate Modes/Mode Selection

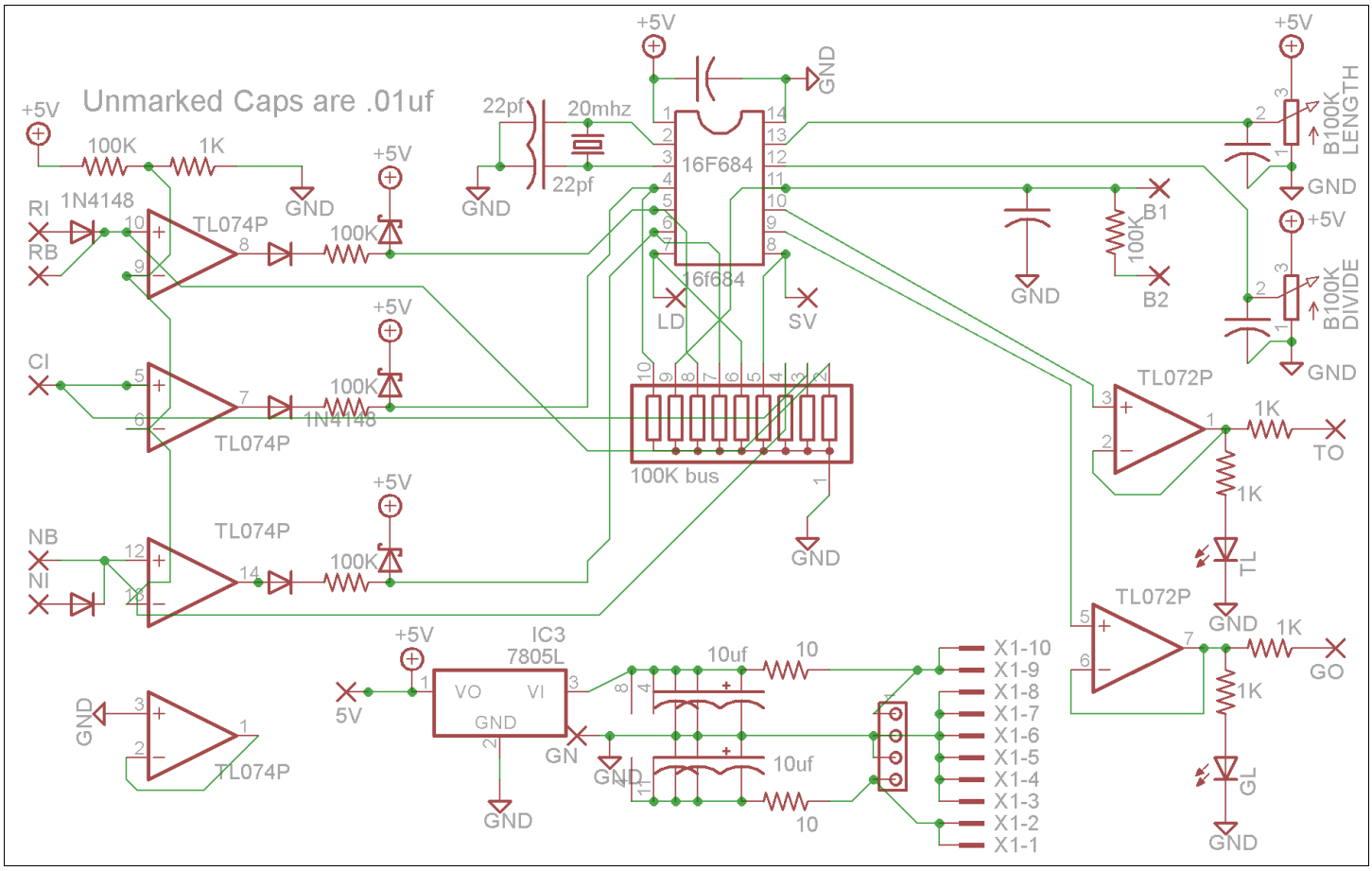
There are two alternate modes to this module, “Double Trigger” and “Double Gate.” In each mode, the two outputs will each output a separate rhythm while still sharing the same controls for length, division and save/load. Modes can be changed on power up, and your selection will be saved to the microcontrollers memory, so next time you power up your rack, it will be in the mode you set it to. Here are instructions for selecting a mode

1.Power off your modular system.
2.Turn the Division and Length knobs fully clockwise
3.Use the bank select toggle to select a mode. The toggle's selection is like this:
    UP = Normal Mode
    CENTER = Double Gates

DOWN = Double triggers

4.Hold down the reset button as you power on your modular system.

5.That's it!



II. Schematic.

Above is the schematic for this module's circuit board, offboard components like jacks and switches are not shown. On the far left are the wirepads for the input jacks and buttons. These are all sent to op-amps wired as comparators. The thresholds for the comparators are set by the 100K/1K voltage divider, setting the threshold at .01V. Each of these comparators output goes through a switching diode and 100K resistor in series with each other and then connecting to the appropirate pin of the microcontroller. The pin is in parallel with a schottky diode connected to the 5V supply which protects from over voltage, and a pin of a 100K bussed resistor array, which forms a voltage divider with the 100K resistor as well as keeping the pin at ground when no signal is presented from the comparator.

In the center is the microcontroller itself. A 20mhz Crystal and a pair of 22pf capacitors are used for timing the microcontroller's operations. The Load and Save wirepads are tied directly to the microcontroller and to the 100K bussed array. The B1 and B2 wirepads correspond to the bank select toggle. B1 is connected to a microcontroller pin and the 100K bus, while B2 goes through a 100K resistor first. So when 5V is applied to B1, the microcontroller pin will have 5V on it, but when 5V is applied to B2 it will only see 2.5V because the 100k resistor in series will form a voltage divider with the 100k bus.

In the upper right are the potentiometers for the divide and length controls. Each is a Linear 100K potentiometer wired as a variable voltage source. The wipers are connected directly to the microcontroller pins and .1uf capacitors which filter high frequency noise from the signal.

In the bottom right are two op-amps which buffer the outputs of the microcontroller. Each is wired as a unity gain buffer and it's output is sent to an LED through a 1k current limiting resistor and an output wirepad through a 1k resistor.

On the bottom are the power connections. Eurorack and MOTM style connecter footprints

are in parallel with each other. The positive and negative rails are filtered by a 10ohm/10uf passive filter. Each op-amp power pin has a .01uf capacitor for further filtering of high frequency digital noise. The 5V supply is created by the 7805L voltage regulator.

III.Construction

A.Parts List

Semiconductors

Value	Qty	Notes
16F684	1	Microcontroller. Provided with your PCB
TL074	1	14 pin DIP packaging
TL072	1	8 pin DIP package
BAT-46 Diode	3	Any small schottky diode will work.
1N4148	5	Any small switching diode will work.
7805L	1	TO-92 Packaging
LED	2	3mm
20mhz Crystal	1	HC49/S packaging

Resistors

Value	Qty	Notes
10 ohm	2	7.5mm lead spacing, 1/4W Metal film
1K ohm	5	" "
100K ohm	5	" "
100K resistor bus	1	10 pin bus, can also be DIYd using nine resistors.
B100K Potentiometer	2	16mm pot, PCB mounted, Linear taper.

Capacitors

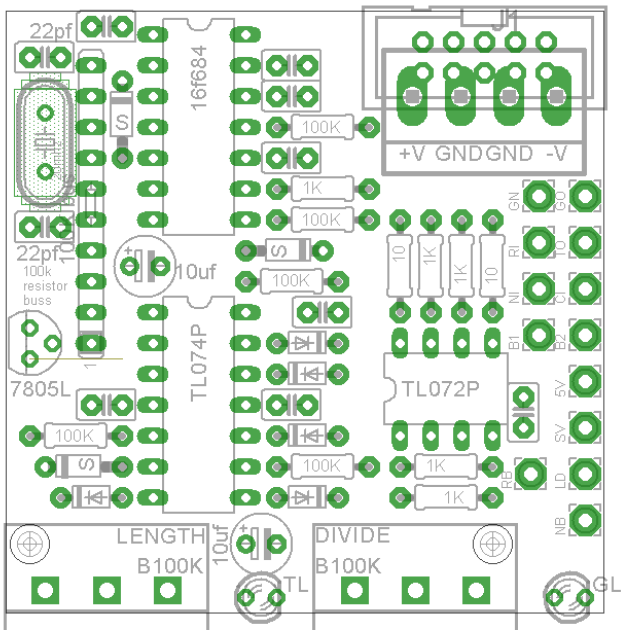
Value	Qty	Notes
22p	2	Cheap ceramic 2.5mm lead spacing
.01uf	8	cheap ceramic 2.5mm lead spacing
10uf	2	Electrolytic

Other

Value	Qty	Notes
Power Connecter	1	Either Eurorack or MOTM
8pin Dip Socket	1	
14pin DIP Socket	1	
Pushbutton	4	OFF-(ON) type

Toggle	1	ON-OFF-ON SPDT type
Jacks	5	
Knobs	2	

B. The PCB/Wiring instructions



To the right is the PCB. It is 50mm x 50mm. The pots are spaced 25.4mm apart, and the mounting holes are 38mm apart.

I advise doing offboard wiring in the following order:
1.Run wires from the center post of the toggle to one post of each pushbutton to the “5V” wirepad. I will use clipped resistor leads for connecting from switch to switch to save wire/wire stripping time.
2.Run wires from the other posts of the buttons to their corresponding wirepads, these are “NB” for New Button, “RB” for Reset Button, “LD” for Load and “SV” for Save.
3.Wire the post of the toggle switch closer to the PCB to the “B1” wirepad, and the post further to the “B2” wirepad.
4.Run wires from the tips of the jacks to the appropriate wirepads. “CI” is Clock In, “NI” is New Input, “RI” is Reset Input, “TO” is Trigger Output and “GO” is Gate Output.
5.Run a wire from the “GN” wirepad to the sleeve of one of the jacks.

Below is a diagram showing how to install the LEDs onto the PCB.