Adjustable e^x generator colors synthesizer's sounds

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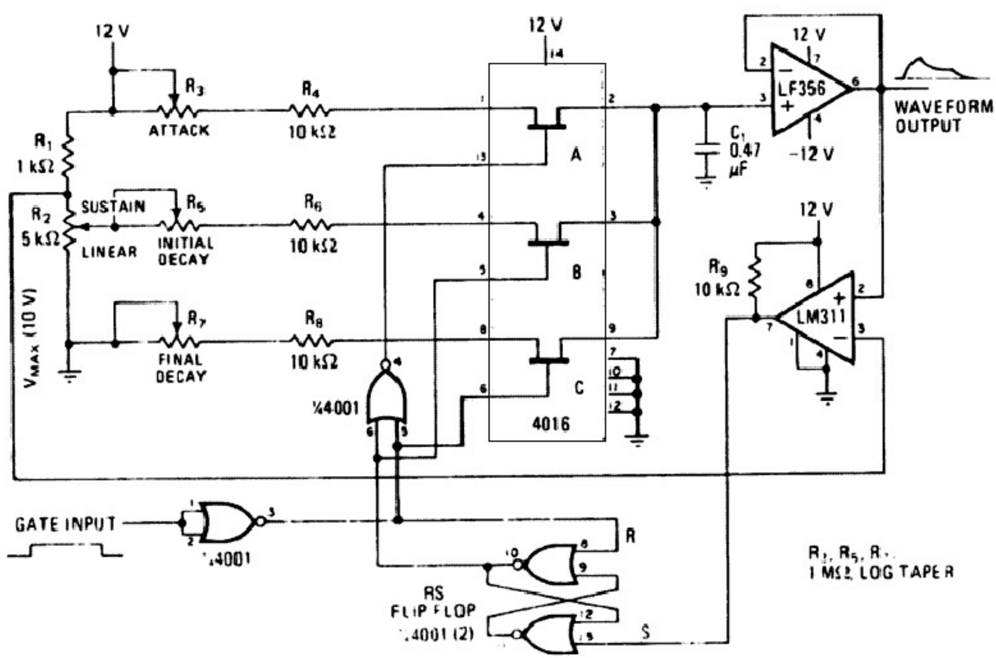
Providing the control signals for voltage-controlled amplifiers, oscillators and filters in order to modulate sound parameters such as loudness, pitch and timbre, this adjustable e^x generator is the indispensable ingredient required to attain superior performance in a music synthesizer. Only four integrated circuits and a few passive components are needed in the inexpensive unit, which costs under $6.

When gated or triggered, the generator 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 large variety of shapes can be generated.

The waveforms are generated by the sequential charging and discharging of capacitor C_1 (see figure). In general operation, C_1 is connected to a current source or sink as required, through the 4016 complementary-MOS



Musical tint. Four-state generator provides myriad control waveforms for modulating voltage-controlled amplifiers, oscillators, and filters in a music synthesizer, and thus is useful for coloring loudness, pitch, and timbre. Attack and decay times are variable from 5 to 500 milliseconds; sustain level is adjustable from 0 to 10 volts.

analog switches. These switches are controlled by simple logic set into action by the gate-input pulse. Triggered operation is made possible by adding a monostable multivibrator to the circuit.

In the dormant state (gate input low), analog switch C is on, switches A and B are off and the RS flip-flop formed by two 4001 NOR gates is reset. The onset of a gate pulse turns on switch A and turns C off. Consequently, C_1 charges through R_3 and R_4, producing the attack segment of the waveform. Note that the LM356 buffer protects C_1 from excessive loading.

When the voltage across C_1 reaches V_{max} (determined by voltage divider R_1–R_2), the LM311 comparator sets the RS flip-flop. This action in turn switches B on and A off. Thus the initial decay segment is generated as C_1 discharges through R_5 and R_6 to reach the sustain voltage, the level of which is determined by the setting of potentiometer R_2.

Concurrently, the comparator's output has gone low, but the RS flip-flop remains set until the gate pulse moves to logic 0, at which time switch C turns on. Thus C_1 discharges through R_7 and R_8 to produce the final-decay portion of the wave, after which the circuit reverts to its dormant state. □