

## LH0004 High Voltage Operational Amplifier

### General Description

The LH0004 is a general purpose operational amplifier designed to operate from supply voltages up to  $\pm 40V$ . The device dissipates extremely low quiescent power, typically 8 mW at  $25^\circ C$  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  $-55^\circ C$  to  $+125^\circ C$  military temperature range. The LH0004C is specified for operation over the  $0^\circ C$  to  $+85^\circ C$  temperature range.

### Features

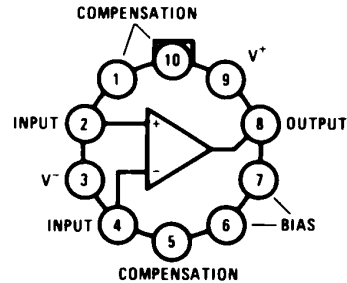
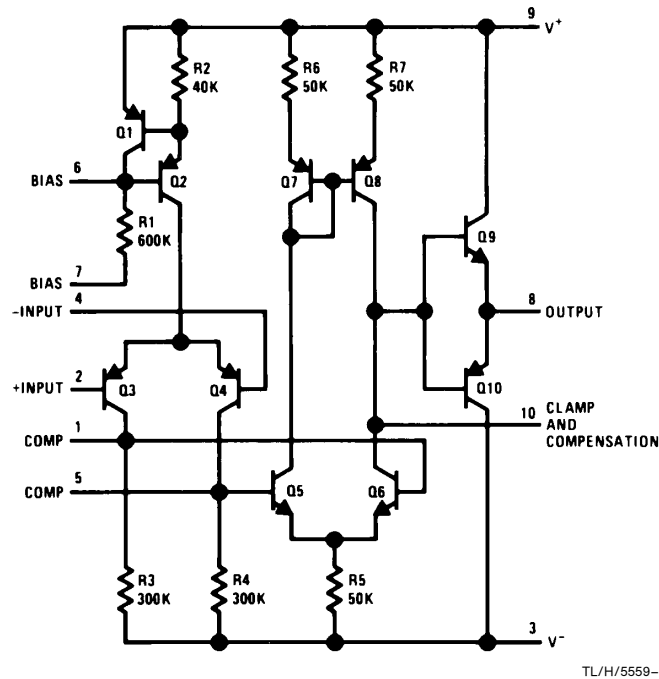
- Capable of operation over the range of  $\pm 5V$  to  $\pm 40V$
- Large output voltage typically  $\pm 35V$  for the LH0004 and  $\pm 33V$  for the LH0004C into a  $2\text{ k}\Omega$  load with  $\pm 40V$  supplies

- Low input offset voltage typically 0.3 mV
- Frequency compensation with 2 small capacitors
- Low power consumption 8 mW at  $\pm 40V$

### Applications

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

### Schematic and Connection Diagrams



**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 k $\Omega$  per volt of potential between Pin 3 and Pin 9.

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

## 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.	

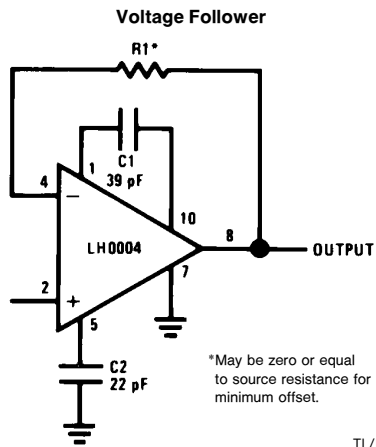
## Electrical Characteristics (Note 1)

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

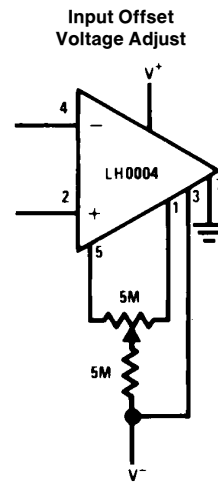
**Note 1:** These specifications apply for  $\pm 5\text{V} \leq V_S \leq \pm 40\text{V}$ , Pin 7 grounded, with capacitors  $C_1 = 39\text{ pF}$  between Pin 1 and Pin 10,  $C_2 = 22\text{ pF}$  between Pin 5 and ground,  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$  for the LH0004, and  $0^\circ\text{C}$  to  $+85^\circ\text{C}$  for the LH0004C unless otherwise specified.

**Note 2:** Refer to RETS0004X for LH0004H military specifications.

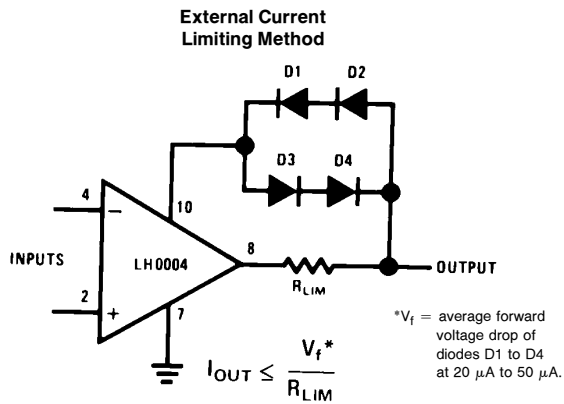
## Typical Applications



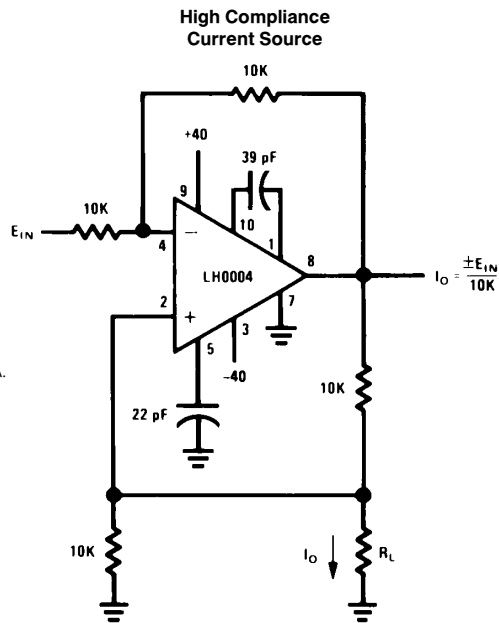
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TL/H/5559-4

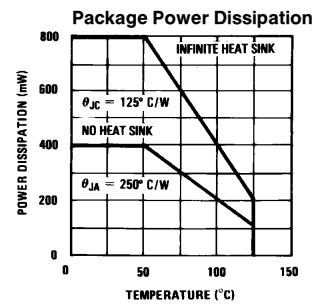
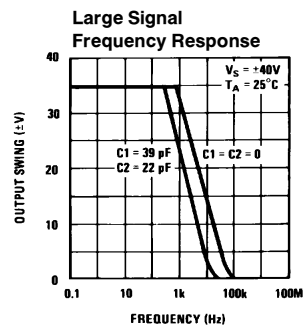
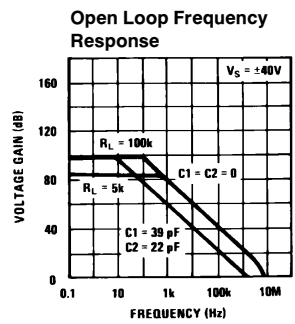
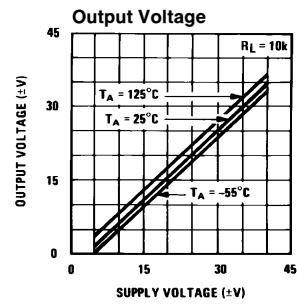
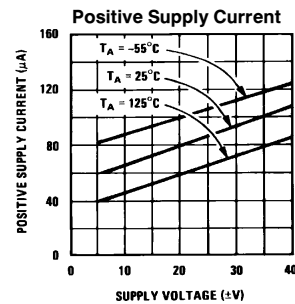
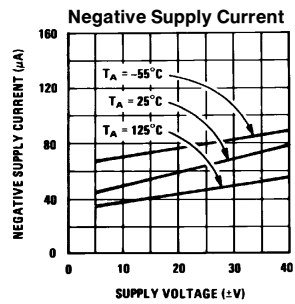
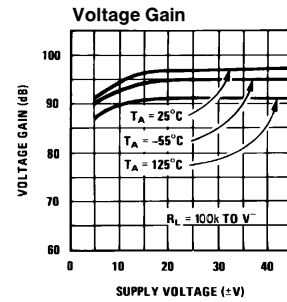
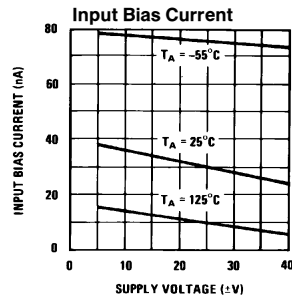
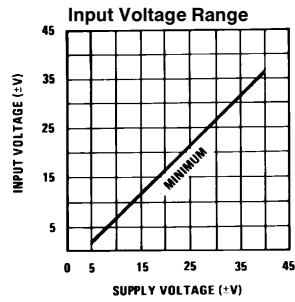


TL/H/5559-5



TL/H/5559-6

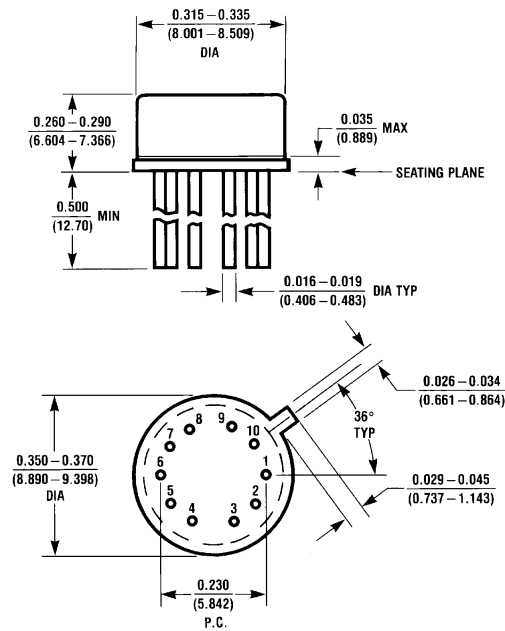
## Typical Performance Characteristics



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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