

BMC107. Dual Comparator With Logic Outputs

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I Features

- What it does/Controls
- Example Patches

II Schematics

III Construction

- Parts List
- PCB information
- 15V builds

I. Features

This module is composed of two voltage controlled comparators which are gate outputs that turn on when an input voltage exceeds a threshold voltage. Four additional gate outputs turn off and on depending on the relative outputs of the comparators. This was initially designed as a way to add soft-sync features to VCOs that only have hard-sync, but has also been useful for turning envelope generators into gated loops.

CONTROLS

1. Threshold Knobs – Each channel has a knob that sets the threshold voltage, ranging from -6V when turned completely counterclockwise to +6V when fully clockwise. If you want the gate output to turn on more, turn this knob to the left to lower the threshold voltage, and do the opposite to have the output turn on less.
2. Threshold CV Knobs – These knobs attenuate the control voltage inputs for the threshold. The voltage input is mixed with the voltage from the threshold knob, so inputting positive voltages will increase the threshold voltage.

INPUTS/OUTPUTS

1. Voltage Inputs – One for each channel, this is the voltage that is compared to the threshold voltage. Any synthesizer signal can be input here.
2. Control Voltage Inputs – One for each channel, these are inputs for threshold modifying voltages.
3. Comparator Out – One for each channel, the +5V gate outputs for each comparator.
4. Both On Out – This output goes high when both comparators outputs are on.
5. 1 On Only Out – This output goes high when only channel 1 is on.
6. 2 On Only Out – This output goes high when only channel 2 is on.
7. Neither Out – This output goes high when neither channel's output is high.

MP3 Demos

[1.Variable Soft Sync](#)

Two VCOs are used as inputs for BMC107, the BOTH output is plugged into the hard sync input of one of the VCOs. This sets it so the VCO will reset it's phase only when both VCOs outputs are above thresholds, meaning they are somewhat in phase already. Threshold voltages are modulated both by hand and by envelope.

[2.Gated Envelope Loop](#)

An envelope generator's output is plugged into input one of BMC107 and a gate is plugged into input 2. The 2 ONLY output is then plugged into the input of the envelope generator. This sets it so the envelope restarts its phase when the release is below the threshold and the gate is on. Increasing the threshold on channel 1 will cause the loop to reset faster, but not go through it's entire release phase.

[3.Psuedo-Random Beat generator](#)

LFOs set to close frequencies are used as inputs. Each output is sent to a different percussion module. As the phases change between the inputs the different gates fire and create a shifting rhythm.

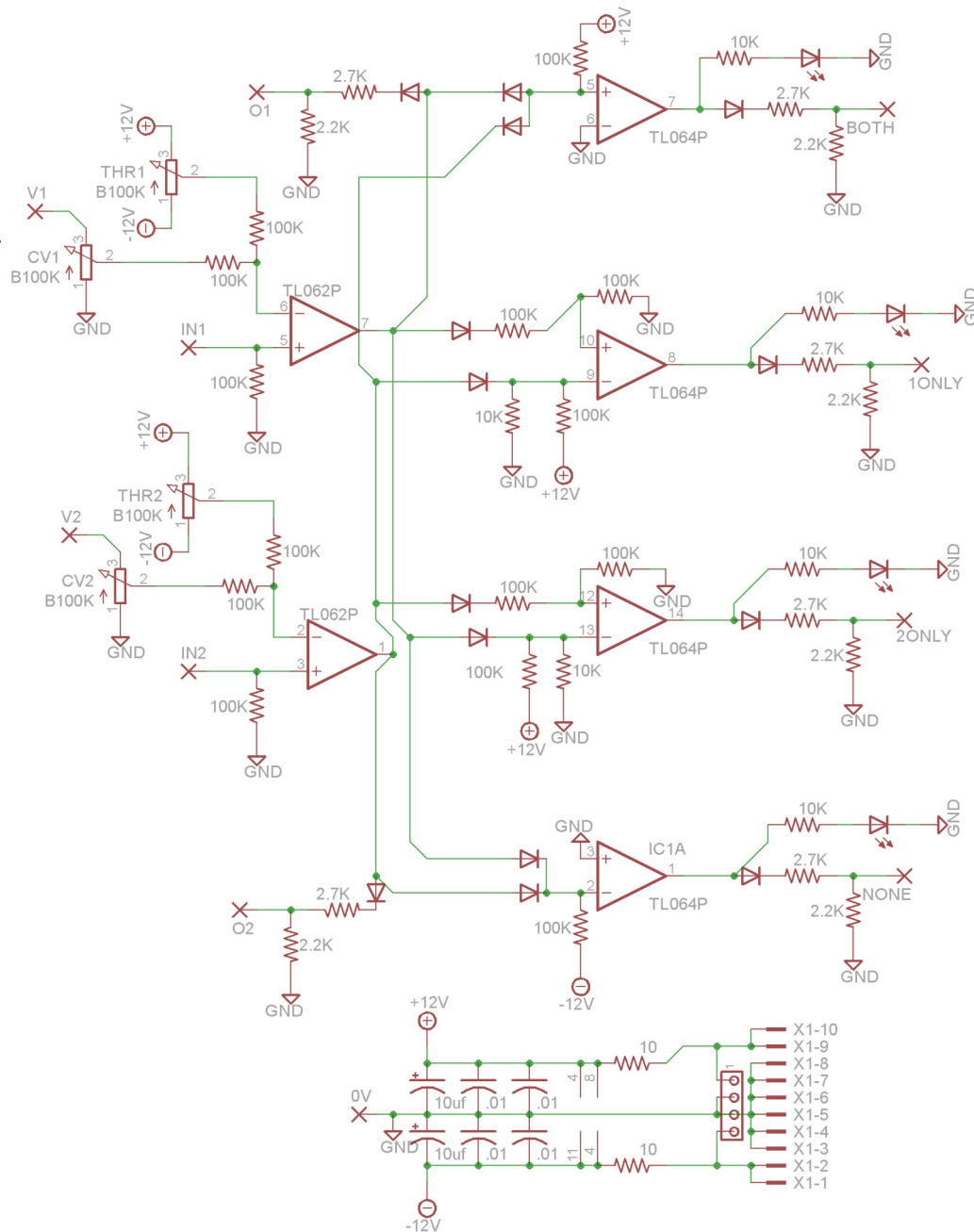
II Schematic

To the right is the schematic. IN1/IN2 wirepads each connect to a 100K resistor providing ground reference and the positive input of an op-amp wired as a comparator. The negative input of the comparator sets the threshold, the voltage is mixed by two 100K resistors, each of which connects to the wiper of a pot. The THR1/THR2 pots are wired to create a variable voltage between +/-12V, and the CV1/CV2 pots are wired as attenuators for the control voltage inputs. The jacks for the CV inputs for threshold should be normalized to ground so that the CV1/CV2 pot position doesn't affect threshold when nothing is plugged into the jack.

The outputs of the comparators go to the O1/O2 wirepads through a diode to pass only positive voltages and then a 2.7K/2.2K voltage divider to lower the op-amps output to +5V. These then connect on to the op-amps for the logic outputs.

Starting at the BOTH output on top, the negative input is grounded, setting threshold at 0V. The positive input is connected to a 100K resistor to the +12V supply, and to diodes from the comparators output that are set to only pass negative voltages. This makes it so either comparator being negative sets the voltage to -12V and the BOTH output is off, but when both are on, the voltage from the 100K resistor to +12V flows to the positive terminal and the output turns on. The output connects to its wirepad the same way as the O1/O2 did, but with the addition of an indicator LED and a 10K current limiting resistor.

The 1ONLY and 2ONLY outputs have the same layout as each other, but with their inputs swapped. The positive terminal is connected to a 100K resistor to ground, and a 100K resistor in series with a diode to a comparator output. This means when the comparator is off, the voltage here is 0V and when it turns on, the two 100K resistors act as a voltage divider and the voltage will be +6V. The negative terminal connects to a 10K resistor to ground and 100K resistor to +12V and a diode to a comparator output channel. The 100K/10K form a divider setting the threshold at +1.2V, but when the comparator fed to this terminal turns on, the voltage goes up to +12V. The only state in which this output turns on is when the comparator to the positive terminal is on, and the negative



terminal is off.

The NONE output is set up like the BOTH output, but with polarities reversed. The positive terminal is grounded instead of the negative terminal, the 100K resistor goes to -12V and the diodes are reversed to only pass positive voltages.

At the bottom of the schematic are power connections. Eurorack and MOTM connectors are in parallel, with their positive voltage rails filtered by a 10ohm/10uf passive filter. .01uf capacitors are placed next to the power pins of op-amps to further filter.

III. Construction

Parts List

Semiconductors

Value	Qty	Notes
TL064	1	Or any quad package op-amp with the same pinout.
TL022	1	Or any dual package op-amp with the same pinout
1N4148	14	
3mm LED	4	

Resistors

Value	Qty	Notes
10 ohm	2	1/4W Metal Film
2.2K	6	1/4W Metal Film
2.7K	6	1/4W Metal Film
10K	6	1/4W Metal Film
100K	14	1/4W Metal Film
B100K potentiometer	4	16mm PCB mounted

Capacitors

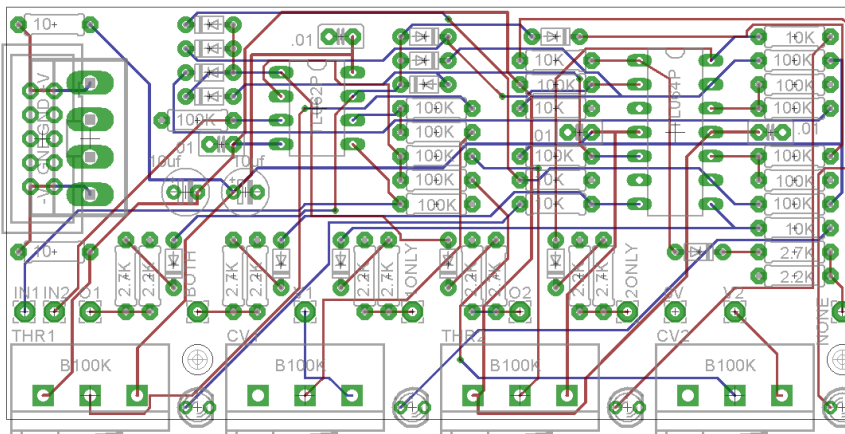
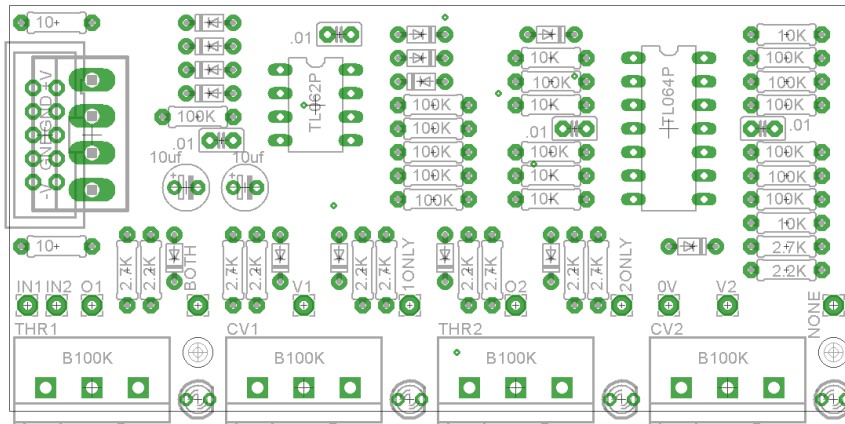
Value	Qty	Notes
.01uf	4	Ceramic disc. 2.5mm lead spacing
10uf electrolytic	2	Non-polarized can be used if at least 15V voltage rating.

Other

Value	Qty	Notes
Power Connector	1	Eurorack or MOTM style
Jack	10	At least two should be switching jacks
Knob	4	
14 Pin DIP socket	1	
8 Pin DIP socket	1	

The Board

Below are renderings of the PCB both with and without traces shown. The PCB's dimensions are 92mm x 44mm, the pots are spaced 22.86mm and the mounting holes are spaced 68.58mm apart.

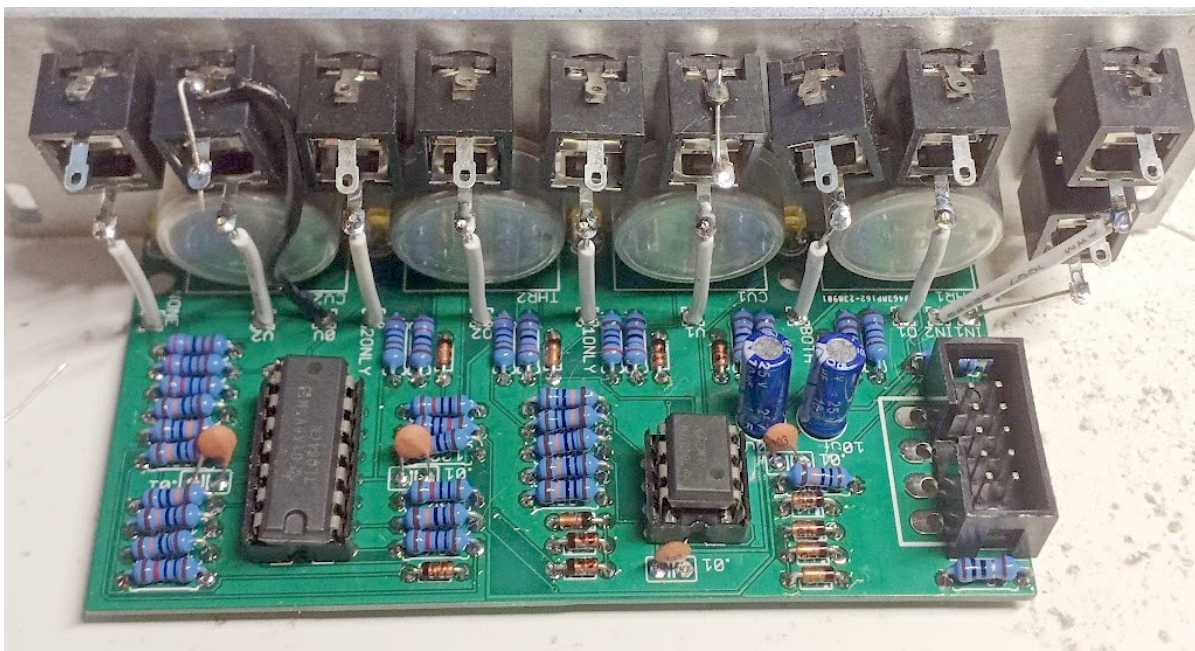


WIRING.

The 0V wirepad is the ground connection. It should be wired to the sleeve of the CV2 jack. If using a non metal front panel, then connect the sleeves of all jacks together to ground them.

The switches on the CV1 and CV2 jacks should be wired to ground, the sleeve of the jack is the easiest spot for this.

The remaining wirepads should each be wired to the tip of their associated jack. The image below is of a wired module.



15V Builds

Increase the value of all 2.7K resistors to 3.3K resistors. This will keep the output voltages at around +5V. Additionally you may want to increase the value of the 100K resistors that connect to the wipers of the threshold knobs to 120K or 150K to reduce dead space at the outer knob positions. The 100K resistors are highlighted in the rendering below:

