Two-chip generator shapes synthesizer's sounds

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Generating the same adjustable modulating waveforms for a music synthesizer as the circuit proposed by Kirschman[1], but using only two integrated circuits, this generator also works from a single supply. It has, in addition, separate gate and trigger inputs for providing a more realistic keyboard response.

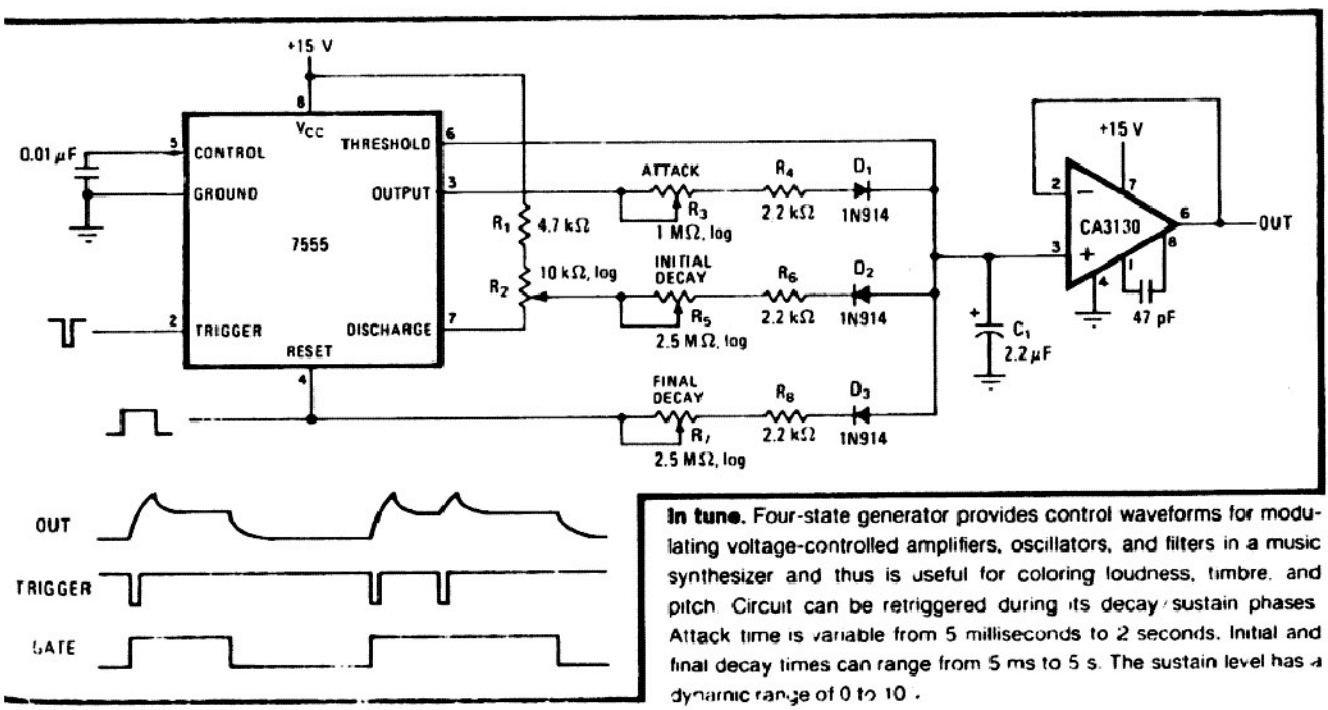
When gated or triggered, the generator, which is built around Intersil Inc.'s C-MOS 7555 timer, produces a waveform that passes through four states:

- An exponential attack.
- An initial decay, or fallback.
- A sustain, or steady dc level.
- A final decay, or release.

Each of these four parameters is continuously variable, so that waveforms having a wide variety of shapes can be generated.

The waveforms are generated by the sequential charging and discharging of capacitor C_1. Here, the 7555 controls the sequencing while diodes switch the currents, unlike Kirschman's circuit where comparators and flip-flops control the stepping and analog switches steer the currents. Furthermore, the 7555 is well suited for handling the two logic signals provided by most synthesizer keyboards—the gate, which is high as long as any key is depressed, and the trigger, which provides a negative pulse as each key is struck. The gate and trigger features eliminate the need to release each key before striking the next to initiate an attack phase.

In the dormant state (the gate input at pin 4 of the 7555 is low), capacitor C_2 is discharged. When the gate goes high and a trigger pulse appears at pin 2, the 7555 output (pin 3) goes high and charges C_1 through R_3, R_4, and D_1, producing the attack segment of the waveform. Note that diode D_2 is reverse-biased because pin 7 of the 7555 is high and that diode D_3 is back-biased by logic 1



In tune. Four-state generator provides control waveforms for modulating voltage-controlled amplifiers, oscillators, and filters in a music synthesizer and thus is useful for coloring loudness, timbre, and pitch. Circuit can be retriggered during its decay/sustain phases. Attack time is variable from 5 milliseconds to 2 seconds. Initial and final decay times can range from 5 ms to 5 s. The sustain level has a dynamic range of 0 to 10.

signal applied to the gate input.

When the voltage across C_1 reaches 10 volts, pin 3 of the 7555 goes low and pin 7 is grounded, terminating the attack phase. D_1 and D_3 are now reverse-biased and C_1 discharges through D_2, R_5, and R_6 to produce the initial decay. The sustain level reached is determined by the voltage divider formed by resistor R_1 and potentiometer R_2. During this phase, a second attack can be obtained by striking another key (see timing diagram). When the last key is released, the gate goes low and C_1 will discharge through D_3, R_7, and R_8 to produce the final decay. The CA3130 operational amplifier serves as a buffer to protect C_1 from excessive loading. □

References
1. Randall K. Kirschman, "Adjustable e' generator colors synthesizer's sounds," Electronics, July 17, 1980, p. 123.