Delaying AR Prototype Build Documentation.

Last updated 10-25-2013

I. Using The Delaying AR

A.Features

The delaying AR is a microcontroller based synth module. It can be built in either +/-12V or +/-15V systems with no modification. It is compatible with the expander from BMC003 (Arpeggiator) for using external control voltage on the 5 analog parameters. It's designed primarily for use with VCAs to imitate the sound of a synthesizer being run through a delay, and the controls should seem familiar to anyone who's used an Attack/Release generator and a delay unit.

B.Controls/Inputs/Outputs

Controls

1.Attack Knob - This sets the time it takes for the output to reach it's peak point (5Volts or -5Volts).
2.Decay Knob - This knob sets how long it takes for the output to reduce back to zero volts after the output has reached it's peak and the input Gate signal has gone back to zero.
3.Delay Time Knob - This sets how long until a new attack is set into motion after going into decay. Because the delay timer starts at the beginning of the decay phase, this control is interactive with both the Attack Knob and how long gates are being held down.
4.Repeats Knob - This sets how much the delayed envelopes are reduced each time they repeat themselves. When set fully counterclockwise there should be no repeats.
5.Delay Level Knob - This attenuates the maximum signal size of the delayed envelopes.
6.Gate Switch - This toggle sets whether the unit recognizes the time of the input pulses used or if it treats all inputs as if they were extremely short.
7.Reset Switch - This toggle sets whether or not when entering an attack phase the output first goes to zero volts. Not resetting can result in a smoother sound, while resetting can provide a more consistent sound.

Inputs

1.Gate Input - The gate or trigger signals should be inputted here.

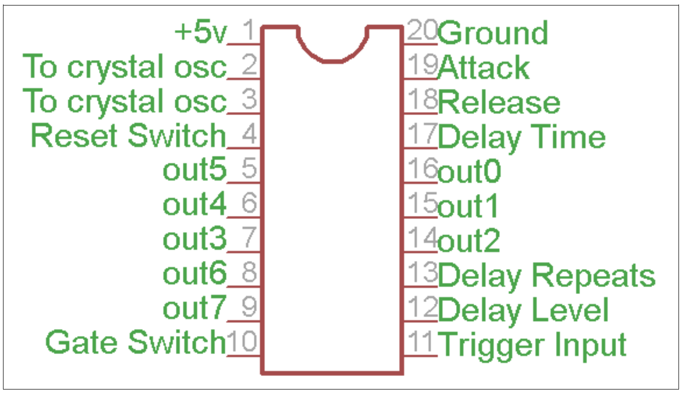
Outputs

1.Non Inverting Output - This output peaks at +5V
2.Inverting Output - This output peaks at -5V

II.Schematics

A.The Chip

The 16F685 microcontroller interacts with all other portions of the circuit, here is it's pinout. Not pictured is the crystal oscillator. It should be 20mhz with two 22pf capacitors to ground.

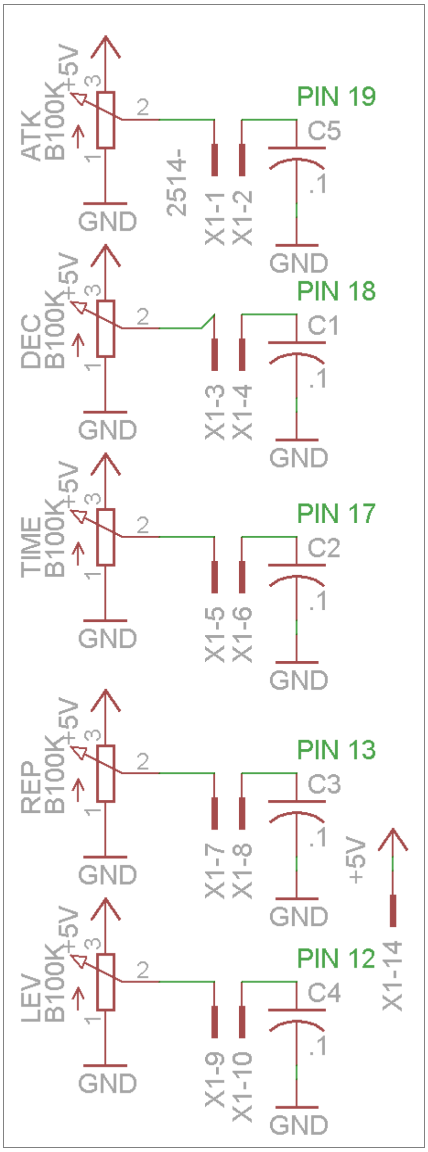


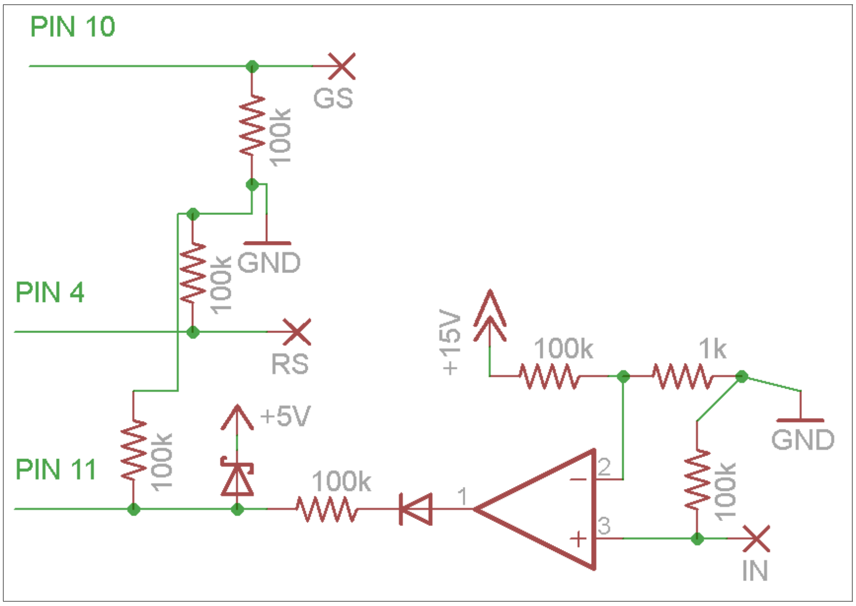
The Attack, Release, Delay Time, Delay Repeats and Delay level are all analog inputs. Gate switch, Trigger Input and Reset switch are all digital inputs. The outs are all part of the analog output circuitry.

B.Analog Inputs.

On the right we see the analog inputs on the PCB. Each consists of a 100K linear pot wired as a voltage divider connected to a pin on a 14pin DIL header, with a corresponding pin connected to a .1uf capacitor and a pin on the microcontroller.

The 14pin DIL header can be used in two different ways. When not connecting the unit to the expander module, jumpers should be placed across the pins so that the pots wipers are directly connected to the microcontroller. When used with the expander, a 14pin connecter is attached between it and the expander module, and the expander mixes the voltage from these pots with attenuated external voltages.





C.Digital Inputs

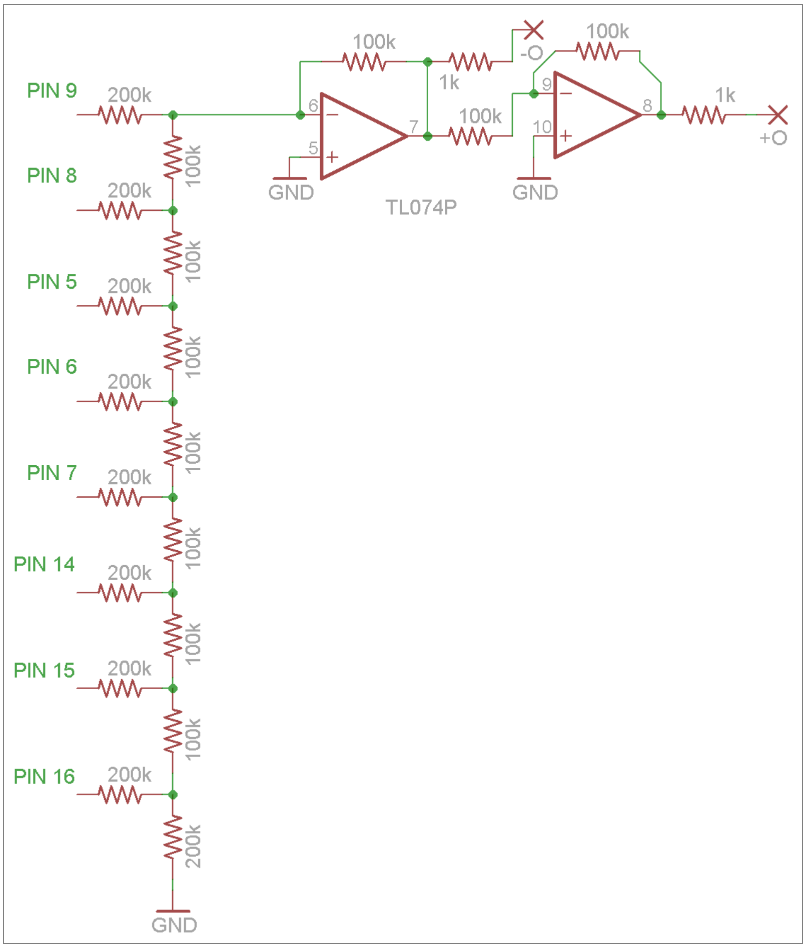
Above we see the digital inputs. The Gate switch (GS) and Reset switch (RS) pads are both connected to 100k pull down resistors and then go straight to the pin. These pads should be connected to SPDT switches that make or break a connecterion between them and +5V.

Below that we see the Gate input (IN). It's connected to a 100K pulldown resistor (keeping the input at zero volts when nothing is plugged in) and then goes to a comparator. The voltage of the comparator is set by the 100K and 1K resistors, and should turn on when any voltage higher than .1volts is inputted. On the comparator's output is a diode, 100K resistor and schottky diode followed by a 100K pulldown resistor. This network makes it so that the microcontroller only "sees" 0 and +5V, even though the comparator's output is actually +/-12V or +/-15V depending on your system.

D.Analog Output

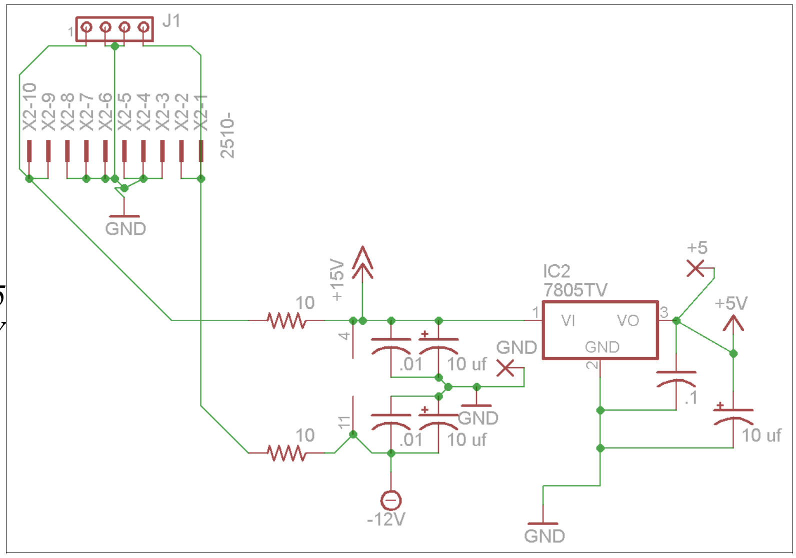
To the right we see the analog outputs. On the far left of the schematic is a R/2R network connected to the digital outputs of the microcontroller.

This voltage is sent to an inverting summing amplifier. The output of this amplifier is sent through a 1K output resistor to the Inverting Output wirepad (-O). It then goes through another inverting output amplifier and 1K resistor to the Non Inverting Output wirepad (+O).



E.Power Supply

Here we see footprints for two different types of power connecters. The Positive and negative voltage rails go through 10 ohm resistors and are then filtered by 10uf caps, and . 01uf caps on the pins of the op amp. The positive rail is then sent to a 7805 voltage regulator which provides +5V reference voltage for the microcontroller.



III.Construction

A. Parts List

Semiconductors

Name/Value	*Qty*	*Notes*
16F685	*1*	*Should have been provided with your PCB*
TL074	*1*	*14pin DIP package.*
7805	*1*	*TO 220 Package*
1n4148	*1*	*or other small signal switching diode*
1N916	*1*	*or other low wattage schottky*

Resistors

Name/Value	*Qty*	*Notes*
10 ohm	*2*	*7.5mm lead spacing*
1K	*3*	*" "*
100K	*16*	*" "*
200K	*9*	*" "*
B100K Lin	*5*	*16mm size, PCB mount.*

Capacitors

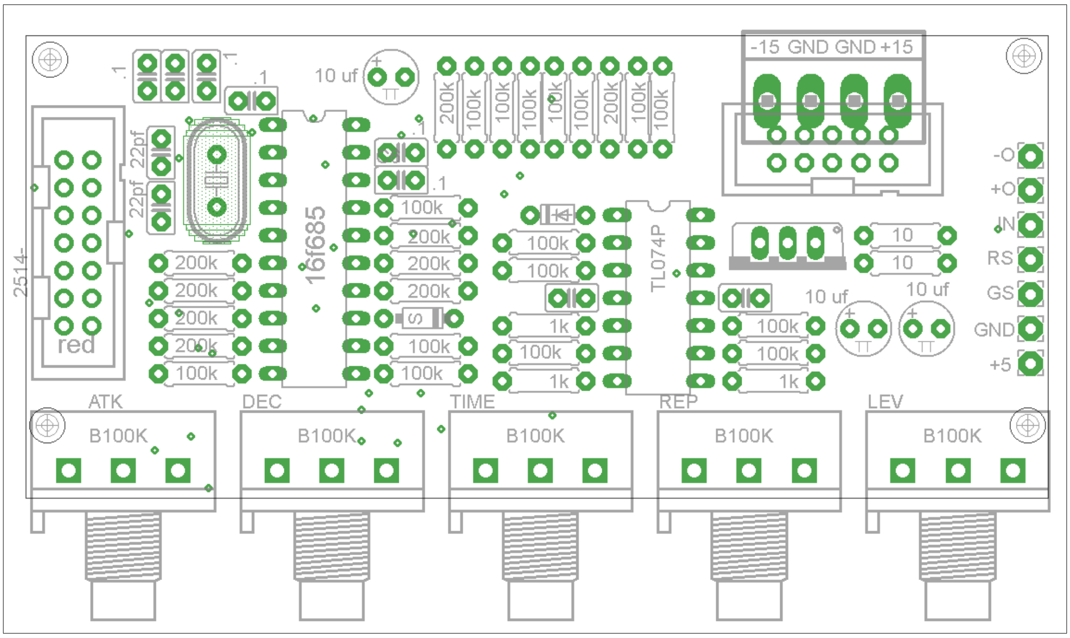
Name/Value	*Qty*	*Notes*
22pf	*2*	*2.5mm lead spacing. Ceramic disks ok.*
.1uf	*8*	*" "*
10uf	*2*	*2mm lead spacing.*

Other

Name/Value	*Qty*	*Notes*
Crystal Resonator	*1*	*20mhz*
20pin DIP socket	*1*	
14pin DIP socket	*1*	
14pin DIL headers	*1*	
Power connecter	*1*	*either eurorack or MOTM style*
Jack	*3*	*either 1/4" or 1/8"*
SPDT toggle	*2*	*or SPST*
2.54mm Jumpers	*5*	*For use when not using expander*

Other than a shrouded header for power/expander connections, all parts for this project should be available from Tayda electronics for very cheap.

If you plan on never using the expander, just wire the jumpers in permanently using clipped resistor leads. Where they go is marked on the board.



B. The PCB

The board's dimensions are 93mm x 43mm. The pots are spaced 3/4" apart from each other. The mounting holes are 90mm x 34mm apart.