

# CEM 3371

## μP Controllable Waveform Generator

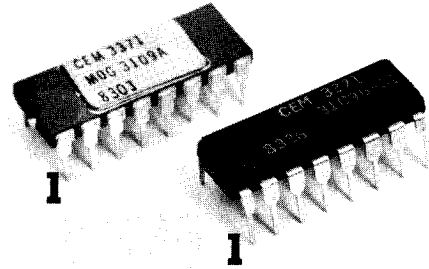
The CEM 3371 is a general purpose dual voltage controlled waveform generator intended for generating arbitrary waveforms when used in conjunction with a microprocessor - DAC system. A typical application would be in the generation of envelope waveforms in musical instruments, where with only three sampled voltages, two completely independent envelopes may be generated with any starting voltage, ending voltage, shape, duration, and amplitude.

The three determining parameters are Asymptote voltage (A), Time control voltage (T), and Peak Clamp voltage (P). All three inputs are very high impedance, low bias current inputs, and therefore may be supplied from a single multiplexed DAC output with only a CMOS multiplexer and hold capacitors.

The output selected with Output Select (OS) will follow any change in the asymptote voltage level, but at a rate determined by the Time control voltage. With proper interconnection of a few external components, the output wave shape may be RC (exponential), linear, or anything in between. The Time control input varies the time constant in an exponential manner over a minimum range of 50,000:1. The Peak Clamp voltage will cause the output, as it is charging or discharging toward its asymptote, to stop and hold indefinitely at that level. Whenever this occurs, the Peak

Sense output (PS) will go low, indicating to the processor that the output is in the clamped condition. The typical application for this clamp circuit would be to set the envelope peak and to indicate the end of the attack portion of the envelope.

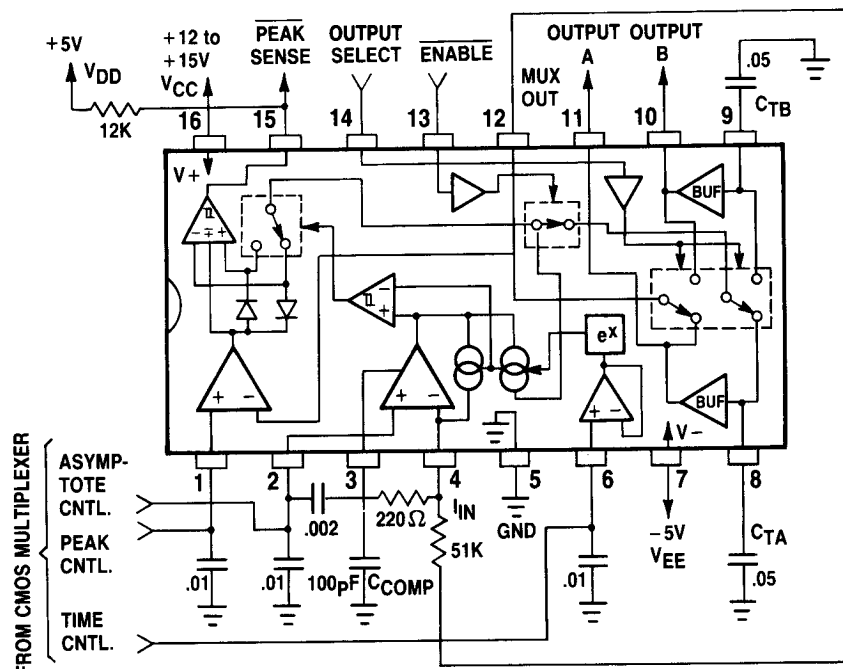
The asymptote, time, and peak clamp circuitry is switchable between two buffered outputs with the Output Select, and therefore may be multiplexed to generate two independent waveforms.



### Features

- Low Cost Minimal Hardware/Minimal Software System
- Extreme Flexibility Determined with Only Three Parameters
- Arbitrary Waveforms Possible - Not Limited to ADSR
- Normal and Inverted Envelope Possible
- Variable Envelope Amplitudes
- Ability to Set Waveform Quiescent Level Eliminates Initial Level S & H and C.V. Mixer.
- 0 to +5V, High Z Control Inputs for Easy Interface to System DAC through CMOS Multiplexer
- Low Offset Between Asymptote and Peak C.V. Inputs and Final Output

### Block and Connection Diagram



# CEM 3371

## Electrical Characteristics

V <sub>CC</sub> = +15V V <sub>EE</sub> = -15V T <sub>A</sub> = 20°C				
Parameters	Minimum	Typical	Maximum	Units
Asymptote Control Input Voltage	-1V	—	+14	V
Offset Between Asymptote and Final Output Level	-20	—	+20	mV
Peak Control Input Voltage	-2	—	+12	V
Offset Between Peak and Output in Clamped State	-20	—	+20	mV
Time Control Input Voltage <sup>1</sup>	-2	—	+6	V
Time Constant Range	50,000:1	—	—	
Time Control Scale Factor	+1.15	+1.25	+1.35	V/decade
Time Control Scale Error <sup>2</sup>	—	0.3	1.0	%
Time Constant at V <sub>TIME</sub> = 0 <sup>3</sup>	0.4	0.5	0.6	R <sub>F</sub> x C
Time Constant Tracking Between Outputs	—	—	C1:C2	match
Time Constant Tracking Between Devices	—	15	—	%
Output Shift with Time C.V. <sup>4</sup>	—	1	3	mV
Output = Asymptote (unclamped)	—	—	—	
Output = Peak (clamped)	—	NONE	—	
Crosstalk Between Outputs <sup>5</sup>	—	20	30	mV
Output = Asymptote (unclamped)	—	20	30	mV
Output = Peak (clamped)	—	20	30	mV
Output Select Threshold Voltage	1.7	2.0	2.3	V
Output Select Input Bias Current <sup>6</sup>	-5	-15	-30	μA
Enable Threshold Voltage	2.4	2.7	3.0	V
Enable Input Bias Current <sup>6</sup>	-3	-10	-30	μA
Peak Sense High Output Current <sup>7</sup>	—	—	-0.05	mA
Peak Sense Low Output Current <sup>8</sup>	-0.4	—	-0.6	mA
Asymptote Control Input Bias Current	—	±3	±10	nA
Peak Control Input Bias Current	—	±1.5	±5	nA
Time Control Input Bias Current	—	±6	±20	nA
Input Bias Required by Feedback Pin (pin 4)	-2	-15	-50	nA
Allowable Feedback Current into Feedback Pin <sup>9</sup>	—	—	150	μA
Output Sink Current	-0.3	-0.4	-0.5	mA
Output Source Current	—	—	3	mA
Positive Supply Range	+11.4	—	+16	V
Positive Supply Current	6.5	8.4	10.5	mA
Negative Supply Range	-4.5	—	-6	V
Negative Supply Current	4.5	5.6	7.0	mA

### Notes

**Note 1.** Nominal input for 10,000:1 time constant range is 0 to +5V.

**Note 2.** For Time control voltages between +1.5 and +5V. Maximum value increases to 10% at 0V.

**Note 3.** For 50% duty cycle Output Select signal. Values are halved when only one output is continuously selected.

**Note 4.** Time control voltage changes from 0 to +5V.

**Note 5.** Waveform amplitude of other channel output is 5V.P.P.

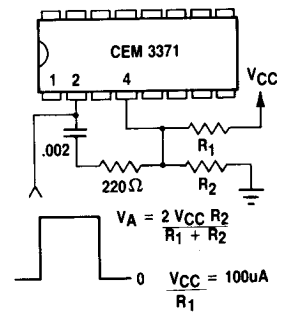
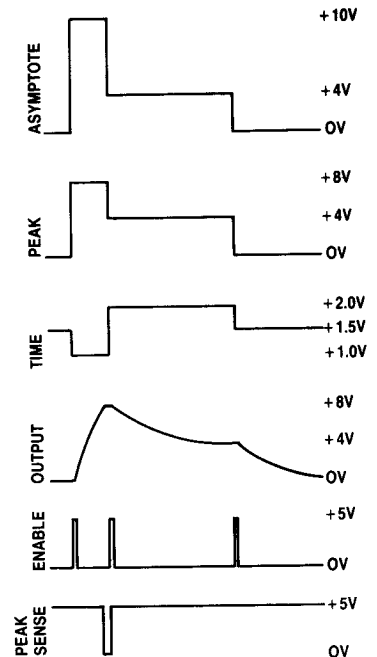
**Note 6.** Logic input level is +5V.

**Note 7.** Pull-up resistor required to digital supply not greater than +6.0V.

**Note 8.** V<sub>LOW</sub> = 0V. Whatever this pin drives must be capable of being pulled down to 0.1V with 400 μA.

**Note 9.** For minimum time control voltage = 0V. This value will be less for time control voltages < 0V.

## Timing



CONNECTION FOR LINEAR WAVEFORM SHAPE

