Electronic-music generator retriggers waveforms

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Only three chips, one transistor, and a few passive components make up a circuit that produces the control signals needed by voltage-controlled oscillators and amplifiers in order to modulate musical parameters like loudness, timbre, and pitch in an electronic synthesizer. The circuit retains the simplicity and compactness of an exponential generator [Electronics, July 17, 1980, p. 123], and it also permits retriggerable operation.

This envelope generator controls the attack, decay and release times of a waveform and its sustained level. The circuit, however, also responds independently to the trigger and gate input signals of a keyboard, thereby creating a continuously repeating attack-decay portion of the waveform.

The synthesizer's keyboard initiates trigger and gate signals that control circuit timing. The gate pulse is produced if at least one key is pushed, and the trigger pulse is produced whenever the lowest note desired is changed by selecting a new key.

Thus a gate and a trigger pulse is generated when a key is pushed. Pressing a second key lower on the keyboard while holding the first key down generates a new trigger pulse, but there is no change in the gate pulse because it remains high.

In the circuit's quiescent state, the charge on timing capacitor C₃ is zero. When a single key is pressed, the 555 timer, which contains a comparator and R-S flipflop, is enabled by the gate signal.

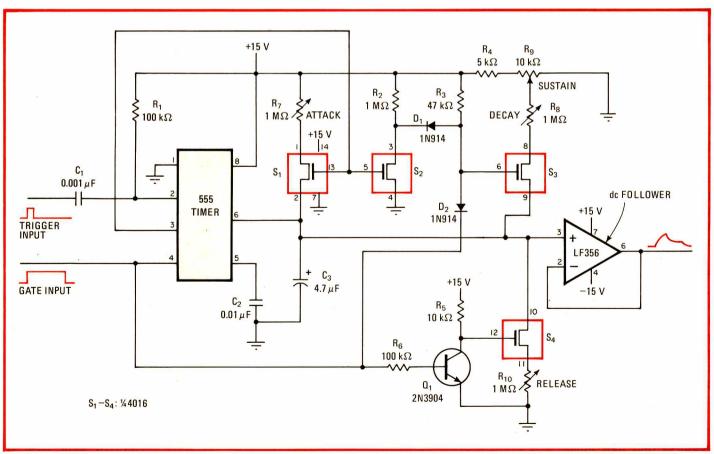
Following this action, the trigger signal is differentiated by the resistor-capacitor combination R_1C_1 and is applied to pin 2 of the timer to set its internal flip-flop and bring pin 3 high. Analog switch S_1 is thus turned on and current flows through resistor R_7 to charge C_3 , initiating the attack portion of the waveform.

When the voltage across C_3 reaches 10 volts, the 555's flip-flop is reset. Pin 3 moves low and S_1 is turned off, thus terminating the cycle's attack portion.

At this time, the AND gate formed by D_1 , D_2 , and R_3 goes high, and analog switch S_3 is turned on. This switching permits C_3 to discharge through R_8 , the decay-control potentiometer, to a voltage level specified by R_9 , the sustain control. Resistor R_4 limits the range of sustain voltage from 0 to 10 v.

When the gate signal is removed, the AND gate goes low and S_3 is turned off. Transistor Q_1 is also turned off, which permits S_4 to turn on and C_3 to discharge through R_{10} for the release portion of the waveform.

If the generator is in the sustain portion of its output cycle, and a new trigger occurs, the flip-flop will be set again and the attack and decay portions of the cycle will recur. Coupling the gate signal to pin 4 of the 555 ensures retriggering even if the wave is not permitted to reach the conclusion of its attack cycle.



Repeating repertoire. The three-chip generator provides a four-step waveform, each cycle of which is adjustable, for modulating voltage-controlled oscillators in music synthesizers. Thus loudness, timbre, and pitch may be adjusted. The circuit costs under \$8.