

## LH0024 High Slew Rate Operational Amplifier

### General Description

The LH0024/LH0024C is a very wide bandwidth, high slew rate operational amplifier intended to fulfill a wide variety of high speed applications such as buffers to A to D and D to A converters and high speed comparators. The device exhibits useful gain in excess of 50 MHz making it possible to use in video applications requiring higher gain accuracy than is usually associated with such amplifiers.

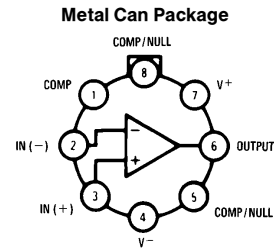
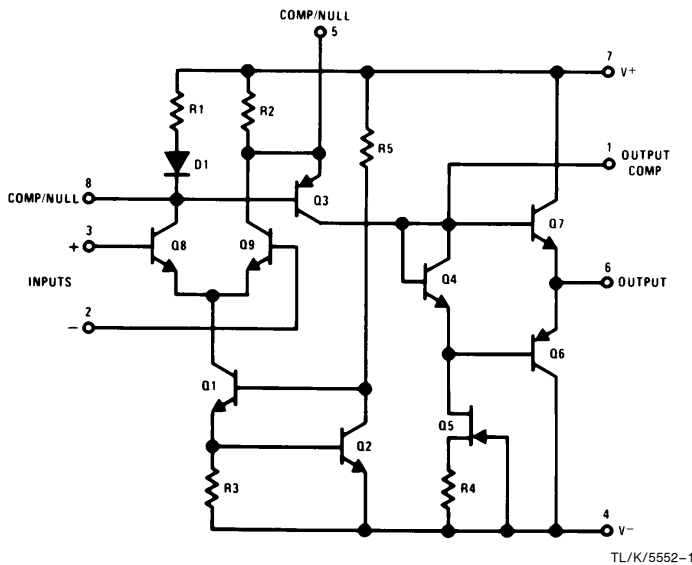
The LH0024/LH0024C's combination of wide bandwidth and high slew rate make it an ideal choice for a variety of high speed applications including active filters, oscillators, and comparators as well as many high speed general purpose applications.

The LH0024 is guaranteed over the temperature range  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ , whereas the LH0024C is guaranteed  $-25^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

### Features

- Very high slew rate—500 V/ $\mu\text{s}$  at  $A_V = +1$
- Wide small signal bandwidth—70 MHz
- Wide large signal bandwidth—15 MHz
- High output swing— $\pm 12\text{V}$  into 1k
- Low input offset—2 mV
- Pin compatible with standard IC op amps

### Schematic and Connection Diagrams



Top View

**Note:** For heat sink use Thermalloy 2230-5 series.

**Order Number LH0024H,  
LH0024H-MIL or LH0024CH  
See NS Package Number H08B**

## 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             | $\pm 18\text{V}$ |
| Input Voltage              | Equal to Supply  |
| Differential Input Voltage | $\pm 5\text{V}$  |
| Power Dissipation          | 600 mW           |

Storage Temperature Range  $-65^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$   
Lead Temperature (Soldering, 10 sec.)  $260^{\circ}\text{C}$   
ESD rating to be determined.

## Operating Temperature Range

|         |   |
|---------|---|
| LH0024  | $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ |
| LH0024C | $-25^{\circ}\text{C}$ to $+85^{\circ}\text{C}$  |

## DC Electrical Characteristics (Note 1)

| Parameter   | Conditions  | LH0024               |          |             | LH0024C              |          |              | Units                          |
|---|---|----------------------|----------|-------------|----------------------|----------|--------------|--------------------------------|
|   |   | Min                  | Typ      | Max         | Min                  | Typ      | Max          |                                |
| Input Offset Voltage                                    | $R_S = 50\Omega$ , $T_A = 25^{\circ}\text{C}$<br>$R_S = 50\Omega$   |                      | 2.0      | 4.0<br>6.0  |                      | 5.0      | 8.0<br>10.0  | mV<br>mV                       |
| Average Temperature Coefficient of Input Offset Voltage | $V_S = \pm 15\text{V}$ , $R_S = 50\Omega$<br>$-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$                             |                      | -20      |             |                      | -25      |              | $\mu\text{V}/^{\circ}\text{C}$ |
| Input Offset Current                                    | $T_A = 25^{\circ}\text{C}$  |                      | 2.0      | 5.0<br>10.0 |                      | 4.0      | 15.0<br>20.0 | $\mu\text{A}$<br>$\mu\text{A}$ |
| Input Bias Current                                      | $T_A = 25^{\circ}\text{C}$  |                      | 15       | 30<br>40    |                      | 18       | 40<br>50     | $\mu\text{A}$<br>$\mu\text{A}$ |
| Supply Current  |   |                      | 12.5     | 15          |                      | 12.5     | 15           | mA                             |
| Large Signal Voltage Gain                               | $V_S = \pm 15\text{V}$ , $R_L = 1\text{k}$ , $T_A = 25^{\circ}\text{C}$<br>$V_S = \pm 15\text{V}$ , $R_L = 1\text{k}$   | 4<br>3               | 5        |             | 3<br>2.5             | 4        |              | V/mV<br>V/mV                   |
| Input Voltage Range                                     | $V_S = \pm 15\text{V}$  | $\pm 12$             | $\pm 13$ |             | $\pm 12$             | $\pm 13$ |              | V                              |
| Output Voltage Swing                                    | $V_S = \pm 15\text{V}$ , $R_L = 1\text{k}$ , $T_A = 25^{\circ}\text{C}$<br>$V_S = \pm 15\text{V}$ , $R_L = 1\text{k}$   | $\pm 12$<br>$\pm 10$ | $\pm 13$ |             | $\pm 10$<br>$\pm 10$ | $\pm 13$ |              | V<br>V                         |
| Slew Rate   | $V_S = \pm 15\text{V}$ , $R_L = 1\text{k}$ ,<br>$C_1 = C_2 = 30\text{ pF}$ ,<br>$A_V = +1$ , $T_A = 25^{\circ}\text{C}$ | 400                  | 500      |             | 250                  | 400      |              | V/ $\mu\text{s}$               |
| Common-Mode Rejection Ratio                             | $V_S = \pm 15\text{V}$ , $\Delta V_{IN} = \pm 10\text{V}$ ,<br>$R_S = 50\Omega$   |                      | 60       |             |                      | 60       |              | dB                             |
| Power Supply Rejection Ratio                            | $\pm 5\text{V} \leq V_S \leq \pm 18\text{V}$ ,<br>$R_S = 50\Omega$  |                      | 60       |             |                      | 60       |              | dB                             |

**Note 1:** These specifications apply for  $V_S = \pm 15\text{V}$  and  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  for the LH0024 and  $-25^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  for the LH0024C.

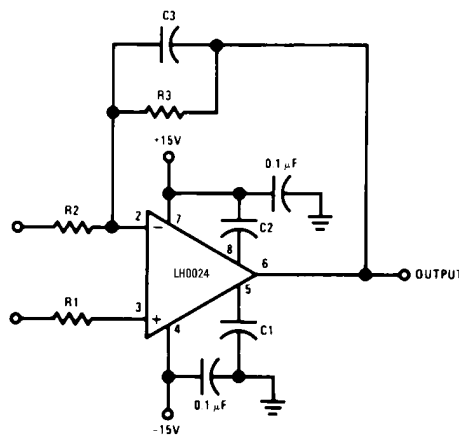
**Note 2:** Refer to RETS0024 for LH0024H military specifications.

## Frequency Compensation

TABLE I

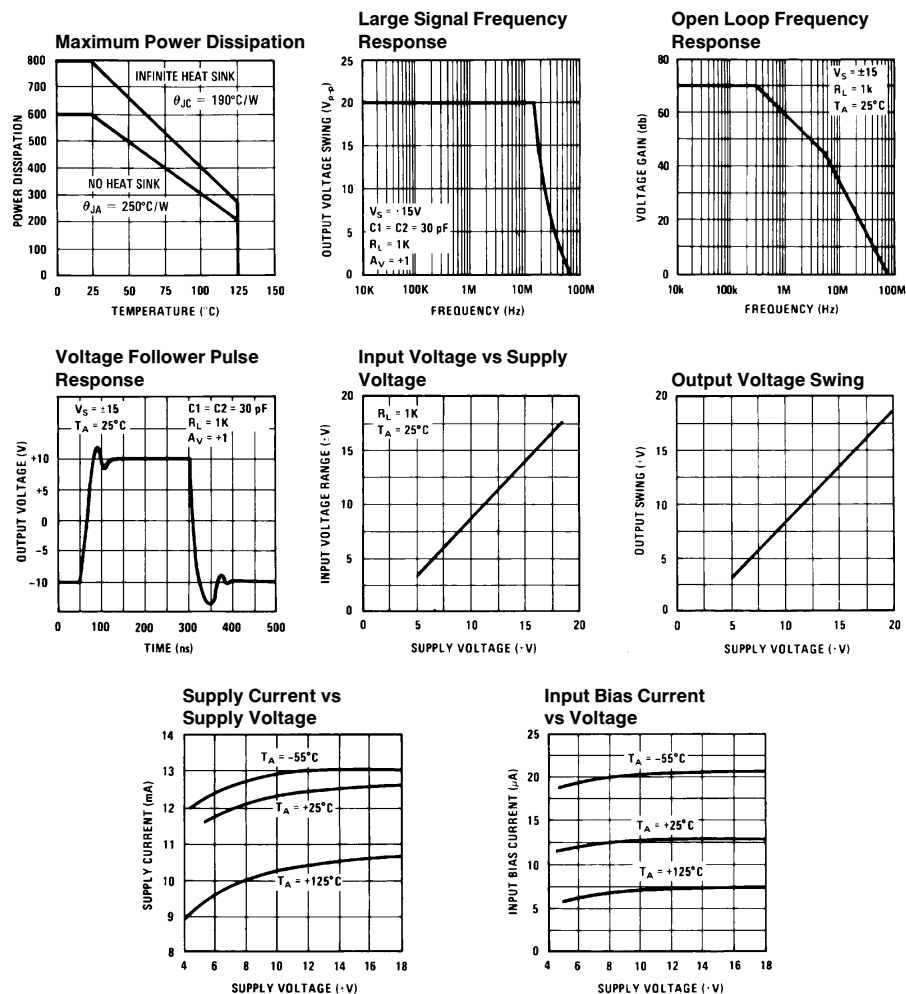
| Closed Loop Gain | $C_1$ | $C_2$ | $C_3$ |
|------------------|-------|-------|-------|
| 100              | 0     | 0     | 0     |
| 20               | 0     | 0     | 0     |
| 10               | 0     | 20 pF | 1 pF  |
| 1                | 30 pF | 30 pF | 3 pF  |

Frequency Compensation Circuit



TL/K/5552-6

## Typical Performance Characteristics



TL/K/5552-7

## Applications Information

### LAYOUT CONSIDERATIONS

The LH0024/LH0024C, like most high speed circuitry, is sensitive to layout and stray capacitance. Power supplies should be by-passed as near the device as is practicable with at least 0.01  $\mu\text{F}$  disc type capacitors. Compensating capacitors should also be placed as close to device as possible.

### COMPENSATION RECOMMENDATIONS

Compensation schemes recommended in Table 1 work well under typical conditions. However, poor layout and long lead lengths can degrade the performance of the LH0024 or cause the device to oscillate. Slight adjustments in the values for C1, C2, and C3 may be necessary for a given layout. In particular, when operating at a gain of  $-1$ , C3 may re-

quire adjustment in order to perfectly cancel the input capacitance of the device.

**When operating the LH0024/LH0024C at a gain of  $+1$ , the value of R1 should be at least 1 k $\Omega$ .**

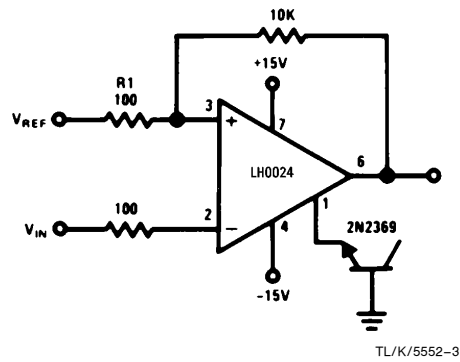
The case of the LH0024 is electrically isolated from the circuit; hence, it may be advantageous to drive the case in order to minimize stray capacitances.

### HEAT SINKING

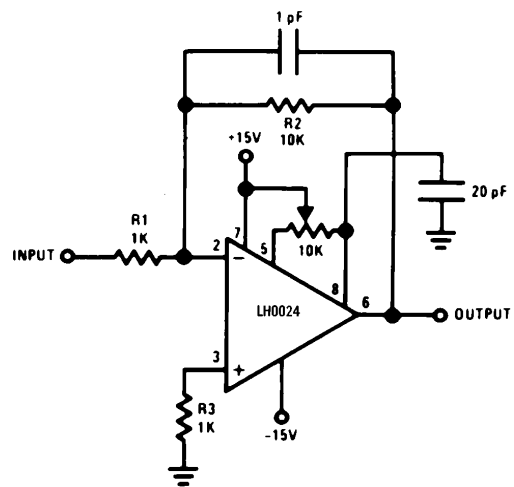
The LH0024/LH0024C is specified for operation without the use of an explicit heat sink. However, internal power dissipation does cause a significant temperature rise. Improved offset voltage drift can be obtained by limiting the temperature rise with a clip-on heat sink such as the Thermalloy 2228B or equivalent.

## Typical Applications

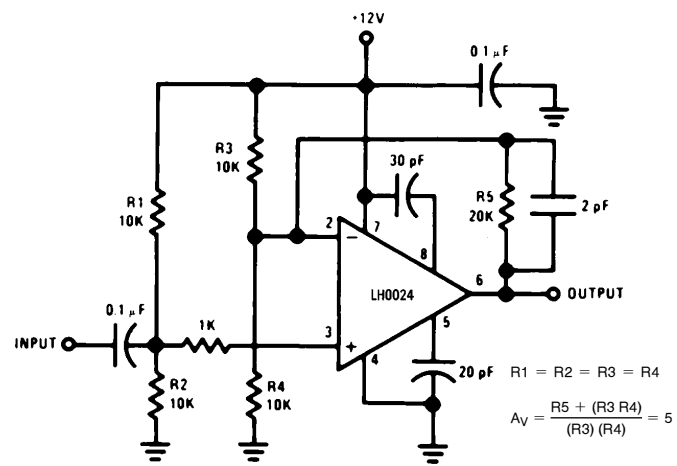
TTL Compatible Comparator



Offset Null

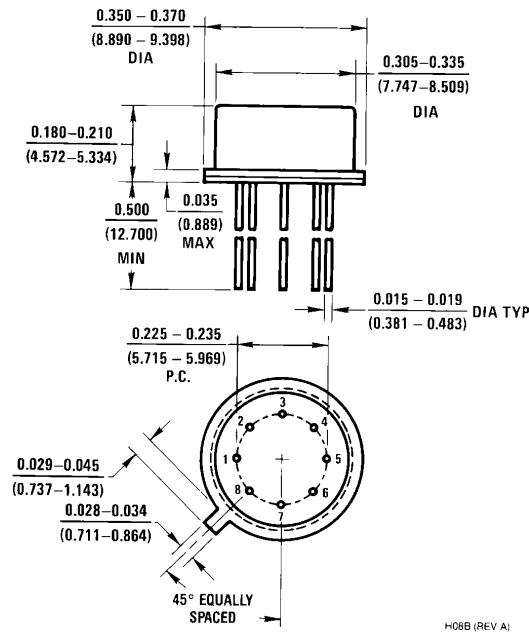


Video Amplifier





## Physical Dimensions inches (millimeters)



**Metal Can Package (H)**  
**Order Number LH0024H, LH0024H-MIL or LH0024CH**  
**NS Package Number H08B**

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Datasheets for electronics components.

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LH0024 - <http://www.ti.com/product/lh0024?HQS=TI-null-null-dscatalog-df-pf-null-ww>

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