



Operational Amplifiers

LH0003/LH0003C* wide bandwidth operational amplifier

general description

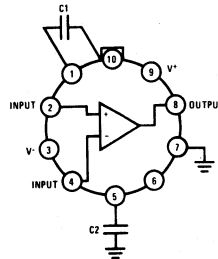
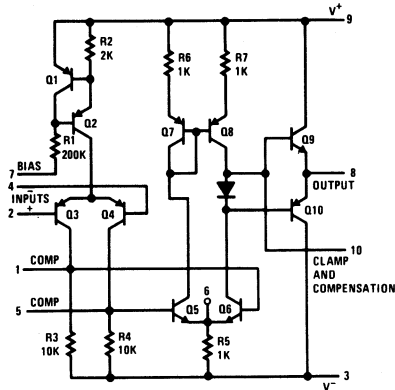
The LH0003/LH0003C is a general purpose operational amplifier which features: slewing rate up to 70 volts/ μ sec, a gain bandwidth of up to 30 MHz, and high output currents. Other features are:

- Very low offset voltage Typically 0.4 mV
- Large output swing $> \pm 10V$ into 100Ω load

- High CMRR Typically > 90 dB
- Good large signal frequency response 50 kHz to 400 kHz depending on compensation

The LH0003 is specified for operation over the $-55^\circ C$ to $+125^\circ C$ military temperature range. The LH0003C is specified for operation over the $0^\circ C$ to $+85^\circ C$ temperature range.

schematic and connection diagrams



TOP VIEW

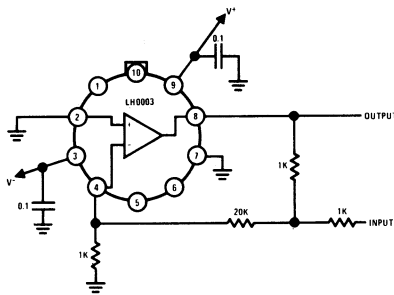
Order Number LH0003H or LH0003CH
See Package 14

Circuit Gain	C ₁ pF	C ₂ pF	Slew Rate R _L > 200 Ω , V/ μ sec	Full Output Frequency R _L 200 Ω ; V _{OUT} ± 10 V
≥ 40	0	0	70	400
≥ 10	5	30	30	350
≥ 5	15	30	15	250
≥ 2	50	50	5	100
≥ 1	90	90	2	50

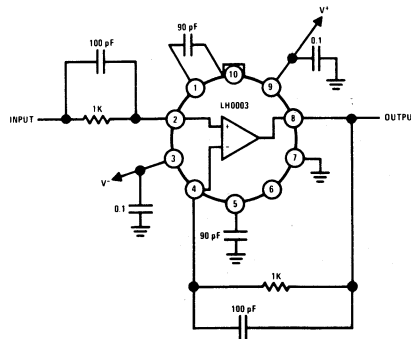
Typical Compensation

typical applications

High Slew Rate Unity Gain Inverting Amplifier



Unity Gain Follower



*Previously called NH0003/NH0003C

absolute maximum ratings

Supply Voltage	±20V
Power Dissipation	See curve
Differential Input Voltage	±7V
Input Voltage	Equal to supply
Load Current	120 mA
Operating Temperature Range	LH0003 -55°C to +125°C
	LH0003C 0°C to +85°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec)	300°C

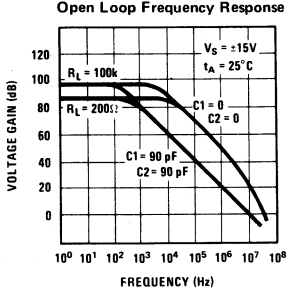
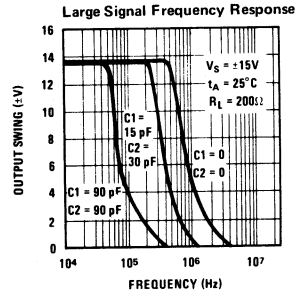
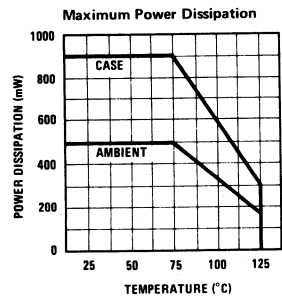
electrical characteristics (Notes 1 & 2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage	$R_S < 1k$		0.4	3.0	mV
Input Offset Current			0.02	0.2	μA
Input Bias Current			0.4	2.0	μA
Supply Current	$V_S = \pm 20V$		1.2	3	mA
Voltage Gain	$R_L = 100k, V_S = \pm 15V, V_{OUT} = \pm 10V$	20	70		V/mV
Voltage Gain	$R_L = 2k, V_S = \pm 15V, V_{OUT} = \pm 10V$	15	40		V/mV
Output Voltage Swing	$V_S = \pm 15, R_L = 100\Omega$	±10	±12		V
Input Resistance			100		k Ω
Average Temperature Coefficient of Offset Voltage	$R_S < 5k$		4		$\mu V/^\circ C$
Average Temperature Coefficient of Bias Current			8		nA/°C
CMRR	$R_S < 1k, V_S = \pm V, V_{IN} = \pm 10V$	70	90		dB
PSRR	$R_S < 1k, V_S = \pm 15V, \Delta V = 5V$ to 20V	70	90		dB
Equivalent Input Noise Voltage	$R_S = 1K, f = 10$ kHz to 100 kHz $V_S = \pm 15V$ dc		1.8		$\mu Vrms$

- Note 1.** These specifications apply for Pin 7 grounded, for $\pm 5V < V_S < \pm 20V$, with capacitor $C_1 = 90$ pF from Pin 1 to Pin 10 and $C_2 = 90$ pF from Pin 5 to ground, over the specified operating temperature range, unless otherwise specified.
- Note 2.** Typical values are for $t_{AMBIENT} = 25^\circ C$ unless otherwise specified.



typical performance





Operational Amplifiers

LH0004/LH0004C* high voltage operational amplifier

general description

The LH0004/LH0004C 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 $V_S = \pm 40V$. Additional features include:

- 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 $2 K\Omega$ load with $\pm 40V$ supplies
- Low input offset current typically 20 nA for the LH0004 and 45 nA for the LH0004C
- Low input offset voltage typically 0.3 mV
- Frequency compensation with 2 small capacitors
- Low power consumption 8 mW at $\pm 40V$

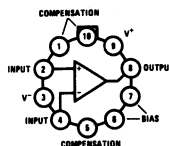
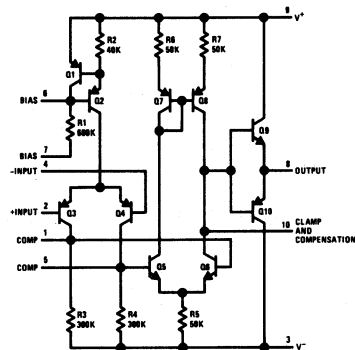
The LH0004's high gain and wide range of operating voltages make it ideal for applications requiring large output swing and low power dissipation.

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.

applications

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

schematic and connection diagrams

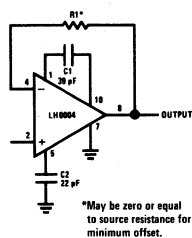


Note: Pin 7 must be grounded or connected to a voltage at least 5V more negative than the positive supply (Pin 9). Pin 7 may be connected to the negative supply; however, the standby current will be increased. A resistor may be inserted in series with Pin 7 to Pin 9. The value of the resistor should be a maximum of $100 K\Omega$ per volt of potential between Pin 3 and Pin 9.

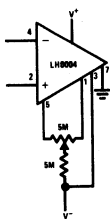
Order Number LH0004H or LH0004CH
See Package 14

typical applications

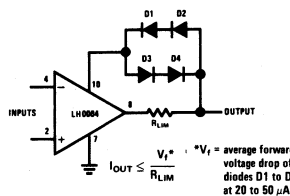
Voltage Follower



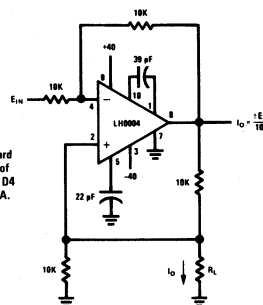
Input Offset Voltage Adjust



External Current Limiting Method



High Compliance Current Source



*Previously called NH0004/NH0004C

absolute maximum ratings

Supply Voltage, Continuous	±45V
Supply Voltage, Transient (≤0.1 sec, no load)	±60V
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)	300°C

electrical characteristics (Note 1)

PARAMETER	CONDITIONS	LH0004			LH0004C			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	$R_S \leq 5k, T_A = 25^\circ C$ $R_S \leq 5k$		0.3	1.0		0.3	1.5	mV
				2.0			3.0	mV
Input Bias Current	$T_A = 25^\circ C$ $= -55^\circ C$		20	100		30	120	nA
				300			300	nA
Input Offset Current	$T_A = 25^\circ C$ $= -55^\circ C$		3	20		10	45	nA
				100			150	nA
Positive Supply Current	$V_S = \pm 40V, T_A = 25^\circ C$ $V_S = \pm 40V$		110	150		110	150	μA
				175			175	μA
Negative Supply Current	$V_S = \pm 40V, T_A = 25^\circ C$ $V_S = \pm 40V$		80	100		80	100	μA
				135			135	μA
Voltage Gain	$V_S = \pm 40V, R_L = 100k, T_A = 25^\circ C$ $V_{OUT} = \pm 30V$ $V_S = \pm 40V, R_L = 100k$ $V_{OUT} = \pm 30V$	30	60		30	60		V/mV
			10			10		
Output Voltage	$V_S = \pm 40V, R_L = 2k$ $V_S = \pm 40V, R_L = 4k$	±30	±35		±30	±33		V
		±34	±36		±33	±35		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 of Offset Voltage	$R_S \leq 5k$		4.0			4.0		μV/°C
Average Temperature Coefficient of Offset Current			0.4			0.4		nA/°C
Equivalent Input Noise Voltage	$R_S = 1k, V_S = \pm 40V$ $f = 500$ Hz to 5 kHz, $T_A = 25^\circ C$		3.0			3.0		μVrms

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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.