BMC029. Single Multiplier/Divider
Last updated 1-4-2015

I. Features

This module is used to multiply or divide the frequency of a clock or VCO signal. It's maximum multiplaction is 4x and it's maximum division /16. The multiplication or division level is set by a single knob, and can be modulated by external control voltage.

CONTROLS
1.Manual Division Knob – This selects the amount of multiplication or division. Turning the knob clockwise increases the amount of division.
2.Aux Division Knob – This attenuates the external CV used to modulate the division knob's setting.

INPUTS
1.Main Input – This is the input for the frequency to be divided/multiplied.
2.Reset Input – This is used to synchronize the divided frequency with another module. This should be a 0 to 5V trigger or gate signal.
3. CV Input – This is control voltage used to adjust the division. The more positive the voltage, the more division.

OUTPUT
1.Main Output – This is a 0 to +5V square wave output of the divided/multiplied signal.

MP3 DEMO #1
A Clock from the BMC004 Clock/Divider is being sent to the Single Multiplier/Divider and to a Decaying Analog Noise module. The output of the Divider is being sent to an Analog Drum module. In this demo you're hearing me turn the Division knob showing all the different divisions and multiplications available.
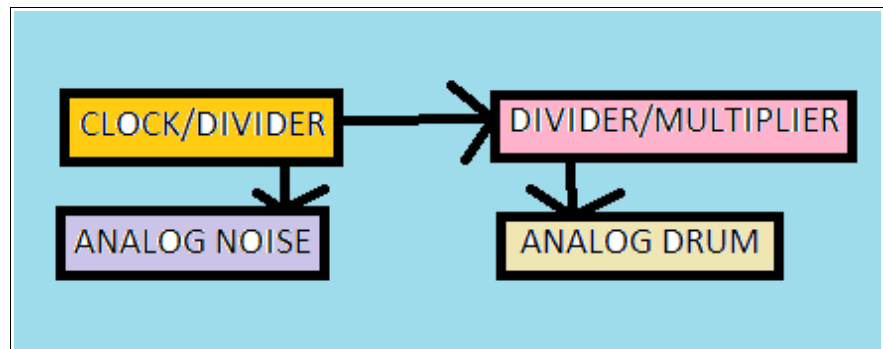
MP3 DEMO #2
The BMC003 Arpeggiator's CV output is controlling a VCO. The VCO's output is going to the input of the Single Multiplier/Divider. The Trigger output of the Arpeggiator is going to a pair of AR generators. One AR generator's output is going to the CV input of the Single Multiplier/Divider, and the other is controlling the VCA on the Output.
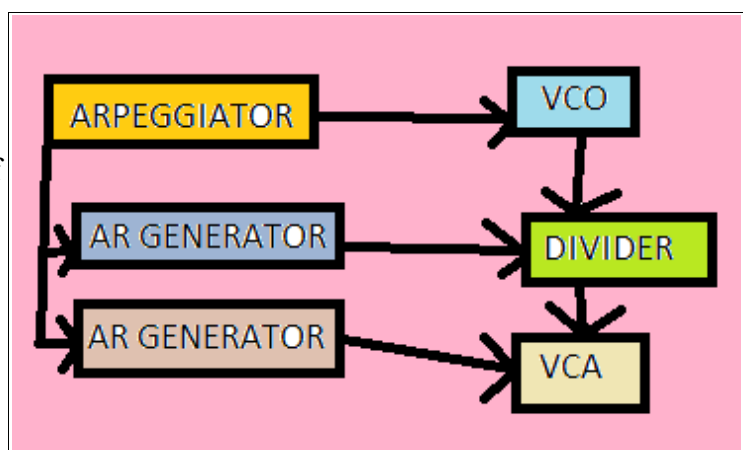
Here you hear some twinkling video-game like sounds.

II Schematics

To the right is the pinout for the 12F683 microcontroller. All of the other schematics intersect with this chip.
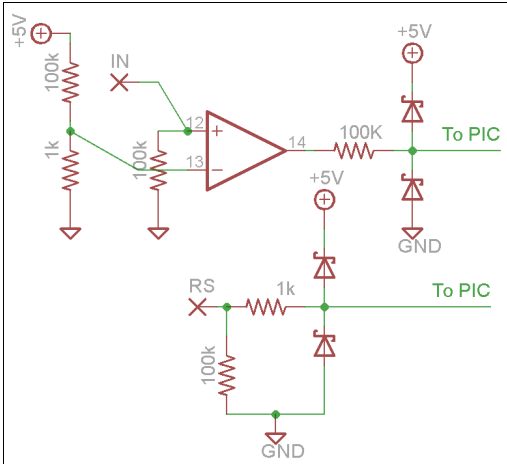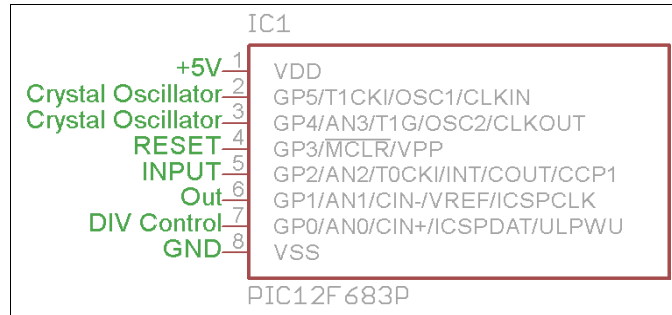
To the left is the schematic for the input and clock input. The main input jack is attached to a comparator and a 100K pull down resistor. The Comparator's threshold is set at .05V by the 1K and 100K voltage divider. The output of the comparator is sent through a 100K dropping resistor and then to two schottky diodes which limit the voltage to between 0V and +5V. The Reset input is sent to a pull down resistor, then a 1K dropping resistor and a pair of schottkys which limit the voltage to the appropriate range.

To the right is the circuit for division control. On the far left of the diagram are the two pots, the top is attenuating the external CV, and the bottom is providing a variable voltage from +5V to ground.
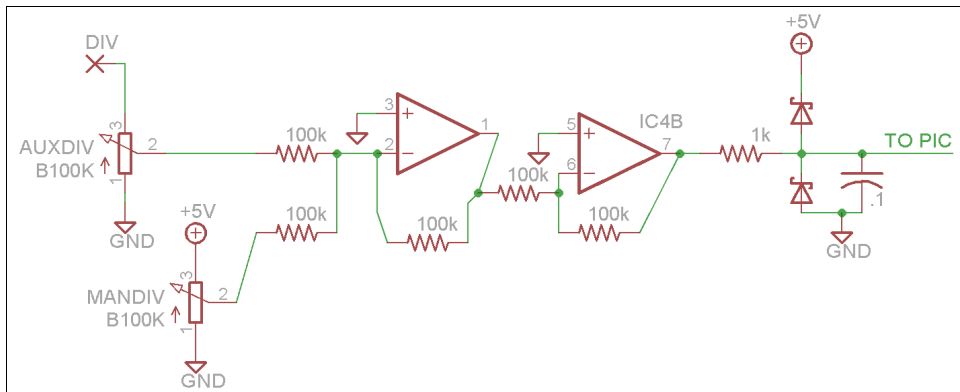
The outputs of these pots are mixed together by two unity gain inverting op-amp stages. The output of the second stage is then sent to another schottky diode voltage limiting circuit, and a .1uf capacitor which filters out high frequency noise from the CV and the diodes.
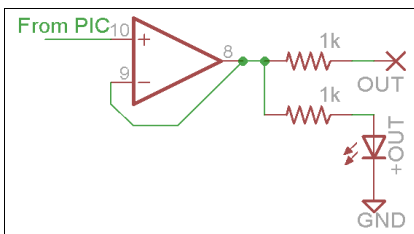
To the left is the output circuit. It consists of an op amp wired as a buffer, with it's output going through a 1K current limiting resistor to an LED and through another 1K resistor to the output jack.

To the right is the power supply schematic. On top are the footprints for the two power connecters. The positive and negative rails are filtered by 10 ohm resistors and 10uf capacitors. The rails are connected to the op-amp, and additional caps are placed near the pins of the ICs for further filtering. The positive rail is sent to a 7805 voltage regulator to create the +5V supply.
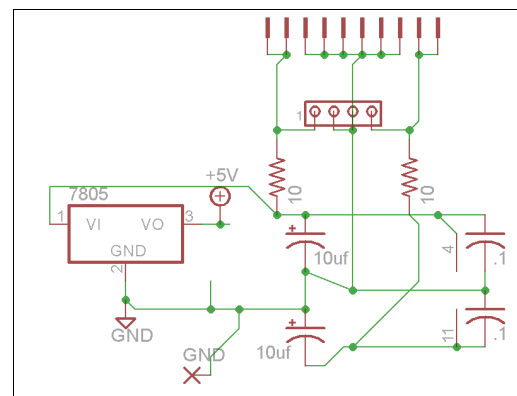
III. Construction

Parts List

Semiconductors

Value	Qty	Notes
12F683	1	Should have come with your PCB
TL074	1	14 pin DIP package
7805 Voltage Regulator	1	TO-220 Package
1N60P	6	Or other schottky
LED	1	3mm

Resistors for +/-12v

Value	Qty	Notes
10 ohm	2	1/4W Metal Film
1K	5	1/4W Metal Film
100K	7	1/4W Metal Film
100K Bussed Array	1	4 Pin, or make your own with 3 more 100K resistors *
B100K Pot	2	16mm PCB mounted

Capacitors

Value	Qty	Notes
10uf	2	Electorlytic 5mm
.1uf	4	Ceramic disc. 2.5mm lead spacing
22pf	2	Ceramic disc. 2.5mm lead spacing

Other

Value	Qty	Notes
Power Connecter	1	Eurorack or MOTM style
20 Mhz Crystal	1	5mm lead spacing
14 Pin DIP Socket	1	
8 PIN DIP Socket	1	
Knob	2	
Jack	4	

*To learn how to make an array, visit this poorly drawn page.

The Board

To the right is a diagram of the PCB. The PCB is 50mm x 47mm. The Pots are 1 1/16" apart and the mounting holes are 43mm apart.

Installing LEDs Sideways

The PCB indicates that the LEDs should be mounted parallel to the board, do not do this. Leds should be pointing in the same direction as the pots. The leads of the LED should be bent at a 90 degree angle, the easiest way to install them is in four steps:

1. Place the LED on the edge of the board facing out with it's leads going over it's pads on the PCB. Make sure the bottom lip of the LED is flush with the board.

2.Clip the leads 2 or 3 mm past the pads on the PCB.

3.Bend the LED leads 90 degrees 2 or 3mm from the edge.

4.The LED should pop into place easily.