OBJECTIVE SPECIFICATION 570/571-N

DESCRIPTION

The 570/571 is a versatile low cost dual gain control circuit in which either channel may be used as a dynamic range compressor or expandor. Each channel has a full wave rectifier to detect the average value of the signal; a linerarized, temperature compensated variable gain cell; and an operational amplifier.

The 570/571 is well suited for use in telephone subscriber and trunk carrier systems, communications systems and hi-fi audio systems.

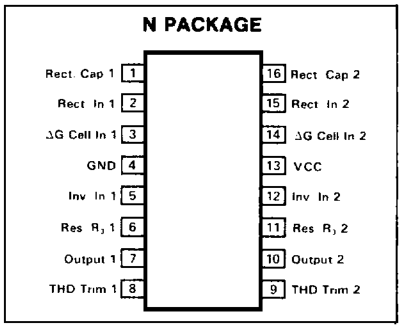
FEATURES

- **Complete compressor and expandor in 1 IC**
- **Temperature compensated**
- **Greater than 110dB dynamic range**
- **Operates down to 6Vdc**
- **System levels adjustable with external components**
- **Distortion may be trimmed out**

APPLICATIONS

- **Telephone trunk compandor—570**
- **Telephone subscriber compandor—571**
- **High level limiter**
- **Low level expandor—noise gate**
- **Dynamic noise reduction systems**
- **Voltage controlled amplifier**
- **Dynamic filters**

PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS

	PARAMETER	RATING	UNIT
	Positive supply		Vdc
	570	24	
	571	18	
T_A	Operating temperature range	-40 to +70	°C
P_D	Power dissipation	400	mW

CIRCUIT DESCRIPTION

The 570/571 compandor building blocks, as shown in the block diagram, are a full wave rectifier, a variable gain cell, an operational amplifier and a bias system. The arrangement of these blocks in the IC result in a circuit which can perform well with few external components, yet can be adapted to many diverse applications.

The full wave rectifier rectifies the input current which flows from the rectifier input, to an internal summing node which is biased at V_{REF}. The rectified current is averaged on an external filter capacitor tied to the C_{RECT} terminal, and the average value of the input current controls the gain of the variable gain cell. The gain will thus be proportional to the average value of the input signal for capacitively coupled voltage inputs as shown in the following equation. Note that for capacitively coupled inputs there is no offset voltage capable of producing a gain error. The only error will come from the bias current of the rectifier (supplied internally) which is less than .1μA.

$$G \propto \frac{|V_{IN} - V_{REF}|\ \text{ave}}{R_1}$$

or

$$G \propto \frac{|V_{IN}|\ \text{ave}}{R_1}$$

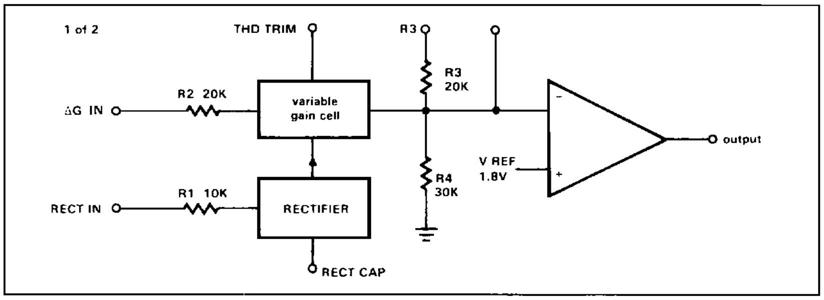
The speed with which gain changes to follow changes in input signal levels is determined by the rectifier filter capacitor. A small capacitor will yield rapid response but will not fully filter low frequency signals. Any ripple on the gain control signal will modulate the signal passing through the variable gain cell. In an expandor or compressor application, this would lead to third harmonic distortion, so there is a tradeoff to be made between fast attack and decay times, and distortion. For step changes in amplitude, the change in gain with time is shown by this equation.

$$G(t) = (G_{initial} - G_{final})\ e^{-t/\tau} + G_{final};\ \tau = 10K \times C_{RECT}$$

The variable gain cell is a current in, current out device with the ratio I_{OUT}/I_{IN} controlled by the rectifier. I_{IN} is the current which flows from the ΔG input to an internal summing node biased at V_{REF}. The following equation applies for capacitively coupled inputs. The output current, I_{OUT}, is fed to the summing node of the op amp.

$$I_{IN} = \frac{V_{IN} - V_{REF}}{R_2} = \frac{V_{IN}}{R_2}$$

BLOCK DIAGRAM



A compensation scheme built into the ΔG cell compensates for temperature, and cancels out odd harmonic distortion. The only distortion which remains is even harmonics, and they exist only because of internal offset voltages. The THD trim terminal provides a means for nulling the internal offsets for low distortion operation.

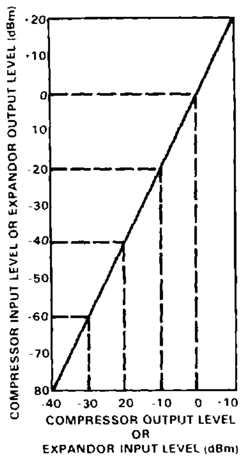
The operational amplifier (which is internally compensated) has the non-inverting input tied to V_{REF}, and the inverting input connected to the ΔG cell output as well as brought out externally. A resistor, R_3, is brought out from the summing node and allows compressor or expandor gain to be determined only by internal components. The output stage is capable of ±20mA output current. This allows a +13dBm (3.5V rms) output into a 300Ω load which, with a series resistor and proper transformer, can result in +13dBm with a 600Ω output impedance.

A band gap reference provides the reference voltage for all summing nodes, a regulated supply voltage for the rectifier and ΔG cell, and a bias current for the ΔG cell. The low tempco of this type of reference provides very stable biasing over a wide temperature range.

The typical performance characteristics illustration shows the basic input-output transfer curve for basic compressor or expandor circuits.

TYPICAL PERFORMANCE CHARACTERISTICS

BASIC INPUT-OUTPUT TRANSFER CURVE



DC ELECTRICAL CHARACTERISTICS $T_A = 25°C$, $V_{CC} = 15V$[1]

PARAMETER	TEST CONDITIONS	NE570 Min	NE570 Typ	NE570 Max	NE571 Min	NE571 Typ	NE571 Max	UNIT
V_{CC} Supply voltage		6		24	6		18	V
I_{CC} Supply current	No signal		3.2	4.0				mA
Output current capability		±20						mA
Output slew rate			±.5					V/us
Gain cell distortion[2]	Untrimmed		.3	1.0		.5	2.0	%
	Trimmed		.05			.1		
Resistor tolerance			±5	±15				%
Internal reference voltage		1.7	1.8	1.9	1.65	1.8	1.95	V
Output dc shift[3]	Untrimmed		±20	±50		±30	±100	mV
Expandor output noise	No signal, 20Hz-20kHz		20					μV
			-15					dBRNC
Unity gain level		-1	0	+1	-1.5	0	+1.5	dBm
Gain change[2,4]	-40°C < T < 70°C		±.1	±.3		±.1	±.5	dB
	0°C < T < 70°C		±.1	±.2		±.1	±.4	
Reference drift[4]	-40°C < T < 70°C		+2, -25	+10, -40		+2, -25	+20, -50	mV
	0°C < T < 70°C		±5	±10		±5	±20	
Resistor drift[4]	-40°C < T < 70°C		+8,-0					%
	0°C < T < 70°C		+1,-0					
Tracking error[5]	Rectifier input=							dB
	+6dBm		±.2					
	-10dBm		+.2	-.2,+.4		+.2	-.2,+.5	
	-20dBm		+.2	-.3,+.6		+.2	-.4,+.7	
	-30dBm		+.2	-.5,+1		+.2	-1,+1.5	
	-40dBm		+.2,-.4			+.2,-.4		

NOTES

1. Except where indicated, the 571 specifications are identical to the 570
2. Measured at 0dBm
3. Expandor ac input change from no signal to 0dBm
4. Relative to value at $T_A = 25°C$
5. Relative to 0dBm

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