Communication Circuits

LM170/LM270/LM370 agc/squelch amplifier

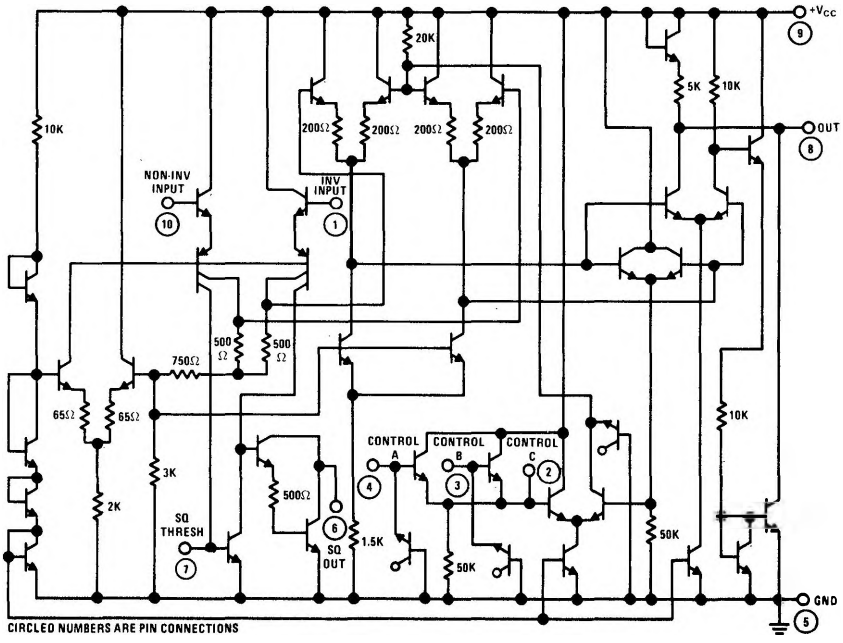
general description

The LM170 is a direct coupled monolithic amplifier whose voltage gain is controlled by an external DC voltage. The device features:

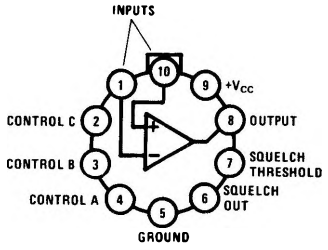
- Large Gain Control Range
- Self-contained AGC/Squelch system, with fast-attack, slow-release.
- Low Distortion
- Minimum DC output shift as gain is varied
- Differential inputs, with large common-mode input range
- Outputs of several amplifiers may be directly summed in multichannel systems.
- Dissipates only 18 mW from +4.5V supply, usable with supply up to +24V.
- Sensitive squelch threshold set by single external resistor.

In addition to communication system squelch and AGC applications, the LM170 is useful as constant-amplitude audio oscillator, linear low frequency modulator, single-sideband automatic load control, and as a variable DC gain element in analog computation.

schematic and connection diagrams



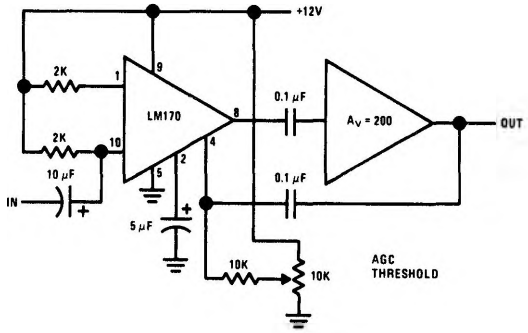
CIRCLED NUMBERS ARE PIN CONNECTIONS



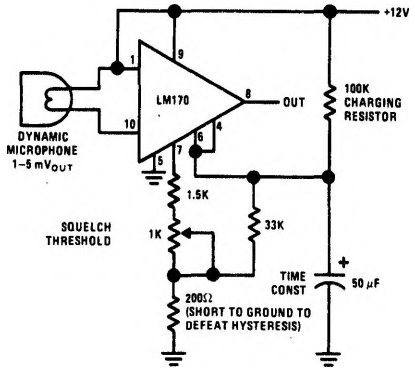
TO-5
TOP VIEW

typical applications

AGC Using Built-in Detection, Driven By Additional System Gain



Squelched Preamplifier with Hysteresis



absolute maximum ratings

Supply Voltage	24V
Storage Temperature	-65°C to +150°C
Operating Temperature LM170	-55°C to +125°C
LM270	-25°C to +75°C
LM370	0°C to +70°C
Differential Input Voltage	±19.5V
Common-mode Input Voltage	(V_{CC} + 0.4)V
Output Short Circuit Duration	Indefinite
Voltage applied to Pin 3 or 4	+6.0V
Voltage applied to Pin 2	+12.0V
Surge power into Pin 6 (1 second max.)	1000 mW
Continuous power into Pin 6	100 mW

electrical characteristics (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS						
DC Output Voltage	V_O(DC)	V_{IN} (dd) = 0, V (gain control) = 0	+5.0	+6.0	+7.0	V
DC Output Voltage	V_O(DC)	V_{IN} (dd) = 0 V (gain control) = +3.0	+5.0	+6.0	+7.0	V
DC Output Shift	ΔV_O(DC)	V_{IN} (dd) = 0 V (gain control) changed from 0 to +3.0V				
		LM170	-200	0	+200	mV
		LM270	-500	0	+500	mV
		LM370	-1000	0	1000	
Power Supply Drain	I_{PS}	V_{CC} = +24V		13.5		mA
		V_{CC} = +4.5V		4.0		
		V_{CC} = +12V (LM170, 270)		8.0	10.0	mA
		(LM370)		8.0	12.0	mA
Input Bias Current	I_{IB}	LM170, 270		5.0	10.0	μA
		LM370		5.0	12.0	
AC CHARACTERISTICS						
Voltage Gain	A_V	V (gain control) = 0				
		LM170, 270	37.5	40.0		
		LM370	35.0	40.0		dB
		f = 1 KHz				
Gain Reduction Range	ΔA_V	V (gain control) changed from 0 to +3.0V. Gain reduction occurs for control voltages between - 2.1 and +2.5 volts, pin 3 or pin 4. f = 1 KHz		-80.0		dB

Note 1: T_A = 25°C, V_{CC} = +12V, $V_{IN(cm)}$ = +6V

operating notes

Voltage gain is continuously variable from a maximum value, dependent upon supply voltage, to a minimum value, by application of a DC control voltage at Pin 3 or 4. DC output voltage is substantially independent of gain changes, provided that differential DC input voltage is minimized, so that direct-coupled or fast gain-control operation is possible with minimum disturbance of succeeding amplifiers.

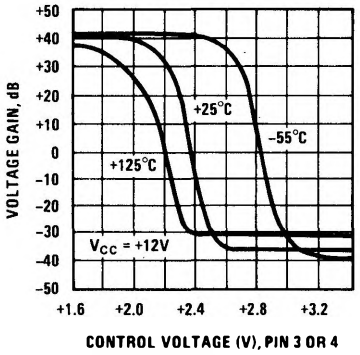
Input characteristics are similar to those of an operational amplifier, with common-mode input range extending from +4.5 volts up to and including the positive supply voltage. Lowest distortion occurs at input levels of 20 mV p-p or less. Outputs of several amplifiers, which will have quiescent DC levels approximately half of the positive supply, may be directly connected together in multi-channel summing systems, without damage.

Emitter-follower control inputs, Pins 3 and 4, may be used as positive peak detectors by connecting a smoothing capacitor at Pin 2, in AGC applications.

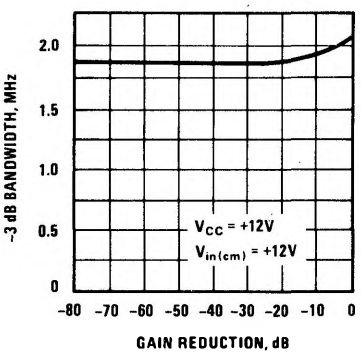
A sensitive squelch detector, independent of the amplifier's gain, provides fast-attack, slow release control at Pin 6, with threshold set by an external resistance from Pin 7 to ground. Injecting a portion of the control voltage at Pin 6 into this threshold results in a hysteresis, reducing response to erratic inputs. Since threshold is dependent on DC levels, differential DC input voltage should be held constant for squelch operation.

variable gain characteristics

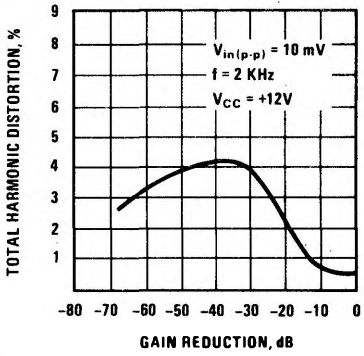
Voltage Gain vs Control Voltage



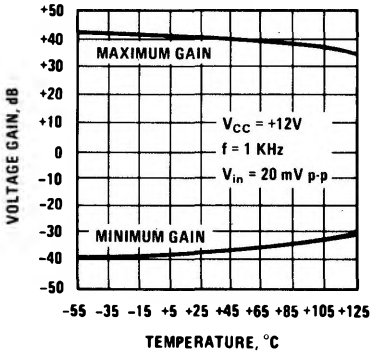
Bandwidth vs Gain Reduction



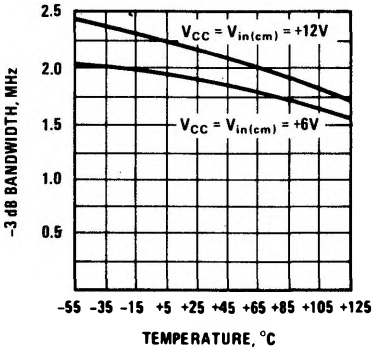
Total Harmonic Distortion vs Gain Reduction



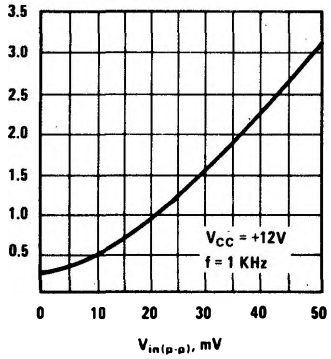
Maximum and Minimum Voltage Gain vs Temperature



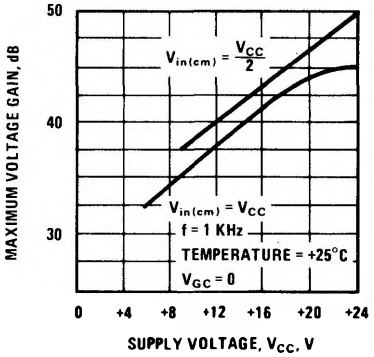
Bandwidth vs Temperature



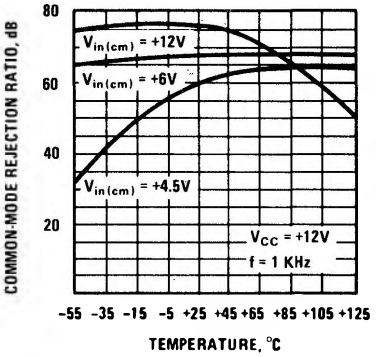
Total Harmonic Distortion vs Input Amplitude



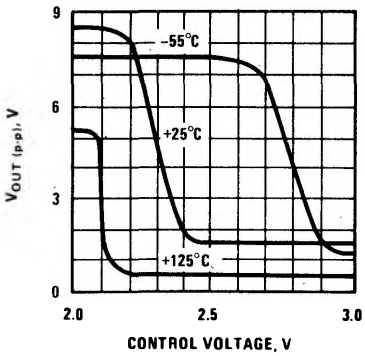
Maximum Voltage Gain vs Supply Voltage



Common-Mode Rejection Ratio vs Temperature

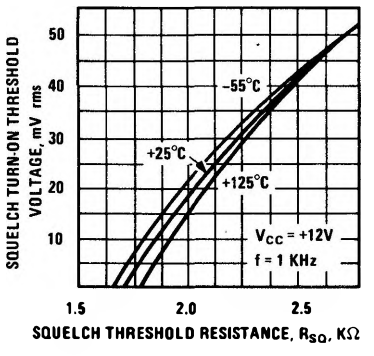


Output Dynamic Range vs Control Voltage

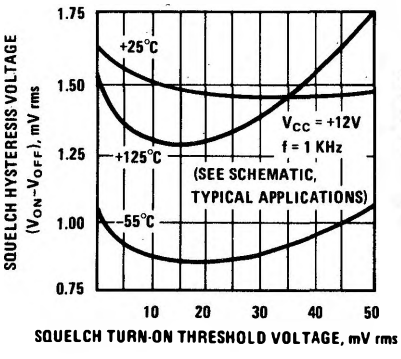


squelch characteristics

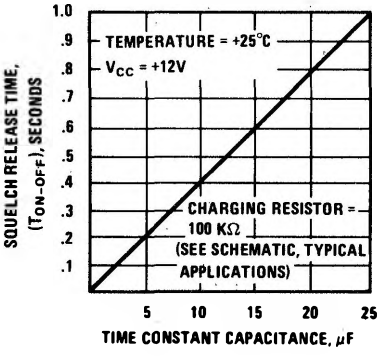
Squelch Threshold Voltage vs Threshold Resistance



Squelch Hysteresis Voltage vs Squelch Threshold Voltage

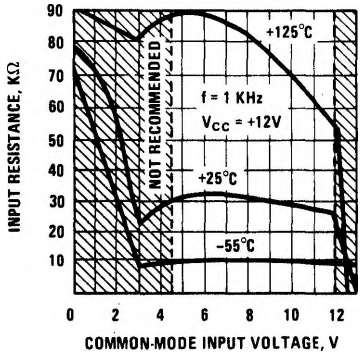


Squelch Release Time vs Time Constant Capacitance

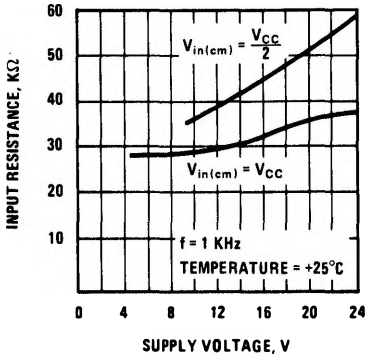


input and output characteristics

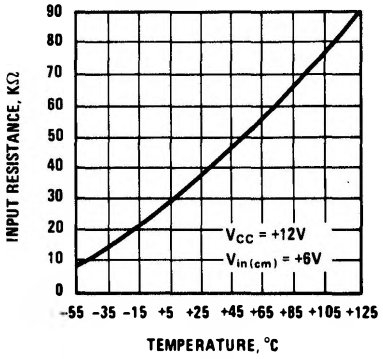
Input Resistance vs Common-Mode Input Voltage



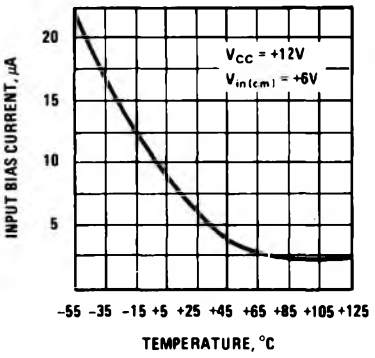
Input Resistance vs Supply Voltage



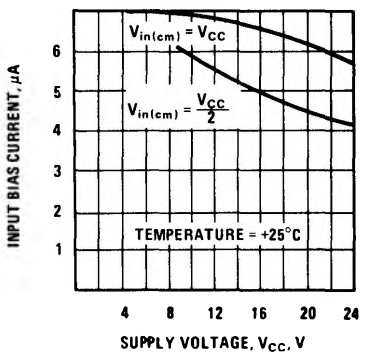
Input Resistance vs Temperature



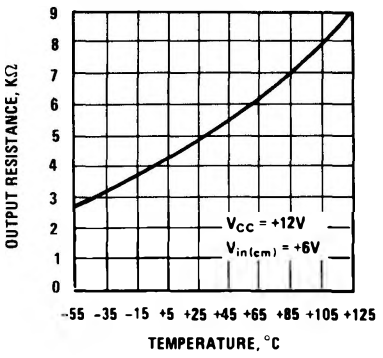
Input Bias Current vs Temperature



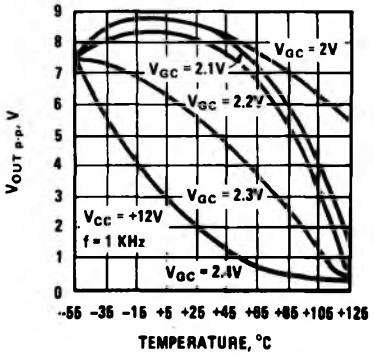
Input Bias Current vs Supply Voltage



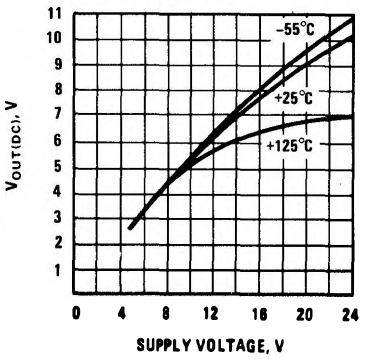
Output Resistance vs Temperature



Output Dynamic Range vs Temperature



Quiescent DC Output Voltage vs Supply Voltage



Power Supply Current vs Supply Voltage