

## 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  $\pm 5V$ , the LH4002 will provide up to 40 mA into  $50\Omega$  at slew rates in excess of  $1000 V/\mu s$ .

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.

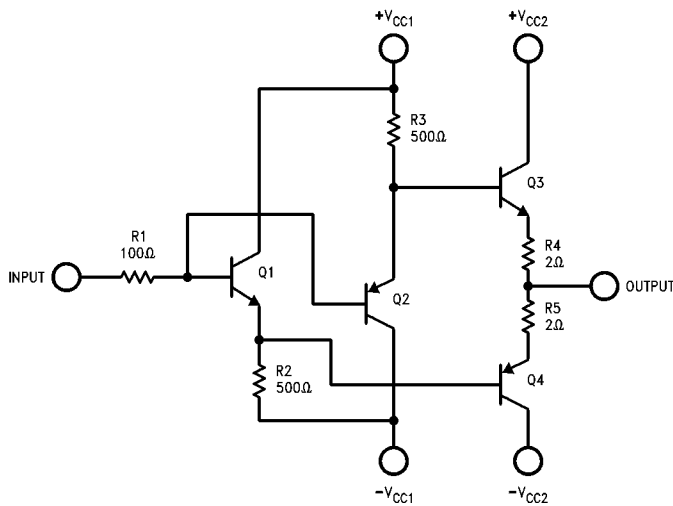
### Features

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

### Applications

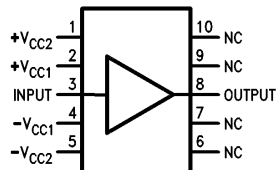
- Wideband Amplifier Buffer
- Wideband Line Driver

### Schematic and Connection Diagrams



TL/K/8686-15

#### Dual-In-Line Package



TL/K/8686-2

#### Top View

Order Number LH4002CN  
See NS Package Number N10A

## 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, $I_O$	$\pm 60\text{ mA}$
Storage Temperature Range, $T_{STG}$	$-65^\circ\text{C}$ to $+150^\circ\text{C}$

Operating Temperature Range, $T_A$	$-25^\circ\text{C}$ to $+85^\circ\text{C}$
LH4002C	
Junction Temperature, $T_J$	$150^\circ\text{C}$
Lead Temperature (Soldering, 10 sec)	$300^\circ\text{C}$
ESD rating is to be determined.	

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

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

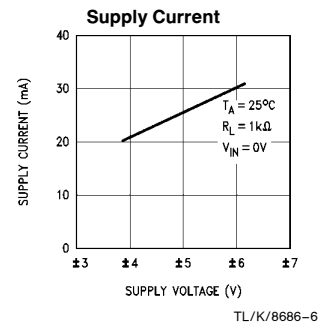
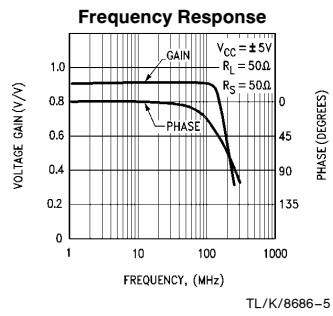
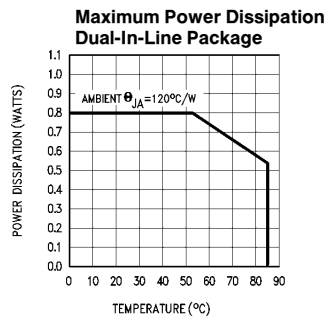
## AC Electrical Characteristics $V_{CC} = \pm 5V$ , $T_A = 25^\circ\text{C}$ .

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		$V/\mu\text{s}$
$f_{3dB}$	Bandwidth, $-3\text{ dB}$ (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
		$V_{OUT} = 100\text{ mV}_{P-P}$		200		MHz
	Phase Non-Linearity	$BW = 1.0\text{--}20\text{ MHz}$		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	$f = 1\text{ kHz}$		0.1		%

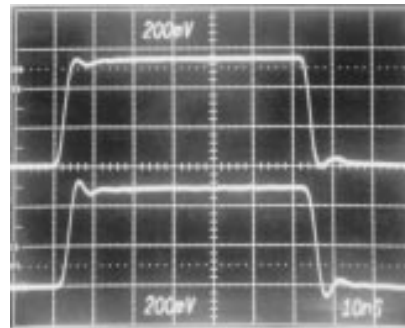
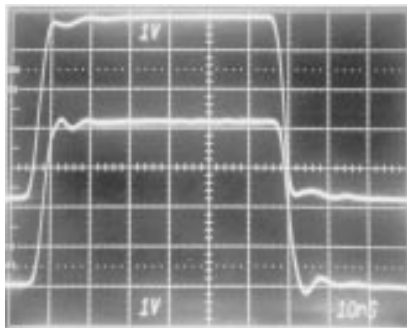
**Note 1:** Under normal operating conditions  $+V_{CC1}$  and  $+V_{CC2}$  should be connected together, and  $-V_{CC1}$  and  $-V_{CC2}$  should be connected together.

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

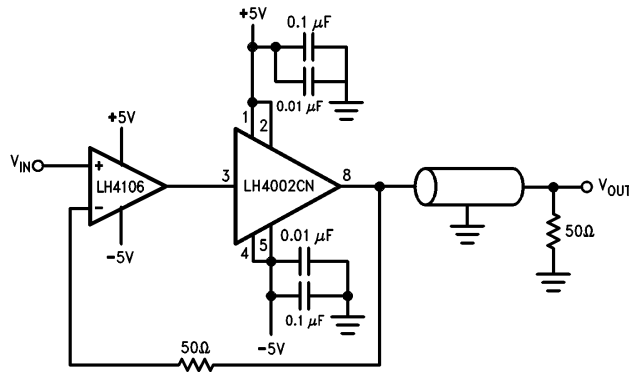
## Typical Performance Characteristics



## Pulse Response

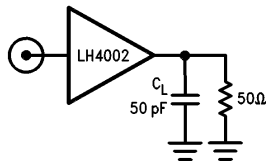


## Typical Applications



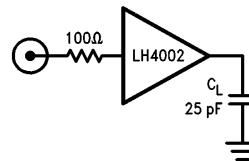
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FIGURE 1. Wideband Unity Gain Amplifier Using LH4002CN



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FIGURE 2. Compensation for Capacitive Loads



TL/K/8686-10

FIGURE 3. Compensation for Capacitive Loads

## Applications Information

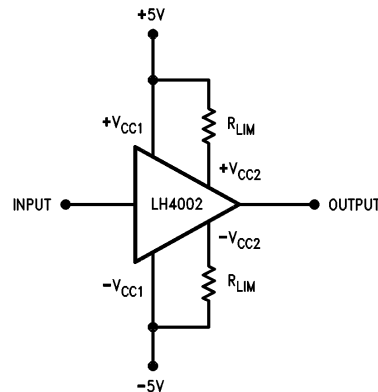
The high speed performance of the LH4002 can only be realized by taking certain precautions in circuit layout and power supply decoupling. Low inductance ceramic chip or disc power supply decoupling capacitors of 0.01  $\mu\text{F}$  in parallel with 0.1  $\mu\text{F}$  should be connected with the shortest 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 50  $\Omega$  should be placed in parallel with the load and *Figure 3* recommends that a 100  $\Omega$  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<sub>CC1</sub> and +V<sub>CC2</sub> pins and between -V<sub>CC1</sub> and -V<sub>CC2</sub> 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  $I_{SC} \leq 100 \text{ mA}$ . The inclusion of 50  $\Omega$  limiting resistors in the collectors of the output transistors limits the short circuit current to approximately 100 mA without reducing the output voltage swing.



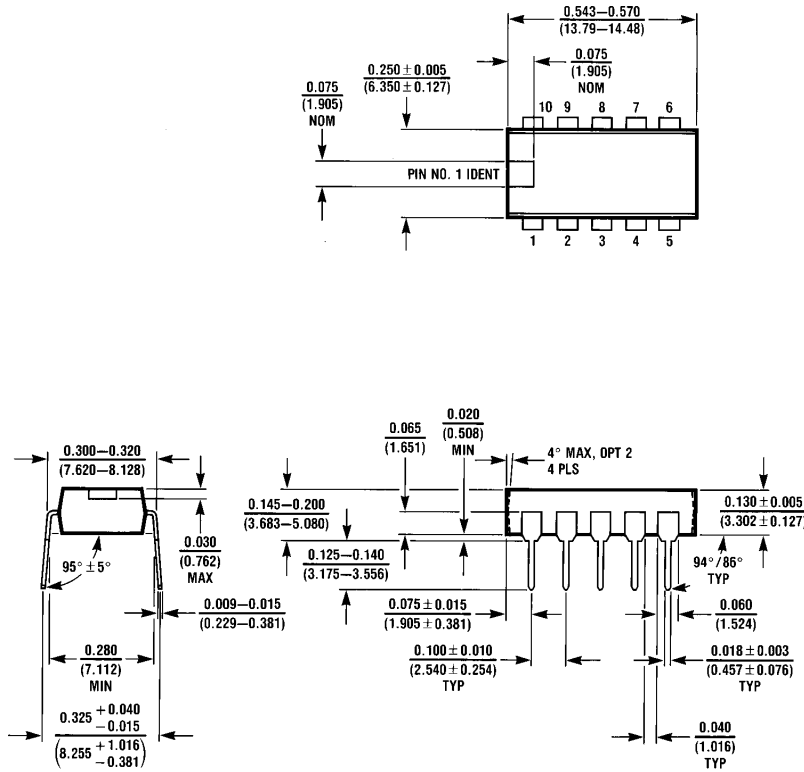
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FIGURE 4. LH4002 Using Resistor Current Limiting



**Physical Dimensions** inches (millimeters)

Lit. # 106409



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

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