National Semiconductor

LH0001 Low Power Operational Amplifier

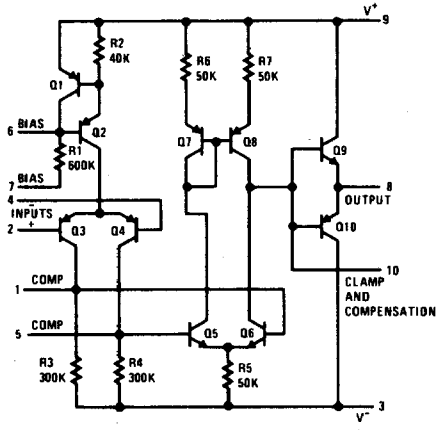
general description

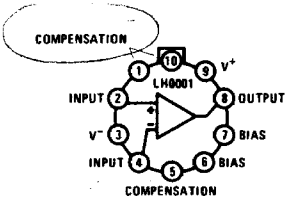
The LH0001 is a general purpose operational amplifier designed for extremely low quiescent power. Typical NO-load dissipation at 25°C is 2 milliwatts at V_S = ±15 volts, and 0.5 milliwatts at V_S = ±5 volts. Even with this low power dissipation, the LH0001 will deliver ±10 volts into a 2K load with ±15 volt supplies, and typical short circuit currents of 20 to 30 milliamps. Additional features are:

- Operation from ±5V to ±20V
- Very low offset voltage: typically 200 μV at 25°C, 600 μV at -55°C to 125°C
- Very low input offset current: typically 3 nA at 25°C, 6 nA at -55°C
- Low noise: typically 3 μV rms
- Frequency compensation with 2 small capacitors
- Output may be clamped at any desired level
- Output is continuously short circuit proof

The LH0001 is ideally suited for space borne applications or where battery operated equipment requires extremely low power dissipation.

schematic and connection diagrams





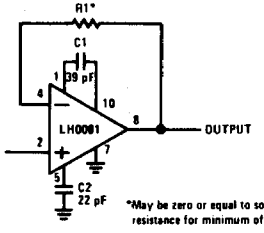
TOP VIEW

Note: Pin 7 must be grounded or connected to a voltage at least 5 volts more negative than the positive supply (Pin 9). Pin 7 may be connected to the negative supply however the standby current will be increased. A resistor may be inserted in series with Pin 7 up to a maximum of 100 kΩ per volt for the voltage difference between Pin 3 and Pin 9.

Order Number LH0001H
See Package H10B

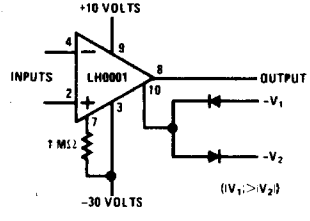
typical applications

Voltage Follower

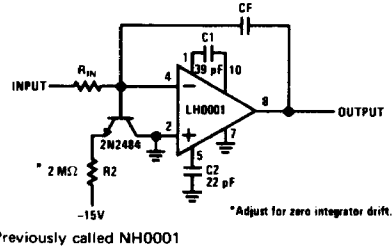


*May be zero or equal to source resistance for minimum offset.

Voltage Comparator for Driving MOS Circuits

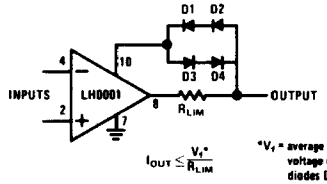


Integrator with Bias Current Compensation



*Adjust for zero integrator drift.

External Current Limiting Method



*Vf = average forward voltage drop of diodes D1 to D4 at 20 to 50 μA.

*Previously called NH0001

absolute maximum ratings

Supply Voltage	±20V
Power Dissipation (see Curve)	400 mW
Differential Input Voltage	±7V
Input Voltage	Equal to supply
Short Circuit Duration (Note 1)	Continuous
Operating Temperature Range	−55°C to +125°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering 10 sec.)	300°C

electrical characteristics (Note 2)

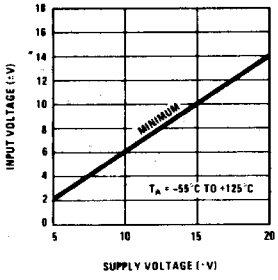
PARAMETER	TEMP (°C)	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage	25	$R_S \leq 100\Omega$		0.2	1.0	mV
	−55 to 125	$R_S \leq 100\Omega$		0.6	2.0	mV
Input Offset Current	25 to 125				20	nA
	−55				100	nA
Input Bias Current	25 to 125				100	nA
	−55				300	nA
Supply Current (+)	25	$V_S = \pm 20V$		90	125	μA
	125	$V_S = \pm 20V$		70	100	μA
	−55	$V_S = \pm 20V$		100	150	μA
Supply Current (−)	25	$V_S = \pm 20V$		60	90	μA
	125	$V_S = \pm 20V$		45	75	μA
	−55	$V_S = \pm 20V$		75	125	μA
Voltage Gain	−55 to 25	R_L = 100 KΩ, $V_S = \pm 15V$, $V_{OUT} = \pm 10V$	25	60		V/mV
	125	R_L = 100 KΩ, $V_S = \pm 15V$, $V_{OUT} = \pm 10V$	10	30		V/mV
V_{OUT}	25	$V_S = \pm 15V$, R_L = 2K	10	11.5		V
	−55	$V_S = \pm 15V$, R_L = 2K	9	10.5		V
	125	$V_S = \pm 15V$, R_L = 2K	11	12.5		V
Common Mode Rejection Ratio	−55 to 125	$V_S = \pm 15V$, $V_{IN} = \pm 10V$, $R_S \leq 100\Omega$	70	90		dB
Power Supply Rejection Ratio	−55 to 125	$V_S = \pm 15V$, ΔV = 5V to 20V, $R_S = \leq 100\Omega$	70	90		dB
Input Resistance	25		0.5	1.5		MΩ
Average Temperature Coefficient of Offset Voltage	−55 to 125	$R_S \leq 100\Omega$		4		μV/°C
Average Temperature Coefficient of Bias Current	−55 to 125			0.4		μA/°C
Equivalent Input Noise Voltage	25	R_S = 1K, f = 5 Hz to 1000 Hz, $V_S = \pm 15V$		3.0		μV rms

Note 1: Based on maximum short circuit current of 50 mA, device may be operated at any combination of supply voltages, and temperature to be within rated power dissipation (see Curve).

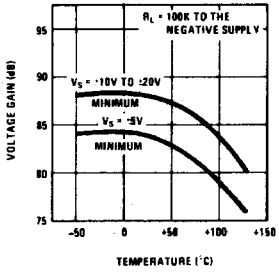
Note 2: These specifications apply for Pin 7 grounded, for $\pm 5V \leq V_S \leq \pm 20V$, with Capacitor C1 = 39 pF from Pin 1 to Pin 10, and C2 = 22 pF from Pin 5 to ground, unless otherwise specified.

guaranteed performance

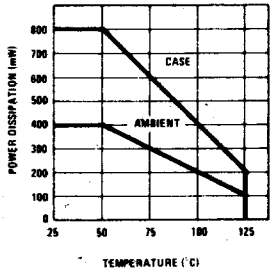
Input Voltage Range



Small Signal Voltage Gain

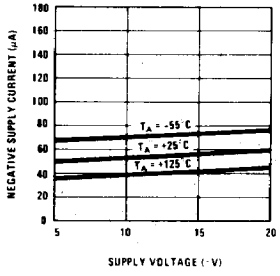


Maximum Power Dissipation

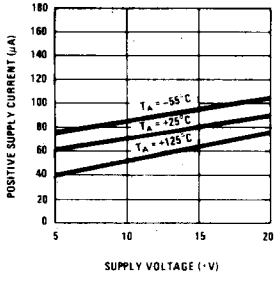


typical performance characteristics

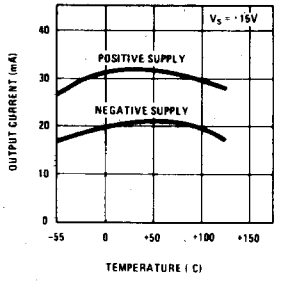
Negative Supply Current



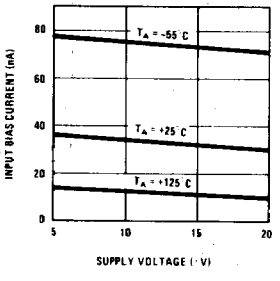
Positive Supply Currents



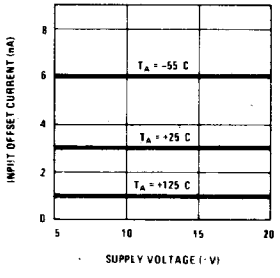
Short Circuit Output Current



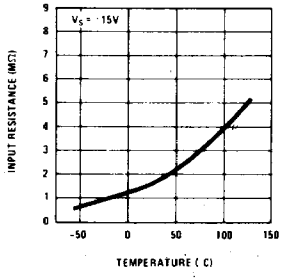
Input Bias Current



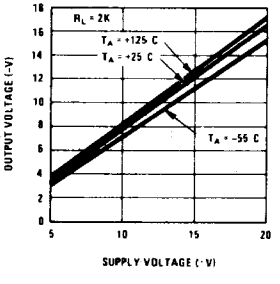
Input Offset Current



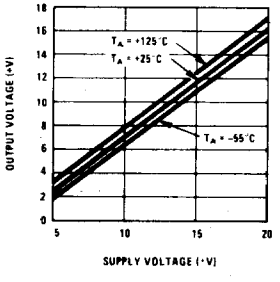
Input Resistance



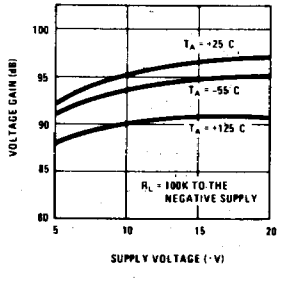
Negative Output Voltage Swing



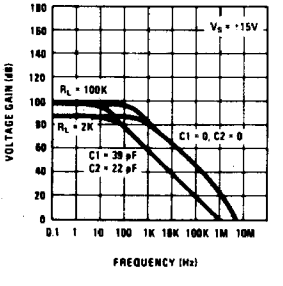
Positive Output Voltage Swing



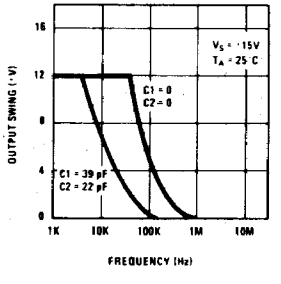
Voltage Gain



Open Loop Frequency Response



Large Signal Frequency Response



Voltage Follower Pulse Response