National Semiconductor

February 1995

LH0004 High Voltage Operational Amplifier

General Description

The LH0004 is a general purpose operational amplifier designed to operate from supply voltages up to ±40V. The device dissipates extremely low quiescent power, typically 8 mW at 25°C and $V_S = \pm 40V$.

The LH0004's high gain and wide range of operating voltages make it ideal for applications requiring large output swing and low power dissipation.

The LH0004 is specified for operation over the −55°C to +125°C military temperature range. The LH0004C is specified for operation over the 0°C to +85°C temperature range.

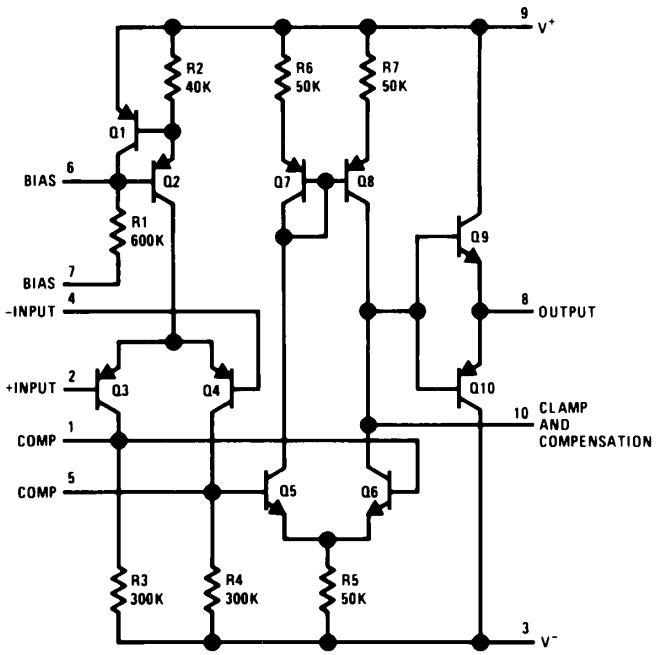
Features

- Capable of operation over the range of ±5V to ±40V
- Large output voltage typically ±35V for the LH0004 and ±33V for the LH0004C into a 2 kΩ load with ±40V supplies
- Low input offset voltage typically 0.3 mV
- Frequency compensation with 2 small capacitors
- Low power consumption 8 mW at ±40V

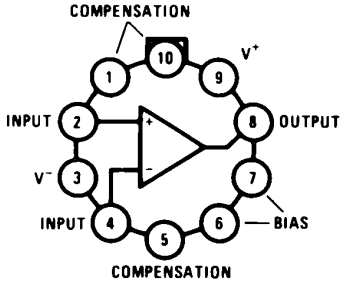
Applications

- High voltage power supply
- Resolver excitation
- Wideband high voltage amplifier
- Transducer power supply

Schematic and Connection Diagrams



TL/H/5559–1



TL/H/5559–2

Note: Pin 7 must be grounded or connected to a voltage at least 5V 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 to Pin 9. The value of the resistor should be a maximum of 100 kΩ per volt of potential between Pin 3 and Pin 9.

Order Number LH0004H,
LH0004H-MIL or LH0004CH
See NS Package Number H10G

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RRD-B30M115/Printed in U. S. A.

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications. (Note 2)

Supply Voltage	±45V
Power Dissipation (see Curve)	400 mW
Differential Input Voltage	±7V
Input Voltage	Equal to Supply
Short Circuit Duration	3 sec
Operating Temperature Range	
LH0004	−55°C to +125°C
LH0004C	0°C to +85°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	260°C

ESD rating to be determined.

Electrical Characteristics (Note 1)

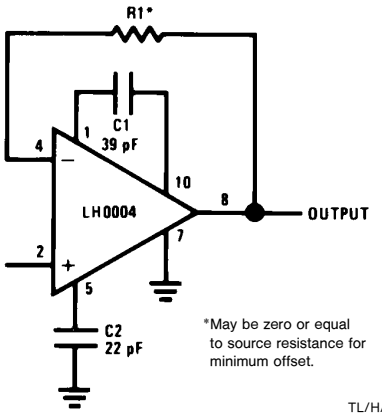
Parameter	Conditions	LH0004			LH0004C			Units
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	$R_S \leq 100\Omega$, $T_A = 25°C$ $R_S \leq 100\Omega$		0.3	1.0 2.0		0.3	1.5 3.0	mV
Input Bias Current	$T_A = 25°C$		20	100 300		30	120 300	nA
Input Offset Current	$T_A = 25°C$		3	20 100		10	45 150	nA
Positive Supply Current	$V_S = \pm 40V$, $T_A = 25°C$ $V_S = \pm 40V$		110	150 175		110	150 175	μA
Negative Supply Current	$V_S = \pm 40V$, $T_A = 25°C$ $V_S = \pm 40V$		80	100 135		80	100 135	μA
Voltage Gain	$V_S = \pm 40V$, $R_L = 100k$, $T_A = 25°C$ $V_{OUT} = \pm 30V$	30	60		30	60		V/mV
	$V_S = \pm 40V$, $R_L = 100k$ $V_{OUT} = \pm 30V$	10			10			V/mV
Output Voltage	$V_S = \pm 40V$, $R_L = 10k$		±35	±30		±33	±30	V
CMRR	$V_S = \pm 40V$, $R_S \leq 5k$ $V_{IN} = \pm 33V$	70	90		70	90		dB
PSRR	$V_S = \pm 40V$, $R_S \leq 5k$ $\Delta V = 20V$ to 40V	70	90		70	90		dB
Average Temperature Coefficient Offset Voltage	$R_S \leq 100\Omega$		4.0			4.0		μV/°C
Average Temperature Coefficient of Offset Current			0.4			0.4		nA/°C
Equivalent Input Noise Voltage	$R_S = 100\Omega$, $V_S = \pm 40V$ $f = 500$ Hz to 5 kHz, $T_A = 25°C$		3.0			3.0		μVrms

Note 1: These specifications apply for $\pm 5V \leq V_S \leq \pm 40V$, Pin 7 grounded, with capacitors C1 = 39 pF between Pin 1 and Pin 10, C2 = 22 pF between Pin 5 and ground, −55°C to +125°C for the LH0004, and 0°C to +85°C for the LH0004C unless otherwise specified.

Note 2: Refer to RETS0004X for LH0004H military specifications.

Typical Applications

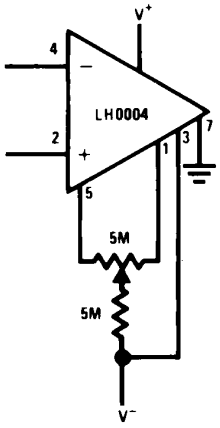
Voltage Follower



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

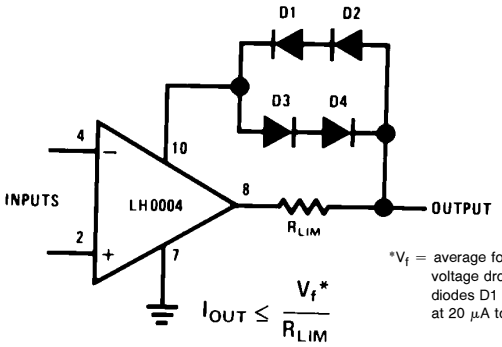
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Input Offset Voltage Adjust



TL/H/5559–4

External Current Limiting Method

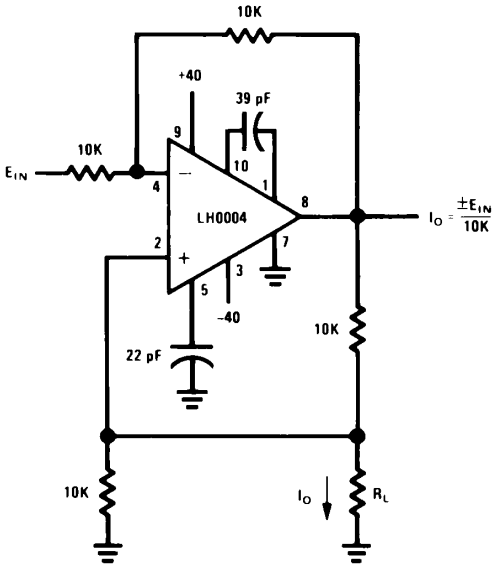


$$I_{OUT} \leq \frac{V_f^*}{R_{LIM}}$$

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

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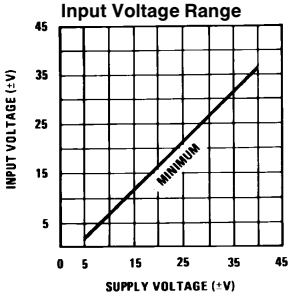
High Compliance Current Source



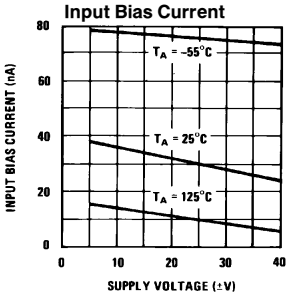
TL/H/5559–6

Typical Performance Characteristics

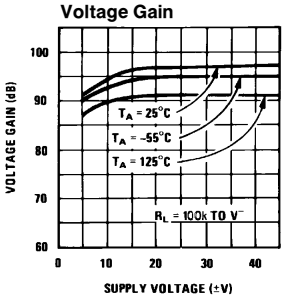
Input Voltage Range



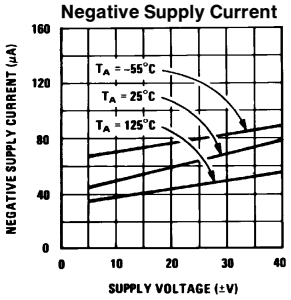
Input Bias Current



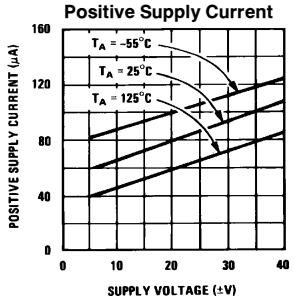
Voltage Gain



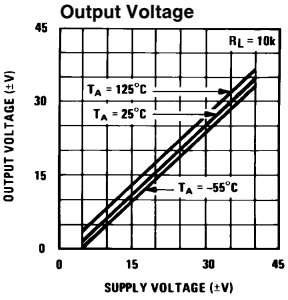
Negative Supply Current



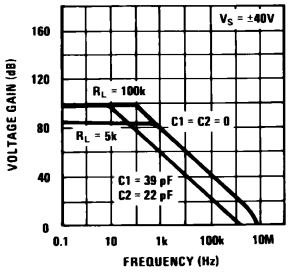
Positive Supply Current



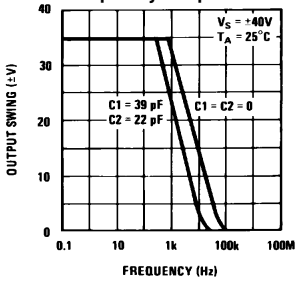
Output Voltage



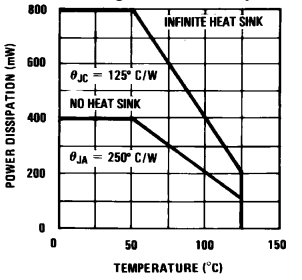
Open Loop Frequency Response



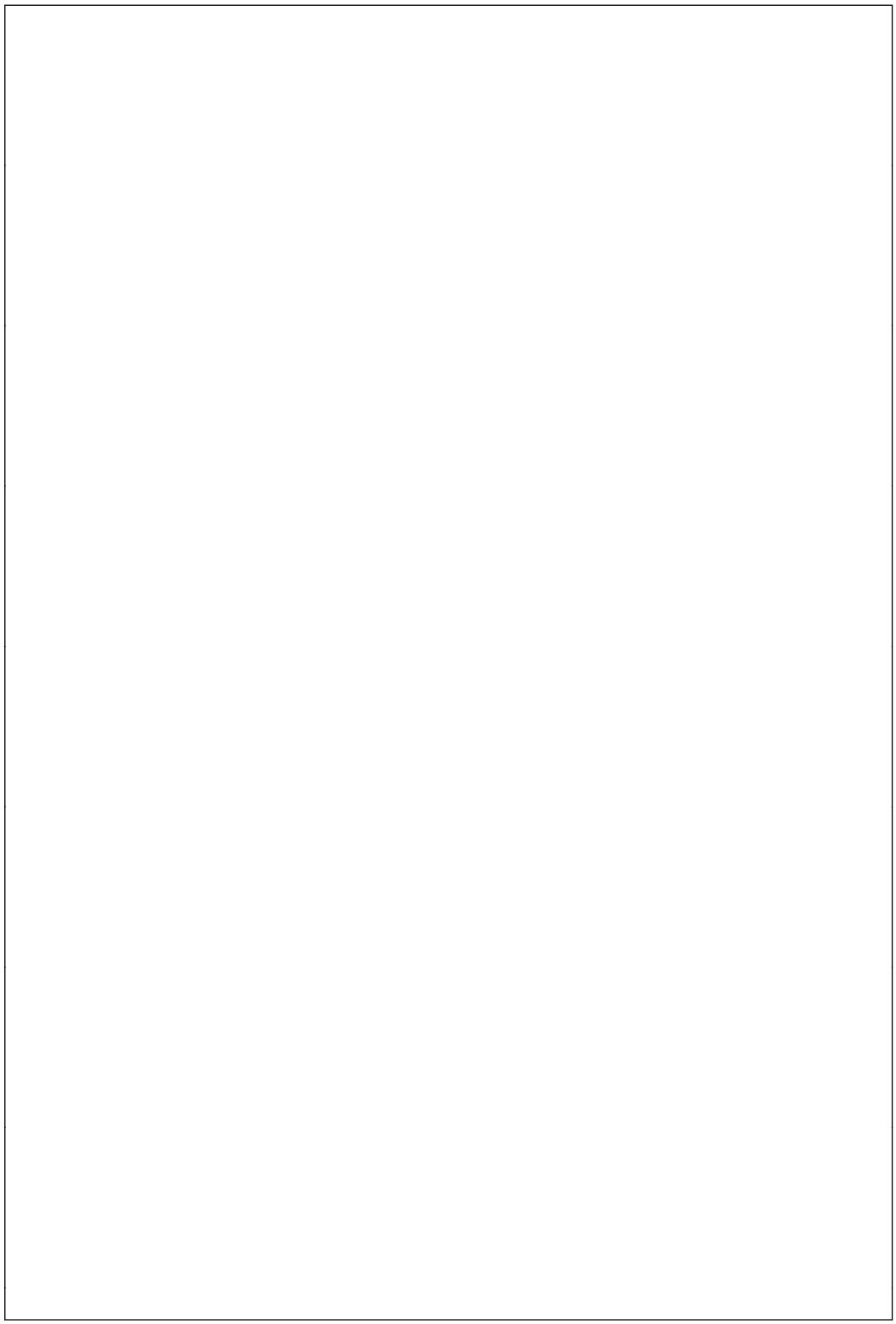
Large Signal Frequency Response



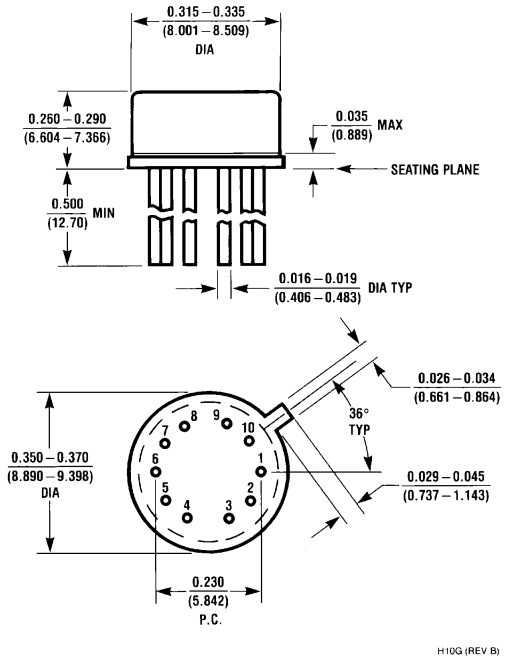
Package Power Dissipation



TL/H/5559–7



Physical Dimensions inches (millimeters)



Metal Can Package (H)
Order Number LH0004H, LH0004H-MIL or LH0004CH
NS Package Number H10G

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