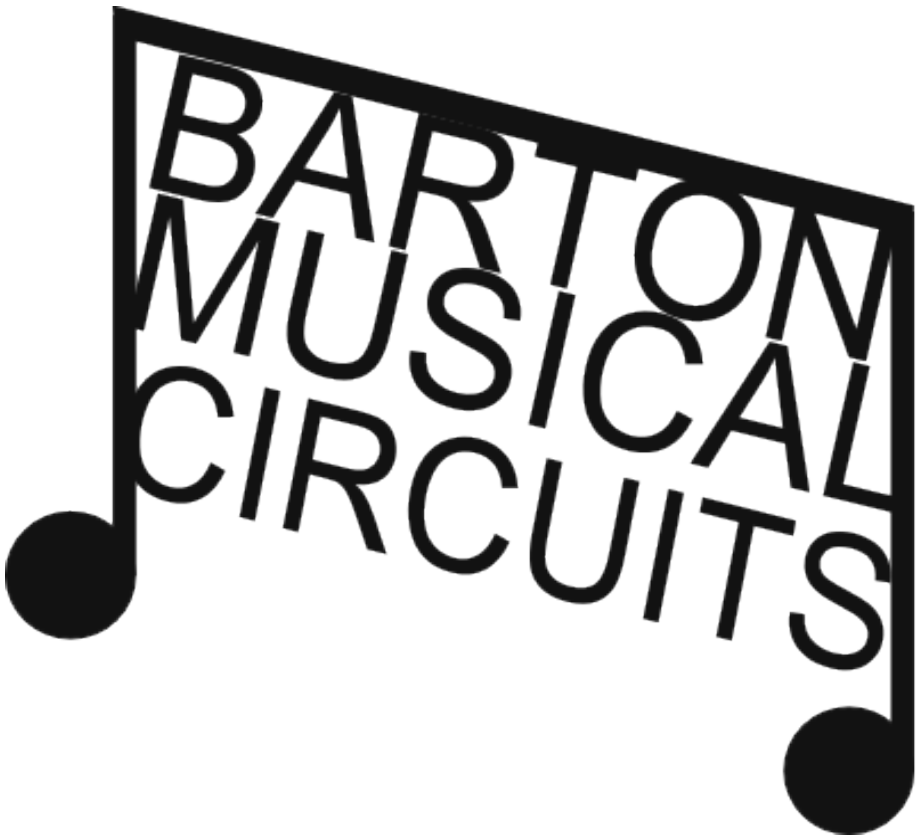


BMC 084. Two Channel Voltage To Rhythm Converter Build Documentation.

I. Using The Module.

This is a compact, easier to build version of BMC006 Voltage To Rhythm converter. This module abandons BMC006's internal clock, reset input, parallel mode and clock dividers, as well as six channels of output.

The module samples an input voltage, converts it to an 8-bit binary number and then outputs that number as an 8-beat long rhythm. 0's in the binary number are off-beats and 1's are on-beats.

This module compatible with +/-12V or +/-15V power systems by changing the values of 3 resistors.

The outputs can be set to gates or triggers. To change between gates and triggers, turn the module off, turn the offset knob fully clockwise and hold down one of the sample buttons as you turn the power on. Holding down sample 1 will set the module to output triggers, and holding down Sample 2 will set the module to output gates.

INPUTS/OUTPUTS

1.Clock – Any waveform can be used as a clock. I have not tested for maximum clock speed but the module appears to function normally at low audio rates.

2. Voltage In – This is the input for the voltage that will be sampled. It will be conditioned by the Volt Offset and Volt Attenuate controls.

3. / 4. Sample 1/2 – These inputs works parallel to the Sample 1/2 Buttons, when a gate/trigger is input the voltage in will be sampled to determine channel 1 or 2's rhythm.

5. / 6. Out 1 / 2 – These are the outputs for the two channels, outputting +5V gates or triggers.

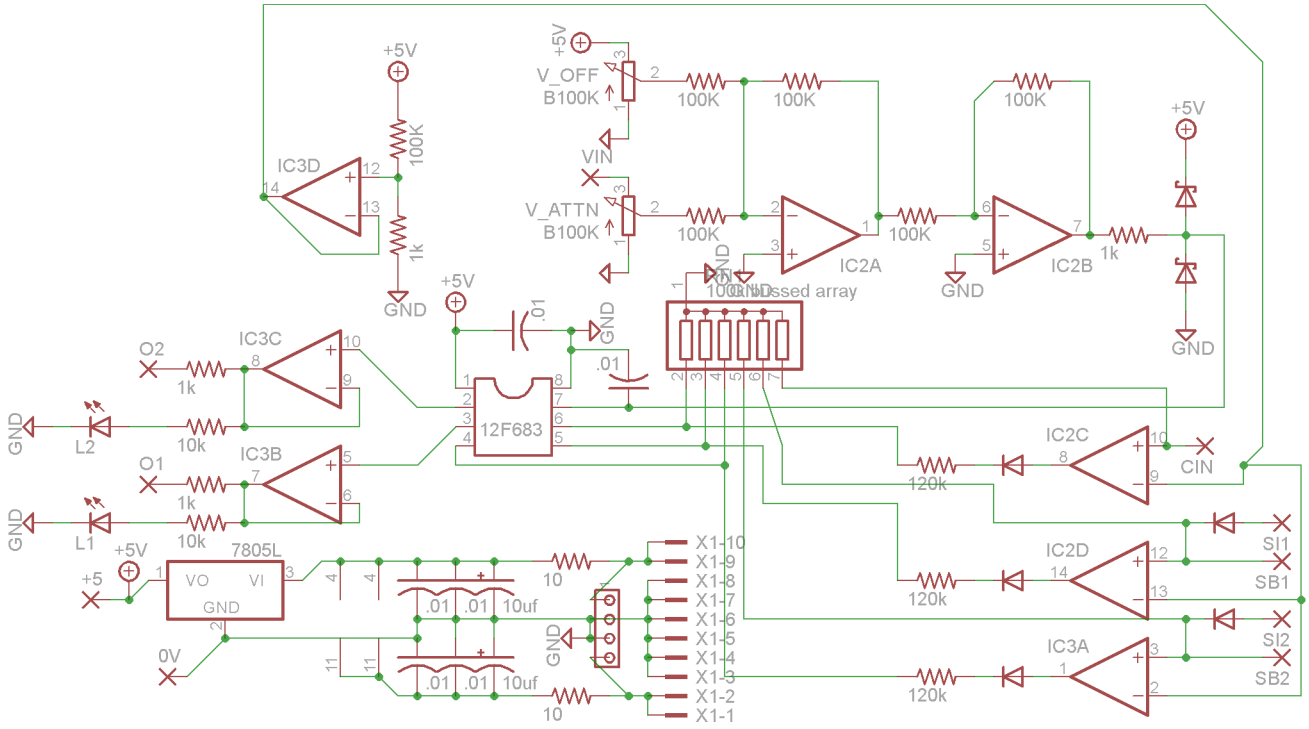
CONTROLS

1.Voltage Offset Knob – This knob provides a positive offset that is applied to the voltage input. When no voltage is input it can act as a manual voltage source with a range of 0 to +5V. When inputting bipolar signals, a positive voltage offset is required to get the entire signal within the analog-to-digital converters 0 to +5V range.

2. Voltage Attenuate Knob – This knob attenuates the voltage input, useful for conditioning signals with a voltage swing larger than +/-2.5V.

3. / 4. Sample 1 / 2 buttons – When these buttons are pressed the voltage in will be sampled to determine channel 1 or 2's rhythm.

II. Schematic.



Above is the schematic for this module. At the center is the 12F683 PIC microcontroller. It's powered by the +5V supply. Immediately to it's right we see a 100k bussed resistor array which provides six 100K resistors referencing ground, these connect to input pins of the 12F683 and to the comparators in the bottom right corner.

The comparators are used to clean up the input signals that would be sent to clock and sample inputs. The wirepads for these inputs are marked CIN, SI1 and SI2. The sample inputs are in series with switching diodes to protect the outputs of the modules patched into them from being exposed to this module's +5V power supply from the sample buttons (marked SB1 and SB2). The threshold of each comparator is set by IC3D's output, which is a buffered .05V. The buffer is unnecessary, but I had a spare op-amp. The comparators outputs go through switching diodes to only pass positive voltages and then to 120K/100K resistor pairs (using the resistor array as the 100K resistors to ground) forming voltage dividers that would reduce the +12V output of the op-amp down to ~4.5V. **If using +/-15V power supply, replace the 120K resistors with 200K resistors.**

The CV inputs are above with the VIN wirepad being attenuated by the V_ATTN potentiometer before being mixed with the offset voltage from V_OFF. A pair of inverting op-amps with a gain 1 are used to mix these signals. Their output is then sent through a 1K resistor and onto a pair of schottky diodes referencing +5V and ground. These schottkys will prevent over-voltage/under-voltage from damaging the microcontroller. The signal is then filtered by a .01uf capacitor next to pin 7.

The outputs of the PIC are sent to a pair of op-amps wired as unity buffers. The output of each buffer is sent to a wirepad for the output jack through a 1K resistor. The outputs are also sent to indicator LEDs through 10K resistors. To increase the brightness of the LEDs, replace these with smaller resistors.

At the bottom left of the module are the power connections. Footprints for Eurorack and MOTM style connectors are in parallel. The positive and negative rails are filtered by a 10ohm/10uf capacitor pair and further filtered at the TL074's power rails by .01uf capacitors.

III. Construction

A. Parts List

Semiconductors

Value	Quantity	Notes
TL074	2	14 pin DIP
12F683	1	Provided with your PCB
7805	1	TO-92 package
1N4148	5	Or any small switching diode
BAT-41	2	Or any small schottky diode
LED	2	3mm

Resistors

Value	Quantity	Notes
10 ohm	2	5mm lead spacing. Use 3.5mm body length or stand up
1K ohm	3	
10K ohm	2	
100K	6	
120K	3	
100K bussed array	1	7 pin, or make your own
B100K Potentiometer	2	PC Mounted 16mm

Capacitors

Value	Quantity	Notes
.01uf	6	Small ceramic disc. Value not critical
10uf	2	Electrolytic

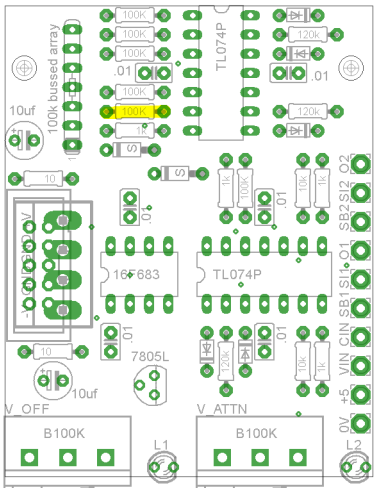
Other/Off Panel

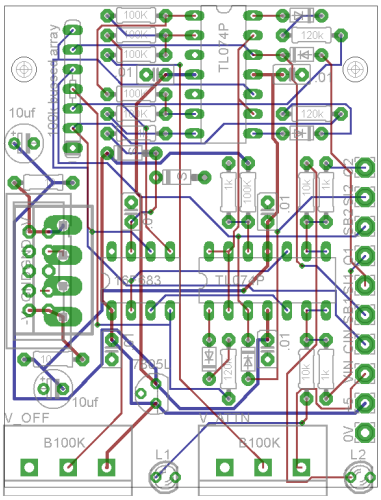
Value	Quantity	Notes
Power connecter	1	Eurorack or MOTM style
Jacks	6	
Pushbuttons	2	
8 pin DIP Socket	1	
14 pin DIP socket	2	
Knobs	2	

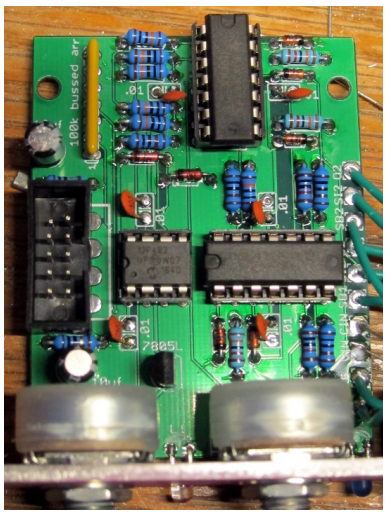
B. PCB Layout

Below are renderings of the PCB. The rendering showing the traces does not show the ground fill plane, so assume any missing connection is a ground fill. The right is a photo of a completed board.

The PCB measures 62mm x 49mm and the pots are spaced 25.4mm (1 inch) apart.







TROUBLESHOOTING – In one of my prototype builds I had trouble getting the PIC to register a full +5V sample using just the V_OFF knob. I replaced the 100K resistor highlighted in yellow (next to pin 6 of the top op-amp) with a 120K and it fixed the problem.

WIRING The wirepads should be connected as follows:

0V → The sleeve of any jack, if you're using a metal panel, you're done. If using a non-conductive panel, then also connect your jack sleeves together.

+5 → Connect to further terminal of the Sample 1 Button, then run a jumper from this connection to further terminal of Sample 2 Button

VIN → Tip of the voltage input jack

CIN –> Tip of the clock input jack

SB1 –> Connect to the closer terminal of the Sample 1 Button

SI1 → tip of the sample 1 jack

O1 → Tip of the Output 1 jack

SB2 → Connect to the closer terminal of the Sample 2 Button

SI2 → Tip of the sample 2 jack

O2 → Tip of the output 2 jack