National Semiconductor

February 1995

LH4002 Wideband Video Buffer

General Description

The LH4002 is a high speed voltage follower designed to drive video signals from DC up to 200 MHz. At voltage supplies of ±5V, the LH4002 will provide up to 40 mA into 50Ω at slew rates in excess of 1000 V/µs.

The device is intended to fulfill a wide range of high speed applications including video distribution, impedance transformation, and load isolation. 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.

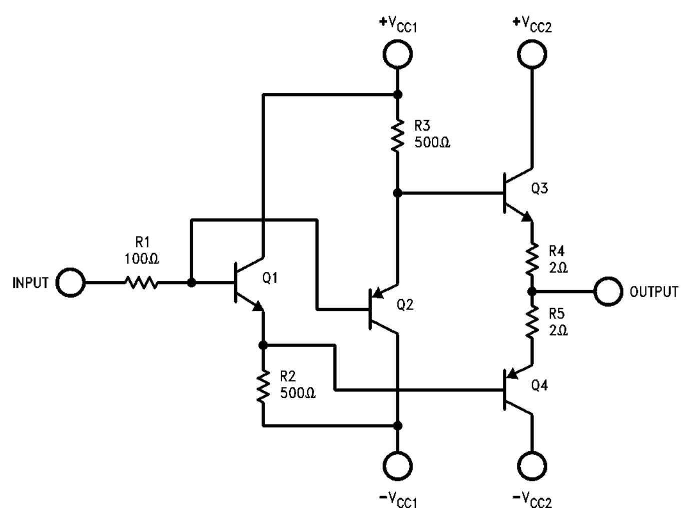
Features

- DC to 200 MHz Bandwidth with $V_S = \pm 5V$
- 1250 V/µs Slew Rate into 50Ω
- 150 MHz Bandwidth with $V_S = \pm 5V$, $R_L = 50\Omega$ and Voltage Swing = 2 V_{P-P}

Applications

- Wideband Amplifier Buffer
- Wideband Line Driver

Schematic and Connection Diagrams



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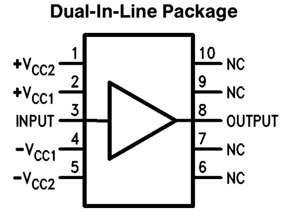
Dual-In-Line Package



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Top View

Order Number LH4002CN
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	$\pm$6V
Input Voltage Range, V_{IN}	$\pm V_S$
Continuous Output Current, I_O	$\pm$60 mA
Storage Temperature Range, T_{STG}	−65°C to +150°C
Operating Temperature Range, T_A	
LH4002C	−25°C to +85°C
Junction Temperature, T_J	150°C
Lead Temperature (Soldering, 10 sec)	300°C

ESD rating is to be determined.

DC Electrical Characteristics $V_{CC} = \pm 5V$, $T_{min} \le T_A \le T_{max}$ unless otherwise stated.

Symbol	Parameter	Conditions		Min	Typ	Max	Units
V_{OS}	Input Offset Voltage	$T_A = T_J = 25°C$ $R_S = 150\Omega$, $R_L = 50\Omega$			20	50	mV
I_B	Input Bias Current	$R_S = 1\ k\Omega$, $R_L = 50\Omega$			100	200	μA
A_V	DC Voltage Gain	$R_S = 10\ k\Omega$, $R_L = 1.0\ k\Omega$, $V_{IN} = \pm 2V$		0.95	0.97		V/V
V_O	Output Voltage Swing	$R_S = 150\Omega$, $V_{IN} = \pm 2.5V$	$R_L = 1\ k\Omega$	$\pm$2.2	$\pm$2.4		V
			$T_A = 25°C$, $R_L = 50\Omega$	$\pm$2.0	$\pm$2.2		V
I_S	Supply Current	$R_S = 10\ k\Omega$, $V_{IN} = 0V$, $R_L = 1\ k\Omega$, $T_A = T_J = 25°C$			20	35	mA
R_{OUT}	Output Resistance	$R_S = 10\ k\Omega$, $R_L = 50\Omega$			6	10	Ω
R_{IN}	Input Resistance	$R_S = 10\ k\Omega$, $R_L = 50\Omega$		10	18		kΩ

AC Electrical Characteristics $V_{CC} = \pm 5V$, $T_A = 25°C$.

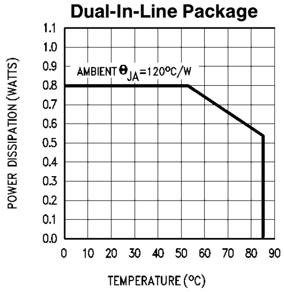
Symbol	Parameter	Conditions		Min	Typ	Max	Units
S_R	Slew Rate	$R_L = 50\Omega$, $R_S = 50\Omega$ $V_{IN} = \pm 2V$		1000	1250		V/μs
f_{3dB}	Bandwidth, −3 dB (Note 2)	$R_S = 50\Omega$ $R_L = 50\Omega$	$V_{OUT} = 4V_{P-P}$		125		MHz
			$V_{OUT} = 2V_{P-P}$	100	150		MHz
			$V_{OUT} = 100\ mV_{P-P}$		200		MHz
	Phase Non-Linearity	BW = 1.0–20 MHz			2.0		degrees
t_r	Rise Time	$\Delta V_{IN} = 0.5V$			3		ns
t_d	Propagation Delay	$\Delta V_{IN} = 0.5V$			1.2		ns
THD	Harmonic Distortion	f = 1 kHz			0.1		%

Note 1: Under normal operating conditions $+V_{CC1}$ and $+V_{CC2}$ should be connected together, and $-V_{CC1}$ and $-V_{CC2}$ should be connected together.

Note 2: Guaranteed by design. This parameter is sample tested.

Typical Performance Characteristics

Maximum Power Dissipation Dual-In-Line Package



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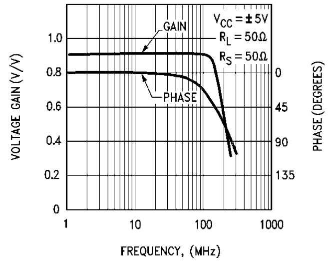
Frequency Response



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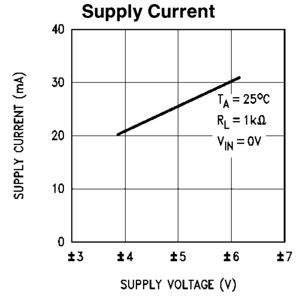
Supply Current



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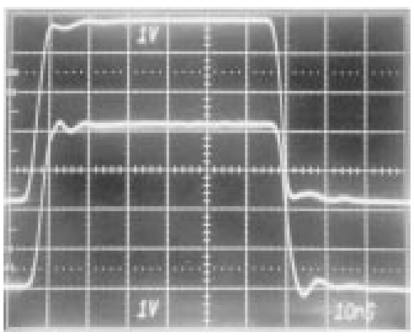
Pulse Response



TOP TRACE
= INPUT

BOTTOM TRACE
= OUTPUT

V_S = ±5V
R_L = 50Ω

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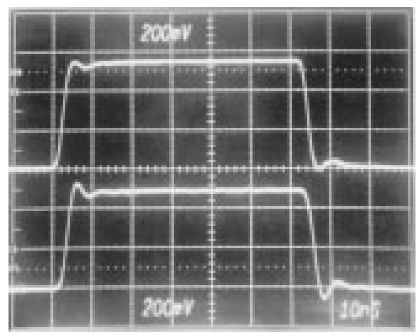

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Typical Applications

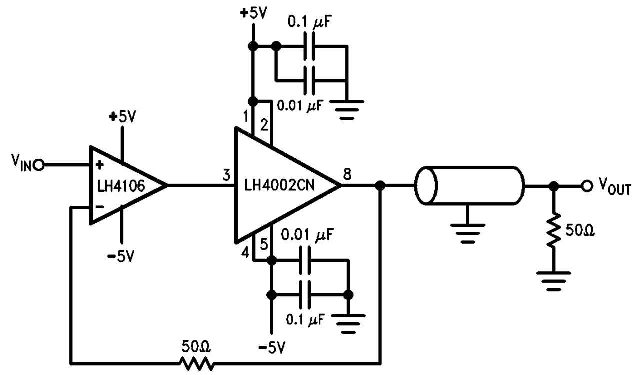

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FIGURE 1. Wideband Unity Gain Amplifier Using LH4002CN

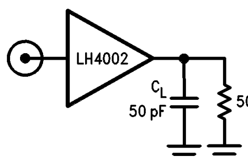

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FIGURE 2. Compensation for Capacitive Loads

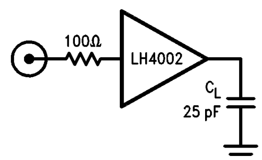

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FIGURE 3. Compensation for Capacitive Loads

Applications Information

The high speed performance of the LH4002 can only be realized by taking certain precautions in circuit layout and power supply decoupling. Low inductance ceramic chip or disc power supply decoupling capacitors of 0.01 μF in parallel with 0.1 μF should be connected with the shortest practical lead length between device supply leads and a ground plane. Failure to follow these rules can result in oscillations. When driving a capacitive load such as inputs to flash converters, the circuits in *Figure 2* and *3* can be used to minimize the amount of overshoot and ringing at the outputs. *Figure 2* indicates that a 50Ω should be placed in parallel with the load and *Figure 3* recommends that a 100Ω resistor be placed in series with the input to the LH4002.

Short Circuit Protection

In order to optimize transient response and output swing, output current limits have been omitted from the LH4002. Short circuit protection may be added by inserting appropriate value resistors between $+V_{CC1}$ and $+V_{CC2}$ pins and between $-V_{CC1}$ and $-V_{CC2}$ pins as illustrated in *Figure 4*. Resistor values may be predicted by:

$$R_{LIM} = \frac{+V_{CC1}}{I_{SC}} = \frac{-V_{CC1}}{I_{SC}}$$

where $I_{SC} \leq 100$ mA. The inclusion of 50Ω limiting resistors in the collectors of the output transistors limits the short circuit current to approximately 100 mA without reducing the output voltage swing.

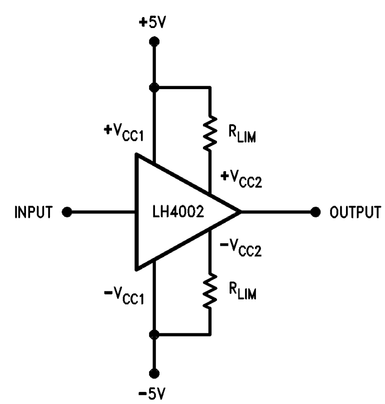

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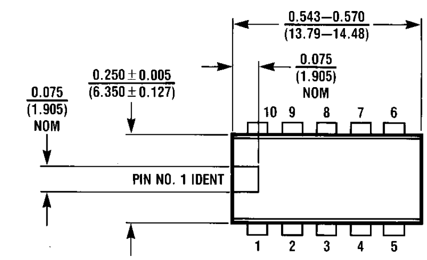
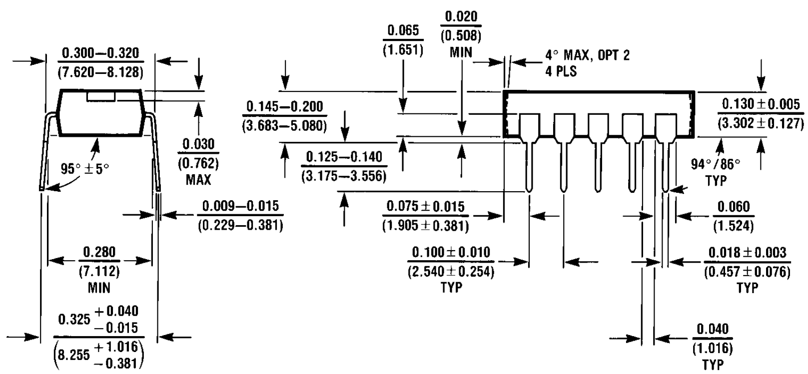
FIGURE 4. LH4002 Using Resistor Current Limiting

Physical Dimensions inches (millimeters)

Lit. # 106409





N10A (REV A)

Molded Dual-In-Line Package (N)
Order Number LH4002CN
NS Package Number N10A

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