CURTIS ELECTROMUSIC SPECIALTIES

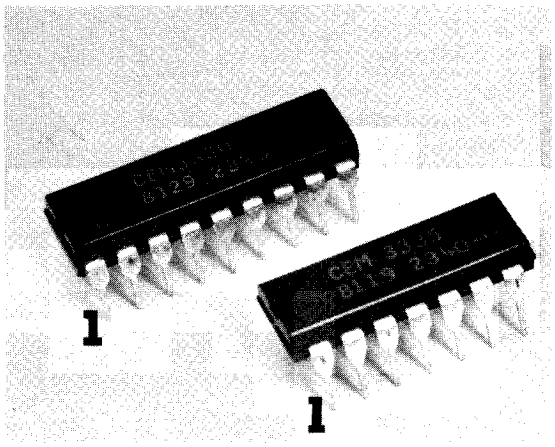
CEM 3330/3335

Dual Voltage Controlled Amplifier

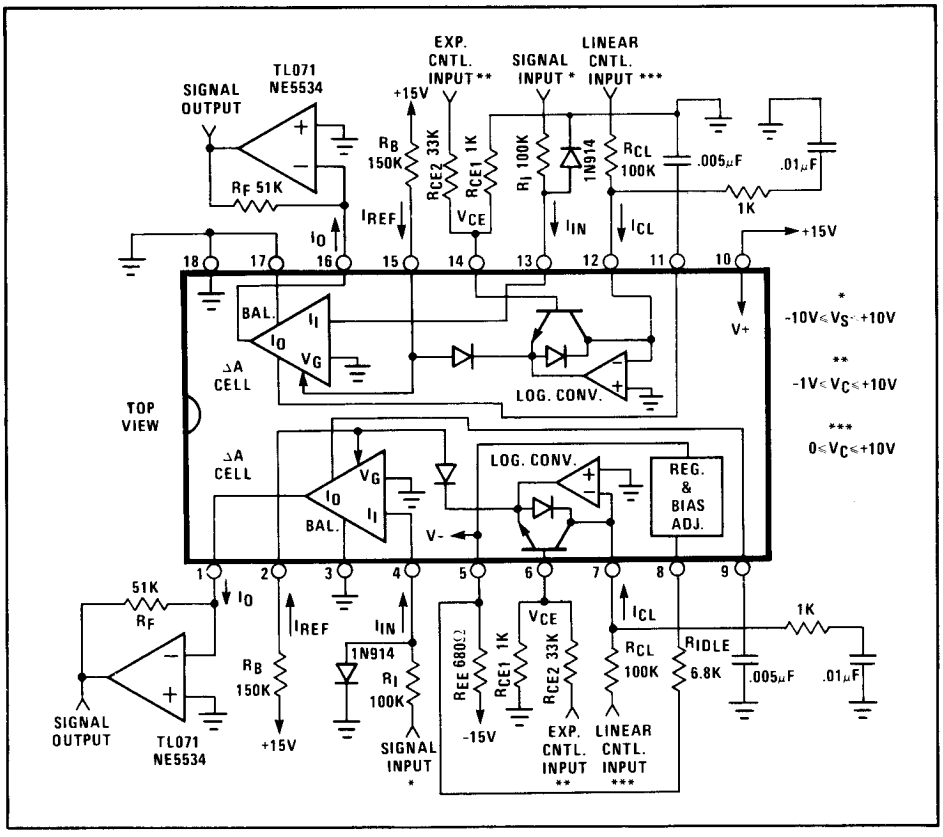
The CEM 3330 and CEM 3335 are dual, high performance, voltage controlled amplifiers intended for electronic musical instrument and professional audio applications. For the 3330, each amplifier includes complete circuitry for simultaneous linear and exponential control of gain. In addition, the operating point of the amplifiers may be set anywhere from Class B to Class A, allowing the user to optimize those parameters critical to the particular application. Also featured are virtual ground summing nodes for both the signal and linear control inputs, so that signal and control mixing may be accomplished within the device itself. Finally, the VCA outputs are signal currents, allowing the device to be conveniently used in two-pole voltage controlled filters, as well as dual voltage controlled amplifiers.

The 3335 is the same device as the 3330 but without the linear control circuitry, and is intended for those applications which require only the exponential control of gain.

The devices include an on-chip 6.5 volt Zener, allowing them to operate off ±15 volt supplies as well as +15, -5 volt supplies.



CEM 3330 Circuit Block and Connection Diagram



Features

- Low Cost
- Two Independent Voltage Controlled Amplifiers in a Single Package
- Simultaneous Linear and Exponential Control Inputs
- Wide Control Range: 120dB min.
- Very Accurate Control Scales for Excellent Gain Tracking
- Exceptionally Low Control Voltage Feedthrough: -60dB minimum without trim, better than -80dB with trim
- Low Distortion: Less than 0.1%
- Exceptionally Low Noise: Better than -100dB
- Class B to Class A Operation
- Summing Signal and Linear Control Inputs
- Current Outputs for Ease of Use in Voltage Controlled 2-Pole Filters
- Can Be Used in VCO and VCF Control Paths Without Causing Shift
- ±15 Volt Supplies

Electrical Characteristics

V_{CC} = +15V		T_A = 25°C			
Parameter	Conditions	Min	Typ	Max	Units
Exponential Control Range		120	150	–	dB
Linear Control Range		100	130		dB
Peak Cell Current, I_{CP} (input plus output)	Class B	±400	±600	–	µA
	Class A	±800	±1400	–	µA
Exponential Control Scale Sensitivity		2.8	3.0	3.2	mV/dB
Tempco of Exponential Control Scale		+3000	+3300	+3600	ppm
Tempco of Linear Control Scale		–	±100	±300	ppm
Exponential Control Scale Error[1]		–	0.3	1	dB
Linear Control Scale Error[1]	$0<I_{CL}<100\mu A$	–	0.3	1.5	%
Cell Current Gain	V_G = 0	.83	1	1.2	
Current Gain Tempco	V_G = 0	–	±100	±300	ppm
Log Converter Output	$I_{CL} = I_{REF}$	-5	0	+5	mV
Output Voltage Compliance		-.3	–	+13.5	V
Untrimmed Distortion[2]	Class B	–	1.5	5	%
	Class A	–	0.3	1	%
Trimmed Distortion[2]	Class B	–	0.2	0.8	%
	Class A	–	.05	0.2	%
Untrimmed Control Feedthrough[3]	Class B	–	0.2	0.8	µA
	Class A	–	7	25	µA
Trimmed Control Feedthrough[3]	Class B	–	.01	.08	µA
	Class A	–	1	5	µA
Output Noise Current in 20KHz Bandwidth (V_G = 0)	Class B	–	1.2	3.5	nARMS
	Class A	–	3.5	12	nARMS
Signal Current Bandwidth[4]	Class B	30	100	–	KHz
	Class A	100	350	–	KHz
Signal Current Slew Rate	Class B	60	150	–	µA/µS
	Class A	400	750	–	µA/µS
Crosstalk Between VCAs	F = 10KHz	-60	-70	–	dB
Internal Bias Current at Signal & Linear Control Inputs	Class B	80	175	350	nA
	Class A	130	300	600	nA
Exponential Control Input Current	I_{CL} = 100µA	.4	0.8	1.3	µA
Linear Control Input Offset Voltage		-7	+3	+15	mV
Signal Input Offset Voltage		-15	-5	+5	mV
Positive Supply Current	Class B	0.8	1.3	2.1	mA
	Class A	2.1	2.7	3.7	mA
Positive Supply Range		+9	–	+18	V
Negative Supply Range[5]		-4.5	–	-18	V

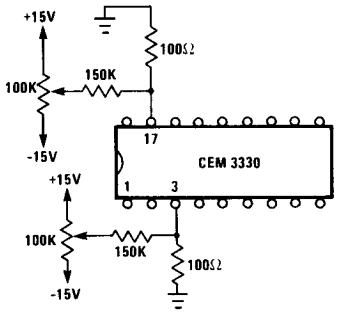


FIGURE 4: DISTORTION TRIM

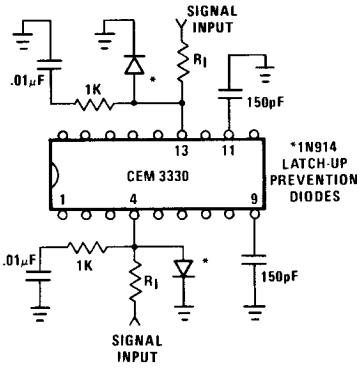


FIGURE 5: GAIN CELL COMPENSATION FOR LARGER BANDWIDTH

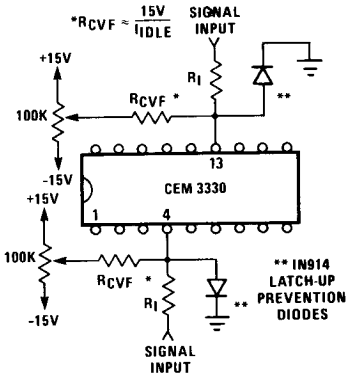


FIGURE 7: CONTROL REJECTION TRIM

Note 1: From current gains of +20dB to -80dB. Peak cell current is less than 100µA.

Note 2: Output signal is 10dB below clipping and is at a frequency of 1KHz. V_G = 0

Note 3: Current gain varies from unity to maximum attenuation (>110dB).

Note 4: Peak Output Current is ±200µA.

Note 5: Current limiting resistor required for negative voltages greater than -6 volts.

Note 6: Class B is defined at an idle current of 1µA; Class A is at an idle current of 100µA.

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