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Contact Linear Technology for Potential Replacement

FEATURES

- 30 Volt Differential Input Range
- 75 nA Input Bias Current
- Wide Common Mode Voltage Range

APPLICATIONS

- Signal Conditioning Amplifiers
- Voltage Followers
- Comparators

DESCRIPTION

The LM101A and LM107 are general purpose operational amplifiers, featuring low bias current and the ability to operate with high input differential voltages up to 30 Volts. Unlike many FET input amplifiers, the output of the LM101A/107 does not reverse if the common mode range is exceeded, making them particularly useful in comparator and oscillator circuits.

The LM101A uses external compensation, allowing the frequency response and slew rate to be optimized for the application. The LM107 is identical to the LM101A with the exception that the compensation capacitor is internal. Linear’s LM101A and LM107 include improved design and processing techniques resulting in superior long term stability and reliability over previous devices. The curve of bias current versus differential input voltage indicates that a minimal change in input current occurs over a wide range of input signal, which is important in many applications.
### Absolute Maximum Ratings

- **Supply Voltage**
  - LM101A/LM107: ±22 Volts
  - LM301A/LM307: ±18 Volts
- **Differential Input Voltage**: ±30 Volts
- **Input Voltage, Note 2**: ±15 Volts
- **Output Short Circuit Duration, Note 3**: Indefinite
- **Operating Temperature Range**
  - LM101A/LM107: -55°C to 125°C
  - LM301A/LM307: 0°C to 70°C
- **Maximum Junction Temperature**
  - LM101A/LM107: 150°C
  - LM301A/LM307: 100°C
- **Storage Temperature Range**
  - All Devices: -65°C to 150°C
- **Lead Temperature (Soldering, 10 sec.)**: 300°C

### Package/Order Information

<table>
<thead>
<tr>
<th>ORDER PART NUMBER</th>
</tr>
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<tbody>
<tr>
<td>LM101AH</td>
</tr>
<tr>
<td>LM301AH</td>
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<tr>
<td>LM107H</td>
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<tr>
<td>LM307H</td>
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*PINS 1, 5, 8 NO CONNECTION ON LM107/307

### Electrical Characteristics (Note 1)

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>LM101A/LM107</th>
<th>LM301A/LM307</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>MIN</td>
<td>TYP</td>
<td>MAX</td>
</tr>
<tr>
<td>V&lt;sub&gt;DS&lt;/sub&gt;</td>
<td>Input Offset Voltage</td>
<td>R&lt;sub&gt;S&lt;/sub&gt; = 50kΩ, T&lt;sub&gt;A&lt;/sub&gt; = 25°C</td>
<td>0.7</td>
<td>2.0</td>
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<td>ΔV&lt;sub&gt;DS&lt;/sub&gt;</td>
<td>Average Temperature Coefficient of Input Offset Voltage</td>
<td>R&lt;sub&gt;S&lt;/sub&gt; = 50kΩ</td>
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<td>I&lt;sub&gt;DS&lt;/sub&gt;</td>
<td>Input Offset Current</td>
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<td>10</td>
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<td>ΔI&lt;sub&gt;DS&lt;/sub&gt;</td>
<td>Average Temperature Coefficient of Input Offset Current</td>
<td>25°C ≤ T&lt;sub&gt;A&lt;/sub&gt; ≤ T&lt;sub&gt;MAX&lt;/sub&gt;</td>
<td>0.01</td>
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<td>T&lt;sub&gt;MIN&lt;/sub&gt; ≤ T&lt;sub&gt;A&lt;/sub&gt; ≤ 25°C</td>
<td>0.02</td>
<td>0.2</td>
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<td>I&lt;sub&gt;B&lt;/sub&gt;</td>
<td>Input Bias Current</td>
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<td>30</td>
<td>75</td>
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<td>A&lt;sub&gt;VOL&lt;/sub&gt;</td>
<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; &gt;&gt; 2kΩ</td>
<td>50</td>
<td>160</td>
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<td></td>
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<td>V&lt;sub&gt;S&lt;/sub&gt; = ±15V</td>
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<td>CMRR</td>
<td>Common Mode Rejection Ratio</td>
<td>R&lt;sub&gt;S&lt;/sub&gt; = 50kΩ</td>
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<td>96</td>
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<td>PSRR</td>
<td>Power Supply Rejection Ratio</td>
<td>R&lt;sub&gt;S&lt;/sub&gt; = 50kΩ</td>
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<td>96</td>
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<td></td>
<td>Input Voltage Range</td>
<td>V&lt;sub&gt;S&lt;/sub&gt; = ±20V</td>
<td>±15</td>
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<tr>
<td></td>
<td></td>
<td>V&lt;sub&gt;S&lt;/sub&gt; = ±15V</td>
<td>±15</td>
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<td></td>
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<td>V&lt;sub&gt;S&lt;/sub&gt; = ±15V</td>
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<td>Output Voltage Swing</td>
<td>V&lt;sub&gt;S&lt;/sub&gt; = ±15V R&lt;sub&gt;L&lt;/sub&gt; = 10kΩ</td>
<td>±10</td>
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<td></td>
<td></td>
<td>R&lt;sub&gt;L&lt;/sub&gt; = 2kΩ</td>
<td>±10</td>
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<td>R&lt;sub&gt;IN&lt;/sub&gt;</td>
<td>Input Resistance</td>
<td>T&lt;sub&gt;A&lt;/sub&gt; = 25°C</td>
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<td>T&lt;sub&gt;A&lt;/sub&gt; = 125°C, V&lt;sub&gt;S&lt;/sub&gt; = ±20V</td>
<td>1.2</td>
<td>2.5</td>
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</table>

The ● denotes the specifications which apply over the full operating temperature range.

**Note 1:** Unless otherwise noted; all measurements are made with unity gain compensation (C<sub>1</sub> = 30pF for the LM101A/301A); these specifications apply for ±5V ≤ V<sub>S</sub> ≤ ±20V for the LM101A/LM107; and ±5V ≤ V<sub>S</sub> ≤ ±15V for the LM301A/LM307.

**Note 2:** For supply voltages less than ±15 Volts, the maximum input voltage is equal to the supply voltage.

**Note 3:** The output may be shunted to ground or either power supply indefinitely, provided the case temperature is below 125°C for the LM101A/107 and below 70°C for the LM301A/307.
**Typical Performance Characteristics (LM101A)**

**Single Pole Compensation**

\[ C_1 = \left( \frac{R_1}{R_1 + R_2} \right) (30 \text{pf}) \]

- \( C_1 = 30 \text{pf} \) for unity gain stability. At gains above 1, frequency response can be maximized by decreasing \( C_1 \).

**Open Loop Frequency Response**

![Graph showing open loop frequency response with voltage gain (dB) vs. frequency (Hz).]

**Single Pole Large Signal Frequency Response**

![Graph showing single pole large signal frequency response with output swing (V) vs. frequency (Hz).]

**Single Pole Voltage Follower Pulse Response**

![Graph showing single pole voltage follower pulse response with voltage swing (V) vs. time (us).]

**Two Pole Compensation**

\[ C_1 = 30 \text{pf} \quad C_2 = 10C_1 \text{ for unit gain. At gains above } 1, \text{ frequency response can be maximized by decreasing } C_1 \text{ and } C_2. \]

**Open Loop Frequency Response**

![Graph showing open loop frequency response with voltage gain (dB) vs. frequency (Hz).]

**2 Pole Large Signal Frequency Response**

![Graph showing 2 pole large signal frequency response with output swing (V) vs. frequency (Hz).]

**2 Pole Voltage Follower Pulse Response**

![Graph showing 2 pole voltage follower pulse response with voltage swing (V) vs. time (us).]

**Feedforward Compensation**

\[ C_2 = \frac{1}{(2\pi)(3 \times 10^9)(R_2)} \]

- \( C_2 \) needed for stability.

**Open Loop Frequency Response**

![Graph showing open loop frequency response with voltage gain (dB) vs. frequency (Hz).]

**Feedforward Large Signal Frequency Response**

![Graph showing feedforward large signal frequency response with output swing (V) vs. frequency (Hz).]

**Feedforward Inverter Pulse Response**

![Graph showing feedforward inverter pulse response with voltage swing (V) vs. time (us).]
TYPICAL PERFORMANCE CHARACTERISTICS (LM101A/LM107)
**LM107**
**Open Loop Frequency Response**

![Graph showing the open loop frequency response with a peak at TA = 25°C, VD = ±15V.](image)

**LM107**
**Large Signal Frequency Response**

![Graph showing the large signal frequency response with a peak at TA = 25°C, VD = ±15V.](image)

**LM107**
**Voltage Follower Pulse Response**

![Graph showing the voltage follower pulse response with a peak at TA = 25°C, VD = ±15V.](image)

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**TYPICAL APPLICATIONS**

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**Standard Compensation and Offset Balancing Circuit**

![Circuit diagram showing the standard compensation and offset balancing circuit.](image)

**Fast Summing Amplifier**

![Circuit diagram showing the fast summing amplifier with a power bandwidth of 250 kHz, a small signal bandwidth of 3.5 MHz, and a slew rate of 10V/μs.](image)

**Fast Voltage Follower**

![Circuit diagram showing the fast voltage follower with a power bandwidth of 15 kHz and a slew rate of 1V/μs.](image)

**Low Frequency Square Wave Generator**

![Circuit diagram showing the low frequency square wave generator.](image)

**Voltage Comparator with Clamp**

![Circuit diagram showing the voltage comparator with clamp.](image)

**Precision Rectifier**

![Circuit diagram showing the precision rectifier.](image)
PACKAGE DESCRIPTION

H Package
Metal Can

J8 Package
8 Lead Hermetic Dip

NOTE: DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.
*LEADS WITHIN 0.007 OF TRUE POSITION (TP) AT GAUGE PLANE

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<th>\theta_{ja}</th>
<th>\theta_{jc}</th>
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<td>150°C</td>
<td>150°C/W</td>
<td>45°C/W</td>
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<tr>
<td>J8</td>
<td>150°C</td>
<td>100°C/W</td>
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