description

The JFET-input operational amplifiers in the TL07_ series are designed as low-noise versions of the TL08_ series amplifiers with low input bias and offset currents and fast slew rate. The low harmonic distortion and low noise make the TL07_ series ideally suited for high-fidelity and audio preamplifier applications. Each amplifier features JFET inputs (for high input impedance) coupled with bipolar output stages integrated on a single monolithic chip.

The C-suffix devices are characterized for operation from 0°C to 70°C. The I-suffix devices are characterized for operation from –40°C to 85°C. The M-suffix devices are characterized for operation over the full military temperature range of –55°C to 125°C.

AVAILABLE OPTIONS

<table>
<thead>
<tr>
<th>T_A</th>
<th>V_{\text{gmax}} AT 25°C</th>
<th>PACKAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SMALL OUTLINE (D)†</td>
<td>CHIP CARRIER (FK)</td>
</tr>
<tr>
<td>0°C to 70°C</td>
<td>10 mV</td>
<td>TL071CD</td>
</tr>
<tr>
<td></td>
<td>6 mV</td>
<td>TL071ACD</td>
</tr>
<tr>
<td></td>
<td>3 mV</td>
<td>TL071BCD</td>
</tr>
<tr>
<td>—40°C to 85°C</td>
<td>10 mV</td>
<td>TL072CD</td>
</tr>
<tr>
<td></td>
<td>6 mV</td>
<td>TL072ACD</td>
</tr>
<tr>
<td></td>
<td>3 mV</td>
<td>TL072BCD</td>
</tr>
<tr>
<td>—55°C to 125°C</td>
<td>10 mV</td>
<td>TL074CD</td>
</tr>
<tr>
<td></td>
<td>6 mV</td>
<td>TL074ACD</td>
</tr>
<tr>
<td></td>
<td>3 mV</td>
<td>TL074BCD</td>
</tr>
</tbody>
</table>

† The D package is available taped and reeled. Add the suffix R to the device type (e.g., TL071CDR). The PW package is only available left-ended taped and reeled (e.g., TL072CPWLE).

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.
NC – No internal connection

symbols

TL071

OFFSET N1

IN+

IN–

OFFSET N2

OUT

TL072 (each amplifier)

TL074 (each amplifier)

IN+

IN–

OUT
schematic (each amplifier)

All component values shown are nominal.

<table>
<thead>
<tr>
<th>COMPONENT COUNT†</th>
<th>TL071</th>
<th>TL072</th>
<th>TL074</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistors</td>
<td>11</td>
<td>22</td>
<td>44</td>
</tr>
<tr>
<td>Transistors</td>
<td>14</td>
<td>28</td>
<td>56</td>
</tr>
<tr>
<td>JFET</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Diodes</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Capacitors</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>epi-FET</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

† Includes bias and trim circuitry
absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage, $V_{CC+}$ (see Note 1)</td>
<td>$18\text{ V}$</td>
</tr>
<tr>
<td>Supply voltage, $V_{CC-}$ (see Note 1)</td>
<td>$-18\text{ V}$</td>
</tr>
<tr>
<td>Differential input voltage, $V_{ID}$ (see Note 2)</td>
<td>$\pm 30\text{ V}$</td>
</tr>
<tr>
<td>Input voltage, $V_I$ (see Notes 1 and 3)</td>
<td>$\pm 15\text{ V}$</td>
</tr>
<tr>
<td>Duration of output short circuit (see Note 4)</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Continuous total power dissipation</td>
<td>See Dissipation Rating Table</td>
</tr>
<tr>
<td>Operating free-air temperature range, $T_A$</td>
<td></td>
</tr>
<tr>
<td>C suffix</td>
<td>$0\text{°C to 70\°C}$</td>
</tr>
<tr>
<td>I suffix</td>
<td>$-40\text{°C to 85\°C}$</td>
</tr>
<tr>
<td>M suffix</td>
<td>$-55\text{°C to 125\°C}$</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>$-65\text{°C to 150\°C}$</td>
</tr>
<tr>
<td>Case temperature for 60 seconds: FK package</td>
<td>$260\text{°C}$</td>
</tr>
<tr>
<td>Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds: J, JG, or W package</td>
<td>$300\text{°C}$</td>
</tr>
<tr>
<td>Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds: D, N, P, or PW package</td>
<td>$260\text{°C}$</td>
</tr>
</tbody>
</table>

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES:
1. All voltage values, except differential voltages, are with respect to the midpoint between $V_{CC+}$ and $V_{CC-}$.
2. Differential voltages are at $IN+$ with respect to $IN-$.
3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
4. The output may be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

**DISSIPATION RATING TABLE**

<table>
<thead>
<tr>
<th>PACKAGE</th>
<th>TA ≤ 25°C POWER RATING</th>
<th>DERATING FACTOR</th>
<th>DERATE ABOVE TA</th>
<th>TA = 70°C POWER RATING</th>
<th>TA = 85°C POWER RATING</th>
<th>TA = 125°C POWER RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>D (8 pin)</td>
<td>680 mW</td>
<td>5.8 mW/°C</td>
<td>33°C</td>
<td>465 mW</td>
<td>378 mW</td>
<td>N/A</td>
</tr>
<tr>
<td>D (14 pin)</td>
<td>680 mW</td>
<td>7.6 mW/°C</td>
<td>60°C</td>
<td>604 mW</td>
<td>490 mW</td>
<td>N/A</td>
</tr>
<tr>
<td>FK</td>
<td>680 mW</td>
<td>11.0 mW/°C</td>
<td>88°C</td>
<td>680 mW</td>
<td>680 mW</td>
<td>273 mW</td>
</tr>
<tr>
<td>J</td>
<td>680 mW</td>
<td>11.0 mW/°C</td>
<td>88°C</td>
<td>680 mW</td>
<td>680 mW</td>
<td>273 mW</td>
</tr>
<tr>
<td>JG</td>
<td>680 mW</td>
<td>8.4 mW/°C</td>
<td>69°C</td>
<td>672 mW</td>
<td>546 mW</td>
<td>210 mW</td>
</tr>
<tr>
<td>N</td>
<td>680 mW</td>
<td>9.2 mW/°C</td>
<td>76°C</td>
<td>680 mW</td>
<td>597 mW</td>
<td>N/A</td>
</tr>
<tr>
<td>P</td>
<td>680 mW</td>
<td>8.0 mW/°C</td>
<td>65°C</td>
<td>640 mW</td>
<td>520 mW</td>
<td>N/A</td>
</tr>
<tr>
<td>PW (8 pin)</td>
<td>525 mW</td>
<td>4.2 mW/°C</td>
<td>70°C</td>
<td>525 mW</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>PW (14 pin)</td>
<td>700 mW</td>
<td>5.6 mW/°C</td>
<td>70°C</td>
<td>700 mW</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>W</td>
<td>680 mW</td>
<td>8.0 mW/°C</td>
<td>65°C</td>
<td>640 mW</td>
<td>520 mW</td>
<td>200 mW</td>
</tr>
</tbody>
</table>
## Electrical Characteristics, \( V_{CC} = \pm 15 \, V \) (unless otherwise noted)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions†</th>
<th>( T_A )‡</th>
<th>TL071C</th>
<th>TL072C</th>
<th>TL071AC</th>
<th>TL072AC</th>
<th>TL071BC</th>
<th>TL072BC</th>
<th>TL071I</th>
<th>TL072I</th>
<th>TL074C</th>
<th>TL074BC</th>
<th>TL074I</th>
<th>TL074BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{IO} ) Input offset voltage</td>
<td>( V_O = 0, \ R_S = 50 , \Omega )</td>
<td>25°C</td>
<td>3</td>
<td>10</td>
<td>3</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{VIO} ) Temperature coefficient of input offset voltage</td>
<td>( V_O = 0, \ R_S = 50 , \Omega )</td>
<td>Full range</td>
<td>13</td>
<td>7.5</td>
<td>5</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_O ) Input offset current</td>
<td>( V_O = 0 )</td>
<td>25°C</td>
<td>±11</td>
<td>–12</td>
<td>±11</td>
<td>–12</td>
<td>±11</td>
<td>–12</td>
<td>±11</td>
<td>–12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( I_{IB} ) Input bias current§</td>
<td>( V_O = 0 )</td>
<td>Full range</td>
<td>7</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{ICR} ) Common-mode input voltage range</td>
<td>( V_O = \pm 10 , V )</td>
<td>25°C</td>
<td>±12</td>
<td>15</td>
<td>±11</td>
<td>15</td>
<td>±11</td>
<td>15</td>
<td>±11</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{OM} ) Maximum peak output voltage swing</td>
<td>( R_L = 10 , k\Omega )</td>
<td>25°C</td>
<td>±12</td>
<td>±12</td>
<td>±12</td>
<td>±12</td>
<td>±12</td>
<td>±12</td>
<td>±12</td>
<td>±12</td>
<td>V</td>
<td>V</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>( A_{VD} ) Large-signal differential voltage amplification</td>
<td>( R_L = 10 , k\Omega )</td>
<td>Full range</td>
<td>±12</td>
<td>±12</td>
<td>±10</td>
<td>±10</td>
<td>±10</td>
<td>±10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( R_L = 2 , k\Omega )</td>
<td>Full range</td>
<td>±10</td>
<td>±12</td>
<td>±12</td>
<td>±10</td>
<td>±10</td>
<td>±10</td>
<td>±10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( B_1 ) Unity-gain bandwidth</td>
<td>( V_O = \pm 10 , V )</td>
<td>25°C</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \gamma ) Input resistance</td>
<td>( V_O = \pm 10 , V )</td>
<td>25°C</td>
<td>10¹²</td>
<td>10¹²</td>
<td>10¹²</td>
<td>10¹²</td>
<td>10¹²</td>
<td>10¹²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( CMRR ) Common-mode rejection ratio</td>
<td>( V_{IC} = V_{ICR\min}, \ V_O = 0, \ R_S = 50 , \Omega )</td>
<td>25°C</td>
<td>70</td>
<td>100</td>
<td>75</td>
<td>100</td>
<td>75</td>
<td>100</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( k_{SVR} ) Supply-voltage rejection ratio (( \Delta V_{CC} / \Delta V_{IO} ))</td>
<td>( V_{CC} = \pm 9 , V )</td>
<td>25°C</td>
<td>70</td>
<td>100</td>
<td>80</td>
<td>100</td>
<td>80</td>
<td>100</td>
<td>80</td>
<td>100</td>
<td>dB</td>
<td>dB</td>
<td>dB</td>
<td>dB</td>
</tr>
<tr>
<td>( V_{IO1}/V_{IO2} ) Crosstalk attenuation</td>
<td>( A_{VD} = 100 )</td>
<td>25°C</td>
<td>1.4</td>
<td>2.5</td>
<td>1.4</td>
<td>2.5</td>
<td>1.4</td>
<td>2.5</td>
<td>1.4</td>
<td>2.5</td>
<td>mA</td>
<td>mA</td>
<td>mA</td>
<td>mA</td>
</tr>
</tbody>
</table>

† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified.
‡ Full range is \( T_A = 0°C \) to 70°C for TL071, TL072, TL074, and is \( T_A = –40°C \) to 85°C for TL071.
§ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 4. Pulse techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.
### Electrical Characteristics, $V_{CC} = \pm 15$ V (unless otherwise noted)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS†</th>
<th>$T_A$‡</th>
<th>TL071M</th>
<th>TL072M</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IO}$ Input offset voltage</td>
<td>$V_O = 0$, $R_S = 50$ $\Omega$</td>
<td>$25^\circ$C</td>
<td>3</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>$\alpha_{VIO}$ Temperature coefficient of input offset voltage</td>
<td>$V_O = 0$, $R_S = 50$ $\Omega$</td>
<td>Full range</td>
<td>9</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>$I_{IO}$ Input offset current</td>
<td>$V_O = 0$</td>
<td>$25^\circ$C</td>
<td>5</td>
<td>100</td>
<td>5</td>
</tr>
<tr>
<td>$I_{IB}$ Input bias current‡</td>
<td>$V_O = 0$</td>
<td>$25^\circ$C</td>
<td>65</td>
<td>200</td>
<td>65</td>
</tr>
<tr>
<td>$V_{ICR}$ Common-mode input voltage range</td>
<td>$R_L = 10$ $k\Omega$</td>
<td>$25^\circ$C</td>
<td>±11 to ±11</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$V_{OM}$ Maximum peak output voltage swing</td>
<td>$R_L \geq 10$ $k\Omega$</td>
<td>$25^\circ$C</td>
<td>±12 to ±12</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$A_{VD}$ Large-signal differential voltage amplification</td>
<td>$V_O = \pm 10$ V, $R_L \geq 2$ $k\Omega$</td>
<td>$25^\circ$C</td>
<td>35</td>
<td>200</td>
<td>35</td>
</tr>
<tr>
<td>$B_1$ Unity-gain bandwidth</td>
<td>$T_A = 25^\circ$C</td>
<td></td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>$r_i$ Input resistance</td>
<td>$T_A = 25^\circ$C</td>
<td></td>
<td>10$^{12}$</td>
<td>10$^{12}$</td>
<td></td>
</tr>
<tr>
<td>CMRR Common-mode rejection ratio</td>
<td>$V_{IC} = V_{ICR\min}$, $V_O = 0$, $R_S = 50$ $\Omega$</td>
<td>$25^\circ$C</td>
<td>80</td>
<td>86</td>
<td>80</td>
</tr>
<tr>
<td>$k_{SVR}$ Supply-voltage rejection ratio ($\Delta V_{CC} / \Delta V_{IO}$)</td>
<td>$V_{CC} = \pm 15$ V, $V_O = 0$, $R_S = 50$ $\Omega$</td>
<td>$25^\circ$C</td>
<td>80</td>
<td>86</td>
<td>80</td>
</tr>
<tr>
<td>$I_{CC}$ Supply current (each amplifier)</td>
<td>$V_O = 0$, No load</td>
<td>$25^\circ$C</td>
<td>1.4</td>
<td>2.5</td>
<td>1.4</td>
</tr>
<tr>
<td>$V_{O1}/V_{O2}$ Crosstalk attenuation</td>
<td>$A_{VD} = 100$</td>
<td>$25^\circ$C</td>
<td>120</td>
<td>120</td>
<td></td>
</tr>
</tbody>
</table>

† Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 4. Pulse techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

‡ All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified. Full range is $T_A = –55^\circ$C to $125^\circ$C.
operating characteristics, $V_{CC} = \pm 15 \, \text{V}$, $T_A = 25^\circ\text{C}$

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITIONS</th>
<th>TL07xM</th>
<th>ALL OTHERS</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR Slew rate at unity gain</td>
<td>$V_I = 10 , \text{V}$, $C_L = 100 , \text{pF}$, $R_L = 2 , \text{k}\Omega$, See Figure 1</td>
<td>5</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>$t_v$ Rise time overshoot factor</td>
<td>$V_I = 20 , \text{mV}$, $C_L = 100 , \text{pF}$, $R_L = 2 , \text{k}\Omega$, See Figure 1</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>$V_n$ Equivalent input noise voltage</td>
<td>$R_S = 20 , \Omega$ $f = 1 , \text{kHz}$</td>
<td>18</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>$I_n$ Equivalent input noise current</td>
<td>$R_S = 20 , \Omega$, $f = 1 , \text{kHz}$</td>
<td>0.01</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>THD Total harmonic distortion</td>
<td>$V_{\text{rms}} = 6 , \text{V}$, $R_L \geq 2 , \text{k}\Omega$, $f = 1 , \text{kHz}$, $A_{VD} = 1$, $R_S \leq 1 , \text{k}\Omega$, $f = 1 , \text{kHz}$</td>
<td>0.003%</td>
<td>0.003%</td>
<td></td>
</tr>
</tbody>
</table>

PARAMETER MEASUREMENT INFORMATION

![Figure 1. Unity-Gain Amplifier](image1)

![Figure 2. Gain-of-10 Inverting Amplifier](image2)

![Figure 3. Input Offset Voltage Null Circuit](image3)
## TYPICAL CHARACTERISTICS

### Table of Graphs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>FIGURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{IB}$</td>
<td>Input bias current</td>
<td>4</td>
</tr>
<tr>
<td>$V_{OM}$</td>
<td>Maximum output voltage</td>
<td>5, 6, 7</td>
</tr>
<tr>
<td>$A_{VD}$</td>
<td>Large-signal differential voltage amplification</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Phase shift</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Normalized unity-gain bandwidth</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Normalized phase shift</td>
<td>13</td>
</tr>
<tr>
<td>$CMRR$</td>
<td>Common-mode rejection ratio</td>
<td>14</td>
</tr>
<tr>
<td>$I_{CC}$</td>
<td>Supply current</td>
<td>15</td>
</tr>
<tr>
<td>$P_{D}$</td>
<td>Total power dissipation</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Normalized slew rate</td>
<td>18</td>
</tr>
<tr>
<td>$V_{N}$</td>
<td>Equivalent input noise voltage</td>
<td>19</td>
</tr>
<tr>
<td>$THD$</td>
<td>Total harmonic distortion</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Large-signal pulse response</td>
<td>21</td>
</tr>
<tr>
<td>$V_{O}$</td>
<td>Output voltage</td>
<td>22</td>
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Typical Characteristics†

**Input Bias Current**

vs Free-Air Temperature

![Graph showing Input Bias Current vs Free-Air Temperature](figure4)

**Maximum Peak Output Voltage**

vs Frequency

![Graph showing Maximum Peak Output Voltage vs Frequency](figure5)

**Maximum Peak Output Voltage**

vs Frequency

![Graph showing Maximum Peak Output Voltage vs Frequency](figure6)

![Graph showing Maximum Peak Output Voltage vs Frequency](figure7)

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
TYPICAL CHARACTERISTICS†

MAXIMUM PEAK OUTPUT VOLTAGE

vs FREE-AIR TEMPERATURE

Figure 8

VOM - Maximum Peak Output Voltage - V

±15

±12.5

±10

±7.5

±5

±2.5

0

−75 −50 −25 0 25 50 75 100 125

T_A - Free-Air Temperature - °C

R_L = 10 kΩ

R_L = 2 kΩ

VCC = ±15 V
See Figure 2

MAXIMUM PEAK OUTPUT VOLTAGE

vs LOAD RESISTANCE

Figure 9

VOM - Maximum Peak Output Voltage - V

±15

±12.5

±10

±7.5

±5

±2.5

0

0.1 0.2 0.4 0.7 1 2 4 7 10

R_L - Load Resistance - kΩ

VCC = ±15 V

T_A = 25°C
See Figure 2

MAXIMUM PEAK OUTPUT VOLTAGE

vs SUPPLY VOLTAGE

Figure 10

VOM - Maximum Peak Output Voltage - V

±15

±12.5

±10

±7.5

±5

±2.5

0

0 2 4 6 8 10 12 14 16

|VCC| - Supply Voltage - V

R_L = 10 kΩ

T_A = 25°C

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION

vs FREE-AIR TEMPERATURE

Figure 11

AVD - Large-Signal Differential Voltage Amplification - V/mV

1000

400

200

100

40

10

1

|VCC| = ±15 V

V_O = ±10 V

R_L = 2 kΩ

VCC = ±15 V

T_A = 25°C

See Figure 2

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
TYPICAL CHARACTERISTICS†

LARGE-SIGNAL
DIFFERENTIAL VOLTAGE AMPLIFICATION
AND PHASE SHIFT

\[ V_{CC} = \pm 5 \text{ V to } \pm 15 \text{ V} \]
\[ R_L = 2 \text{ k}\Omega \]
\[ T_A = 25^\circ \text{C} \]

Figure 12

NORMIALIZED UNITY-GAIN BANDWIDTH
AND PHASE SHIFT

\[ f = B_1 \text{ for Phase Shift} \]
\[ V_{CC} = \pm 15 \text{ V} \]
\[ R_L = 2 \text{ k}\Omega \]

Figure 13

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
TYPICAL CHARACTERISTICS†

COMMON-MODE REJECTION RATIO

VERSUS FREE-AIR TEMPERATURE

SUPPLY CURRENT PER AMPLIFIER

VERSUS SUPPLY VOLTAGE

SUPPLY CURRENT PER AMPLIFIER

VERSUS FREE-AIR TEMPERATURE

TOTAL POWER DISSIPATION

VERSUS FREE-AIR TEMPERATURE

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
TYPICAL CHARACTERISTICS

NORMALIZED SLEW RATE
VS
FREE-AIR TEMPERATURE

EQUIVALENT INPUT NOISE VOLTAGE
VS
FREQUENCY

TOTAL HARMONIC DISTORTION
VS
FREQUENCY

VOLTAGE-FOLLOWER
LARGE-SIGNAL PULSE RESPONSE

Figure 18

Figure 19

Figure 20

Figure 21
TYPICAL CHARACTERISTICS

OUTPUT VOLTAGE
VS
ELAPSED TIME

V₀ − Output Voltage mV

VCC ± = ±15 V
R_L = 2 kΩ
T_A = 25°C

Overshoot
90%
10%

t – Elapsed Time µs

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7

Figure 22
APPLICATION INFORMATION

Table of Application Diagrams

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<td>High-Q notch filter</td>
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<td>Audio-distribution amplifier</td>
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<td>100-kHz quadrature oscillator</td>
<td>TL072</td>
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<tr>
<td>AC amplifier</td>
<td>TL071</td>
<td>27</td>
</tr>
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Figure 23. 0.5-Hz Square-Wave Oscillator

\[
f = \frac{1}{2\pi R_F C_F}
\]

\[
R_F = 100 \text{ k}\Omega
\]

\[
3.3 \text{ k}\Omega
\]

\[
1 \text{ k}\Omega
\]

\[
9.1 \text{ k}\Omega
\]

\[
15 \text{ V}
\]

\[
-15 \text{ V}
\]

\[
3.3 \text{ k}\Omega
\]

\[
C_F = 3.3 \mu\text{F}
\]

Figure 24. High-Q Notch Filter

\[
R_1 = R_2 = 2R_3 = 1.5 \text{ M}\Omega
\]

\[
C_1 = C_2 = \frac{C_3}{2} = 110 \text{ pF}
\]

\[
f_o = \frac{1}{2\pi R_1 C_1} = 1 \text{ kHz}
\]

\[
V_{CC+}
\]

\[
V_{CC-}
\]

\[
V_{CC+}
\]

\[
V_{CC-}
\]

\[
V_{CC+}
\]

\[
V_{CC-}
\]

\[
V_{CC+}
\]

\[
V_{CC-}
\]

\[
V_{CC+}
\]

\[
V_{CC-}
\]

\[
V_{CC+}
\]

\[
V_{CC-}
\]

Figure 25. Audio-Distribution Amplifier
APPLICATION INFORMATION

![Diagram of 100-kHz Quadrature Oscillator](image)

NOTE A: These resistor values may be adjusted for a symmetrical output.

Figure 26. 100-kHz Quadrature Oscillator

![Diagram of AC Amplifier](image)

Figure 27. AC Amplifier
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