LM748 Operational Amplifier

General Description
The LM48 is a general purpose operational amplifier with external frequency compensation.

The unity-gain compensation specified makes the circuit stable for all feedback configurations, even with capacitive loads. It is possible to optimize compensation for best high frequency performance at any gain. As a comparator, the output can be clamped at any desired level to make it compatible with logic circuits.

The LM748C is specified for operation over the 0°C to +70°C temperature range.

Features
- Frequency compensation with a single 30 pF capacitor
- Operation from ±5V to ±20V
- Continuous short-circuit protection
- Operation as a comparator with differential inputs as high as ±30V
- No latch-up when common range is exceeded
- Same pin configuration as the LM101

Connection Diagram

Dual-In-Line Package

Top View
Order Number LM748CN
See NS Package Number N08B
**Absolute Maximum Ratings** (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

- Supply Voltage: ±22V
- Power Dissipation (Note 2): 500 mW
- Differential Input Voltage: ±30V

**Electrical Characteristics** (Note 5)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Offset Voltage</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C, R&lt;sub&gt;S&lt;/sub&gt; ≤ 10 kΩ</td>
<td>1.0</td>
<td>5.0</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>Input Offset Current</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C</td>
<td>40</td>
<td>200</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>Input Bias Current</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C</td>
<td>120</td>
<td>500</td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>Input Resistance</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C</td>
<td>300</td>
<td>800</td>
<td></td>
<td>kΩ</td>
</tr>
<tr>
<td>Supply Current</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C, V&lt;sub&gt;S&lt;/sub&gt; = ± 15V</td>
<td>1.8</td>
<td>2.8</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Large Signal Voltage Gain</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C, V&lt;sub&gt;S&lt;/sub&gt; = ± 15V, V&lt;sub&gt;OUT&lt;/sub&gt; = ± 10V, R&lt;sub&gt;L&lt;/sub&gt; ≥ 2 kΩ</td>
<td>50</td>
<td>160</td>
<td></td>
<td>V/mV</td>
</tr>
<tr>
<td>Input Offset Voltage</td>
<td>R&lt;sub&gt;S&lt;/sub&gt; ≤ 10 kΩ</td>
<td>6.0</td>
<td></td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>Average Temperature Coefficient of Input Offset Voltage</td>
<td>R&lt;sub&gt;S&lt;/sub&gt; ≤ 50Ω</td>
<td>3.0</td>
<td></td>
<td></td>
<td>µV/°C</td>
</tr>
<tr>
<td></td>
<td>R&lt;sub&gt;S&lt;/sub&gt; ≤ 10 kΩ</td>
<td>6.0</td>
<td></td>
<td></td>
<td>µV/°C</td>
</tr>
<tr>
<td>Input Offset Current</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 0°C to +70°C</td>
<td>300</td>
<td></td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td></td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = −55°C to +125°C</td>
<td>500</td>
<td></td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>Input Bias Current</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 0°C to +70°C</td>
<td>0.8</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = −55°C to +125°C</td>
<td>1.5</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>Supply Current</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = +125°C, V&lt;sub&gt;S&lt;/sub&gt; = ± 15V</td>
<td>1.2</td>
<td>2.25</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = −55°C to +125°C</td>
<td>1.9</td>
<td>3.3</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Large Signal Voltage Gain</td>
<td>V&lt;sub&gt;S&lt;/sub&gt; = ± 15V, V&lt;sub&gt;OUT&lt;/sub&gt; = ± 10V, R&lt;sub&gt;L&lt;/sub&gt; ≥ 2 kΩ</td>
<td>25</td>
<td></td>
<td></td>
<td>V/mV</td>
</tr>
<tr>
<td>Output Voltage Swing</td>
<td>V&lt;sub&gt;S&lt;/sub&gt; = ± 15V, R&lt;sub&gt;L&lt;/sub&gt; = 10 kΩ</td>
<td>±12</td>
<td>±14</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>V&lt;sub&gt;S&lt;/sub&gt; = ± 15V, R&lt;sub&gt;L&lt;/sub&gt; = 2 kΩ</td>
<td>±10</td>
<td>±13</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>V&lt;sub&gt;S&lt;/sub&gt; = ± 15V</td>
<td>±12</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Common-Mode Rejection Ratio</td>
<td>R&lt;sub&gt;S&lt;/sub&gt; ≤ 10 kΩ</td>
<td>70</td>
<td>90</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>Supply Voltage Rejection Mode</td>
<td>R&lt;sub&gt;S&lt;/sub&gt; ≤ 10 kΩ</td>
<td>77</td>
<td>90</td>
<td></td>
<td>dB</td>
</tr>
</tbody>
</table>

**Note 1:** Absolute maximum ratings indicate limits beyond which damage to the device may occur. Electrical characteristic specifications do not apply when operating the device outside of its rated operating conditions.

**Note 2:** For operating at elevated temperatures, the device must be derated based on a maximum junction to case thermal resistance of 45°C per watt, or 150°C per watt junction to ambient. (See Curves).

**Note 3:** For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

**Note 4:** Continuous short circuit is allowed for case temperatures to +125°C and ambient temperatures to +70°C.

**Note 5:** These specifications apply for ±5V ≤ V<sub>S</sub> ≤ +15V and 0°C ≤ T<sub>A</sub> ≤ +70°C, unless otherwise specified.
Typical Applications

Inverting Amplifier with Balancing Circuit

†May be zero or equal to parallel combination of R1 and R2 for minimum offset.

Voltage Comparable for Driving
DTL or TTL Integrated Circuits

Voltage Comparable for Driving
RTL Logic or High Current Driver
Guaranteed Performance Characteristics (Note 5)

**Input Voltage Range**

- **Supply Voltage (V)** vs. **Input Voltage Range (V)**
  - Minimum

**Output Swing**

- **Supply Voltage (V)** vs. **Output Swing (V)**
  - Minimum R_L = 10k
  - Minimum R_L = 2k

**Voltage Gain**

- **Supply Voltage (V)** vs. **Voltage Gain (dB)**
  - Minimum

**Supply Current**

- **Supply Voltage (V)** vs. **Supply Current (mA)**
  - T_A = -55°C
  - T_A = 25°C
  - T_A = 125°C

**Voltage Gain**

- **Supply Voltage (V)** vs. **Voltage Gain (dB)**
  - T_A = -55°C
  - T_A = 25°C
  - T_A = 125°C

**Input Bias Current**

- **Supply Voltage (V)** vs. **Input Bias Current (mA)**
  - T_A = -55°C
  - T_A = 25°C
  - T_A = 125°C

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Current Limiting

Input Current

Maximum Power Dissipation

Open Loop Frequency Response

Large Signal Frequency Response

Voltage Follower Pulse Response
Physical Dimensions

inches (millimeters) unless otherwise noted

LM748

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