# TL061, TL061A, TL061B, TL061Y, TL062, TL062A, TL062B, TL062Y, TL064, TL064A, TL064B, TL064Y LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS

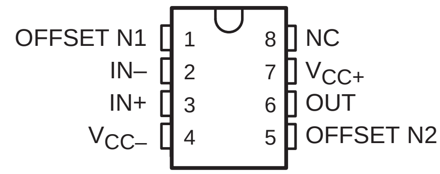
- **Very Low Power Consumption**
- **Typical Supply Current . . . 200 μA (Per Amplifier)**
- **Wide Common-Mode and Differential Voltage Ranges**
- **Low Input Bias and Offset Currents**
- **Common-Mode Input Voltage Range Includes $V_{CC+}$**
- **Output Short-Circuit Protection**
- **High Input Impedance . . . JFET-Input Stage**
- **Internal Frequency Compensation**
- **Latch-Up-Free Operation**
- **High Slew Rate . . . 3.5 V/μs Typ**

## description

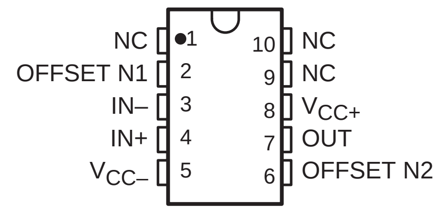
The JFET-input operational amplifiers of the TL06_ series are designed as low-power versions of the TL08_ series amplifiers. They feature high input impedance, wide bandwidth, high slew rate, and low input offset and input bias currents. The TL06_ series feature the same terminal assignments as the TL07_ and TL08_ series. Each of these JFET-input operational amplifiers incorporates well-matched, high-voltage JFET and bipolar transistors in a monolithic integrated circuit.

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, and the M-suffix devices are characterized for operation over the full military temperature range of –55°C to 125°C.

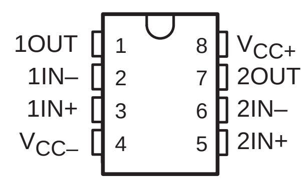
**TL061, TL061A, TL061B**
**D, JG, P, OR PW PACKAGE**
**(TOP VIEW)**



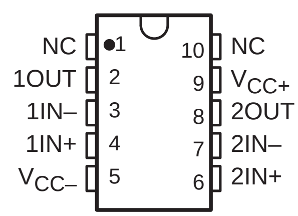

**TL061 . . . U PACKAGE**
**(TOP VIEW)**



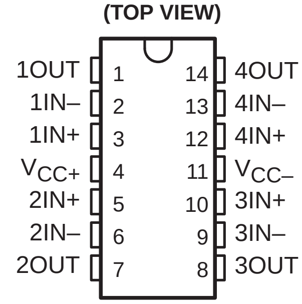

**TL062, TL062A, TL062B**
**D, JG, P, OR PW PACKAGE**
**(TOP VIEW)**




**TL062 . . . U PACKAGE**
**(TOP VIEW)**



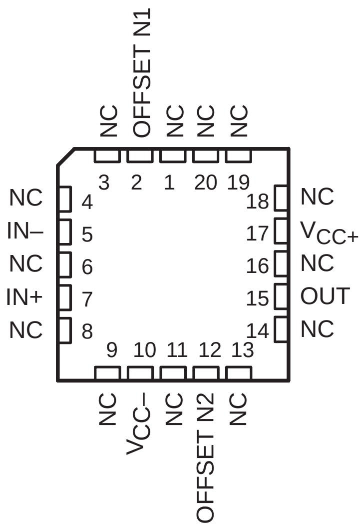

**TL064 . . . D, J, N, PW, OR W PACKAGE**
**TL064A, TL064B . . . D OR N PACKAGE**
**(TOP VIEW)**



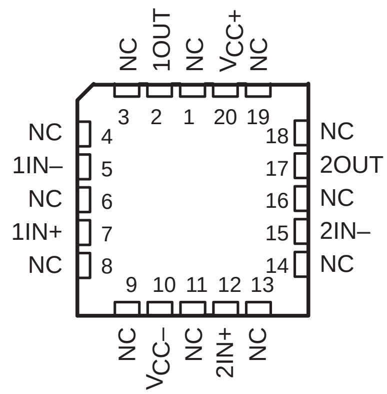

NC – No internal connection

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.

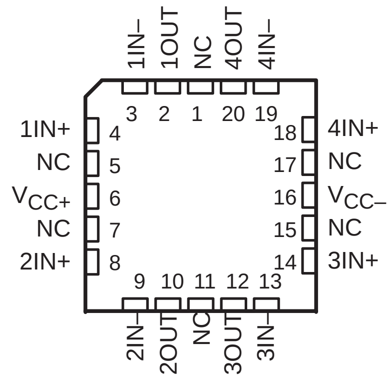
**TL061 . . . FK PACKAGE**
**(TOP VIEW)**




**TL062 . . . FK PACKAGE**
**(TOP VIEW)**




**TL064 . . . FK PACKAGE**
**(TOP VIEW)**




NC – No internal connection

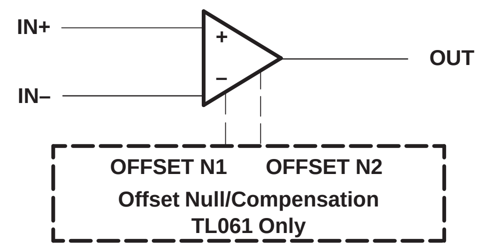
**AVAILABLE OPTIONS**

| $T_A$ | $V_{IO}$MAX AT 25°C | PACKAGED DEVICES | | | | | CHIP FORM (Y) |
|---|---|---|---|---|---|---|---|
| | | SMALL OUTLINE (D008)† | SMALL OUTLINE (D014)† | PLASTIC DIP (N) | PLASTIC DIP (P) | TSSOP (PW) | |
| 0°C to 70°C | 15 mV<br>6 mV<br>3 mV | TL061CD<br>TL061ACD<br>TL061BCD | | | TL061CP<br>TL061ACP<br>TL061BCP | TL061CPW | TL061Y |
| | 15 mV<br>6 mV<br>3 mV | TL062CD<br>TL062ACD<br>TL062BCD | | | TL062CP<br>TL062ACP<br>TL062BCP | TL062CPW | TL062Y |
| | 15 mV<br>6 mV<br>3 mV | | TL064CD<br>TL064ACD<br>TL064BCD | TL064CN<br>TL064ACN<br>TL064BCN | | TL064CPW | TL064Y |

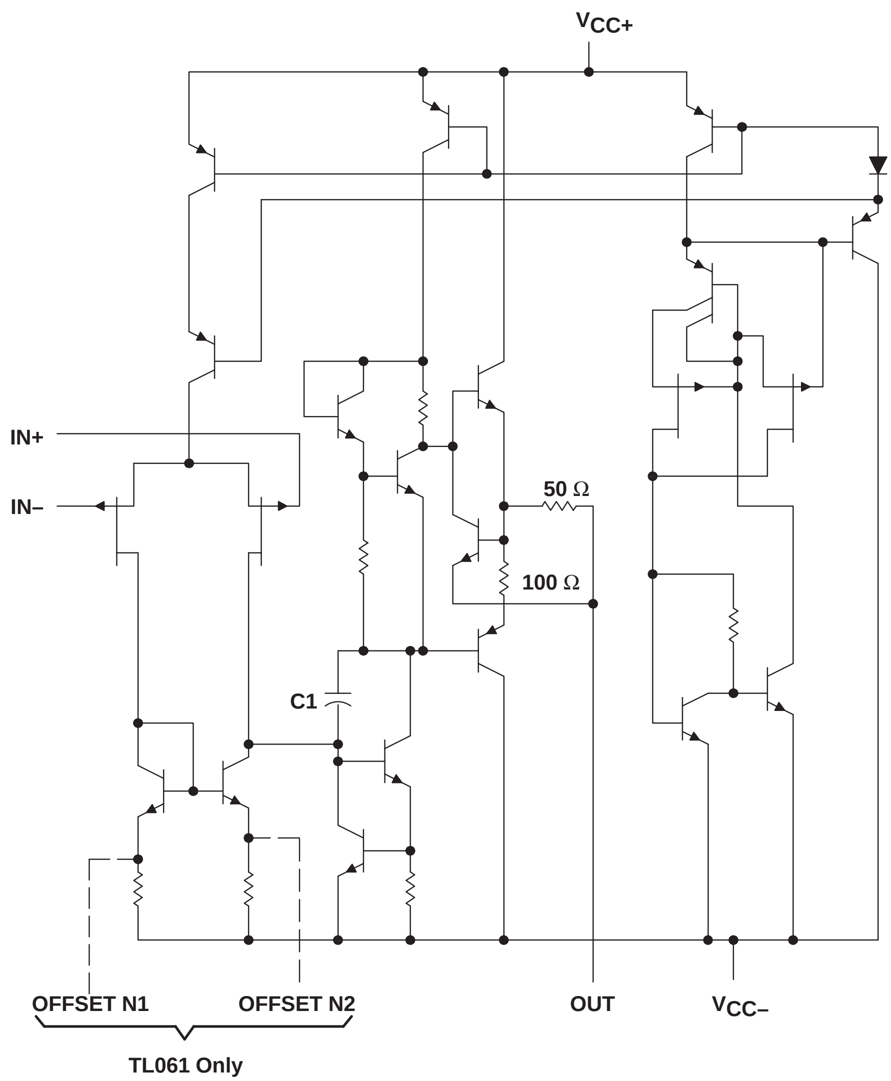
| $T_A$ | $V_{IO}$MAX AT 25°C | PACKAGE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | SMALL OUTLINE (D008)† | SMALL OUTLINE (D014)† | CHIP CARRIER (FK) | CERAMIC DIP (J) | CERAMIC DIP (JG) | PLASTIC DIP (N) | PLASTIC DIP (P) | FLAT PACK (U) | FLAT PACK (W) |
| –40°C to 85°C | 6 mV | TL061ID<br>TL062ID | TL064ID | | | | TL064IN | TL061IP<br>TL062IP | | |
| –55°C to 125°C | 6 mV<br>6 mV<br>9 mV | | | TL061MFK<br>TL062MFK<br>TL064MFK | TL064MJ | TL061MJG<br>TL062MJG | | | TL061MU<br>TL062MU | TL064MW |

† The D package is available taped and reeled. Add the suffix R to the device type (e.g., TL061CDR).

## symbol (each amplifier)




## schematic (each amplifier)

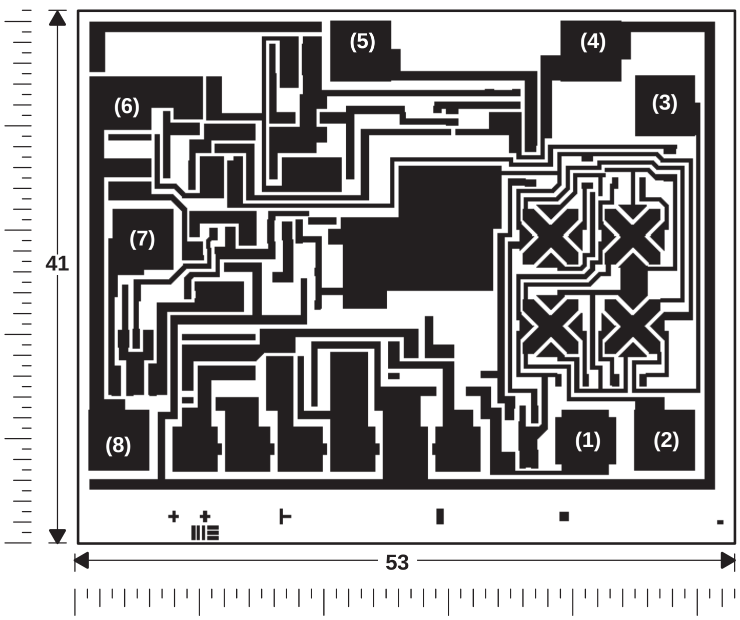


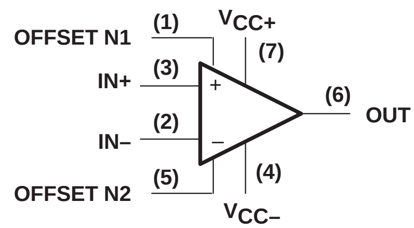

C1 = 10 pF on TL061, TL062, and TL064
Component values shown are nominal.

## TL061Y chip information

This chip, when properly assembled, has characteristics similar to the TL061. Thermal compression or ultrasonic bonding can be used on the doped-aluminum bonding pads. The chips can be mounted with conductive epoxy or a gold-silicon preform.

**Bonding-Pad Assignments**



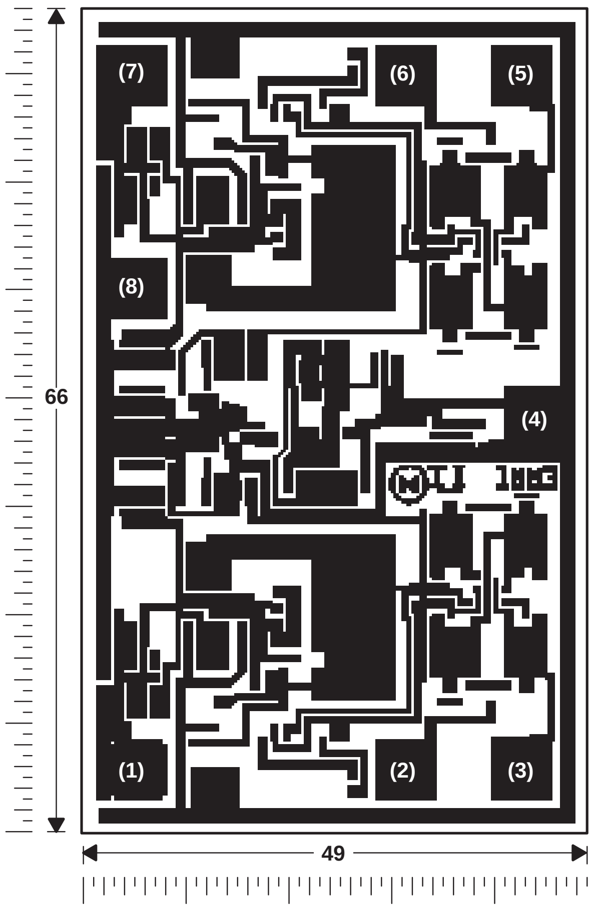



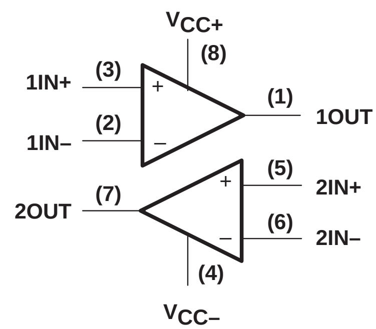

**Chip Thickness: 15 Mils Typical**
**Bonding Pads: 4 × 4 Mils Minimum**
**$T_J$(max) = 150°C**
**Tolerances Are ±10%.**
**All Dimensions Are in Mils.**
**Pin (4) is Internally Connected to Backside of Chip.**

## TL062Y chip information

This chip, when properly assembled, has characteristics similar to the TL062. Thermal compression or ultrasonic bonding can be used on the doped-aluminum bonding pads. The chips can be mounted with conductive epoxy or a gold-silicon preform.

**Bonding-Pad Assignments**



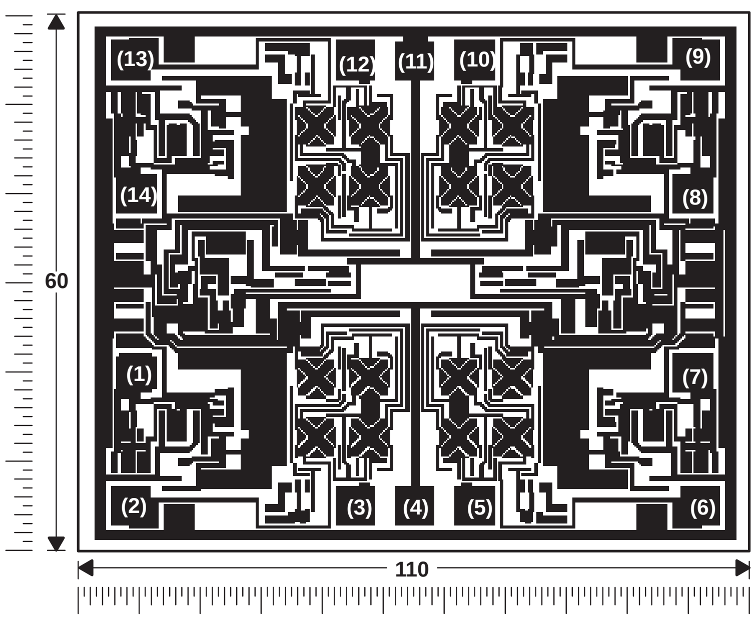



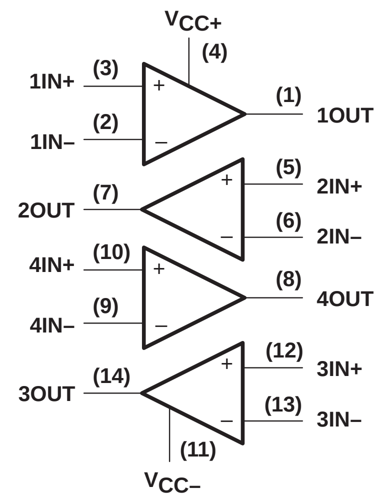

**Chip Thickness: 15 Mils Typical**
**Bonding Pads: 4 × 4 Mils Minimum**
**$T_J$(max) = 150°C**
**Tolerances Are ±10%.**
**All Dimensions Are in Mils.**
**Pin (4) is Internally Connected to Backside of Chip.**

## TL064Y chip information

This chip, when properly assembled, has characteristics similar to the TL064. Thermal compression or ultrasonic bonding can be used on the doped-aluminum bonding pads. The chips can be mounted with conductive epoxy or a gold-silicon preform.

**Bonding-Pad Assignments**




**Chip Thickness: 15 Mils Typical**
**Bonding Pads: 4 × 4 Mils Minimum**
**$T_J$(max) = 150°C**
**Tolerances Are ±10%.**
**All Dimensions Are in Mils.**
**Pin (11) is Internally Connected to Backside of Chip.**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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

| | | TL06_C TL06_AC TL06_BC | TL06_I | TL06_M | UNIT |
|---|---|---|---|---|---|
| Supply voltage, $V_{CC+}$ (see Note 1) | | 18 | 18 | 18 | V |
| Supply voltage, $V_{CC-}$ (see Note 1) | | –18 | –18 | –18 | V |
| Differential input voltage, $V_{ID}$ (see Note 2) | | ±30 | ±30 | ±30 | V |
| Input voltage, $V_I$ (see Notes 1 and 3) | | ±15 | ±15 | ±15 | V |
| Duration of output short circuit (see Note 4) | | unlimited | unlimited | unlimited | |
| Continuous total dissipation | | See Dissipation Rating Table | | | |
| Storage temperature range, $T_{stg}$ | | –65 to 150 | –65 to 150 | –65 to 150 | °C |
| Case temperature for 60 seconds | FK package | | | 260 | °C |
| Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds | J, JG, U, or W package | | | 300 | °C |
| Lead temperature 1,6 mm (1/6 inch) from case for 10 seconds | D, N, P, or PW package | 260 | 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 | $T_A \leq 25°C$ POWER RATING | DERATING FACTOR | DERATE ABOVE $T_A$ | $T_A = 70°C$ POWER RATING | $T_A = 85°C$ POWER RATING | $T_A = 125°C$ POWER RATING |
|---|---|---|---|---|---|---|
| D (8 pin) | 680 mW | 5.8 mW/°C | 33°C | 465 mW | 378 mW | N/A |
| D (14 pin) | 680 mW | 7.6 mW/°C | 60°C | 604 mW | 490 mW | N/A |
| FK | 680 mW | 11.0 mW/°C | 88°C | 680 mW | 680 mW | 273 mW |
| J | 680 mW | 11.0 mW/°C | 88°C | 680 mW | 680 mW | 273 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 | 597 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 | 25°C | 336 mW | N/A | N/A |
| PW (14 pin) | 700 mW | 5.6 mW/°C | 25°C | 448 mW | N/A | N/A |
| U | 675 mW | 5.4 mW/°C | 25°C | 432 mW | 351 mW | 135 mW |
| W | 680 mW | 8.0 mW/°C | 65°C | 640 mW | 520 mW | 200 mW |

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

| PARAMETER | | TEST CONDITIONS† | | TL061C TL062C TL064C | | | TL061AC TL062AC TL064AC | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | $V_O$ = 0, $R_S$ = 50 Ω | $T_A$ = 25°C | | 3 | 15 | | 3 | 6 | mV |
| | | | $T_A$ = Full range | | | 20 | | | 7.5 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | $V_O$ = 0, $R_S$ = 50 Ω, $T_A$ = Full range | | | 10 | | | 10 | | μV/°C |
| $I_{IO}$ | Input offset current | $V_O$ = 0 | $T_A$ = 25°C | | 5 | 200 | | 5 | 100 | pA |
| | | | $T_A$ = Full range | | | 5 | | | 3 | nA |
| $I_{IB}$ | Input bias current‡ | $V_O$ = 0 | $T_A$ = 25°C | | 30 | 400 | | 30 | 200 | pA |
| | | | $T_A$ = Full range | | | 10 | | | 7 | nA |
| $V_{ICR}$ | Common-mode input voltage range | $T_A$ = 25°C | | ±11 | –12 to 15 | | ±11 | –12 to 15 | | V |
| $V_{OM}$ | Maximum peak output voltage swing | $R_L$ = 10 kΩ, | $T_A$ = 25°C | ±10 | ±13.5 | | ±10 | ±13.5 | | V |
| | | $R_L$ ≥ 10 kΩ, | $T_A$ = Full range | ±10 | | | ±10 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O$ = ± 10 V, $R_L$ ≥ 10 kΩ | $T_A$ = 25°C | 3 | 6 | | 4 | 6 | | V/mV |
| | | | $T_A$ = Full range | 3 | | | 4 | | | |
| $B_1$ | Unity-gain bandwidth | $R_L$ = 10 kΩ, | $T_A$ = 25°C | | 1 | | | 1 | | MHz |
| $r_i$ | Input resistance | $T_A$ = 25°C | | | $10^{12}$ | | | $10^{12}$ | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = V_{ICR}$min, $V_O$ = 0, $R_S$ = 50 Ω, $T_A$ = 25°C | | 70 | 86 | | 80 | 86 | | dB |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC}$ = ± 9 V to ± 15 V, $V_O$ = 0, $R_S$ = 50 Ω, $T_A$ = 25°C | | 70 | 95 | | 80 | 95 | | dB |
| $P_D$ | Total power dissipation (each amplifier) | $V_O$ = 0, No load | $T_A$ = 25°C, | | 6 | 7.5 | | 6 | 7.5 | mW |
| $I_{CC}$ | Supply current (each amplifier) | $V_O$ = 0, No load | $T_A$ = 25°C, | | 200 | 250 | | 200 | 250 | μA |
| $V_{O1}/V_{O2}$ | Crosstalk attenuation | $A_{VD}$ = 100, | $T_A$ = 25°C | | 120 | | | 120 | | dB |

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. Full range for $T_A$ is 0°C to 70°C for TL06_C, TL06_AC, and TL06_BC and –40°C to 85°C for TL06_I.
‡ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 15. Pulse techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

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

| PARAMETER | | TEST CONDITIONS† | | TL061BC TL062BC TL064BC | | | TL061I TL062I TL064I | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | $V_O = 0$, $R_S = 50\ \Omega$ | $T_A = 25°C$ | | 2 | 3 | | 3 | 6 | mV |
| | | | $T_A$ = Full range | | | 5 | | | 9 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | $V_O = 0$, $R_S = 50\ \Omega$, $T_A$ = Full range | | | 10 | | | 10 | | µV/°C |
| $I_{IO}$ | Input offset current | $V_O = 0$ | $T_A = 25°C$ | | 5 | 100 | | 5 | 100 | pA |
| | | | $T_A$ = Full range | | | 3 | | | 10 | nA |
| $I_{IB}$ | Input bias current‡ | $V_O = 0$ | $T_A = 25°C$ | | 30 | 200 | | 30 | 200 | pA |
| | | | $T_A$ = Full range | | | 7 | | | 20 | nA |
| $V_{ICR}$ | Common-mode input voltage range | $T_A = 25°C$ | | ±11 | –12 to 15 | | ±11 | –12 to 15 | | V |
| $V_{OM}$ | Maximum peak output voltage swing | $R_L = 10\ k\Omega$, | $T_A = 25°C$ | ±10 | ±13.5 | | ±10 | ±13.5 | | V |
| | | $R_L \geq 10\ k\Omega$, | $T_A$ = Full range | ±10 | | | ±10 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O = \pm 10$ V, $R_L \geq 10\ k\Omega$ | $T_A = 25°C$ | 4 | 6 | | 4 | 6 | | V/mV |
| | | | $T_A$ = Full range | 4 | | | 4 | | | |
| $B_1$ | Unity-gain bandwidth | $R_L = 10\ k\Omega$, | $T_A = 25°C$ | | 1 | | | 1 | | MHz |
| $r_i$ | Input resistance | $T_A = 25°C$ | | | $10^{12}$ | | | $10^{12}$ | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = V_{ICR}min$, $V_O = 0$, $R_S = 50\ \Omega$, $T_A = 25°C$ | | 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, $V_O = 0$, $R_S = 50\ \Omega$, $T_A = 25°C$ | | 80 | 95 | | 80 | 95 | | dB |
| $P_D$ | Total power dissipation (each amplifier) | $V_O = 0$, No load | $T_A = 25°C$, | | 6 | 7.5 | | 6 | 7.5 | mW |
| $I_{CC}$ | Supply current (each amplifier) | $V_O = 0$, No load | $T_A = 25°C$, | | 200 | 250 | | 200 | 250 | µA |
| $V_{O1}/V_{O2}$ | Crosstalk attenuation | $A_{VD} = 100$, | $T_A = 25°C$ | | 120 | | | 120 | | dB |

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. Full range for $T_A$ is 0°C to 70°C for TL06_C, TL06_AC, and TL06_BC and –40°C to 85°C for TL06_I.

‡ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 15. Pulse techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

## electrical characteristics, $V_{CC\pm} = \pm15$ V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS† | | TL061M TL062M | | | TL064M | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | $V_O = 0$, $R_S = 50\ \Omega$ | $T_A = 25°C$ | | 3 | 6 | | 3 | 9 | mV |
| | | | $T_A = -55°C$ to 125°C | | | 9 | | | 15 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | $V_O = 0$, $R_S = 50\ \Omega$, $T_A = -55°C$ to 125°C | | | 10 | | | 10 | | μV/°C |
| $I_{IO}$ | Input offset current | $V_O = 0$ | $T_A = 25°C$ | | 5 | 100 | | 5 | 100 | pA |
| | | | $T_A = -55°C$ | | | 20* | | | 20* | nA |
| | | | $T_A = 125°C$ | | | 20 | | | 20 | |
| $I_{IB}$ | Input bias current‡ | $V_O = 0$ | $T_A = 25°C$ | | 30 | 200 | | 30 | 200 | pA |
| | | | $T_A = -55°C$ | | | 50* | | | 50* | nA |
| | | | $T_A = 125°C$ | | | 50 | | | 50 | |
| $V_{ICR}$ | Common-mode input voltage range | $T_A = 25°C$ | | ±11.5 | –12 to 15 | | ±11.5 | –12 to 15 | | V |
| $V_{OM}$ | Maximum peak output voltage swing | $R_L = 10\ k\Omega$, | $T_A = 25°C$ | ±10 | ±13.5 | | ±10 | ±13.5 | | V |
| | | $R_L \geq 10\ k\Omega$, | $T_A = -55°C$ to 125°C | ±10 | | | ±10 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O = \pm10$ V, $R_L \geq 10\ k\Omega$ | $T_A = 25°C$ | 4 | 6 | | 4 | 6 | | V/mV |
| | | | $T_A = -55°C$ to 125°C | 4 | | | 4 | | | |
| $B_1$ | Unity-gain bandwidth | $R_L = 10\ k\Omega$, | $T_A = 25°C$ | | | | | | | MHz |
| $r_i$ | Input resistance | $T_A = 25°C$ | | | $10^{12}$ | | | $10^{12}$ | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = V_{ICR}min$, $V_O = 0$, $R_S = 50\ \Omega$, $T_A = 25°C$ | | 80 | 86 | | 80 | 86 | | dB |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC} = \pm9$ V to $\pm15$ V, $V_O = 0$, $R_S = 50\ \Omega$, $T_A = 25°C$ | | 80 | 95 | | 80 | 95 | | dB |
| $P_D$ | Total power dissipation (each amplifier) | $V_O = 0$, No load | $T_A = 25°C$, | | 6 | 7.5 | | 6 | 7.5 | mW |
| $I_{CC}$ | Supply current (each amplifier) | $V_O = 0$, No load | $T_A = 25°C$, | | 200 | 250 | | 200 | 250 | μA |
| $V_{O1}/V_{O2}$ | Crosstalk attenuation | $A_{VD} = 100$, | $T_A = 25°C$ | | 120 | | | 120 | | dB |

* This parameter is not production tested.
† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified.
‡ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 15. Pulse techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

## operating characteristics, $V_{CC\pm} = \pm15$ V, $T_A = 25°C$

| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| SR | Slew rate at unity gain (see Note 5) | $V_I = 10$ V, $C_L = 100$ pF, | $R_L = 10\ k\Omega$, See Figure 1 | 2 | 3.5 | | V/μs |
| $t_r$ | Rise time | $V_I = 20$ V, $C_L = 100$ pF, | $R_L = 10\ k\Omega$, See Figure 1 | | 0.2 | | μs |
| | Overshoot factor | | | | 10% | | |
| $V_n$ | Equivalent input noise voltage | $R_S = 20\ \Omega$, | f = 1 kHz | | 42 | | $nV/\sqrt{Hz}$ |

NOTE 5: Slew rate at –55°C to 125°C is 0.7 V/μs min.

## electrical characteristics, $V_{CC\pm} = \pm15$ V, $T_A = 25°C$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS† | | TL061Y TL062Y TL064Y | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | $V_O = 0$, | $R_S = 50\ \Omega$ | | 3 | 15 | mV |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | $V_O = 0$, | $R_S = 50\ \Omega$ | | 10 | | µV/°C |
| $I_{IO}$ | Input offset current | $V_O = 0$ | | | 5 | 200 | pA |
| $I_{IB}$ | Input bias current‡ | $V_O = 0$ | | | 30 | 400 | pA |
| $V_{ICR}$ | Common-mode input voltage range | | | ±11 | –12 to 15 | | V |
| $V_{OM}$ | Maximum peak output voltage swing | $R_L = 10\ k\Omega$ | | ±10 | ±13.5 | | V |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O = \pm10$ V, | $R_L \geq 2\ k\Omega$ | 3 | 6 | | V/mV |
| $B_1$ | Unity-gain bandwidth | $R_L = 10\ k\Omega$ | | | 1 | | MHz |
| $r_i$ | Input resistance | | | | $10^{12}$ | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = V_{ICR}min$, $R_S = 50\ \Omega$ | $V_O = 0$, | 70 | 86 | | dB |
| $k_{SVR}$ | Supply voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC} = \pm9$ V to ±15 V, $R_S = 50\ \Omega$ | $V_O = 0$, | 70 | 95 | | dB |
| $P_D$ | Total power dissipation (each amplifier) | $V_O = 0$, | No load | | 6 | 7.5 | mW |
| $I_{CC}$ | Supply current (per amplifier) | $V_O = 0$, | No load | | 200 | 250 | µA |
| $V_{O1}/V_{O2}$ | Crosstalk attenuation | $A_{VD} = 100$ | | | 120 | | dB |

† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified.
‡ Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive as shown in Figure 15. Pulse techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

## operating characteristics, $V_{CC\pm} = \pm15$ V, $T_A = 25°C$

| PARAMETER | | TEST CONDITIONS | | TL061Y TL062Y TL064Y | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain | $V_I = 10$ mV, $C_L = 100$ pF, | $R_L = 10\ k\Omega$, See Figure 1 | 1.5 | 3.5 | | V/µs |
| $t_r$ | Rise time | $V_I = 20$ V, $C_L = 100$ pF, | $R_L = 10\ k\Omega$, See Figure 1 | | 0.2 | | µs |
| | Overshoot factor | | | | 10% | | |
| $V_n$ | Equivalent input noise voltage | $R_S = 20\ \Omega$, | f = 1 kHz | | 42 | | $nV/\sqrt{Hz}$ |

## PARAMETER MEASUREMENT INFORMATION

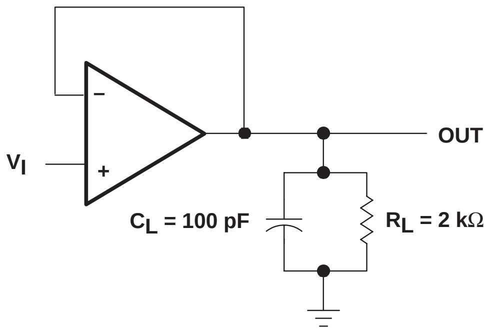



Figure 1. Unity-Gain Amplifier

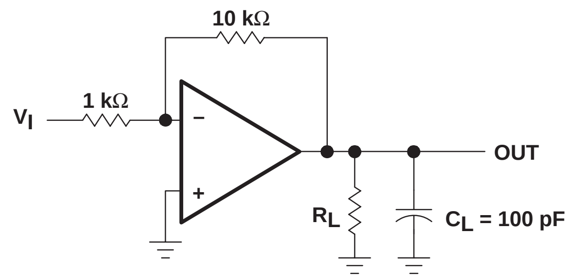



Figure 2. Gain-of-10 Inverting Amplifier

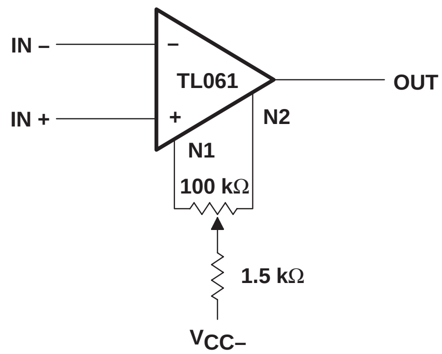



Figure 3. Input Offset-Voltage Null Circuit

## TYPICAL CHARACTERISTICS

### Table of Graphs

| | FIGURE |
|---|---|
| Maximum peak output voltage vs Supply voltage | 4 |
| Maximum peak output voltage vs Free-air temperature | 5 |
| Maximum peak output voltage vs Load resistance | 6 |
| Maximum peak output voltage vs Frequency | 7 |
| Differential voltage amplification vs Free-air temperature | 8 |
| Large-signal differential voltage amplification vs Frequency | 9 |
| Phase shift vs Frequency | 9 |
| Supply current vs Supply voltage | 10 |
| Supply current vs Free-air temperature | 11 |
| Total power dissipation vs Free-air temperature | 12 |
| Common-mode rejection ratio vs Free-air temperature | 13 |
| Normalized unity-gain bandwidth vs Free-air temperature | 14 |
| Normalized slew rate vs Free-air temperature | 14 |
| Normalized phase shift vs Free-air temperature | 14 |
| Input bias current vs Free-air temperature | 15 |
| Voltage-follower large-signal pulse response vs Time | 16 |
| Output voltage vs Elapsed time | 17 |
| Equivalent input noise voltage vs Frequency | 18 |

## TYPICAL CHARACTERISTICS†

### MAXIMUM PEAK OUTPUT VOLTAGE vs SUPPLY VOLTAGE

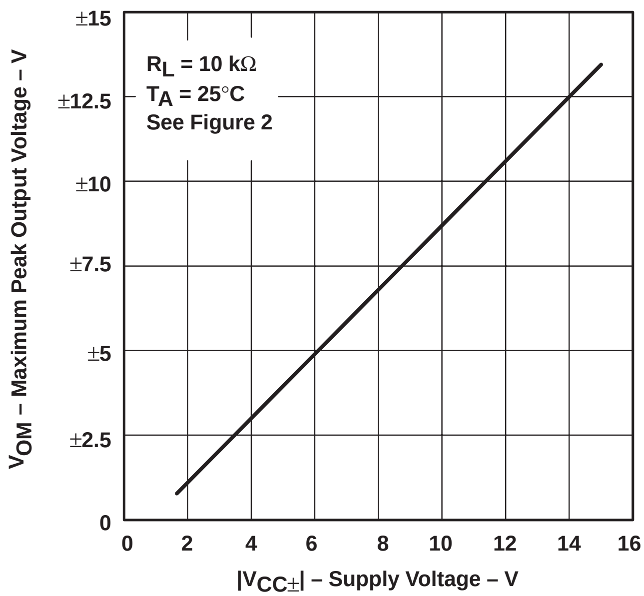



**Figure 4**

### MAXIMUM PEAK OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE

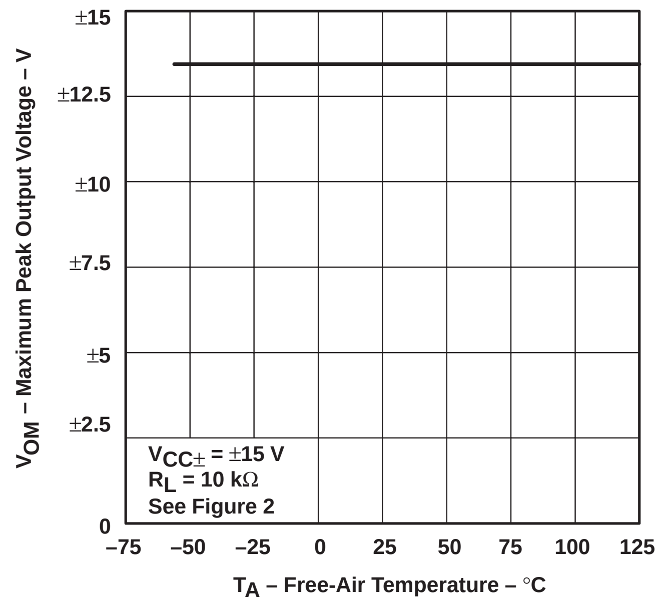



**Figure 5**

### MAXIMUM PEAK OUTPUT VOLTAGE vs LOAD RESISTANCE

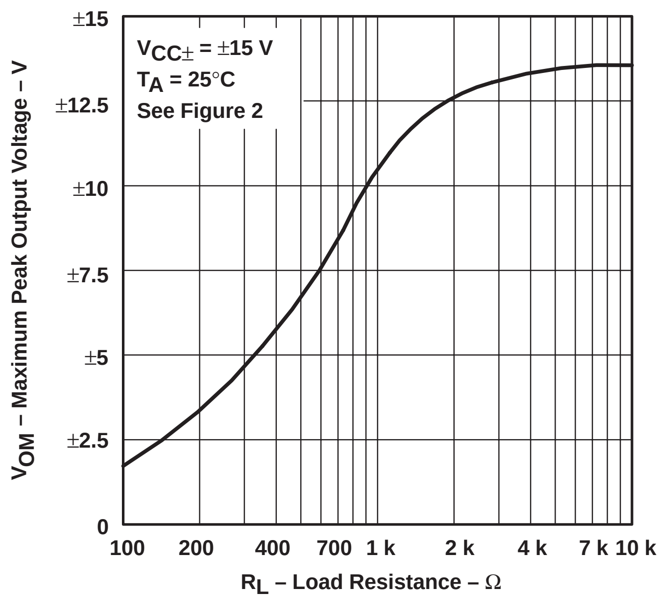



**Figure 6**

### MAXIMUM PEAK OUTPUT VOLTAGE vs FREQUENCY

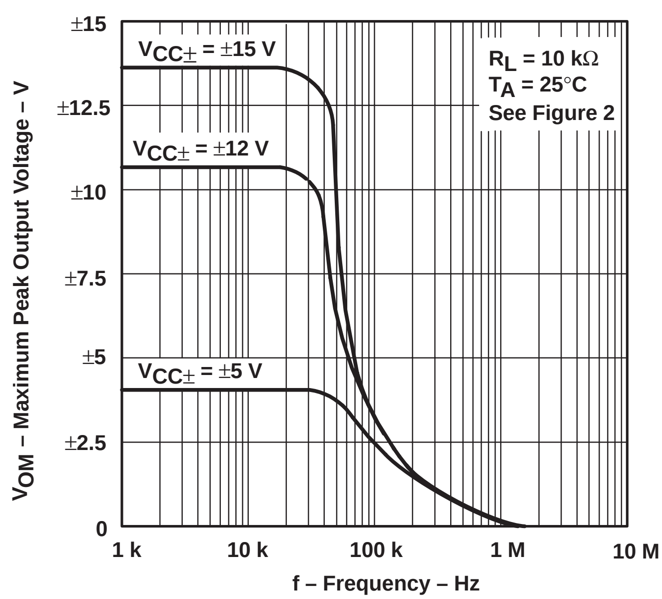



**Figure 7**

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

## TYPICAL CHARACTERISTICS†

DIFFERENTIAL VOLTAGE AMPLIFICATION
vs
FREE-AIR TEMPERATURE

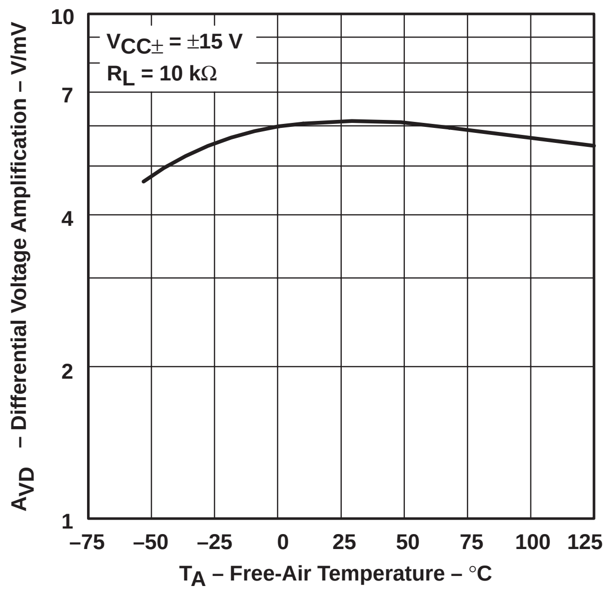



Figure 8

LARGE-SIGNAL
DIFFERENTIAL VOLTAGE
AMPLIFICATION AND PHASE SHIFT
vs
FREQUENCY

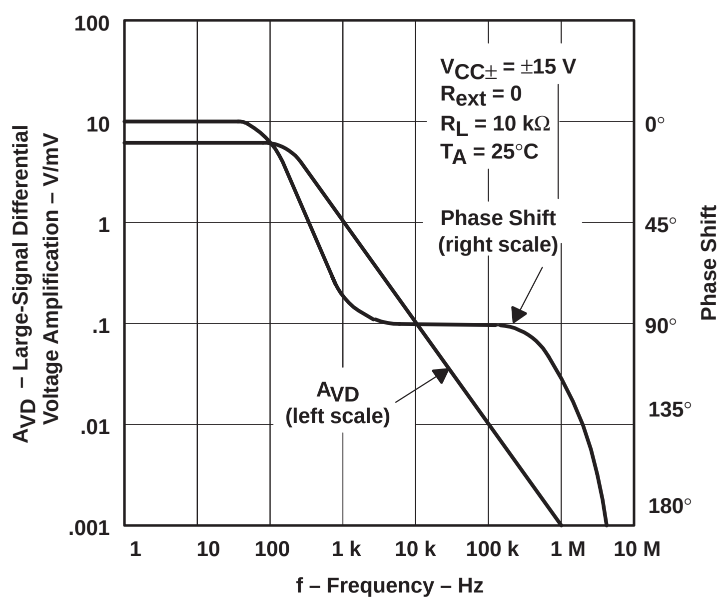



Figure 9

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

## TYPICAL CHARACTERISTICS†

SUPPLY CURRENT
vs
SUPPLY VOLTAGE

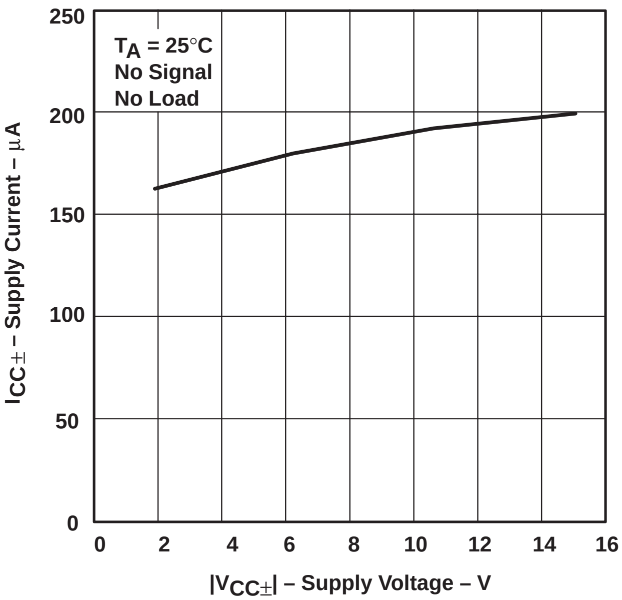



Figure 10

SUPPLY CURRENT
vs
FREE-AIR TEMPERATURE

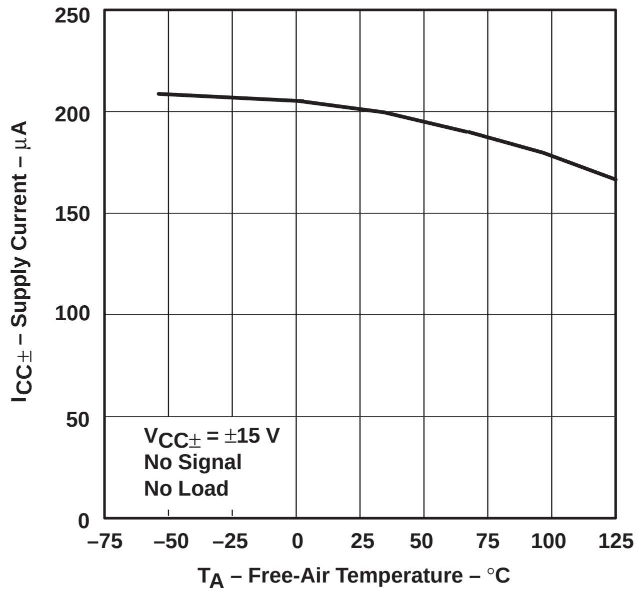



Figure 11

TOTAL POWER DISSIPATION
vs
FREE-AIR TEMPERATURE

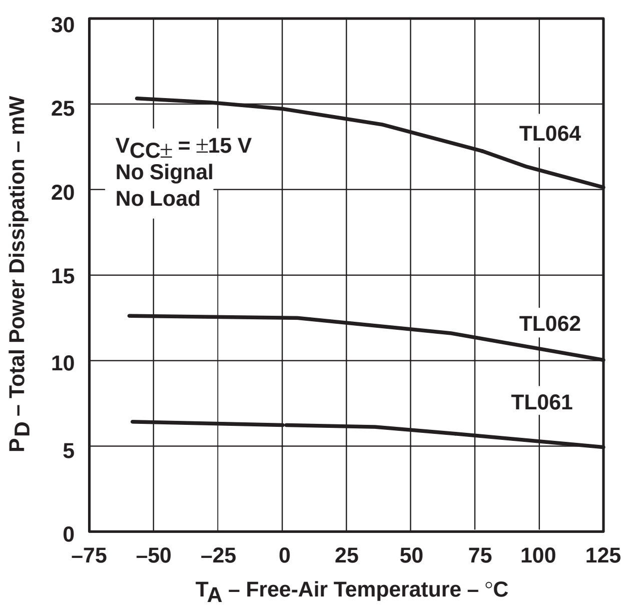



Figure 12

ALL EXCEPT TL06_C
COMMON-MODE REJECTION RATIO
vs
FREE-AIR TEMPERATURE

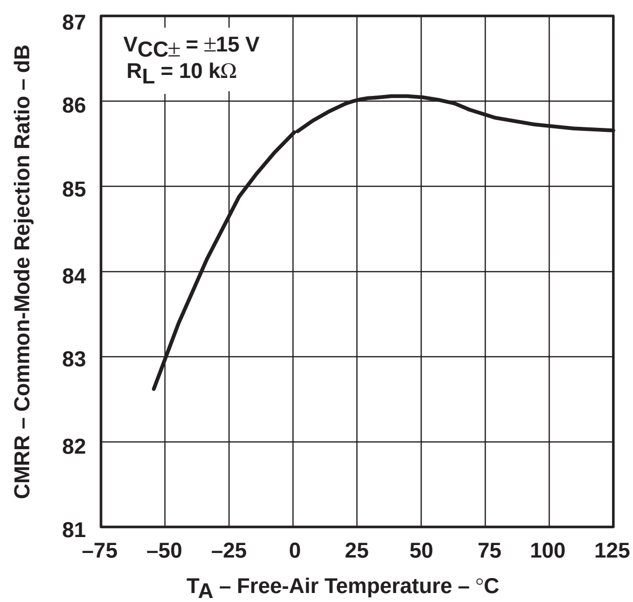



Figure 13

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

## TYPICAL CHARACTERISTICS

**NORMALIZED UNITY-GAIN BANDWIDTH, SLEW RATE, AND PHASE SHIFT vs FREE-AIR TEMPERATURE**

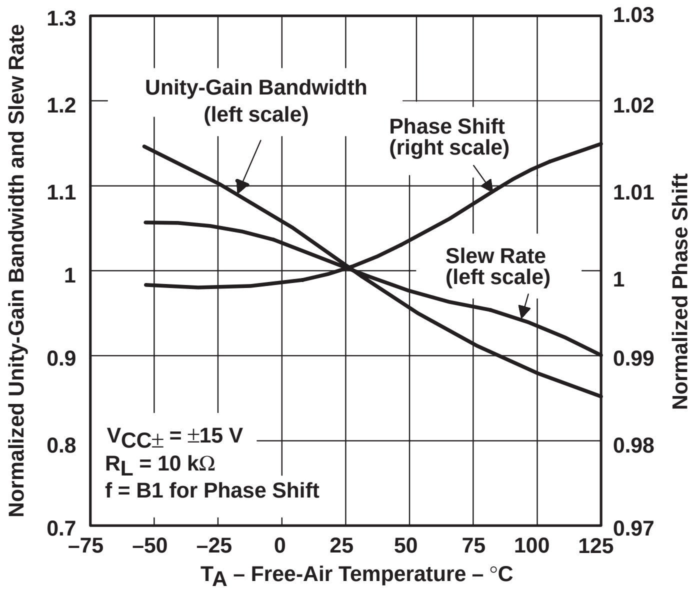



**Figure 14**

**INPUT BIAS CURRENT vs FREE-AIR TEMPERATURE**

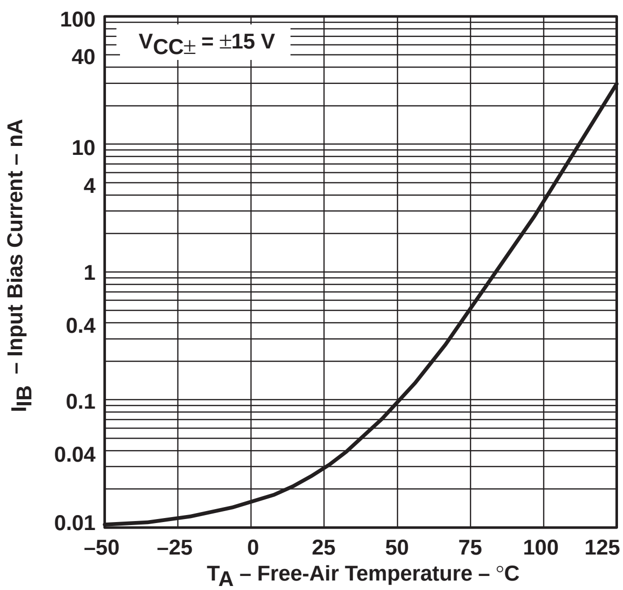



**Figure 15**

**VOLTAGE-FOLLOWER LARGE-SIGNAL PULSE RESPONSE vs TIME**

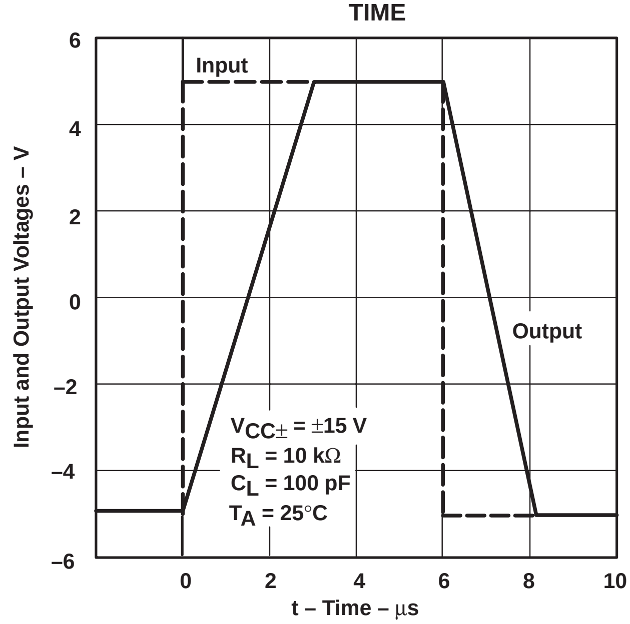



**Figure 16**

## TYPICAL CHARACTERISTICS

**OUTPUT VOLTAGE vs ELAPSED TIME**

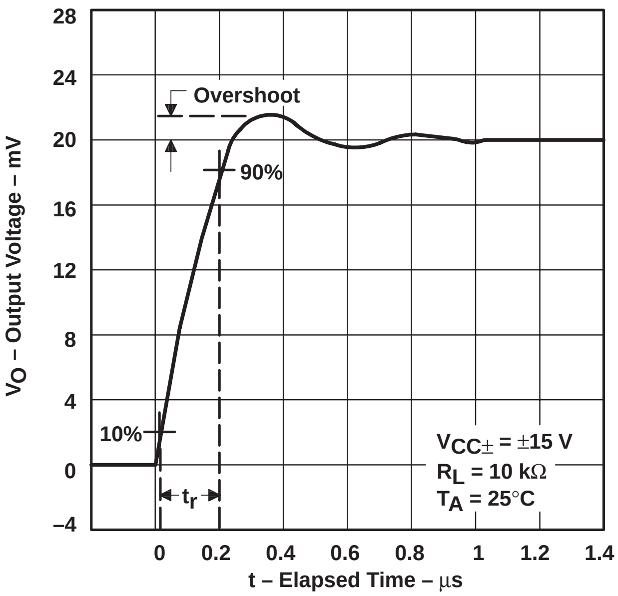



Figure 17

**EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY**

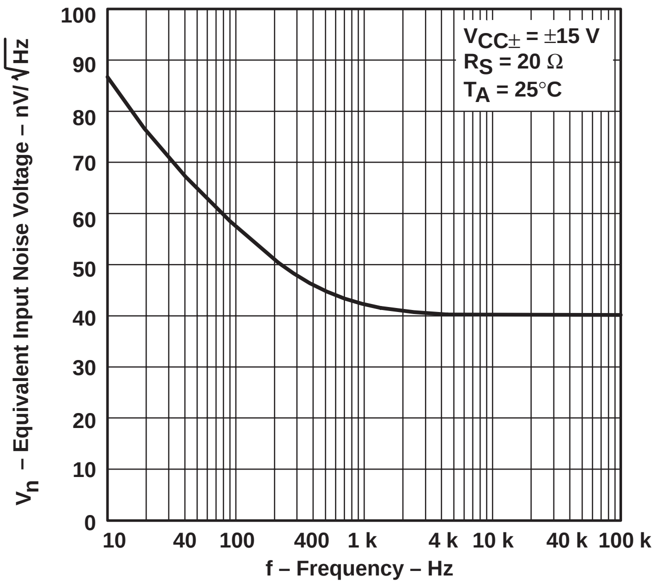



Figure 18

## APPLICATION INFORMATION

### Table of Application Diagrams

| APPLICATION DIAGRAM | PART NUMBER | FIGURE |
|---|---|---|
| Instrumentation amplifier | TL064 | 19 |
| 0.5-Hz square-wave oscillator | TL061 | 20 |
| High-Q notch filter | TL061 | 21 |
| Audio-distribution amplifier | TL064 | 22 |
| Low-level light detector preamplifier | TL061 | 23 |
| AC amplifier | TL061 | 24 |
| Microphone preamplifier with tone control | TL061 | 25 |
| Instrumentation amplifier | TL062 | 26 |
| IC preamplifier | TL062 | 27 |

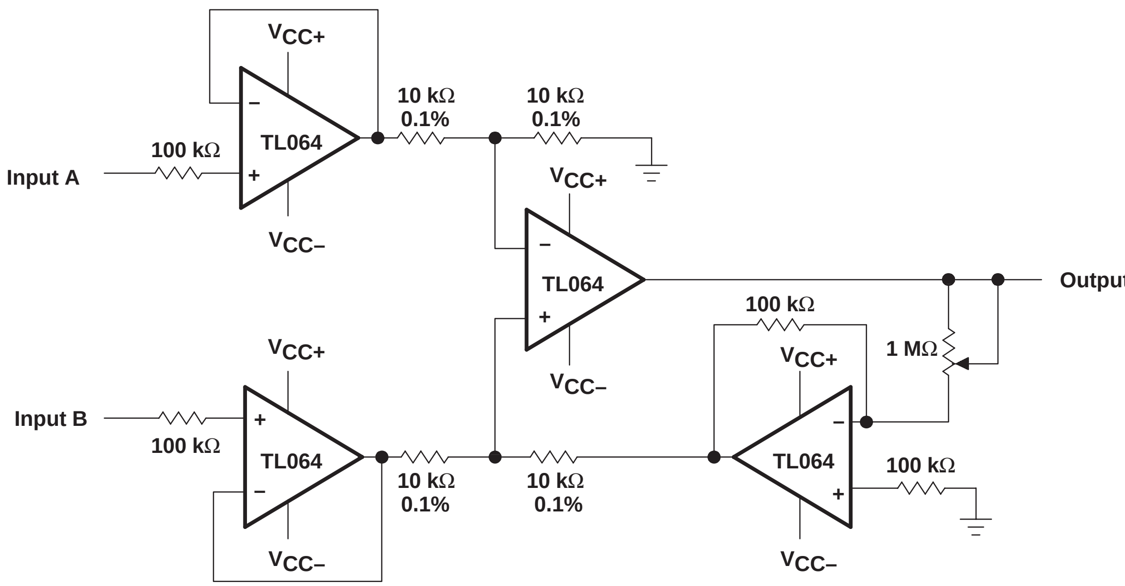



Figure 19. Instrumentation Amplifier

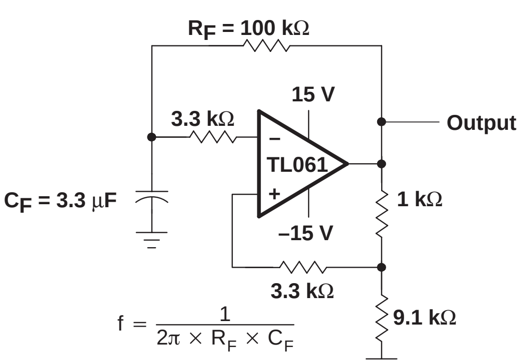



Figure 20. 0.5-Hz Square-Wave Oscillator

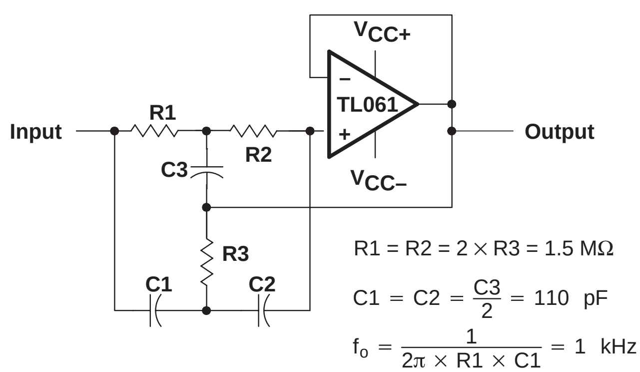



Figure 21. High-Q Notch Filter

## APPLICATION INFORMATION

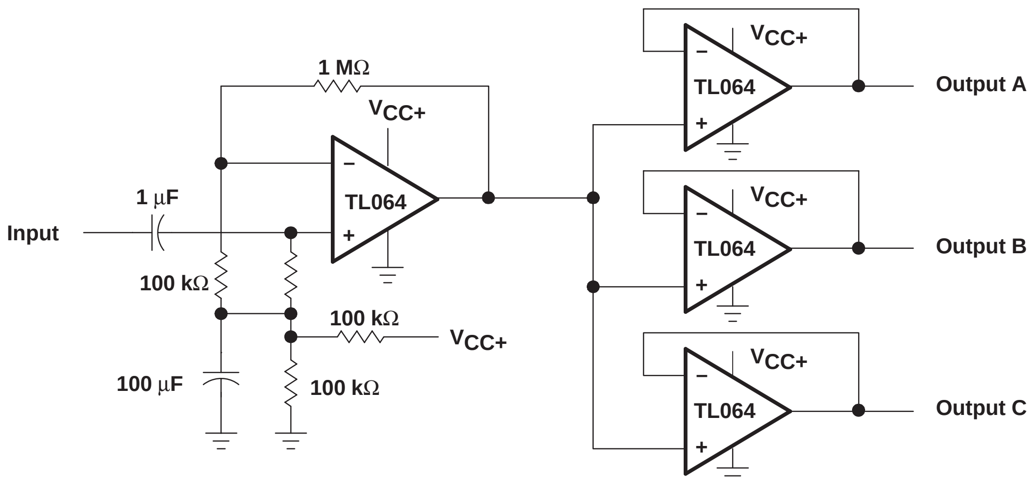



**Figure 22. Audio-Distribution Amplifier**

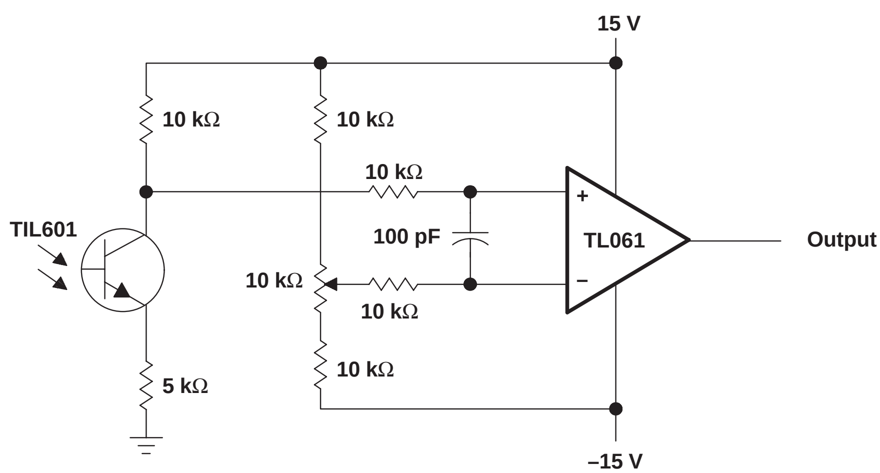



**Figure 23. Low-Level Light Detector Preamplifier**

## APPLICATION INFORMATION

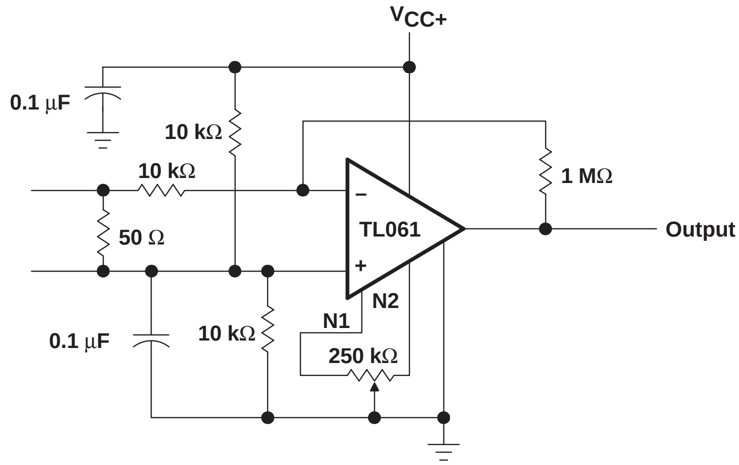



**Figure 24. AC Amplifier**

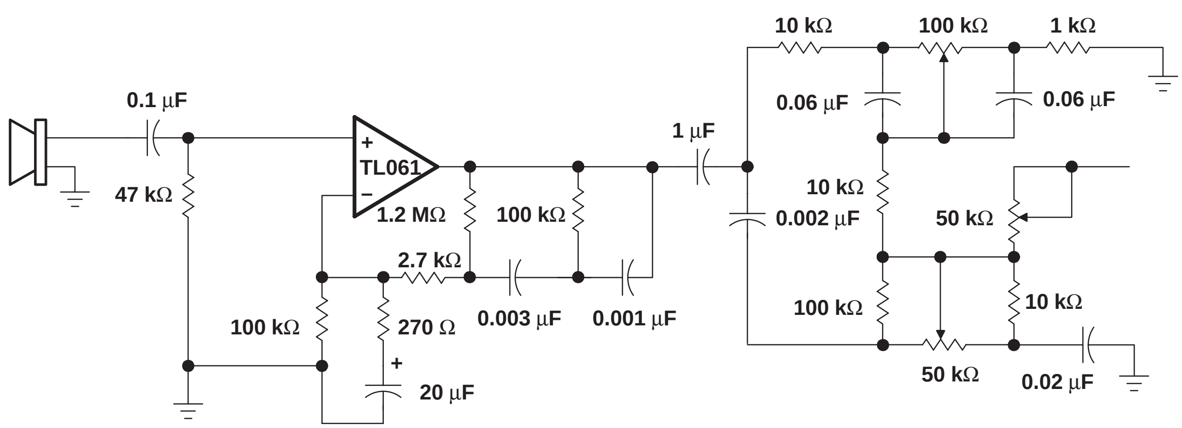



**Figure 25. Microphone Preamplifier With Tone Control**

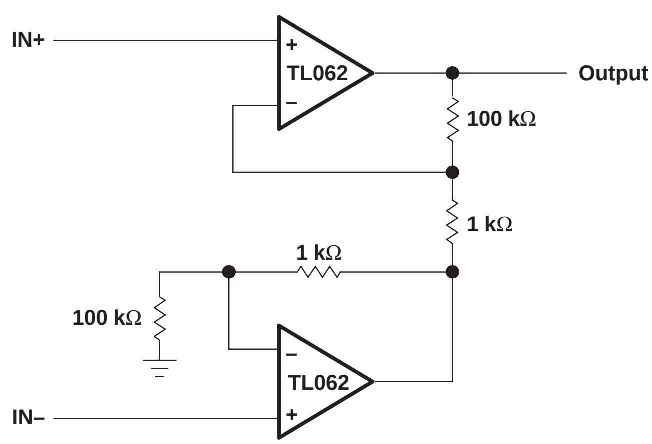
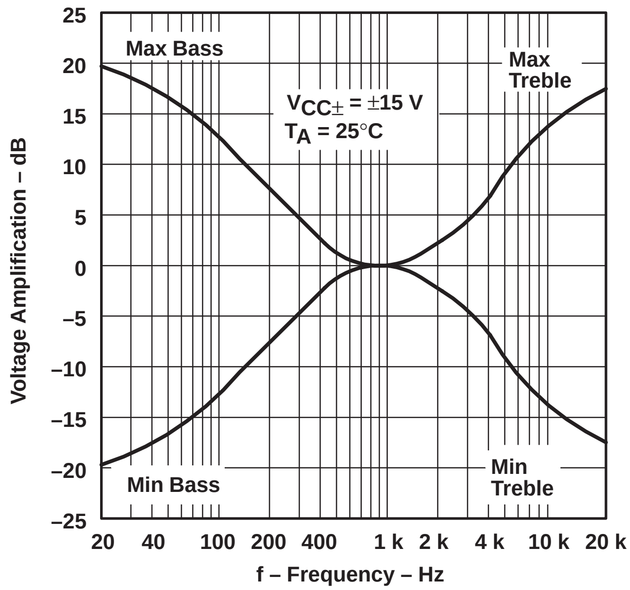



**Figure 26. Instrumentation Amplifier**

## APPLICATION INFORMATION



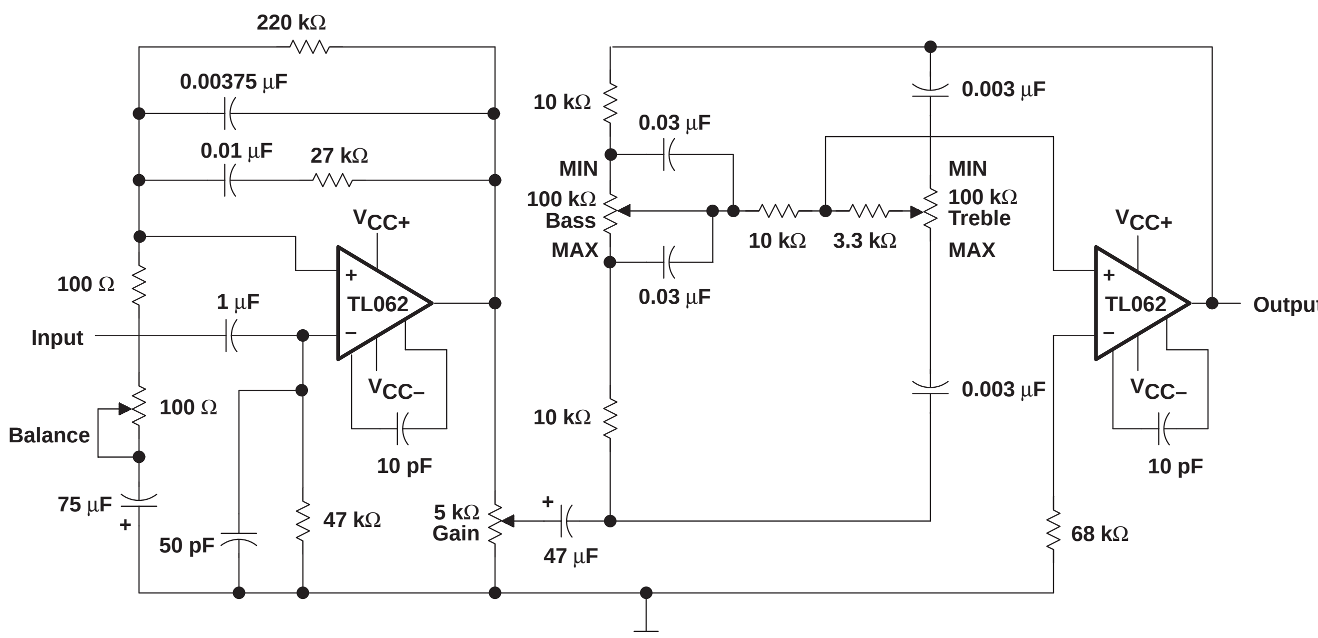




**Figure 27. IC Preamplifier**

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