Electric Druid ENVGEN 8

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Introduction

This chip is a completely modern, microprocessor-based design that provides a fully voltage-controlled looping ADSR envelope generator. The output from the chip is via a 10 bit DAC which produces a genuine ADSR envelope shape.

In addition to full voltage control of Attack, Decay, Sustain, and Release, the chip also has CV control of output level (envelope depth) and an overall Time CV which can modulate the length of the entire envelope.

A Mode CV input allows selection between three envelope modes - a normal ADSR envelope, a gated looping mode and a LFO looping mode. There is also a "Punch" control which adds extra thump to very short percussive envelopes.

The chip improves on the previous generation of Druid envelope chips (VCADSR7B/LOOPENV1B) since it does away with the need for an external crystal, improves the 19.5KHz sample rate to 31.25KHz, and combines the features of both chips into one, allowing both Gate and Trigger inputs on a chip with full looping functionality.

Features

Range of under 1 mSec to over 10 Sec

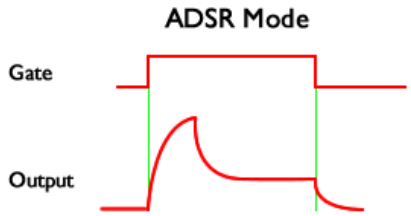
The Minimoog, Sequential Pro-One and SH101 all have a famously quick attack time. I've never measured it, but it's supposed to be around 1 mSec. This envelope generator can also produce times that short.

Most analogue synths can do a slow attack of a handful of seconds, but 10 seconds gives a neat range of 1:10000 to be covered by the control voltages, and allows really slowly evolving sounds to be generated.

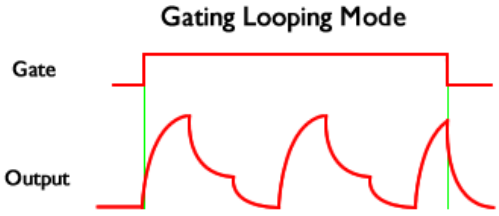
ADSR, Gated Looping, and LFO Looping modes

The MODE CV pin allows selection between three different modes of operation.

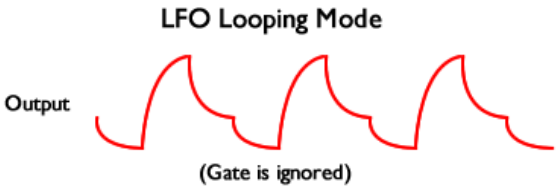
ADSR mode is a normal envelope.



Gated Looping will trigger the ATTACK stage when the GATE goes high, then continue looping whilst the GATE remains high, and will RELEASE to zero when the GATE goes low.



The LFO Looping mode loops continuously and ignores input from the GATE. It is easy to provide a switch to select these modes.



LFO frequencies to 300Hz

Since the segment times can be as short as 1ms, it is possible to produce LFO waveforms up to around 300Hz. This is above Middle C!

Exponential and Linear Envelopes

The chip can produce classic exponential ADSR curves suitable for volume control with a linear VCA, or can produce linear envelopes typical of early digital synths. These can be more suitable for use with exponential VCAs, but are also useful for modulation control duties, or when using the envelope as an LFO.

Gate and Trigger available

The chip can be used with just a Gate, but also has a Trigger input to retrigger the envelope whilst the Gate is high. Additionally, a range of AD, AR, and ASR envelopes can be produced by using Trigger alone.

Time CV for envelope/LFO modulation

The TIME CV input shortens the entire envelope, providing global modulation of ATTACK, DECAY and RELEASE times. Since this input works in LFO mode too, it can also provide frequency modulation of the LFO waveforms. Don't forget that modulation of the Sustain CV also provides LFO shape modulation!

Level CV for voltage-controlled envelope depth

The chip also includes a LEVEL CV input which controls the output level of the envelope. This offers a very simple way to provide voltage-controlled envelope depth and saves a VCA. The Level CV is implemented using the reference voltage of the output DAC, so no resolution is lost at reduced amplitude.

8-bit resolution on the control voltages

The Sequential Prophet 5 used a 7-bit control resolution, so this is going slightly better. Whether a standard potentiometer actually has the accuracy to directly produce 8 bit resolution is another question.

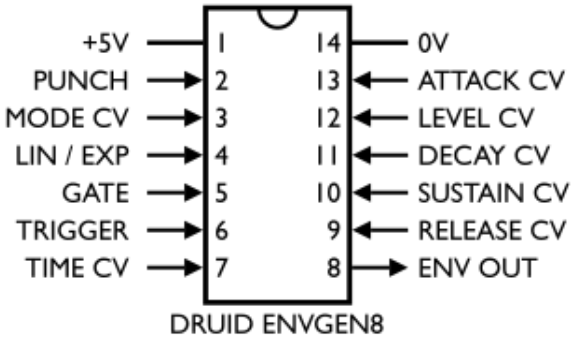
Sample output rate improved 31.25KHz from 19.5KHz

The DAC output sample rate is 31.25KHz. This means that there is plenty of detail to describe even the shortest curves.

Logarithmic time control response over 1:10,000 range

The A, D and R control voltage inputs give the full range from 1 mSec to 10 Secs in four even decades, eg 1-10mSecs, 10-100mSecs, 100-1000mSecs, and 1-10Secs. Since the response of the CV inputs is logarithmic, this is possible with simple linear potentiometers.

Pinout Diagram



Pin	Function	Details	Notes
1	+5V	Power supply	
2	PUNCH	0-5V digital input	Adds extra Punch stage between Attack and Decay. 0V = Punch on, 5V/NC = Punch off
3	MODE CV	0-5V analogue input	Selects envelope mode: • 0-1.25V: Normal ADSR • 1.25-3.75V: Gated Looping • 3.75-5V: LFO/Looping
4	EXP/LIN INPUT	0-5V digital input	0V = Linear envelope, 5V/NC = Exponential envelope
5	GATE INPUT	0-5V digital input	Envelope goes to RELEASE stage on falling edge of 0-5V pulse.
6	TRIGGER INPUT	0-5V digital input	Envelope goes to ATTACK stage on rising edge of 0-5V pulse.
7	TIME CV	0-5V analogue input	Shortens A, D, and R times by x1 to x0.01
8	ENV OUT	0-5V analogue output	10 bit DAC envelope output
9	RELEASE CV	0-5V analogue input	Release time from 1msec to 10 secs
10	SUSTAIN CV	0-5V analogue input	Sustain level from 0 to 100%
11	DECAY CV	0-5V analogue input	Decay time from 1msec to 10 secs
12	LEVEL CV	0-5V analogue input	Reference voltage for multiplying DAC
13	ATTACK CV	0-5V analogue input	Attack time from 1msec to 10 secs
14	0V	Power supply	

NC = Not connected (pin has an internal pull-up and can be left open)

Application Notes

Example circuit: Fully-featured ADSR envelope generator

This example circuit shows the basic features of the chip and would be suitable for use in a non-programmable monosynth, for example. The circuit provides both Gate and Trigger inputs, and hardwires the Punch control on for extra-punchy envelopes at the very shortest settings.

The ENVGEN8 chip has LEVEL CV (pin 12) hard-wired to R4/C3 which provide a lowpass filtered 5V, so the chip outputs a 0-5V envelope signal at ENV OUT (Pin 8). The R1/15K, R3/10K potential divider reduces this to 0-2V for the AS3360 VCA. The Time CV modulation input is ignored and is simply tied to ground with a 1K resistor.

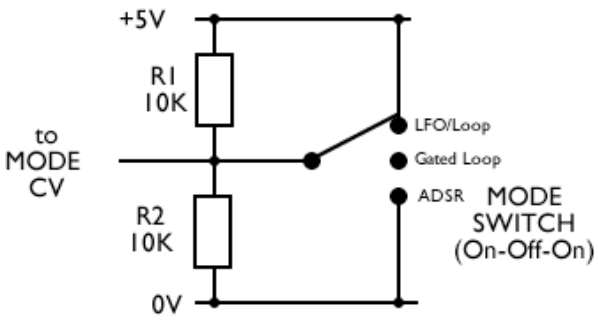
Example circuit: Fully voltage-controlled ADSR envelope generator with Time and Level CV control

<Coming soon!>

Using a switch for MODE CV

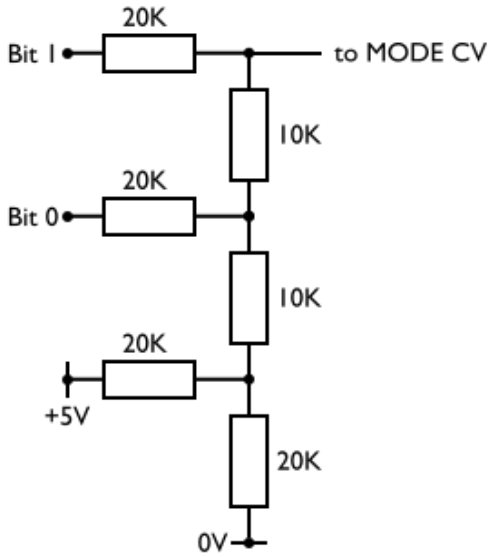
A simple On-Off-On toggle switch can be used to produce the MODE CV.

The two 10K resistors provide 2.5V when the switch is off, giving Gated Loop mode. Switching the switch gives either +5V or 0V.



Using digital control of MODE CV

The Mode CV can be generated by a R-2R network fed from two digital bits, as shown. Input 00 is ADSR mode, Input 11 is LFO mode, and either 01 or 10 are Gated Looping. Notice that the R-2R DAC is actually a three bit network, with the lowest bit permanently tied high. This ensures that the produced voltages are in the middle of the range for each option.



Disabling unwanted inputs

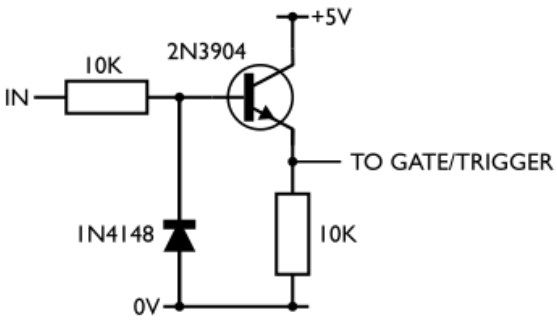
If not required, TIME CV should be connected to 0V via 1K. LEVEL CV can be disabled by connecting to +5V with a 1K resistor. If linear envelopes are not required, EXP/LIN can be left unconnected.

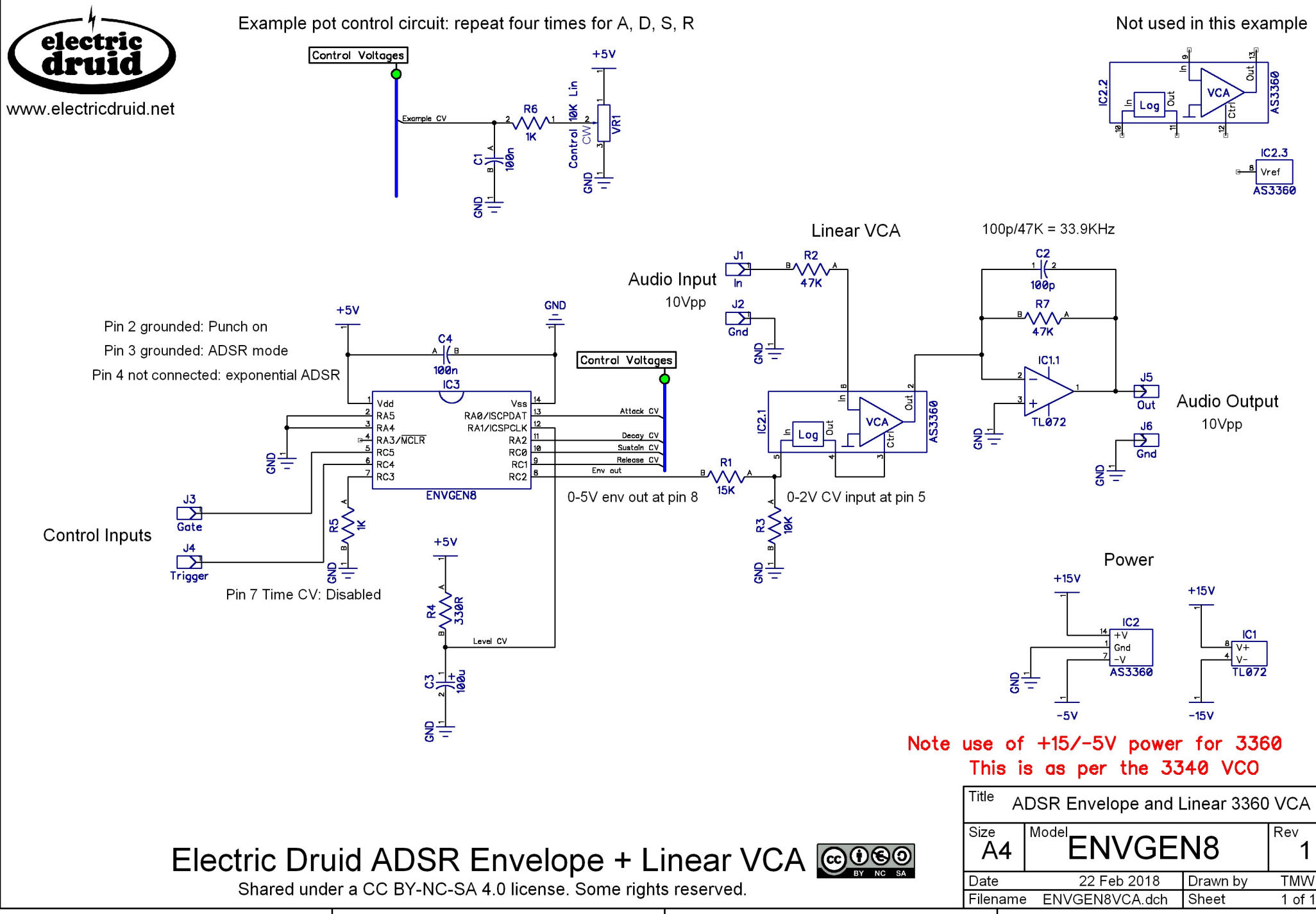
Using the chip with GATE only

For GATE only use, the TRIGGER input can simply be connected directly to the GATE input. Since only the TRIGGER responds to the leading edge of the pulse (starting the ATTACK stage), and only the GATE responds to the falling edge (starting the RELEASE stage), there is no problem. If an optional TRIGGER jack input is required, it can be connected to GATE with a normalled jack connection.

Protecting the Gate and/or Trigger inputs from external signals

If the Gate and Trigger inputs are exposed to the outside world, for example in a modular system, then the inputs should be protected from negative voltage and over-voltage. An example circuit is given on the right.




www.electricdruid.net
Example pot control circuit: repeat four times for A, D, S, R
Control Voltages
Example CV
R6
1K
C1
100n
+5V
10K Lin
Control CW
VR1
GND
Not used in this example
IC2.2
In
Log
Out
VCA
Ctrl
AS3360
IC2.3
Vref
Linear VCA
100p/47K = 33.9KHz
Audio Input
10Vpp
J1
In
J2
Gnd
R2
47K
C2
100p
R7
47K
IC1.1
TL072
J5
Out
Audio Output
10Vpp
J6
Gnd
Pin 2 grounded: Punch on
Pin 3 grounded: ADSR mode
Pin 4 not connected: exponential ADSR
C4
100n
IC3
Vdd
RA5
RA4
RA3/MCLR
RC5
RC4
RC3
Vss
RA0/ICSPDAT
RA1/ICSPCLK
RA2
RC0
RC1
RC2
ENVGEN8
Attack CV
Decay CV
Sustain CV
Release CV
Env out
Control Voltages
IC2.1
R1
15K
R3
10K
0-5V env out at pin 8
0-2V CV input at pin 5
Control Inputs
J3
Gate
J4
Trigger
R5
1K
Pin 7 Time CV: Disabled
R4
330R
Level CV
C3
100u
Power
IC2
+V
Gnd
-V
AS3360
IC1
V+
V-
TL072
+15V
-5V
-15V
Note use of +15/-5V power for 3360
This is as per the 3340 VCO
Title
ADSR Envelope and Linear 3360 VCA
Size
A4
Model
ENVGEN8
Rev
1
Date
22 Feb 2018
Drawn by
TMW
Filename
ENVGEN8VCA.dch
Sheet
1 of 1
Electric Druid ADSR Envelope + Linear VCA
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