Quad, 3.5MHz, Operational Amplifier

HA-4741, which contains four amplifiers on a monolithic chip, provides a new measure of performance for general purpose operational amplifiers. Each amplifier in the HA-4741 has operating specifications that equal or exceed those of the 741-type amplifier in all categories of performance.

HA-4741 is well suited to applications requiring accurate signal processing by virtue of its low values of input offset voltage (0.5mV), input bias current (60nA) and input voltage noise (9nV/√Hz at 1kHz). 3.5MHz bandwidth, coupled with high open-loop gain, allow the HA-4741 to be used in designs requiring amplification of wide band signals, such as audio amplifiers. Audio application is further enhanced by the HA-4741’s negligible output crossover distortion.

These excellent dynamic characteristics also make the HA-4741 ideal for a wide range of active filter designs. Performance integrity of multi-channel designs is assured by a high level of amplifier-to-amplifier isolation (69dB at 10kHz).

A wide range of supply voltages (±2V to ±20V) can be used to power the HA-4741, making it compatible with almost any system including battery-powered equipment.

A-4741/883 product and data sheets available upon request.

Ordering Information

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TEMP. RANGE (°C)</th>
<th>PACKAGE</th>
<th>PKG. NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HA1-4741-2</td>
<td>-55 to 125</td>
<td>14 Ld CERDIP</td>
<td>F14.3</td>
</tr>
<tr>
<td>HA1-4741-5</td>
<td>0 to 75</td>
<td>14 Ld CERDIP</td>
<td>F14.3</td>
</tr>
<tr>
<td>HA3-4741-5</td>
<td>0 to 75</td>
<td>14 Ld PDIP</td>
<td>E14.3</td>
</tr>
<tr>
<td>HA9P4741-9</td>
<td>-40 to 85</td>
<td>16 Ld SOIC</td>
<td>M16.3</td>
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</tbody>
</table>

Features

- Slew Rate .................................. 1.6V/µs
- Bandwidth .................................. 3.5MHz
- Input Voltage Noise ...................... 9nV/√Hz
- Input Offset Voltage ..................... 0.5mV
- Input Bias Current ....................... 60nA
- Supply Range .............................. ±2V to ±20V
- No Crossover Distortion
- Standard Quad Pinout

Applications

- Universal Active Filters
- D3 Communications Filters
- Audio Amplifiers
- Battery-Powered Equipment

Pinouts

HA-4741 (PDIP, CERDIP)

HA-4741 (SOIC)
Absolute Maximum Ratings

- $T_A = 25^\circ C$ Unless Otherwise Stated
- Supply Voltage Between V+ and V- Terminals: $40V$
- Differential Input Voltage: $30V$
- Input Voltage: $V_{SUPPLY}$
- Output Short Circuit Duration (Note 3): Indefinite

Operating Conditions

- Temperature Range:
  - HA-4741-2: $-55^\circ C$ to $125^\circ C$
  - HA-4741-5: $0^\circ C$ to $75^\circ C$
  - HA-4741-9: $-40^\circ C$ to $85^\circ C$

CAUTION: Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTES:

1. Maximum power dissipation, including output load, must be designed to maintain junction temperature below $175^\circ C$ for the ceramic package, and below $150^\circ C$ for the plastic packages.
2. $\theta_{JA}$ is measured with the component mounted on an evaluation PC board in free air.
3. One amplifier may be shorted to ground indefinitely.

Electrical Specifications

- $V_{SUPPLY} = \pm 15V$, Unless Otherwise Specified

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>TEMP. ($^\circ C$)</th>
<th>HA-4741-2</th>
<th>HA-4741-5</th>
<th>HA-4741-9</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MIN</td>
<td>TYP</td>
<td>MAX</td>
<td>MIN</td>
</tr>
<tr>
<td>INPUT CHARACTERISTICS</td>
<td></td>
<td></td>
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<tr>
<td>Offset Voltage</td>
<td></td>
<td>25</td>
<td>-</td>
<td>0.5</td>
<td>-</td>
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<tr>
<td>Average Offset Voltage Drift</td>
<td></td>
<td>Full</td>
<td>-</td>
<td>4</td>
<td>-</td>
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<tr>
<td>Bias Current</td>
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<td>25</td>
<td>-</td>
<td>60</td>
<td>-</td>
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<tr>
<td>Differential Input Resistance</td>
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<td>Full</td>
<td>-</td>
<td>325</td>
<td>-</td>
</tr>
<tr>
<td>Common Mode Range</td>
<td>Full</td>
<td>±12</td>
<td>-</td>
<td>-</td>
<td>±12</td>
</tr>
<tr>
<td>Channel Separation (Note 5)</td>
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<td>25</td>
<td>0.5</td>
<td>-</td>
<td>0.5</td>
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<tr>
<td>Small Signal Bandwidth</td>
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<td>25</td>
<td>2.5</td>
<td>3.5</td>
<td>2.5</td>
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<td>OUTPUT CHARACTERISTICS</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage Swing</td>
<td></td>
<td>Full</td>
<td>±12</td>
<td>±13.7</td>
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</tr>
<tr>
<td>Full Power Bandwidth (Notes 6, 7)</td>
<td>Full</td>
<td>±10</td>
<td>±12.5</td>
<td>-</td>
<td>±10</td>
</tr>
<tr>
<td>Output Current</td>
<td></td>
<td>Full</td>
<td>±5</td>
<td>±15</td>
<td>-</td>
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<tr>
<td>Output Resistance</td>
<td></td>
<td>25</td>
<td>-</td>
<td>300</td>
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</table>

NOTES:

1. Maximum power dissipation, including output load, must be designed to maintain junction temperature below $175^\circ C$ for the ceramic package, and below $150^\circ C$ for the plastic packages.
2. $\theta_{JA}$ is measured with the component mounted on an evaluation PC board in free air.
3. One amplifier may be shorted to ground indefinitely.
Electrical Specifications  $V_{\text{SUPPLY}} = \pm 15\text{V}$, Unless Otherwise Specified  (Continued)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>TEMP. ($^\circ\text{C}$)</th>
<th>HA-4741-2</th>
<th>HA-4741-5</th>
<th>(NOTE 4) HA-4741-9</th>
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<tbody>
<tr>
<td></td>
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<td>MIN</td>
<td>TYP</td>
<td>MAX</td>
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<td>TRANSIENT RESPONSE</td>
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<tr>
<td>$R_L = 2\text{k}\Omega$, $C_L = 50\text{pF}$</td>
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<tr>
<td>Rise Time</td>
<td>$V_{\text{OUT}} = \pm 200\text{mV}$</td>
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<td>-</td>
<td>75</td>
<td>140</td>
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<td>Overshoot</td>
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<tr>
<td>Slew Rate</td>
<td>$V_{\text{OUT}} = \pm 5\text{V}$</td>
<td>25</td>
<td>-</td>
<td>$\pm 1.6$</td>
<td>-</td>
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</tbody>
</table>

POWER SUPPLY CHARACTERISTICS

| Supply Current          |                 |                            | 25         | -         | 4.5       | 5         | -         | 5         | 7         | 7       | mA      |
| Power Supply Rejection Ratio | $\Delta V_S = \pm 5\text{V}$ | Full | 80        | 95        | -         | 80        | 95        | -         | -         | -       | dB      |

NOTES:
4. Typical and Minimum specifications for the -9 version are the same as those for the -5 version.
5. Referred to input; $f = 10\text{kHz}$, $R_S = 1\text{k}\Omega$, $V_{\text{IN}} = 100\text{mV}_{\text{PEAK}}$.
6. $V_{\text{OUT}} = \pm 10\text{V}$, $R_L = 2\text{k}\Omega$.
7. Full power bandwidth guaranteed based upon slew rate measurement: $\text{FPBW} = \text{S.R.}/2\pi$, $V_{\text{PEAK}}$.

Test Circuit and Waveforms

![Figure 1. Small and Large Signal Test Circuit](image)

FIGURE 1. SMALL AND LARGE SIGNAL TEST CIRCUIT

![Figure 2. Large Signal Response](image)

FIGURE 2. LARGE SIGNAL RESPONSE

![Figure 3. Small Signal Response](image)

FIGURE 3. SMALL SIGNAL RESPONSE
**Schematic Diagram**

![Schematic Diagram](image)

**Typical Performance Curves** \( V_{\text{SUPPLY}} = \pm 15V , T_A = 25^\circ C, \) Unless Otherwise Specified

- **Figure 4. Open Loop Frequency Response**
- **Figure 5. Output Voltage Swing vs Frequency**
- **Figure 6. Normalized AC Parameters vs Supply Voltage**
- **Figure 7. Normalized AC Parameters vs Temperature**
Typical Performance Curves \( V_{\text{SUPPLY}} = \pm 15\, \text{V}, \, T_A = 25^\circ\, \text{C}, \) Unless Otherwise Specified (Continued)
**Die Characteristics**

**DIE DIMENSIONS:**
87 mils x 75 mils x 19 mils
2210µm x 1910µm x 483µm

**METALLIZATION:**
Type: Al, 1% Cu
Thickness: 16kÅ ±2kÅ

**PASSIVATION:**
Type: Nitride (Si₃N₄) over Silox (SiO₂, 5% Phos.)
Silox Thickness: 12kÅ ±2kÅ
Nitride Thickness: 3.5kÅ ±1.5kÅ

**Metallization Mask Layout**

```
HA-4741

-IN4  +IN4  V-  +IN3  -IN3

OUT4

OUT1

-IN1  +IN1  V+  +IN2  -IN2

OUT3

OUT2
```

All Intersil semiconductor products are manufactured, assembled and tested under ISO9000 quality systems certification.