Analog Metropolis

AM3310
ADSR Envelope Generator

Project Notes
V1.0

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1 Module Description

This module is an ADSR Envelope Generator based around the classic CEM3310 chip that was used in the Prophet 5 Revision 3.

The CEM3310 was introduced in 1979 and it quickly established itself as a fast and agile envelope generator, the basis of the SCI Prophet 5 Rev 3, Oberheim OBXA, and SCI Pro One. The design of the chip is covered by US Patent 4,004,141 and it features low CV fee through as well as accuracy exponential output curves.

The AM3310 has the following controls and connections:

INPUTS	GATE ON/OFF
OUTPUTS	OUT+, OUT+, OUT-
POTS	ATTACK, DECAY, SUSTAIN, RELEASE
LEDS	ATTACK, GATE

Specifications

Attack duration:	2ms to 20 seconds
Decay duration:	2ms to 20 seconds
Sustain Level:	0 to 10V
Release duration:	2ms to 20 seconds
Voltage output:	0 to +10V, 0 to - 10V on inverted output

2 The AM Circuit

The Analog Metropolis circuit is based on the around components of the Digisound modular design, which is a bit more sophisticated than some of the basic SCI implementations.

The envelopes timing is set by R16 and C6. They are a fixed value as there is no need to match timing unless the CEM3310 is used in a polyphonic synthesizer. C6 is set at 33nF slightly lower than the standard 39nF.

The sustain circuit ensures that the peak attack voltage does not exceed the sustain level. Pin 3 of the CEM3310 outputs the peak attack voltage and is connected to an Op Amp (IC5A) working as a precision voltage follower, with the sustain voltage as the other input. This is more sophisticated than the standard SCI implementation and it avoids envelope spikes when low sustain values are used.

Two LED circuits have been added. One to monitor the GATE signal as the ADSR is turned on and off (GLED) and the other to monitor the attack phase of the ADSR (ALED).

The REV04 board is the production board. There are no errors.

3 PCB

The PCB is double sided with solder mask and silkscreen on the upper surface. The component names are shown in the silk screen but not the component values. The size of the PCB is 80mmx100mm.

The PCB is held to the front panel at 90 degrees by the use of two pot brackets manufactured by Omeg (www.omeg.oc.uk). These brackets (and pots) are centred at 27mm apart. The ATTACK, DEACY and SUSTAIN pots hold the PCB to the front panel.

4 PCB Connections

The PCB has a number of connections designed for MTA 0.1" headers, so that the panel components can be connected to the PCB. I use headers and sockets to enable the board to be easily replaced, however you can solder wires straight to the PCB.

PCB Header Name	Pin #	What is it?	Where does it go?
GATE	Pin 1	Gate Input	Jack Socket Gate Input
	Pin 2	Not Used	No Connection
RELEASE	Pin 1	Pot	Release Pot Pin 1
	Pin 2	Pot	Release Pot Pin 2
	Pin 3	Pot	Release Pot Pin 3
ALED	Pin A	LED	Attack LED Anode
	Pin C	LED	Attack LED Cathode
GLED	Pin A	LED	Gate LED Anode
	Pin C	LED	Gate LED Cathode
OUTS	Pin 1	Audio Output +	Jack Socket Audio Output +
	Pin 2	Audio Output +	Jack Socket Audio Output +
	Pin 3	Audio Output -	Jack Socket Audio Output -
PAD	Pin 1	Panel Earth	Jack socket earth bus

5 Pots

The PCB is designed to be used with Spectrol 248J conductive plastic pots; they are a reasonable price and very high quality. The PCB will work with either 3.18mm or 6.35mm spindle diameter models. The PCB can be used with other pots such as sliders provided they are all mounted off the PCB.

6 Power

The module should be powered from a well regulated +15V and -15V power supply, current consumption is around 25mA. The power connector is the standard two ground MOTM/Oakley 4-pin Molex connector. One ground is for the circuit, the other is for the panel ground (PAD).

7 Front Panel Format

The AM3310 PCB is designed to work with the AM Low and High Density panel format, to be mounted to the front panel by using three ECO pot brackets which fit Spectrol 248 potentiometers. The pot spacing is 27mm.

AM High Density

This panel format enables a higher density of controls on each panel, and panels are usually 90mm wide. All the pots have a small spindle diameter of 3.18mm which enables the control knobs to be located closer together. With the ADSR 13mm control knobs are used. The "look and feel" is similar to the ARP 2500.

Panels are 4U high and 90mm wide. Panels are fitted to horizontal 12mm angled aluminium strip using 4mm diameter machine screws in each corner of the panel. The strip is mounted into a standard 19" rack unit with small wooden end strips.

AM Low Density

The PCB is not designed for this format.

MOTM Panels

This established panel format has pot spacing at 41.275mm compared with 27mm of this particular PCB. This probably means you will want to have 41.275mm s[pacing and therefore you'll want to mount the PCB on a bracket and not directly to the front panel.

8 Building the Module

This module is simple to build. The recommended build order is:

- Resistors
- Inductors
- IC Sockets
- Capacitors
- Trimmers
- Connectors
- Transistors
- Pot Brackets and Potentiometers

Check all the electrolytic capacitors and transistors are fitted the right way round. Before fitting the IC's its worth connecting up the module to a power supply and checking that the power rail voltages are as expected at

each IC socket, then power down, and fit the IC's ensuring correct orientation.

5V Output Modification
If you need 0-5V outputs rather than 0-10V outputs you should replace R17 and R18 with wire links.

Power up and try out the ADSR, there is no trimming.

9 Trimming

This module needs no trimming.

10 Special Components

The AM3310 makes use of a small number of specialist components:

CEM3310
The CEM3310 chip is hard to locate, but it be found especially on eBay.

ECO/Omeg Pot Brackets
These can be obtained from Omeg in the UK. http://www.omeg.co.uk/. Oakley have them again, and I have stock them too.

11 Parts Listing

Part Number	Value	Quantity	Comments
Capacitors			
C1, C2, C10, C11, C12, C13	100nF	6	Multi-layer Axial Ceramic
C3, C4, C8, C9	22uF 25V	4	Radial Electrolytic
C5	22nF	1	Multi-layer Polyester
C6	33nF	1	Multi-layer Polyester
C7	10nF	1	Multi-layer Polyester
Resistors			
R1, R2, R3	62K	3	1/4W 1% metal film
R4, R5, R6, R21, R22, R23	1K	6	1/4W 1% metal film
R7	150K	1	1/4W 1% metal film
R8	51K	1	1/4W 1% metal film
R9, R10, R13, R17, R18, R19, R20, R28	100K	8	1/4W 1% metal film
R11	24K	1	1/4W 1% metal film
R12	750	1	1/4W 1% metal film
R14	10K	1	1/4W 1% metal film
R15	LDR1[1]	1	1/4W 1% metal film
R16	24K	1	1/4W 1% metal film
R24	1K3	1	1/4W 1% metal film
R25, R26	47R	2	1/4W 1% metal film
R29	36K	1	1/4W 1% metal film
R30	LDR2[2]	1	1/4W 1% metal film
Potentiometers			
ATTACK, DECAY, SUSTAIN, RELEASE	100K LIN	4	SPECTROL 248
Passives			
L1, L2		2	Inductor
Semiconductors			
IC1	CEM3310	1	
IC2, IC3, IC4, IC5	TL072	4	Op Amp
ALED	LED	1	LED
GLED	LED	1	LED
Hardware			
GATE, OUTS		2	MTA 0.1” 2-pin header
OUTS, RELEASE		2	MTA 0.1” 3-pin header
POWER		1	MTA 0.156” 4-pin header

[1] Value depends on LED used – calculate from current used by LED
[2] Value depends on LED used – calculate from current used by LED