

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

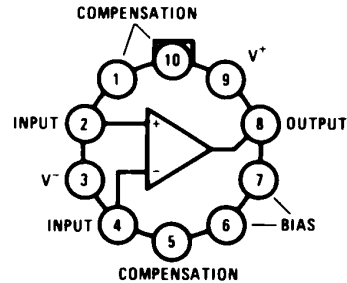
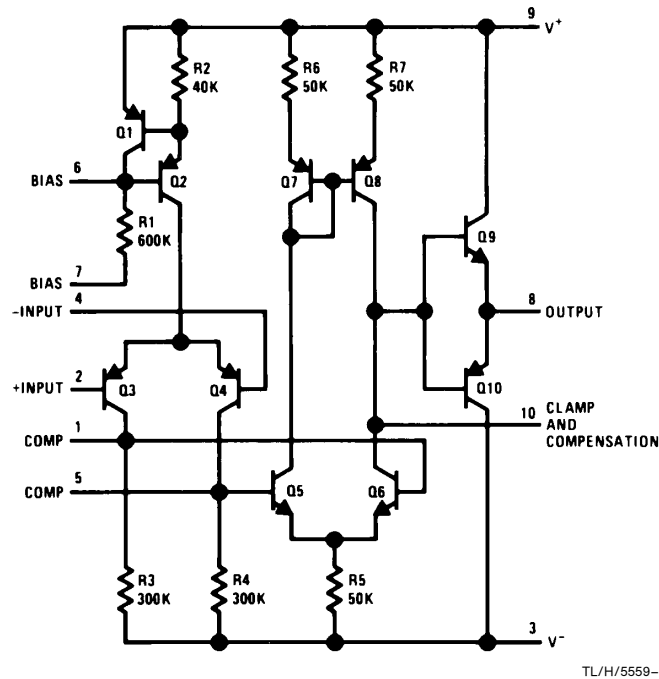
- Capable of operation over the range of $\pm 5V$ to $\pm 40V$
- Large output voltage typically $\pm 35V$ for the LH0004 and $\pm 33V$ for the LH0004C into a $2\text{ k}\Omega$ load with $\pm 40V$ supplies

- 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 $100\text{ k}\Omega$ 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.	

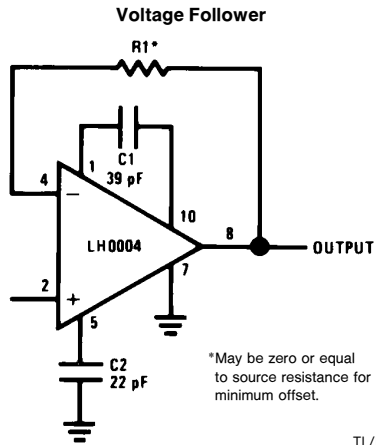
Electrical Characteristics (Note 1)

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	μA
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	μA
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		μVrms

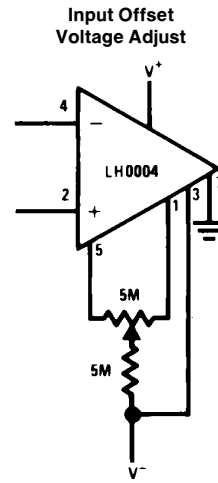
Note 1: These specifications apply for $\pm 5\text{V} \leq V_S \leq \pm 40\text{V}$, Pin 7 grounded, with capacitors $C_1 = 39\text{ pF}$ between Pin 1 and Pin 10, $C_2 = 22\text{ pF}$ between Pin 5 and ground, -55°C to $+125^\circ\text{C}$ for the LH0004, and 0°C to $+85^\circ\text{C}$ for the LH0004C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

Note 2: Refer to RETS0004X for LH0004H military specifications.

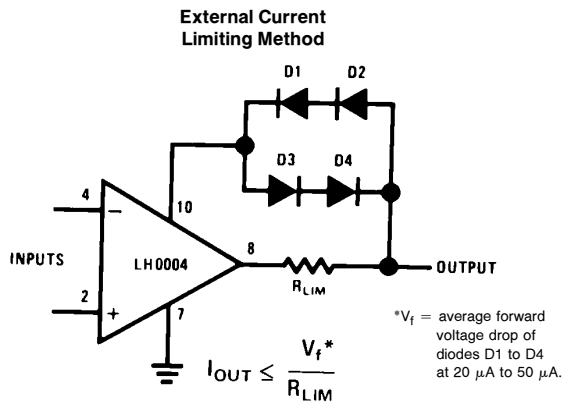
Typical Applications



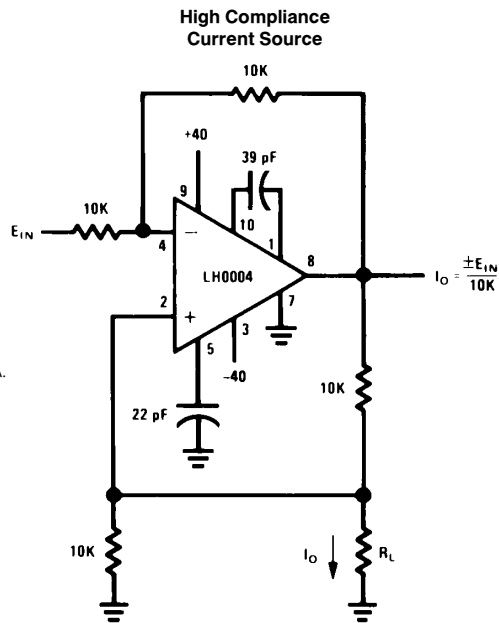
TL/H/5559-3



TL/H/5559-4

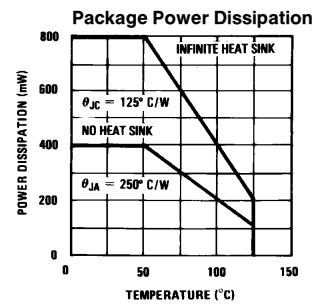
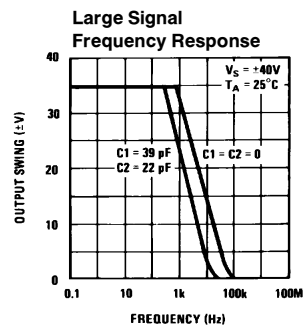
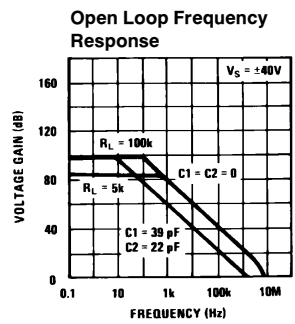
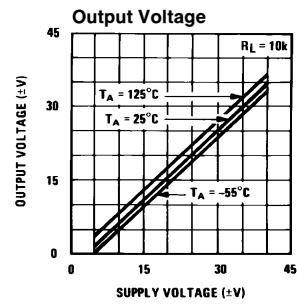
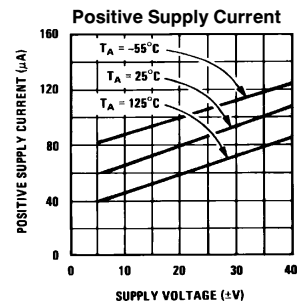
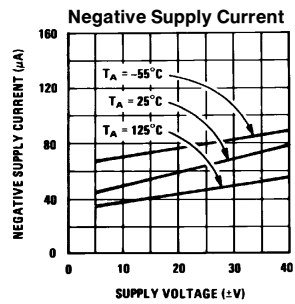
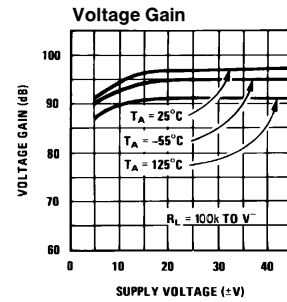
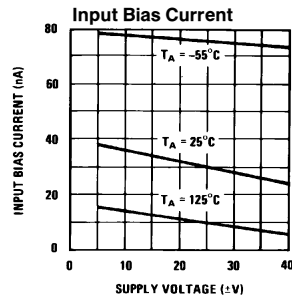
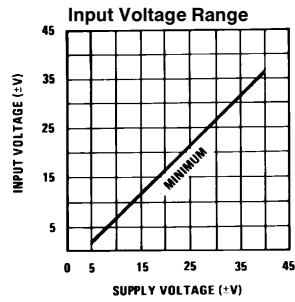


TL/H/5559-5

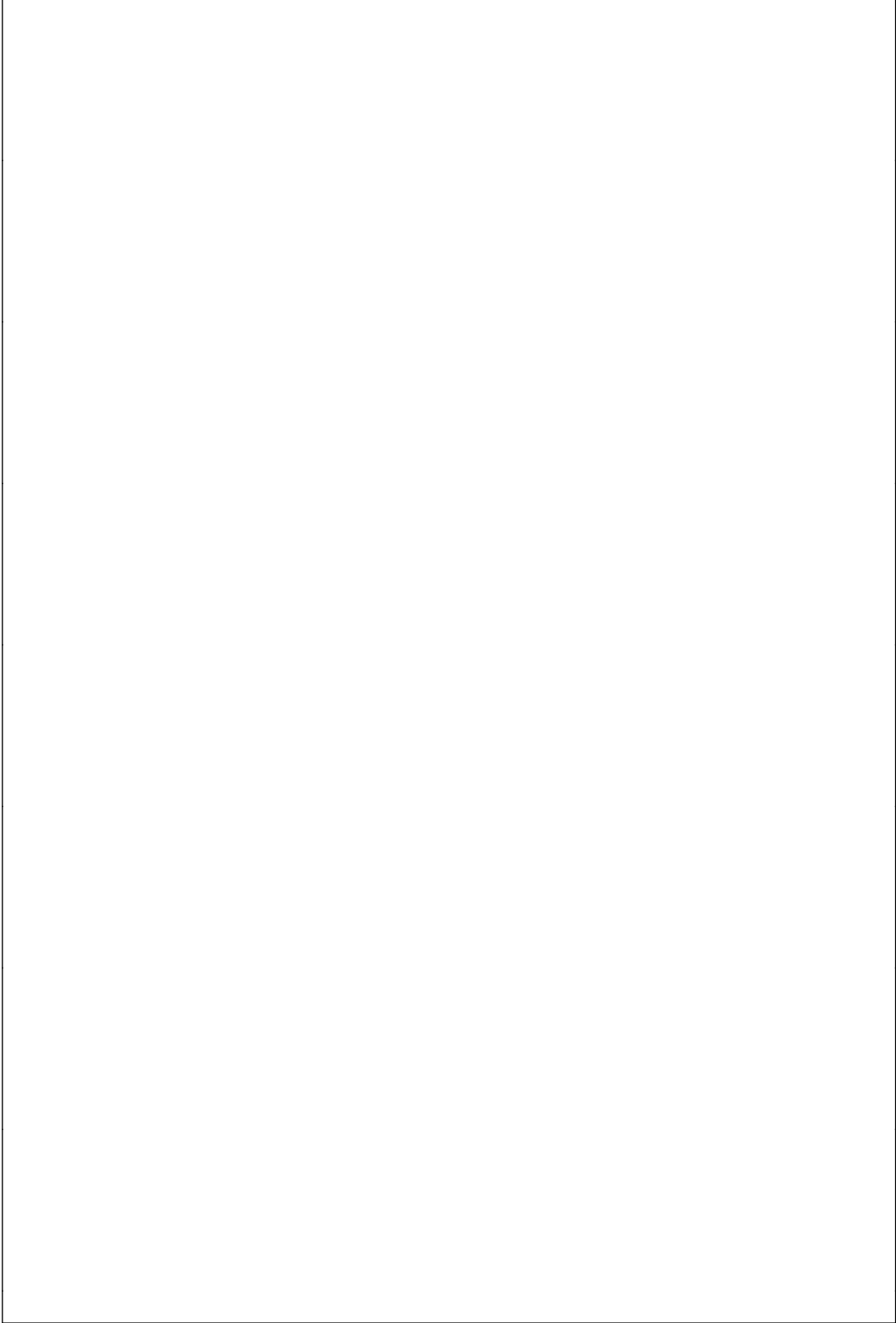


TL/H/5559-6

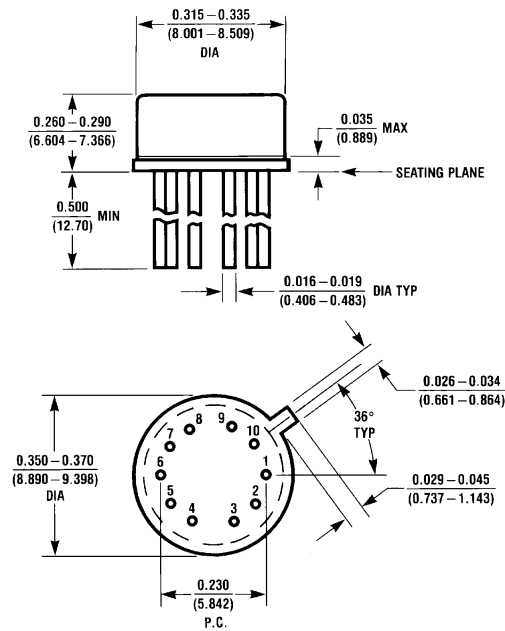
Typical Performance Characteristics



TL/H/5559-7



Physical Dimensions inches (millimeters)



H10G (REV B)

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

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
 1111 West Bardin Road
 Arlington, TX 76017
 Tel: 1(800) 272-9959
 Fax: 1(800) 737-7018

National Semiconductor Europe
 Fax: (+49) 0-180-530 85 86
 Email: cnjwge@tevm2.nsc.com
 Deutsch Tel: (+49) 0-180-530 85 85
 English Tel: (+49) 0-180-532 78 32
 Français Tel: (+49) 0-180-532 93 58
 Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
 19th Floor, Straight Block,
 Ocean Centre, 5 Canton Rd.
 Tsimshatsui, Kowloon
 Hong Kong
 Tel: (852) 2737-1600
 Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
 Tel: 81-043-299-2309
 Fax: 81-043-299-2408

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.