National Semiconductor

February 1995

LH4001 Wideband Current Buffer

General Description

The LH4001 is a high speed unity gain buffer designed to provide high current drive capability at frequencies from DC to over 25 MHz. It is capable of providing a continuous output current of ±100 mA and a peak of ±200 mA.

The LH4001 is designed to fulfill a wide range of applications such as impedance transformation, high impedance input buffers for A/D converters and comparators, as well as high speed line drivers. It is also suitable for use in current booster applications within an op amp loop. This allows the output current capability of existing op amps to be increased to ±100 mA.

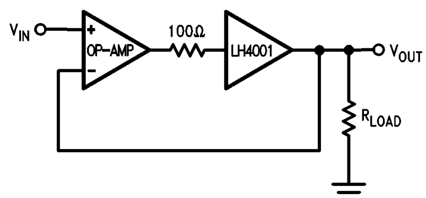
Features

- DC to 25 MHz bandwidth
- 125 V/μs slew rate
- Drives ±10V into 50Ω
- Operates from ±5 to ±20V supplies
- Output swing approaches supply voltage

Applications

- Boost op amp output
- Buffer amplifiers
- Isolate capacitive loads
- Drive long cables

Typical Applications and Connection Diagram



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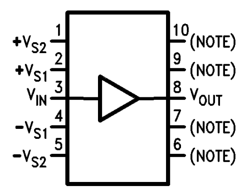
Dual-In-Line Package



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Top View

***Note:** Electrically connected internally. No connection should be made to these pins.

Order Number LH4001CN
See NS Package Number N10A

 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.

Supply Voltage, V_S	±22V
Continuous Output Current, I_O	±100 mA
Peak Output Current, $I_{O(peak)}$ (50 ms On/1 Sec Off)	±200 mA
Input Voltage Range, V_{IN}	$\pm V_S$
Power Dissipation	500 mW
Storage Temperature Range, T_{STG}	−65°C to +150°C
Junction Temperature, T_J	150°C
Lead Temp. (Soldering, <10 seconds)	260°C

ESD rating is to be determined.

Operating Ratings

Temperature Range, T_A	0°C to +70°C
Thermal Resistance θ_{JA}	120°C/W

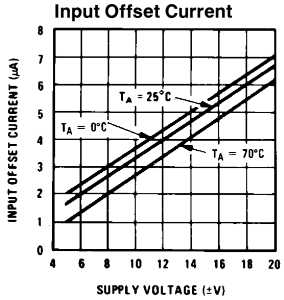
Electrical Characteristics (Note 1)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
A_V	Voltage Gain	R_S = 10 kΩ, R_L = 1 kΩ V_{IN} = ±10V	0.95	0.97	1	V/V
R_{IN}	Input Impedance	R_S = 200 kΩ, R_L = 1 kΩ V_{IN} = ±1.0V	180	400		kΩ
R_{OUT}	Output Impedance	R_S = 10 kΩ, R_L = 50Ω V_{IN} = ±1.0V		6	10	Ω
V_O	Output Swing	V_S = ±15V, R_S = 50Ω R_L = 100Ω, V_{IN} = ±12V	±10	±11		V
I_B	Input Bias Current	R_S = 10 kΩ, R_L = 1 kΩ		±10	±50	μA
t_r	Rise Time	R_L = 100Ω, ΔV_{IN} = 100 mV		7		ns
SR	Slew Rate	V_{IN} = ±5V, R_L = 100Ω		125		V/μs
I_S	Supply Current	R_S = 10 kΩ		±6	±10	mA
V_{OS}	Offset Voltage	R_S = 300Ω, R_L = 1 kΩ		±10	±50	mV

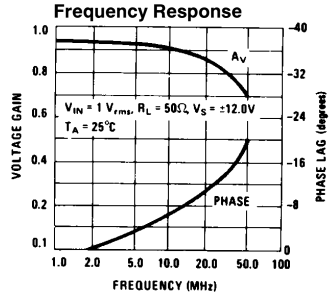
Note 1: Specification applies for T_A = 25°C with +12V on Pins 1 & 2; −12V on Pins 4 & 5 unless otherwise specified.

Typical Performance Characteristics

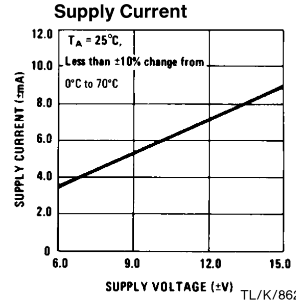
Input Offset Current



Frequency Response



Supply Current



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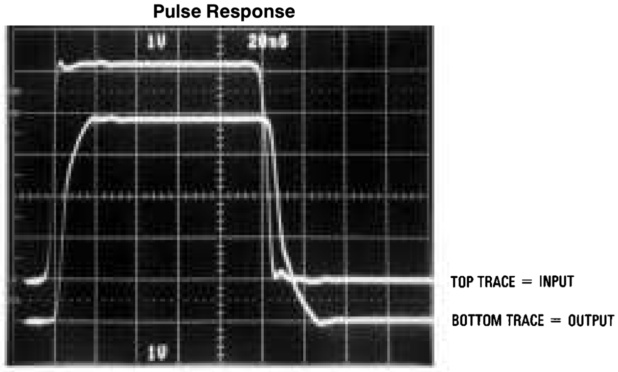
Pulse Response



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V_{IN} = ±2.5V, R_S = R_L = 50Ω

Applications Information

Figure 1 shows a simple implementation of a non-inverting buffer amplifier of unity gain. Popular industry standard operational amplifiers such as LF156, LF351, LF411, LF441, LM11, LM741, etc. can be used in this configuration. Due to the high bandwidth of the LH4001, it is suitable for use with most monolithic op amps.

Figure 2 shows an implementation of an inverting amplifier with output current capability in excess of ±100 mA. The gain of this amplifier is determined by the values of R_F and R_{IN}. The resistor between the non-inverting input and ground is used to minimize the output offset voltage resulting from the input bias current.

Because of its high current drive capability, the LH4001 buffer amplifier is suitable for driving terminated or unterminated co-axial cables, and high current or reactive loads.

Figure 3 shows a co-axial cable drive circuit. The 43Ω resistor matches the driving source to the cable, however, its inclusion rarely will result in substantial improvement in pulse response into a terminated cable. If the 43Ω resistor is included, the output voltage to the load is about half what it would be without the near end termination.

Figure 4 shows a non-inverting amplifier with gain and output current capability in excess of ±100 mA. It is capable of providing ±10 mA into a 1 kΩ load or ±100 mA into a 100Ω load (±10V swing). *Figures 5* and *6* show two different methods of providing current limit or short circuit protection for the LH4001. In *Figure 6,* the 10Ω resistor limits the output current to approximately 70 mA. This circuit is highly recommended if there is a potential for a short circuit to occur.

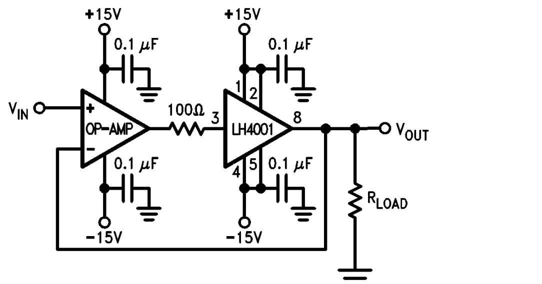
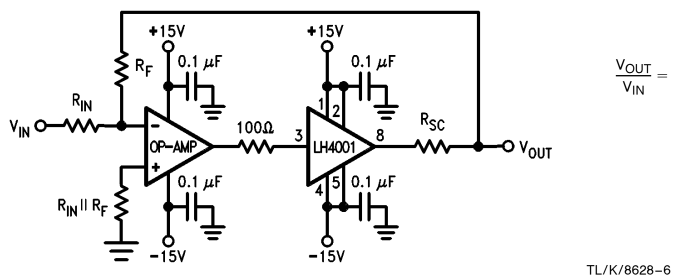


FIGURE 1. Non-Inverting Buffer Amplifier



$$\frac{V_{OUT}}{V_{IN}} = -\frac{R_F}{R_{IN}}$$

FIGURE 2. Inverting Buffer Amplifier with Current Limit

Applications Information (Continued)

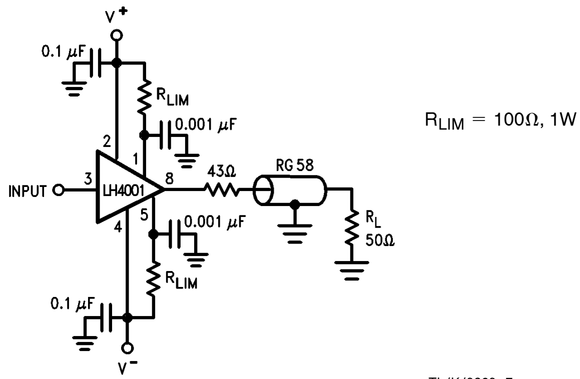


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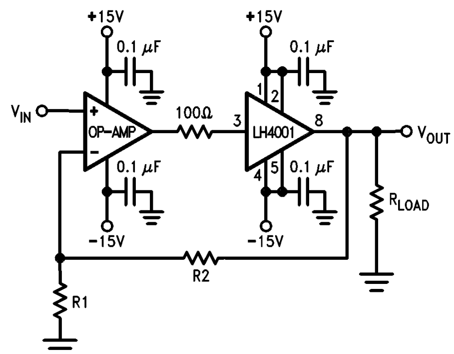
FIGURE 3. Coaxial Cable Drive Circuit



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$$V_{OUT} = V_{IN}\left(1 + \frac{R2}{R1}\right)$$

FIGURE 4. Non-Inverting Buffer Amplifier with Gain

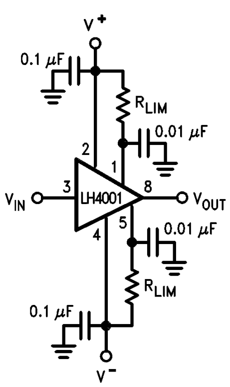

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FIGURE 5. LH4001 Using Resistor Current Limiting

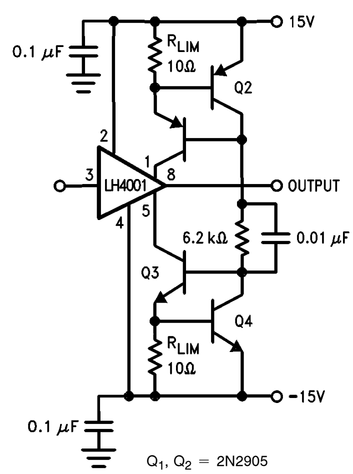

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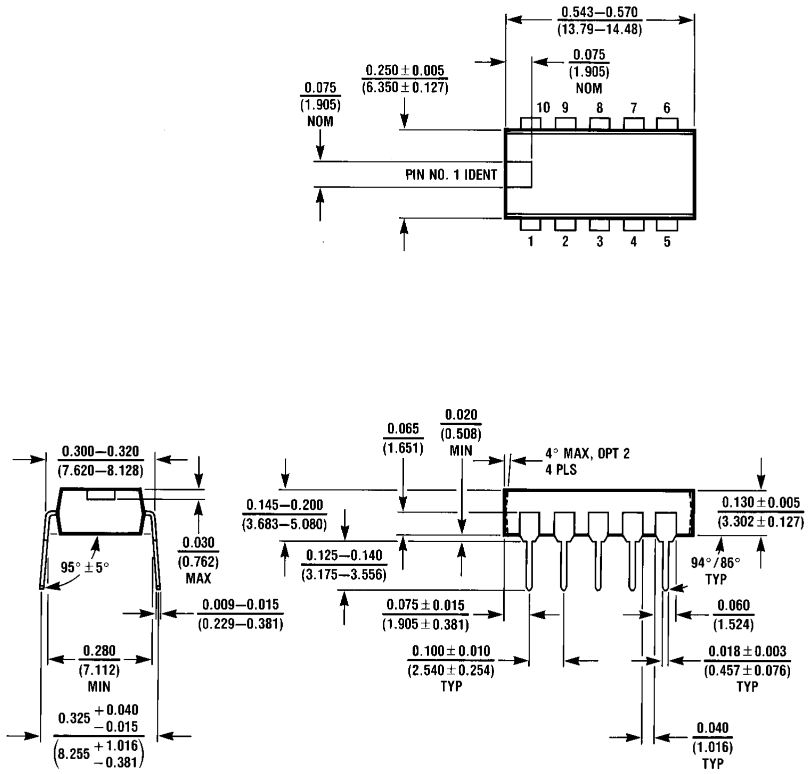
FIGURE 6. Current Limit Using Current Sources

Physical Dimensions inches (millimeters)

Lit. # 106408



N10A (REV A)

Molded Dual-in-Line Package (N)
Order Number LH4001CN
NS Package Number N10A

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