

## **BMC040. Dual Logic.**

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## I. Overview/Features

This module provides two channels of selectable Boolean logic functions for processing synthesizer signals. Each channel has two inputs, “X” and “Y” and a single Gate output. The output is on or off depending on whether the voltages on the two inputs are above (“ON”) or below (“OFF”) 0.12V. This voltage was selected so that input voltages that alternated between 0 and 5V or signals that went from -5V to +5V could be used.

There are six select able logic operations. When the operation select knob is fully counterclockwise the AND function is selected, and as the knob is turned clockwise it then selects NAND, OR, NOR, XOR and XNOR functions in that order. Below are the truth tables for these operations.

### AND

X	Y	OUT
OFF	OFF	OFF
ON	OFF	OFF
OFF	ON	OFF
ON	ON	ON

### NAND

X	Y	OUT
OFF	OFF	ON
ON	OFF	ON
OFF	ON	ON
ON	ON	OFF

### OR

X	Y	OUT
OFF	OFF	OFF
ON	OFF	ON
OFF	ON	ON
ON	ON	ON

### NOR

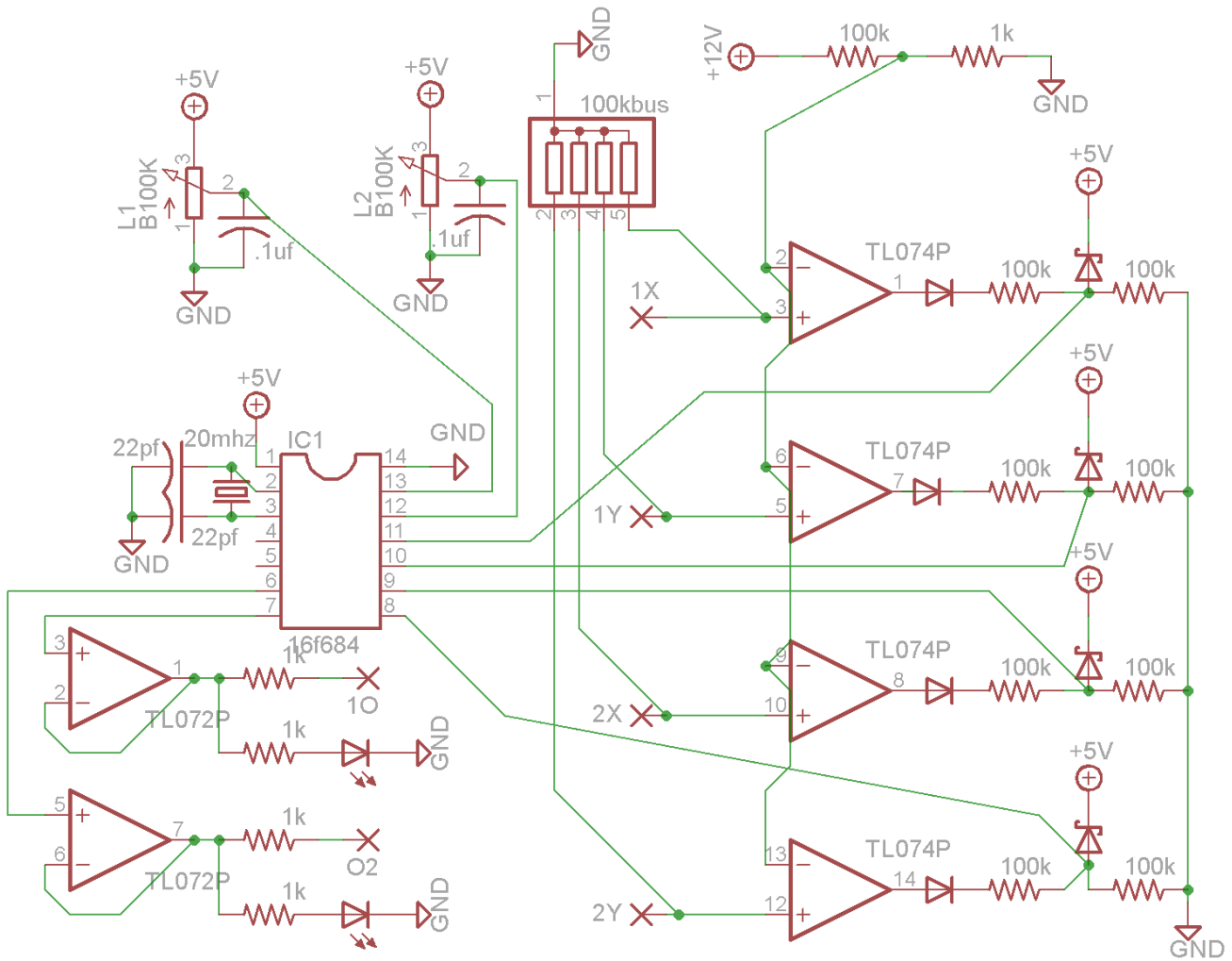
X	Y	OUT
OFF	OFF	ON
ON	OFF	OFF
OFF	ON	OFF
ON	ON	OFF

**XOR**

X	Y	OUT
OFF	OFF	OFF
ON	OFF	ON
OFF	ON	ON
ON	ON	OFF

**XNOR**

X	Y	OUT
OFF	OFF	ON
ON	OFF	OFF
OFF	ON	OFF
ON	ON	ON



## II. Schematic.

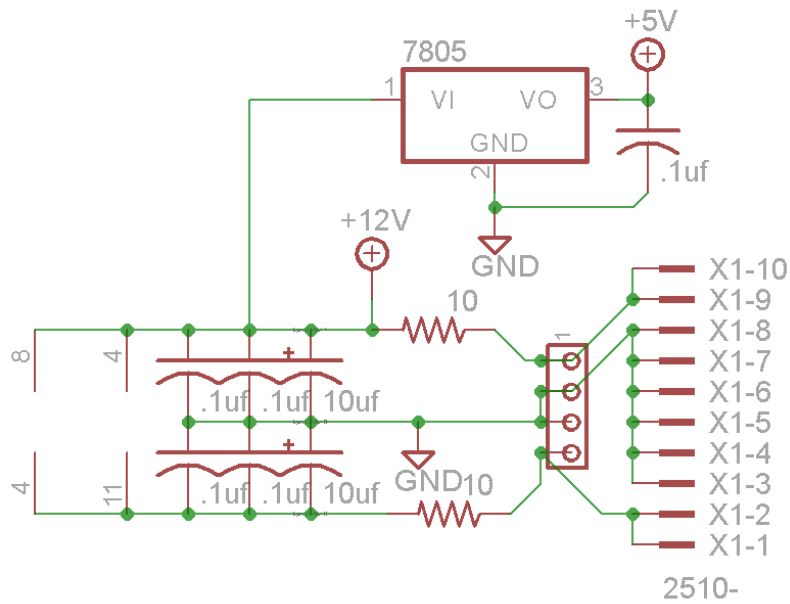
Above is the schematic for this project. On the left is the 16f684 PIC microcontroller which is the “brain” of the circuit. It's powered from a +5V buss and uses a 20mhz crystal oscillator for timing, which has 22pf capacitors to ground to stabilize it's oscillation.

Above this are the two operation selector pots. Each is wired as a variable voltage source between 0 and 5V, the voltage on the wiper is filtered by a .1uf capacitor, and their voltages are being read by the PIC.

To the right of the PIC are the input wiring pads. Each pad is connected to a 100K resistor buss, this keeps the inputs at zero volts when nothing is plugged in. Each is then connected to an op-amp wired as a comparator with a threshold of .12V (or .15V when using a 15V system) being set by the 100K/1K resistor network at the top of the schematic. The output of the schematic goes through a switching diode to only pass the positive half of it's signal, the signal then passes through a 100K resistor to a junction with a pin from the PIC, a schottky diode which protects the PIC from overvoltages and another 100K resistor to ground which helps attenuate the signal and keep the PIC at zero volts when the input is below the comparator's threshold.

Below the PIC are the outputs. Each output is composed of an op-amp wired as a buffer with a pair of 1K resistors coming from it's output, one of which is in series with the output wirepad, and the other to an LED.

On the next page is the schematic for the power section. On the right are the two power connector footprints in parallel with each other. The power rails are filtered by a 10 ohm/10uf passive low pass filter. The ICs have .1uf capacitors attached near their power pins for further filtering. The 5V buss is provided by a 7805 voltage regulator.



### III. Construction

#### A.Parts List

##### Semiconductors

Name	Quantity	Notes
16F684 PIC	1	Should be provided with your PCB
TL074	1	14 pin DIP package
TL072	1	8 pin DIP package
7805 Voltage Regulator	1	TO-220 Packaging
1N4148	4	Or other small signal switching diode
1N60P	4	Or other schottky diode,
LED	2	3mm

##### Resistors

Name/Value	Quantity	Notes
10 ohm	2	1/4W Metal film for resistors unless otherwise noted
1K	5	
100K ohm	9	
100K buss, 5 Pin	1	Or can be made with 4 resistors
B100K Potentiometer	2	PC Mounted 16MM

## Capacitors

Name/Value	Quantity	Notes
22pf	2	Cheap ceramic disc
.1uf	7	Cheap ceramic disc
10uf	2	Electrolytic

## Other

Name/Value	Quantity	Notes
Power connector	1	Eurorack or MOTM
20Mhz Crystal	1	HC-49 Package
8 pin DIP socket	1	
14 pin DIP socket	2	
Knobs	2	
Jacks	6	

## B. The PCB

To the right is a rendering of the PCB. It is 50mm x 50mm and the pots are 1.025" apart.

The wirepads should all be wired to the tips of the appropriate jacks. "1Y" and "1X" are inputs for channel 1 and "1O" is the output for this channel, and channel 2 follows the same convention.

Below is an image showing the steps to installing the LEDs onto the PCB.

