

# Q109 Envelope Generator

Aug 2014

The Q109 Envelope Generator is one of the basic modules every synthesizer must have. It generates a voltage envelope in response to a gate signal from a keyboard, oscillator or other source. The envelope is used to control amplifiers, filters, oscillators and other modules. The operator has complete manual control over Attack time, Decay time, Sustain level, and Release time. A manual gate button can be used to trigger the Envelope Generator at any time, and an LED gives a visual indication of the output level.

## Specifications

**Panel Size:** Single width 2.125"w x 8.75"h.

**Attack Time Range:** 1ms - 7+ seconds

**Decay Time Range:** 1ms - 12+ seconds

**Release Time Range:** 1ms - 12+ seconds

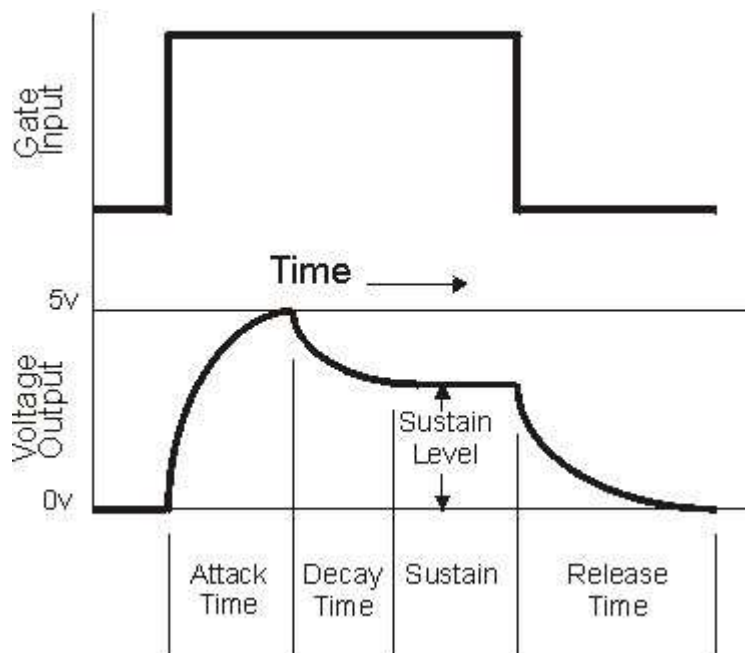
**Sustain Level Range:** 0-5 volts

**Output Level:** 0-5 volts

**Gate Threshold:** 1.5 volts

**Power:** +15V@30ma, -15V@30ma, +5@5ma.

## Waveforms



# Q109 Envelope Generator

Aug 2014

This controls the length of the Attack phase of the envelope. The Attack phase goes from 0 to 5 volts.

This controls the length of the Decay phase of the envelope. The Decay phase drops to the voltage level set by the Sustain level control.

This controls the length of the Release phase. The Release phase finishes at 0 volts.

Manual Gate button is mixed with the gate signal.

Gate input. 0 volts = off, 5 volts = on. Typically comes from a keyboard controller or a sequencer.

**Q109**

**ENVELOPE GENERATOR**

**ATTACK** **TIME**

**DECAY** **TIME**

**SUSTAIN** **LEVEL**

**RELEASE** **TIME**

**GATE** **OUTPUT**

Synthesizers.com

Gate Input

5v

0v

Time

Attack Time

Decay Time

Sustain Level

Release Time

Voltage Output

This controls the sustain voltage level after the Decay phase. This voltage remains as long as the Gate is on. The Release phase begins when the Gate signal turns off.

LED indicates the output voltage

Envelope output. Typically 0-5 volts. Can be jumpered for different levels/ranges.

## Usage and Patch Tips

### Basics

The envelope generator is usually triggered from the keyboard gate signal and creates a voltage that changes over time (envelope). Envelope signals are used to change sound parameters over time - usually filters, amplifiers, and oscillators but really any voltage controllable parameter can be controlled. Study the waveform pictures to understand what each control does to affect the envelope's shape. When a gate signal goes high (key is pressed), the Attack phase begins. The time it takes for this attack phase to complete is determined by the Attack control. The voltage will rise slowly until it reaches +5 volts. At that time the Decay phase begins and its time is determined by the Decay control. The voltage will decay to the voltage set by the Sustain level control and will stay there as long as the gate signal is high (key pressed). When the gate signal goes low the release phase begins and its time is set by the Release control. If you turn the sustain level full clockwise, there will be no decay phase.

### Routing

Since you often need a separate envelope generator for filters and amplifiers, use a Q124 Multiple to route a single gate signal from the keyboard to several envelope generators.

### Inverted, Amplified, Attenuated Envelopes

Some module's inputs have inverters and attenuators that allow you to modify the envelope's affect on the parameter, but some do not due to space constraints. Use a Q125 Signal Processor to invert, amplify, attenuate, or offset an envelope signal.

### Voltage Levels

The output of the envelope generator is 0 to 5 volts. The Q108 Amplifier responds well to this voltage range (0 volts = off, +5 volts = full on) so you can patch the envelope directly into the control input of the amplifier. If you need the envelope to span a larger range such as -5 to +5 volts, simply use a Q125 Signal Processor to amplify the signal by 200% then offset it by -5 volts. This expanded envelope voltage range can be useful when you want to sweep the Q107 Filter its entire range.

### Gates and Triggers

A gate signal stays on as long as a key is pressed, but a trigger signal is a very short pulse that only occurs at the beginning of a keypress. The envelope generator can be started by a gate or a trigger with different results. When using a gate signal to start the envelope generator, all controls act upon the waveform as you would expect, but when using a trigger signal to start it you'll lose the attack and decay control (Set them to 0). The Sustain and Release controls will work as expected. The result will be the same regardless of how long you hold down a key.

### Starting Envelopes from other Sources

Envelopes are usually started from keyboard gate signals, but you can use an oscillator or a sequencer to start them too. When using an oscillator to continuously start an envelope generator, you essentially are creating an oscillator with a customized waveform. Any of the gate signal outputs or the Done output on the Q119 Sequential Controller can be used to start an envelope generator too. You can start an envelope at a certain stage of a sequence by using a bank's (in 3x8 mode) output signal. Set all of the controls for the bank to 0 except the stage that you wish to fire which should be set to +5.

### Delaying Envelope Triggering

You can delay the triggering of the Q109 using the Q105 slew limiter. Simply run your gate signal through the Q105. Setting the direction to Up will let the Amount control adjust the delay of the beginning of the output gate. Setting the direction to Down will let the Amount control adjust the extension of the output gate. Setting the direction to Both will let the Amount control adjust both the beginning delay and the extension resulting in a shifting of the entire gate signal.

### Combining Delayed Envelopes to Create Complex Patterns

Using 2 Q109's, trigger one from an unmodified gate signal (possibly from a keyboard or sequencer), and also patch the gate into a Q105 to create a delay for the second Q109. Combine the outputs of the 2

## Q109 Envelope Generator

Aug 2014

## Calibration and Testing

This module requires no calibration.

1. Turn the Attack, Decay and Release controls to 0.
2. Apply a 10hz 10v PP square wave to the Gate input.
3. View the output on an oscilloscope.
4. Turning Attack clockwise should make a longer attack section of the waveform.
5. Turning Decay clockwise should make a longer decay section of the waveform.
6. Turning Sustain clockwise should make a higher sustain level of the waveform.
7. Turning Release clockwise should make a longer release section.
8. Remove the Gate input, set all controls to 0 except Sustain to 10.
9. Pressing the Gate button should cause the LED to come on.

## Power Connector

6 pin .1" MTA type connector made by AMP. Available from Mouser Electronics or Digi-Key. Modules have a male PCB mount connector and cable harnesses have a female.

### Part Numbers:

Female cable mount: #6404416

Male PCB mount: #6404566

### Pinout:

$$1 = +15v$$

2 = key (pin removed)

$$3 = +5v$$

4 = gnd

$$5 = -15v$$

Not all voltages are used on all modules.

## PC Board Layout

Q109 ENVELOPE GENERATOR REV A

