

TL072A, TL072B, TL074, TL074A, TL074B  
**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

**15 DEVICES COVER COMMERCIAL, INDUSTRIAL,  
 AND MILITARY TEMPERATURE RANGES**

- Low Power Consumption
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Total Harmonic Distortion 0.003% Typ
- Low Noise  
 $V_n = 18 \text{ nV}/\sqrt{\text{Hz}}$  Typ at  $f = 1 \text{ kHz}$
- High Input Impedance . . . JFET Input Stage
- Internal Frequency Compensation
- Latch-Up-Free Operation
- High Slew Rate . . . 13 V/ $\mu\text{s}$  Typ
- Common-Mode Input Voltage Range Includes  $V_{CC+}$

**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**

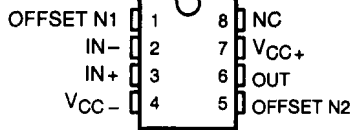
| TA                | V <sub>IO</sub> max<br>AT 25°C | PACKAGE                         |                                  |                       |                           |                                 |                                 |                          |                        |
|-------------------|--------------------------------|---------------------------------|----------------------------------|-----------------------|---------------------------|---------------------------------|---------------------------------|--------------------------|------------------------|
|                   |                                | SMALL<br>OUTLINE<br>(D)†        | CHIP<br>CARRIER<br>(FK)          | CERAMIC<br>DIP<br>(J) | CERAMIC<br>DIP<br>(JG)    | PLASTIC<br>DIP<br>(N)           | PLASTIC<br>DIP<br>(P)           | TSSOP<br>PACKAGE<br>(PW) | FLAT<br>PACKAGE<br>(W) |
| 0°C to<br>70°C    | 10 mV<br>6 mV<br>3 mV          | TL071CD<br>TL071ACD<br>TL071BCD | —                                | —                     | —                         | —                               | TL071CP<br>TL071ACP<br>TL071BCP | TL071CPWLE<br>—<br>—     | —                      |
|                   | 10 mV<br>6 mV<br>3 mV          | TL072CD<br>TL072ACD<br>TL072BCD | —                                | —                     | —                         | —                               | TL072CP<br>TL072ACP<br>TL072BCP | TL072CPWLE<br>—<br>—     | —                      |
|                   | 10 mV<br>6 mV<br>3 mV          | TL074CD<br>TL074ACD<br>TL074BCD | —                                | —                     | —                         | TL074CN<br>TL074ACN<br>TL074BCN | —                               | TL074CPWLE<br>—<br>—     | —                      |
| -40°C to<br>85°C  | 6 mV                           | TL071ID<br>TL072ID<br>TL074ID   | —                                | —                     | —                         | —<br>—<br>TL074IN               | TL071IP<br>TL072P<br>—          | —                        | —                      |
| -55°C to<br>125°C | 6 mV<br>6 mV<br>9 mV           | —                               | TL071MFK<br>TL072MFK<br>TL074MFK | —<br>—<br>TL074MJ     | TL071MJG<br>TL072MJG<br>— | —                               | —                               | —                        | —<br>—<br>TL074MW      |

† 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).

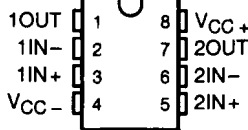


**TL071, TL071A, TL071B, TL072**  
**TL072A, TL072B, TL074, TL074A, TL074B**  
**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**  
 SLOS080C – SEPTEMBER 1976 – REVISED AUGUST 1994

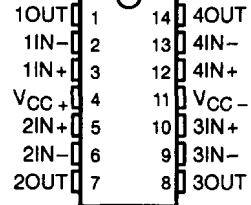
**TL071, TL071A, TL071B**  
 D, JG, P, OR PW PACKAGE  
 (TOP VIEW)



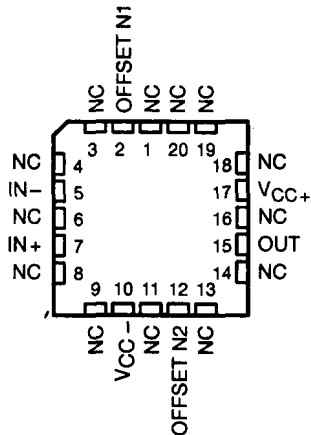
**TL072, TL072A, TL072B**  
 D, JG, P, OR PW PACKAGE  
 (TOP VIEW)



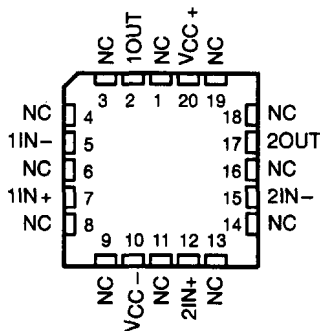
**TL074, TL074A, TL074B**  
 D, J, N, OR PW PACKAGE  
 TL074...W PACKAGE  
 (TOP VIEW)



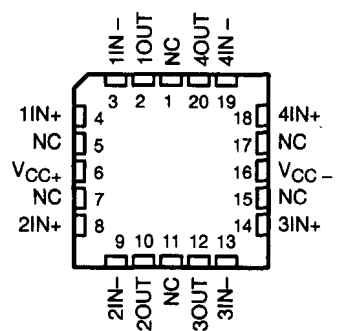
**TL071**  
 FK PACKAGE  
 (TOP VIEW)



**TL072**  
 FK PACKAGE  
 (TOP VIEW)

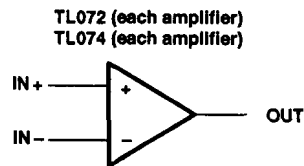
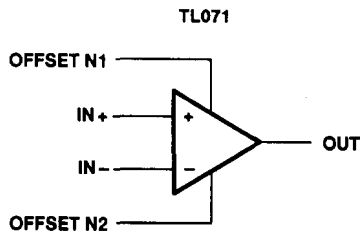


**TL074**  
 FK PACKAGE  
 (TOP VIEW)



NC – No internal connection

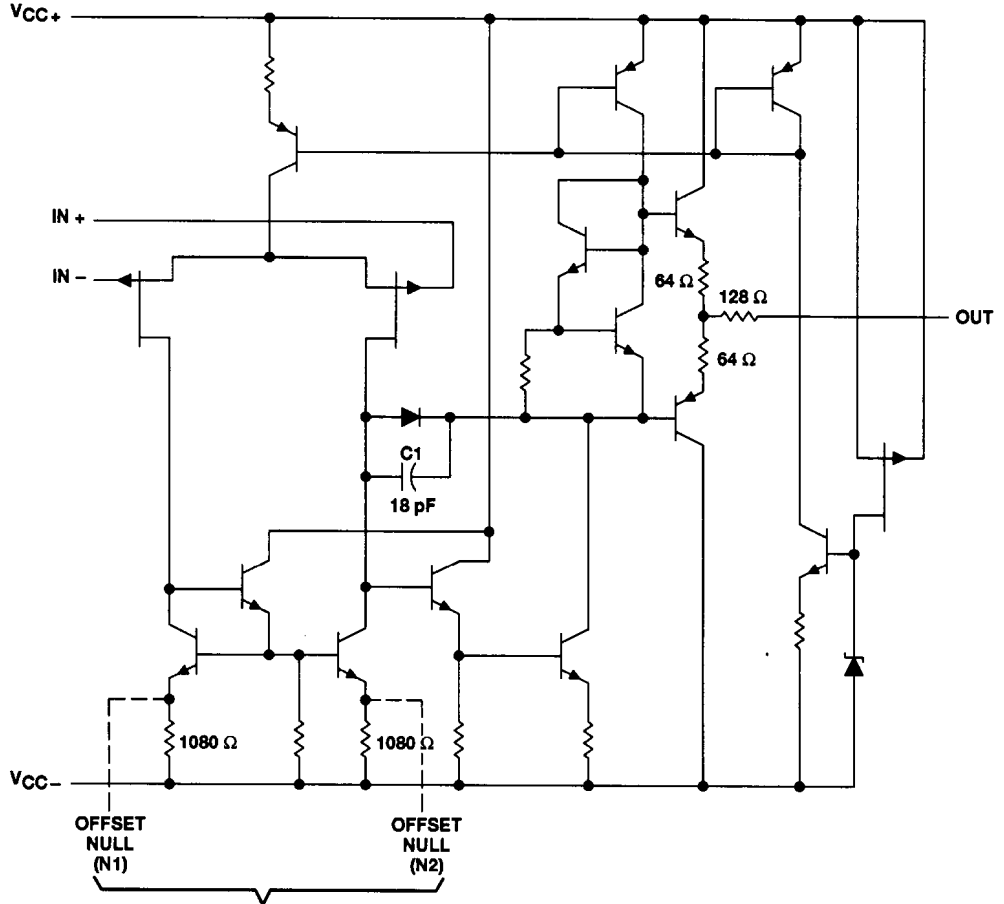
**symbols**



**TL071, TL071A, TL071B, TL072**  
**TL072A, TL072B, TL074, TL074A, TL074B**  
**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

SLOS080C - SEPTEMBER 1978 - REVISED AUGUST 1994

schematic (each amplifier)



TL071 Only

All component values shown are nominal.

| COMPONENT COUNT† |       |       |       |
|------------------|-------|-------|-------|
| COMPONENT TYPE   | TL071 | TL072 | TL074 |
| Resistors        | 11    | 22    | 44    |
| Transistors      | 14    | 28    | 56    |
| JFET             | 2     | 4     | 6     |
| Diodes           | 1     | 2     | 4     |
| Capacitors       | 1     | 2     | 4     |
| epi-FET          | 1     | 2     | 4     |

† Includes bias and trim circuitry

**TL071, TL071A, TL071B, TL072  
TL072A, TL072B, TL074, TL074A, TL074B  
LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†**

|  |                              |
|--|------------------------------|
| Supply voltage, $V_{CC+}$ (see Note 1)   | 18 V                         |
| Supply voltage, $V_{CC-}$ (see Note 1)   | -18 V                        |
| Differential input voltage, $V_{ID}$ (see Note 2)                                    | $\pm 30$ V                   |
| Input voltage, $V_I$ (see Notes 1 and 3)   | $\pm 15$ V                   |
| Duration of output short-circuit (see Note 4)  | unlimited                    |
| Continuous total dissipation   | See Dissipation Rating Table |
| Operating free-air temperature range, $T_A$ : C suffix                               | 0°C to 70°C                  |
| I suffix   | -40°C to 85°C                |
| M suffix   | -55°C to 125°C               |
| Storage temperature range  | -65°C to 150°C               |
| Case temperature for 60 seconds: FK package  | 260°C                        |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: J, JG, or W package    | 300°C                        |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D, N, P, or PW package | 260°C                        |

† 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**

| PACKAGE     | $T_A \leq 25^\circ\text{C}$<br>POWER RATING | DERATING<br>FACTOR | DERATE<br>ABOVE $T_A$ | $T_A = 70^\circ\text{C}$<br>POWER RATING | $T_A = 85^\circ\text{C}$<br>POWER RATING | $T_A = 125^\circ\text{C}$<br>POWER RATING |
|-------------|---|--------------------|-----------------------|--|--|---|
| D (8 pin)   | 680 mW                                      | 5.8 mW/°C          | 33°C                  | 464 mW                                   | 377 mW                                   | N/A                                       |
| D (14 pin)  | 680 mW                                      | 7.6 mW/°C          | 60°C                  | 608 mW                                   | 494 mW                                   | N/A                                       |
| FK          | 680 mW                                      | 11.0 mW/°C         | 88°C                  | 680 mW                                   | 680 mW                                   | 275 mW                                    |
| J           | 680 mW                                      | 11.0 mW/°C         | 88°C                  | 680 mW                                   | 680 mW                                   | 275 mW                                    |
| JG          | 680 mW                                      | 8.4 mW/°C          | 69°C                  | 672 mW                                   | 546 mW                                   | 210 mW                                    |
| N           | 680 mW                                      | 9.2 mW/°C          | 76°C                  | 680 mW                                   | 598 mW                                   | N/A                                       |
| P           | 680 mW                                      | 8.0 mW/°C          | 65°C                  | 640 mW                                   | 520 mW                                   | N/A                                       |
| PW (8 pin)  | 525 mW                                      | 4.2 mW/°C          | 70°C                  | 525 mW                                   | N/A                                      | N/A                                       |
| PW (14 pin) | 700 mW                                      | 5.6 mW/°C          | 70°C                  | 700 mW                                   | N/A                                      | N/A                                       |
| W           | 680 mW                                      | 8.0 mW/°C          | 65°C                  | 640 mW                                   | 520 mW                                   | 200 mW                                    |

**TL071, TL071A, TL071B, TL072  
TL072A, TL072B, TL074, TL074A, TL074B  
LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

SLOS080C - SEPTEMBER 1978 - REVISED AUGUST 1994

**electrical characteristics,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER                                       | TEST CONDITIONS†  | T <sub>A</sub> ‡ | TL071C<br>TL072C<br>TL074C |       |     | TL071AC<br>TL072AC<br>TL074AC |       |     | TL071BC<br>TL072BC<br>TL074BC |       |     | TL071I<br>TL072I<br>TL074I |       |      | UNIT  |
|---|---|------------------|----------------------------|-------|-----|-------------------------------|-------|-----|-------------------------------|-------|-----|----------------------------|-------|------|-------|
|   |   |                  | MIN                        | TYP   | MAX | MIN                           | TYP   | MAX | MIN                           | TYP   | MAX | MIN                        | TYP   | MAX  |       |
| V <sub>IO</sub>                                 | V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω   | 25°C             | 3                          | 10    | 13  | 3                             | 3     | 6   | 2                             | 2     | 3   | 3                          | 3     | 6    | mV    |
| exV <sub>IO</sub>                               | V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω   | Full range       |                            |       |     | 18                            | 18    | 7.5 | 18                            | 18    | 18  | 18                         | 18    | 8    | μV/°C |
| I <sub>IO</sub>                                 | V <sub>O</sub> = 0  | 25°C             | 5                          | 100   |     | 5                             | 5     | 100 | 5                             | 5     | 100 | 5                          | 5     | 100  | pA    |
| I <sub>IB</sub>                                 | V <sub>O</sub> = 0  | Full range       |                            |       |     | 10                            | 2     |     | 2                             | 2     |     | 2                          | 2     | nA   |       |
| V <sub>ICR</sub>                                | V <sub>O</sub> = 0  | 25°C             | 65                         | 200   |     | 65                            | 65    | 200 | 65                            | 65    | 200 | 65                         | 65    | 200  | pA    |
| V <sub>OM</sub>                                 | V <sub>O</sub> = 0  | Full range       |                            |       |     | 7                             | 7     |     | 7                             | 7     |     | 7                          | 7     | nA   |       |
| Common-mode input voltage range                 |   | 25°C             | -12                        | to    | 15  | -12                           | to    | 15  | -12                           | to    | 15  | -12                        | to    | 15   | V     |
|   |   | Full range       | ±11                        |       |     | ±11                           |       |     | ±11                           |       |     | ±11                        |       |      |       |
|   |   | Full range       | ±12                        |       |     | ±12                           |       |     | ±12                           |       |     | ±12                        |       |      |       |
| Maximum peak output voltage swing               | R <sub>L</sub> = 10 kΩ  | 25°C             | ±12                        | ±13.5 |     | ±12                           | ±13.5 |     | ±12                           | ±13.5 |     | ±12                        | ±13.5 |      | V     |
|   | R <sub>L</sub> ≥ 10 kΩ  | Full range       | ±10                        |       |     | ±10                           |       |     | ±10                           |       |     | ±10                        |       |      |       |
|   | R <sub>L</sub> ≥ 2 kΩ   | Full range       | ±10                        |       |     | ±10                           |       |     | ±10                           |       |     | ±10                        |       |      |       |
| Large-signal differential voltage amplification | V <sub>O</sub> = ±10 V, R <sub>L</sub> ≥ 2 kΩ                                     | 25°C             | 25                         | 200   |     | 50                            | 200   |     | 50                            | 200   |     | 50                         | 200   | V/mV |       |
|   |   | Full range       | 15                         |       |     | 25                            |       |     | 25                            |       |     | 25                         |       |      |       |
| B <sub>1</sub>                                  |   | 25°C             | 3                          |       |     | 3                             |       |     | 3                             |       |     | 3                          |       | MHz  |       |
| r <sub>i</sub>                                  |   | 25°C             | 10 <sup>12</sup>           |       |     | 10 <sup>12</sup>              |       |     | 10 <sup>12</sup>              |       |     | 10 <sup>12</sup>           |       | Ω    |       |
| CMRR  | V <sub>IC</sub> = V <sub>ICRmin</sub> , V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω | 25°C             | 70                         | 100   |     | 75                            | 100   |     | 75                            | 100   |     | 75                         | 100   | dB   |       |
| kSVR  | V <sub>CC</sub> = ±9 V to ±15 V, V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω        | 25°C             | 70                         | 100   |     | 80                            | 100   |     | 80                            | 100   |     | 80                         | 100   | dB   |       |
| I <sub>CC</sub>                                 | V <sub>O</sub> = 0, No load   | 25°C             | 1.4                        | 2.5   |     | 1.4                           | 2.5   |     | 1.4                           | 2.5   |     | 1.4                        | 2.5   | mA   |       |
| V <sub>O1</sub> /V <sub>O2</sub>                | Crosstalk attenuation   | 25°C             | 120                        |       |     | 120                           |       |     | 120                           |       |     | 120                        |       | dB   |       |

† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified.

‡ Full range is T<sub>A</sub> = 0°C to 70°C for TL07\_C, TL07\_AC, TL07\_BC and is T<sub>A</sub> = -40°C to 85°C for TL07\_I.

§ Input bias currents of a JFET-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.

**TL071, TL071A, TL071B, TL072  
TL072A, TL072B, TL074, TL074A, TL074B  
LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

**electrical characteristics,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER   | TEST CONDITION†   | $T_A$ ‡    | TL071M<br>TL072M |            |     | TL074M   |            |     | UNIT             |
|---|---|------------|------------------|------------|-----|----------|------------|-----|------------------|
|   |   |            | MIN              | TYP        | MAX | MIN      | TYP        | MAX |                  |
| $V_{IO}$ Input offset voltage   | $V_O = 0, R_S = 50 \Omega$                                      | 25°C       |                  | 3          | 6   |          | 3          | 9   | mV               |
|   |   | Full range |                  |            | 9   |          |            | 15  |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                | $V_O = 0, R_S = 50 \Omega$                                      | Full range |                  | 18         |     |          | 18         |     | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current   | $V_O = 0$   | 25°C       |                  | 5          | 100 |          | 5          | 100 | $\mu A$          |
|   |   | Full range |                  |            | 20  |          |            | 20  | nA               |
| $I_{IB}$ Input bias current‡  | $V_O = 0$   | 25°C       |                  | 65         | 200 |          | 65         | 200 | $\mu A$          |
|   |   | Full range |                  |            | 50  |          |            | 50  | nA               |
| $V_{ICR}$ Common-mode input voltage range                                     |   | 25°C       | $\pm 11$         | -12 to 15  |     | $\pm 11$ | -12 to 15  |     | V                |
| $V_{OM}$ Maximum peak output voltage swing                                    | $R_L = 10 k\Omega$  | 25°C       | $\pm 12$         | $\pm 13.5$ |     | $\pm 12$ | $\pm 13.5$ |     | V                |
|   | $R_L \geq 10 k\Omega$   | Full range | $\pm 12$         |            |     | $\pm 12$ |            |     |                  |
|   | $R_L \geq 2 k\Omega$  | Full range | $\pm 10$         |            |     | $\pm 10$ |            |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10$ V,<br>$R_L \geq 2 k\Omega$                       | 25°C       | 35               | 200        |     | 35       | 200        |     | V/mV             |
|   |   | Full range | 15               |            |     | 15       |            |     |                  |
| $B_1$ Unity-gain bandwidth  | $T_A = 25^\circ C$  |            |                  | 3          |     |          | 3          |     | MHz              |
| $r_i$ Input resistance  | $T_A = 25^\circ C$  |            |                  | $10^{12}$  |     |          | $10^{12}$  |     | $\Omega$         |
| CMRR Common-mode rejection ratio  | $V_{IC} = V_{ICRmin},$<br>$V_O = 0, R_S = 50 \Omega$            | 25°C       | 80               | 86         |     | 80       | 86         |     | dB               |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC} = \pm 9$ V to $\pm 15$ V,<br>$V_O = 0, R_S = 50 \Omega$ | 25°C       | 80               | 86         |     | 80       | 86         |     | dB               |
| $I_{CC}$ Supply current (each amplifier)                                      | $V_O = 0, \text{ No load}$                                      | 25°C       |                  | 1.4        | 2.5 |          | 1.4        | 2.5 | mA               |
| $V_{O1}/V_{O2}$ Crosstalk attenuation   | $A_{VD} = 100$  | 25°C       |                  | 120        |     |          | 120        |     | dB               |

† 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.

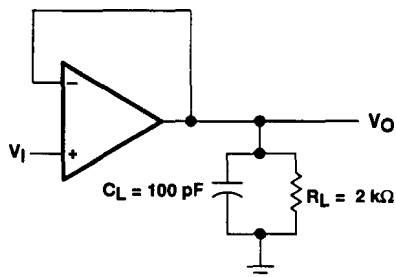
‡ All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified. Full range is  $T_A = -55^\circ C$  to  $125^\circ C$ .

**TL071, TL071A, TL071B, TL072**  
**TL072A, TL072B, TL074, TL074A, TL074B**  
**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**  
 SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

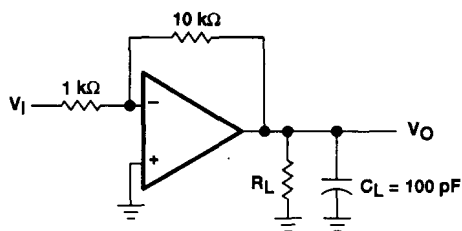
**operating characteristics,  $V_{CC\pm} = \pm 15\text{ V}$ ,  $T_A = 25^\circ\text{C}$**

| PARAMETER | TEST CONDITIONS  | TL07xM                              |     |     | ALL OTHERS |     |     | UNIT                         |
|-----------|--|-------------------------------------|-----|-----|------------|-----|-----|------------------------------|
|           |  | MIN                                 | TYP | MAX | MIN        | TYP | MAX |                              |
| SR        | Slew rate at unity gain<br>$V_I = 10\text{ V}$ ,<br>$C_L = 100\text{ pF}$ ,<br>$R_L = 2\text{ k}\Omega$ ,<br>See Figure 1                                | 5                                   | 13  |     | 8          | 13  |     | $\text{V}/\mu\text{s}$       |
| $t_r$     | Rise time overshoot factor<br>$V_I = 20\text{ mV}$ ,<br>$C_L = 100\text{ pF}$ ,<br>See Figure 1  | 0.1                                 |     |     | 0.1        |     |     | $\mu\text{s}$                |
|           |  | 20%                                 |     |     | 20%        |     |     |                              |
| $V_n$     | Equivalent input noise voltage<br>$R_S = 20\ \Omega$   | $f = 1\text{ kHz}$                  |     |     | 18         |     |     | $\text{nV}/\sqrt{\text{Hz}}$ |
|           |  | $f = 10\text{ Hz to }10\text{ kHz}$ |     |     | 4          |     |     | $\mu\text{V}$                |
| $I_n$     | Equivalent input noise current<br>$R_S = 20\ \Omega$ ,<br>$f = 1\text{ kHz}$   | 0.01                                |     |     | 0.01       |     |     | $\text{pA}/\sqrt{\text{Hz}}$ |
| THD       | Total harmonic distortion<br>$V_{O(\text{RMS})} = 10\text{ V}$ ,<br>$R_L \geq 2\text{ k}\Omega$ ,<br>$R_S \leq 1\text{ k}\Omega$ ,<br>$f = 1\text{ kHz}$ | 0.003%                              |     |     | 0.003%     |     |     |                              |

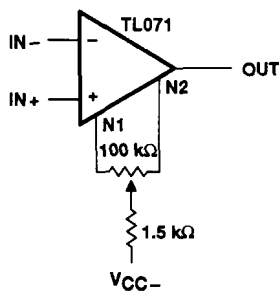
**PARAMETER MEASUREMENT INFORMATION**



**Figure 1. Unity-Gain Amplifier**



**Figure 2. Gain-of-10 Inverting Amplifier**



**Figure 3. Input Offset Voltage Null Circuit**

**TL071, TL071A, TL071B, TL072  
 TL072A, TL072B, TL074, TL074A, TL074B  
 LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**  
 SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

**TYPICAL CHARACTERISTICS**

**Table of Graphs**

|          |   | <b>FIGURE</b>               |                         |
|----------|---|-----------------------------|-------------------------|
| $I_{IB}$ | Input bias current                              | vs Free-air temperature     | 4                       |
| $V_{OM}$ | Maximum output voltage                          | vs Frequency                | 5, 6, 7                 |
|          |   | vs Free-air temperature     | 8                       |
|          |   | vs Load resistance          | 9                       |
|          |   | vs Supply voltage           | 10                      |
| $A_{VD}$ | Large-signal differential voltage amplification | vs Free-air temperature     | 11                      |
|          |   | vs Frequency                | 12                      |
|          | Phase shift                                     | vs Frequency                | 12                      |
|          | Normalized unity-gain bandwidth                 | vs Free-air temperature     | 13                      |
|          | Normalized phase shift                          | vs Free-air temperature     | 13                      |
| $CMRR$   | Common-mode rejection ratio                     | vs Free-air temperature     | 14                      |
| $I_{CC}$ | Supply current                                  | vs Supply voltage           | 15                      |
|          |   | vs Free-air temperature     | 16                      |
| $P_D$    | Total power dissipation                         | vs Free-air temperature     | 17                      |
|          |   | Normalized slew rate        | vs Free-air temperature |
| $V_n$    | Equivalent input noise voltage                  | vs Frequency                | 19                      |
| THD      | Total harmonic distortion                       | vs Frequency                | 20                      |
|          |   | Large-signal pulse response | vs Time                 |
| $V_O$    | Output voltage                                  | vs Time                     | 22                      |



TL071, TL071A, TL071B, TL072  
TL072A, TL072B, TL074, TL074A, TL074B  
LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

TYPICAL CHARACTERISTICS†

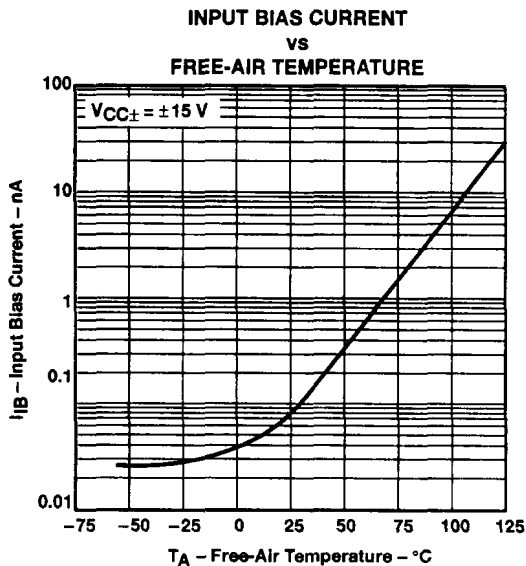


Figure 4

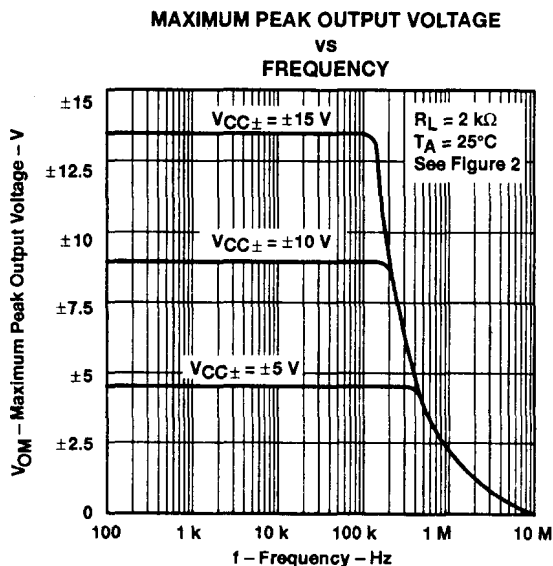


Figure 5

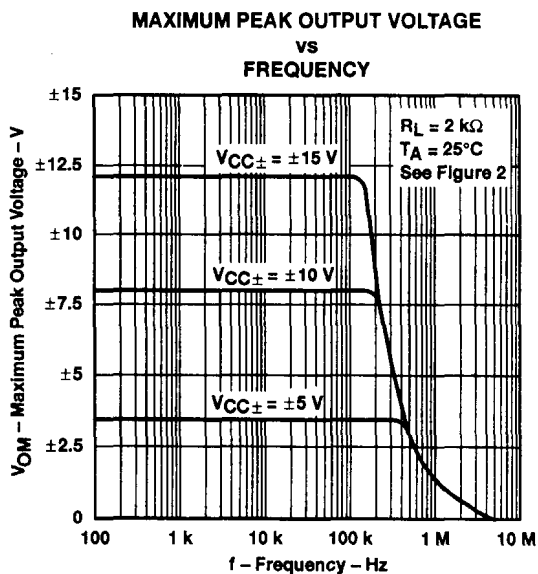


Figure 6

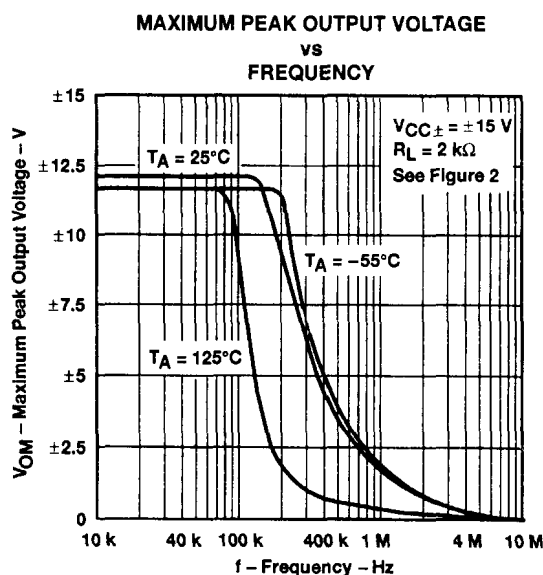


Figure 7

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

**TL071, TL071A, TL071B, TL072  
TL072A, TL072B, TL074, TL074A, TL074B  
LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**  
SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

**TYPICAL CHARACTERISTICS†**

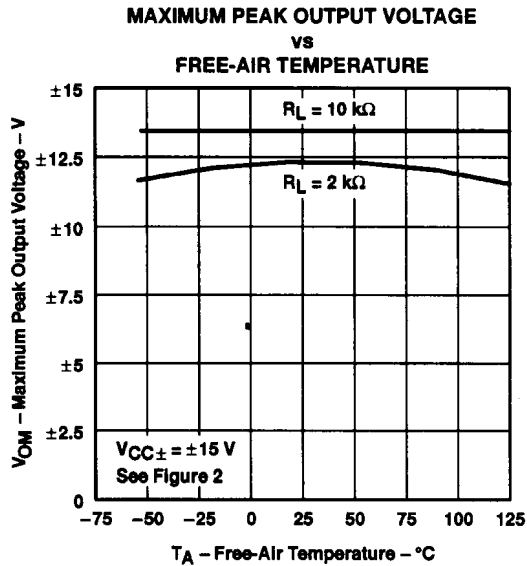


Figure 8

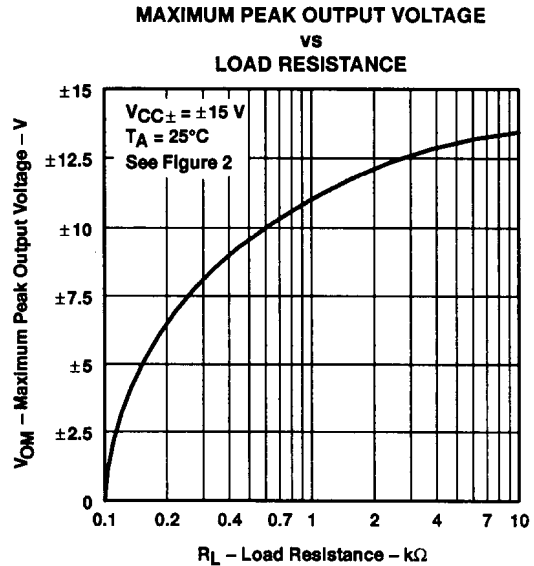


Figure 9

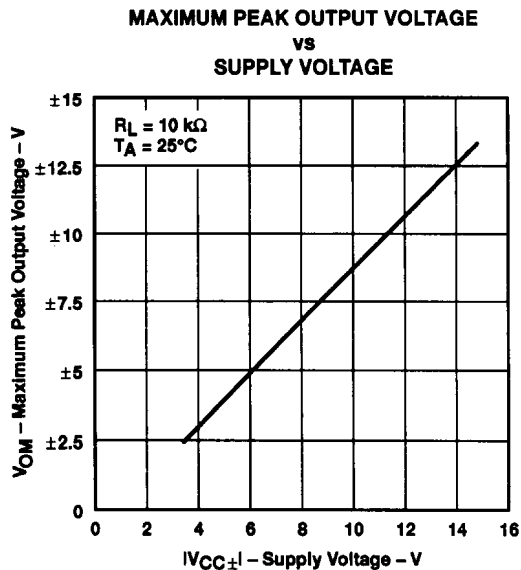


Figure 10

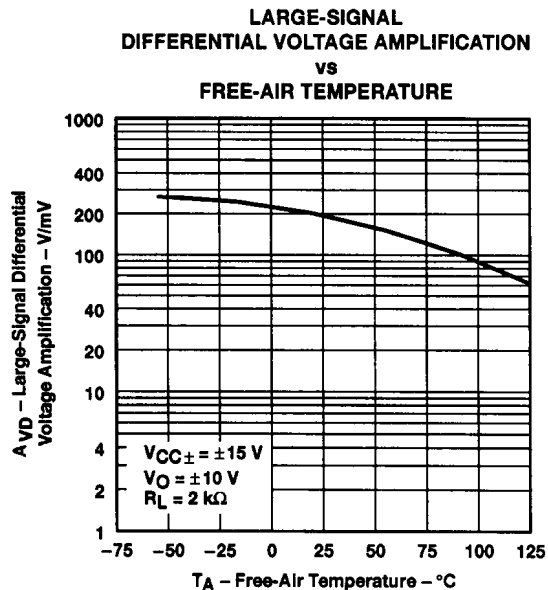


Figure 11

† 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  
 vs  
 FREQUENCY

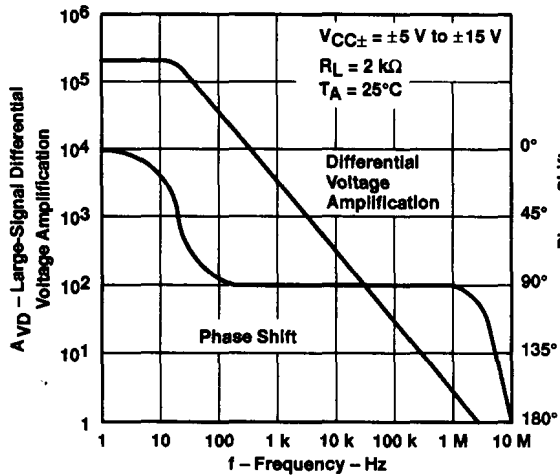


Figure 12

NORMALIZED UNITY-GAIN BANDWIDTH  
 AND PHASE SHIFT  
 vs  
 FREE-AIR TEMPERATURE

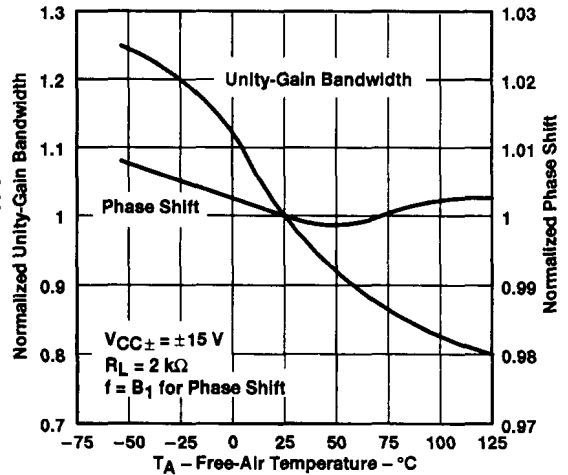


Figure 13

COMMON-MODE REJECTION RATIO  
 vs  
 FREE-AIR TEMPERATURE

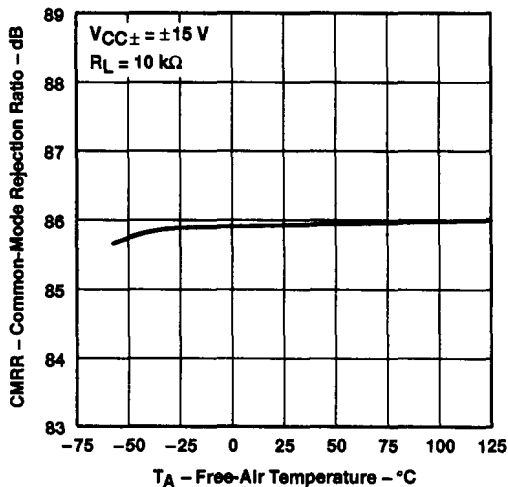


Figure 14

SUPPLY CURRENT PER AMPLIFIER  
 vs  
 SUPPLY VOLTAGE

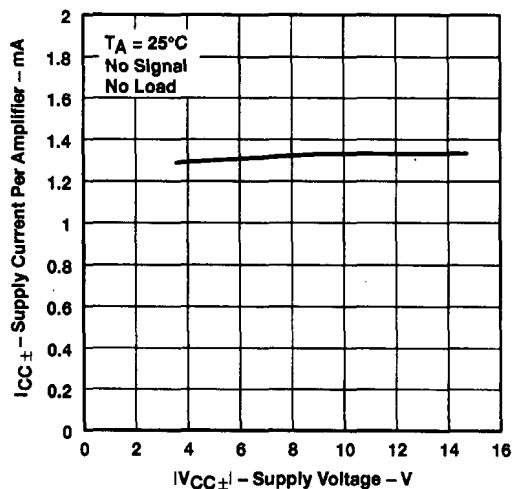


Figure 15

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

**TL071, TL071A, TL071B, TL072**  
**TL072A, TL072B, TL074, TL074A, TL074B**  
**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**  
 SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

**TYPICAL CHARACTERISTICS†**

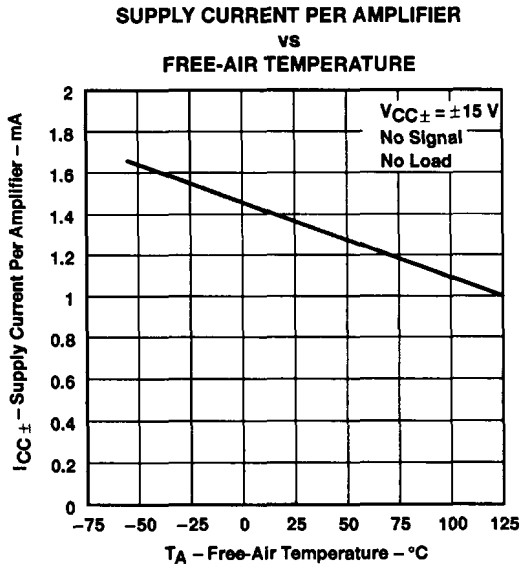


Figure 16

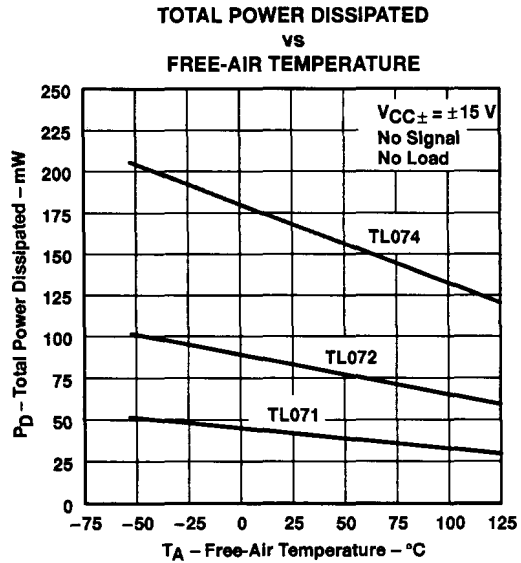


Figure 17

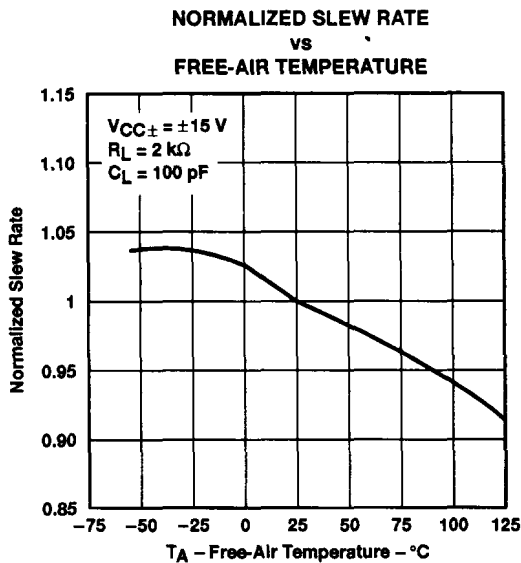


Figure 18

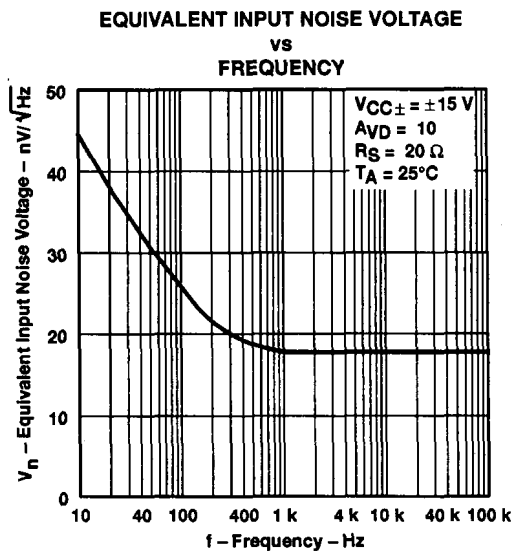


Figure 19

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

**TL071, TL071A, TL071B, TL072**  
**TL072A, TL072B, TL074, TL074A, TL074B**  
**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**  
 SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

**TYPICAL CHARACTERISTICS**

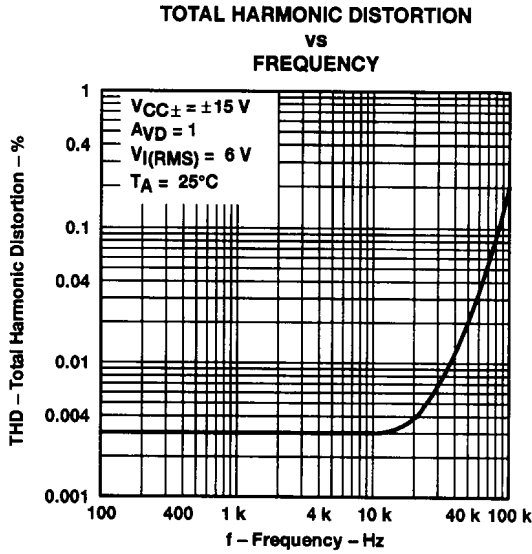


Figure 20

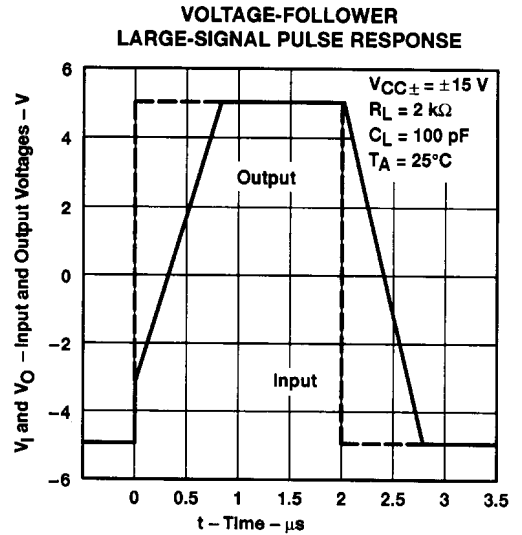


Figure 21

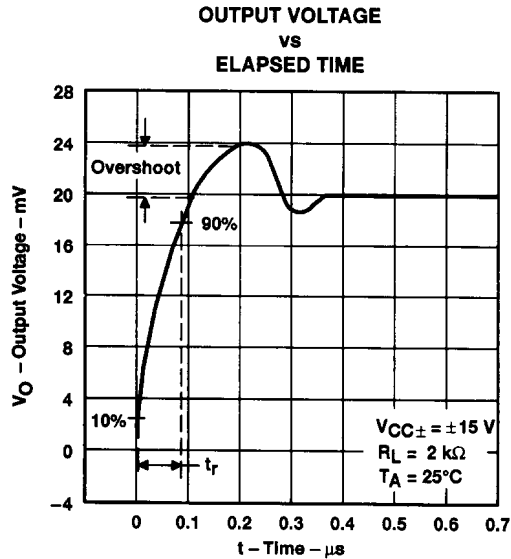


Figure 22

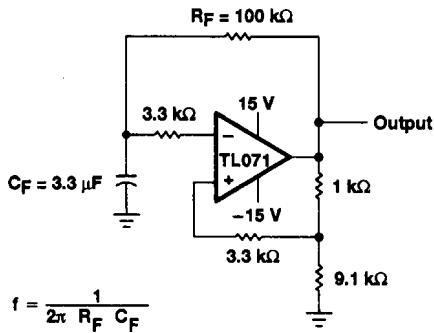
**TL071, TL071A, TL071B, TL072  
 TL072A, TL072B, TL074, TL074A, TL074B  
 LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

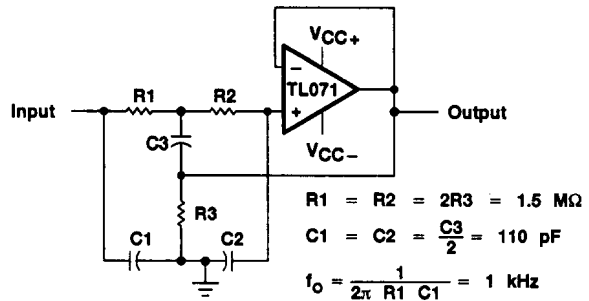
**APPLICATION INFORMATION**

**Table of Application Diagrams**

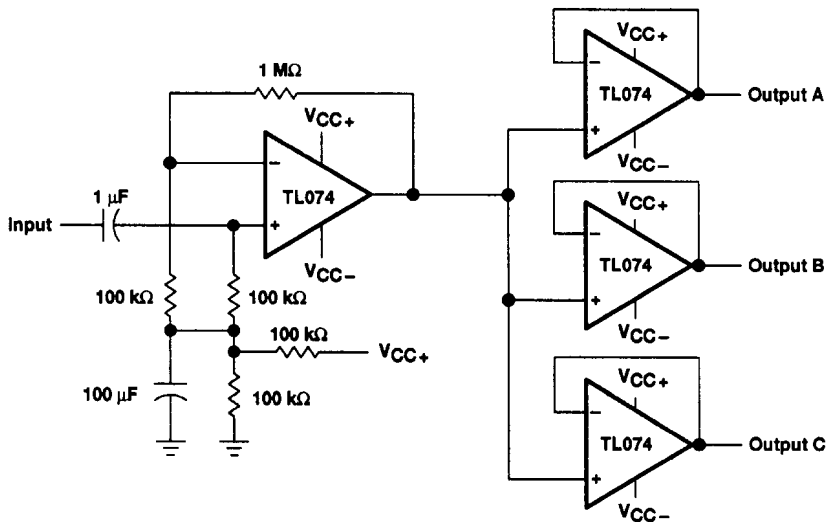
| APPLICATION DIAGRAM           | PART NUMBER | FIGURE |
|-------------------------------|-------------|--------|
| 0.5-Hz square-wave oscillator | TL071       | 23     |
| High-Q notch filter           | TL071       | 24     |
| Audio-distribution amplifier  | TL074       | 25     |
| 100-kHz quadrature oscillator | TL072       | 26     |
| AC amplifier                  | TL071       | 27     |



**Figure 23. 0.5-Hz Square-Wave Oscillator**



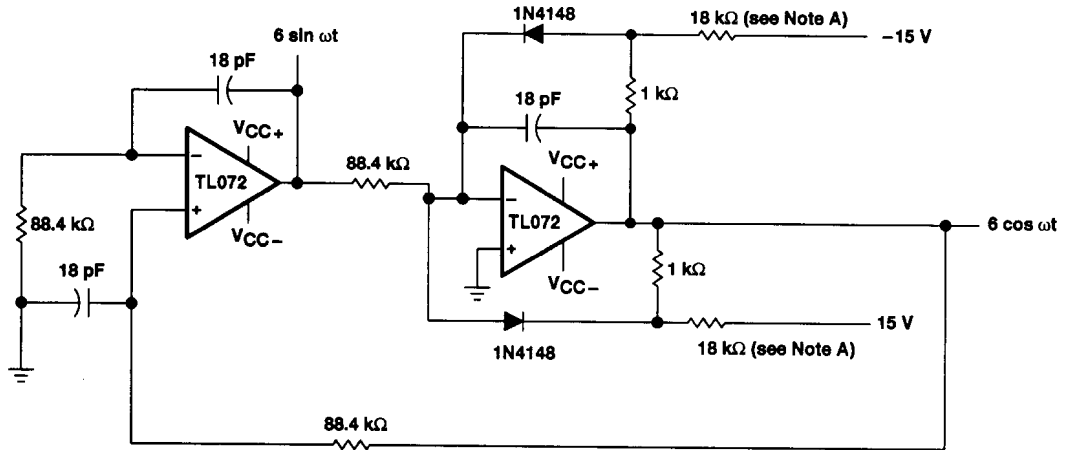
**Figure 24. High-Q Notch Filter**



**Figure 25. Audio-Distribution Amplifier**

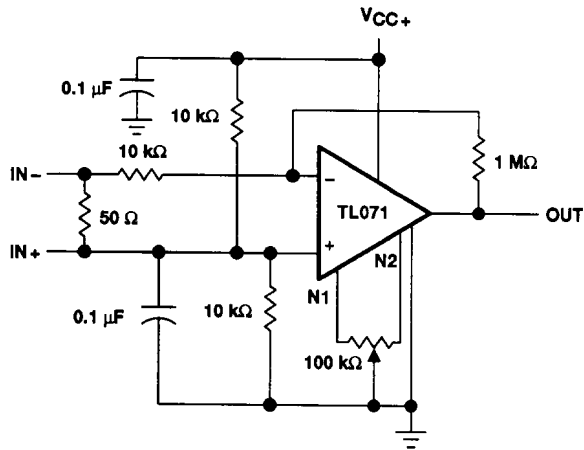
**TL071, TL071A, TL071B, TL072**  
**TL072A, TL072B, TL074, TL074A, TL074B**  
**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**  
SLOS080C – SEPTEMBER 1978 – REVISED AUGUST 1994

**APPLICATION INFORMATION**



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

**Figure 26. 100-kHz Quadrature Oscillator**



**Figure 27. AC Amplifier**