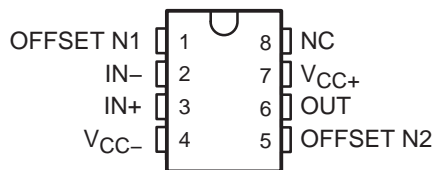


# TL061, TL061A, TL061B, TL062, TL062A TL062B, TL064, TL064A, TL064B LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS

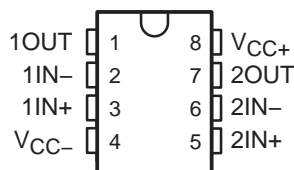
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- Very Low Power Consumption
- Typical Supply Current . . . 200  $\mu$ A (Per Amplifier)
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Common-Mode Input Voltage Range Includes  $V_{CC+}$
- Output Short-Circuit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

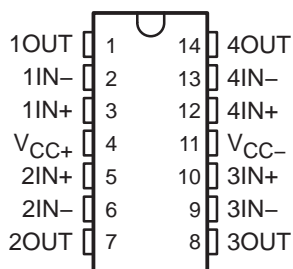
TL061, TL061A . . . D, P, OR PS PACKAGE  
TL061B . . . P PACKAGE  
(TOP VIEW)



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

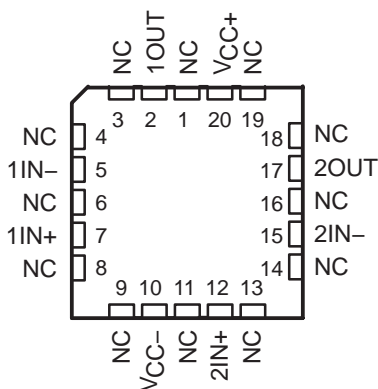


TL064 . . . D, J, N, NS, PW, OR W PACKAGE  
TL064A, TL064B . . . D OR N PACKAGE  
(TOP VIEW)

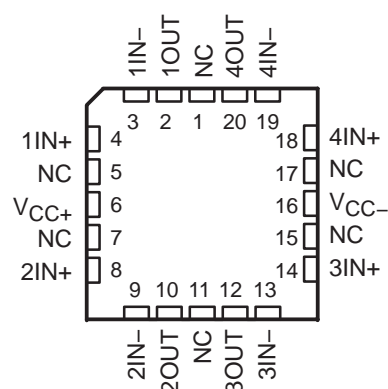


NC – No internal connection

TL062 . . . FK PACKAGE  
(TOP VIEW)



TL064 . . . FK PACKAGE  
(TOP VIEW)



## description/ordering information

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 features 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 an 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.



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

**TL061, TL061A, TL061B, TL062, TL062A  
 TL062B, TL064, TL064A, TL064B  
 LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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**description/ordering information (continued)**

**ORDERING INFORMATION**

| TA          | V <sub>IO</sub> MAX<br>AT 25°C | PACKAGE†   |              | ORDERABLE<br>PART NUMBER | TOP-SIDE<br>MARKING |          |
|-------------|--------------------------------|------------|--------------|--------------------------|---------------------|----------|
| 0°C to 70°C | 15 mV                          | PDIP (P)   | Tube of 50   | TL061CP                  | TL061CP             |          |
|             |                                |            |              | TL062CP                  | TL062CP             |          |
|             |                                | PDIP (N)   | Tube of 25   | TL064CN                  | TL064CN             |          |
|             |                                | SOIC (D)   | Tube of 75   | TL061CD                  | TL061C              |          |
|             |                                |            |              | TL061CDR                 |                     |          |
|             |                                |            | Tube of 75   | TL062CD                  | TL062C              |          |
|             |                                |            |              | TL062CDR                 |                     |          |
|             |                                |            | Tube of 50   | TL064CD                  | TL064C              |          |
|             |                                |            |              | TL064CDR                 |                     |          |
|             |                                | SOP (PS)   | Reel of 2000 | TL061CPSR                | T061                |          |
|             |                                |            |              | TL062CPSR                | T062                |          |
|             |                                | SOP (NS)   | Reel of 2000 | TL064CNSR                | TL064               |          |
|             |                                | TSSOP (PW) | Tube of 150  | TL062CPW                 | T062                |          |
|             |                                |            |              | TL062CPWR                |                     |          |
|             |                                |            | Tube of 90   | TL064CPW                 | T064                |          |
|             | TL064CPWR                      |            |              |                          |                     |          |
|             | 6 mV                           | PDIP (P)   | Tube of 50   | TL061ACP                 | TL061ACP            |          |
|             |                                |            |              | TL062ACP                 | TL062ACP            |          |
|             |                                | PDIP (N)   | Tube of 25   | TL064ACN                 | TL064ACN            |          |
|             |                                | SOIC (D)   | Tube of 75   | TL061ACD                 | 061AC               |          |
|             |                                |            |              | TL061ACDR                |                     |          |
|             |                                |            | Tube of 75   | TL062ACD                 | 062AC               |          |
|             |                                |            |              | TL062ACDR                |                     |          |
|             |                                |            | Tube of 50   | TL064ACD                 | TL064AC             |          |
|             |                                |            |              | TL064ACDR                |                     |          |
|             |                                | SOP (PS)   | Reel of 2000 | TL061ACPSR               | T061A               |          |
|             |                                |            |              | TL062ACPSR               | T062A               |          |
|             |                                | 3 mV       | PDIP (P)     | Tube of 50               | TL061BCP            | TL061BCP |
|             |                                |            |              |                          | TL062BCP            | TL062BCP |
|             |                                |            | PDIP (N)     | Tube of 25               | TL064BCN            | TL064BCN |
| SOIC (D)    |                                |            | Tube of 75   | TL062BCD                 | 062BC               |          |
|             | TL062BCDR                      |            |              |                          |                     |          |
|             | Tube of 50                     |            | TL064BCD     | TL064BC                  |                     |          |
|             |                                | TL064BCDR  |              |                          |                     |          |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



**TL061, TL061A, TL061B, TL062, TL062A  
TL062B, TL064, TL064A, TL064B  
LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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**description/ordering information (continued)**

**ORDERING INFORMATION (continued)**

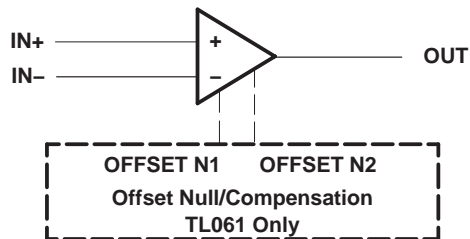
| TA             | V <sub>IO</sub> MAX<br>AT 25°C | PACKAGE†   |              | ORDERABLE<br>PART NUMBER | TOP-SIDE<br>MARKING |
|----------------|--------------------------------|------------|--------------|--------------------------|---------------------|
| –40°C to 85°C  | 6 mV                           | PDIP (P)   | Tube of 50   | TL061IP                  | TL061IP             |
|                |                                |            |              | TL062IP                  | TL062IP             |
|                |                                | PDIP (N)   | Tube of 25   | TL064IN                  | TL064IN             |
|                |                                | SOIC (D)   | Tube of 75   | TL061ID                  | TL061I              |
|                |                                |            |              | TL061IDR                 |                     |
|                |                                |            | Tube of 75   | TL062ID                  | TL062I              |
|                |                                |            |              | TL062IDR                 |                     |
|                |                                |            | Tube of 50   | TL064ID                  | TL064I              |
|                |                                |            |              | TL064IDR                 |                     |
|                |                                | TSSOP (PW) | Reel of 2000 | TL062IPWR                | TL062I              |
| –55°C to 125°C | 6 mV                           | CDIP (JG)  | Tube of 50   | TL062MJG                 | TL062MJG            |
|                |                                | LCCC (FK)  | Tube of 55   | TL062MFK                 | TL062MFK            |
|                | 9 mV                           | CDIP (J)   | Tube of 25   | TL064MJ                  | TL064MJ             |
|                |                                | CFP (W)    | Tube of 150  | TL064MW                  | TL064MW             |
|                |                                | LCCC (FK)  | Tube of 55   | TL064MFK                 | TL064MFK            |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

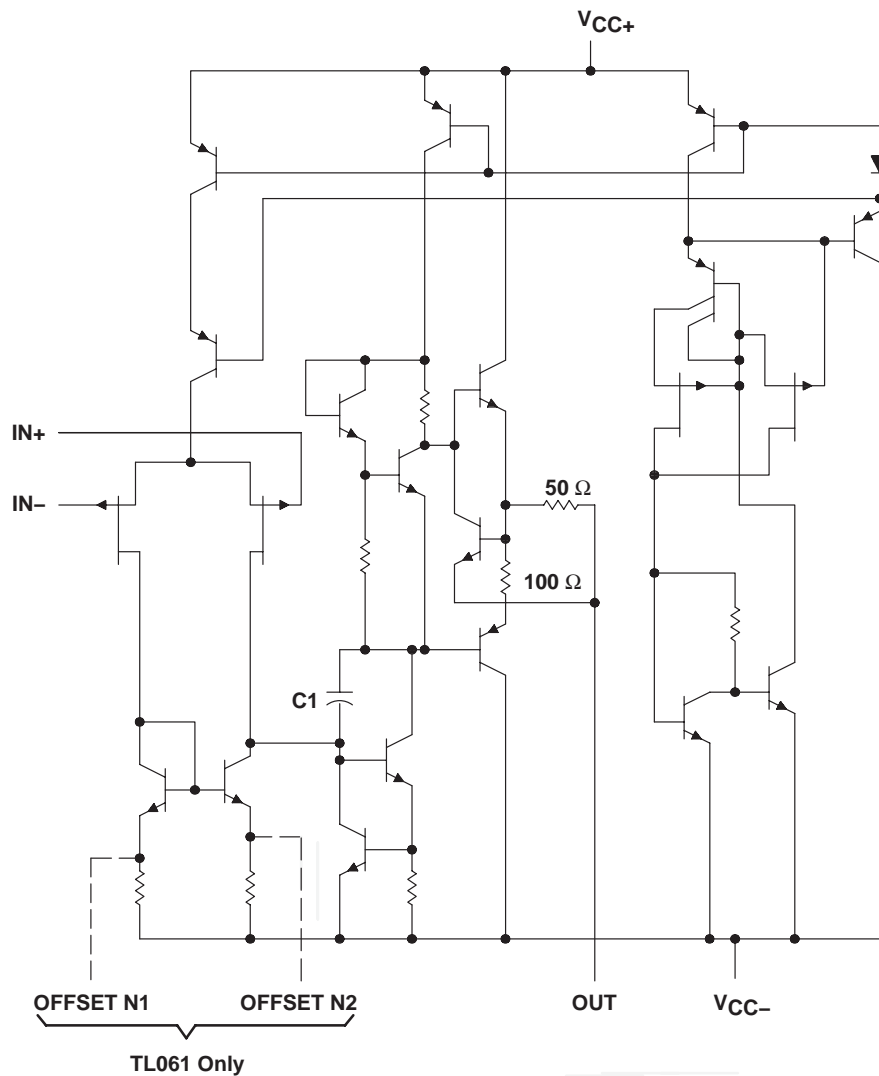
**TL061, TL061A, TL061B, TL062, TL062A  
 TL062B, TL064, TL064A, TL064B  
 LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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symbol (each amplifier)



schematic (each amplifier)



$C1 = 10 \text{ pF}$  on TL061, TL062, and TL064  
 Component values shown are nominal.

**TL061, TL061A, TL061B, TL062, TL062A  
TL062B, TL064, TL064A, TL064B  
LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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

|  |                                | TL06_C<br>TL06_AC<br>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)            |                                | $\pm 30$                     | $\pm 30$   | $\pm 30$   | V    |
| Input voltage, $V_I$ (see Notes 1 and 3)                     |                                | $\pm 15$                     | $\pm 15$   | $\pm 15$   | V    |
| Duration of output short circuit (see Note 4)                |                                | Unlimited                    | Unlimited  | Unlimited  |      |
| Package thermal impedance, $\theta_{JA}$ (see Notes 5 and 6) | D (8-pin) package              | 97                           | 97         |            | °C/W |
|  | D (14-pin) package             | 86                           | 86         |            |      |
|  | N package                      | 80                           | 80         |            |      |
|  | NS package                     | 76                           | 76         |            |      |
|  | P package                      | 85                           | 85         |            |      |
|  | PS package                     | 95                           | 95         |            |      |
|  | PW (8-pin) package             | 149                          | 149        |            |      |
| Package thermal impedance, $\theta_{JC}$ (see Notes 7 and 8) | FK package                     |                              |            | 5.61       | °C/W |
|  | J package                      |                              |            | 15.05      |      |
|  | JG package                     |                              |            | 14.5       |      |
|  | W package                      |                              |            | 14.65      |      |
| Operating virtual junction temperature, $T_J$                |                                | 150                          | 150        | 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 (1/16 inch) from case for 10 seconds | D, N, NS, P, PS, or PW package | 260                          | 260        |            | °C   |
| Storage temperature range, $T_{stg}$                         |                                | -65 to 150                   | -65 to 150 | -65 to 150 | °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:
- All voltage values except differential voltages are with respect to the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .
  - Differential voltages are at  $IN+$  with respect to  $IN-$ .
  - The magnitude of the input voltage should never exceed the magnitude of the supply voltage or 15 V, whichever is less.
  - 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.
  - Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\max) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  - The package thermal impedance is calculated in accordance with JESD 51-7.
  - Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JC}$ , and  $T_C$ . The maximum allowable power dissipation at any allowable case temperature is  $P_D = (T_J(\max) - T_C)/\theta_{JC}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  - The package thermal impedance is calculated in accordance with MIL-STD-883.



**TL061, TL061A, TL061B, TL062, TL062A  
TL062B, TL064, TL064A, TL064B  
LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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

| PARAMETER         | TEST CONDITIONS†  | TL061C<br>TL062C<br>TL064C   |     |                           | TL061AC<br>TL062AC<br>TL064AC |                 |           | UNIT            |                              |
|-------------------|---|--|-----|---------------------------|-------------------------------|-----------------|-----------|-----------------|------------------------------|
|                   |   | MIN  | TYP | MAX                       | MIN                           | TYP             | MAX       |                 |                              |
| $V_{IO}$          | Input offset voltage  | $V_O = 0,$<br>$R_S = 50\ \Omega$   |     | $T_A = 25^\circ\text{C}$  | 3                             | 15              | 3         | 6               | mV                           |
|                   |   |  |     | $T_A = \text{Full range}$ | 20                            |                 | 7.5       |                 |                              |
| $\alpha_{V_{IO}}$ | Temperature coefficient of input offset voltage                     | $V_O = 0, R_S = 50\ \Omega,$<br>$T_A = \text{Full range}$  |     |                           | 10                            |                 | 10        |                 | $\mu\text{V}/^\circ\text{C}$ |
| $I_{IO}$          | Input offset current  | $V_O = 0$  |     | $T_A = 25^\circ\text{C}$  | 5                             | 200             | 5         | 100             | pA                           |
|                   |   |  |     | $T_A = \text{Full range}$ | 5                             |                 | 3         |                 | nA                           |
| $I_{IB}$          | Input bias current‡   | $V_O = 0$  |     | $T_A = 25^\circ\text{C}$  | 30                            | 400             | 30        | 200             | pA                           |
|                   |   |  |     | $T_A = \text{Full range}$ | 10                            |                 | 7         |                 | nA                           |
| $V_{ICR}$         | Common-mode input voltage range                                     | $T_A = 25^\circ\text{C}$   |     |                           | $\pm 11$                      | -12<br>to<br>15 | $\pm 11$  | -12<br>to<br>15 | V                            |
| $V_{OM}$          | Maximum peak output voltage swing                                   | $R_L = 10\ \text{k}\Omega,$  |     | $T_A = 25^\circ\text{C}$  | $\pm 10$                      | $\pm 13.5$      | $\pm 10$  | $\pm 13.5$      | V                            |
|                   |   | $R_L \geq 10\ \text{k}\Omega,$   |     | $T_A = \text{Full range}$ | $\pm 10$                      |                 | $\pm 10$  |                 |                              |
| $A_{VD}$          | Large-signal differential voltage amplification                     | $V_O = \pm 10\ \text{V},$<br>$R_L \geq 10\ \text{k}\Omega$   |     | $T_A = 25^\circ\text{C}$  | 3                             | 6               | 4         | 6               | V/mV                         |
|                   |   |  |     | $T_A = \text{Full range}$ | 3                             |                 | 4         |                 |                              |
| $B_1$             | Unity-gain bandwidth  | $R_L = 10\ \text{k}\Omega,$  |     | $T_A = 25^\circ\text{C}$  | 1                             |                 | 1         |                 | MHz                          |
| $r_i$             | Input resistance  | $T_A = 25^\circ\text{C}$   |     |                           | $10^{12}$                     |                 | $10^{12}$ |                 | $\Omega$                     |
| CMRR              | Common-mode rejection ratio   | $V_{IC} = V_{ICRmin}, V_O = 0,$<br>$R_S = 50\ \Omega, T_A = 25^\circ\text{C}$                                |     |                           | 70                            | 86              | 80        | 86              | dB                           |
| $k_{SVR}$         | Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC} = \pm 9\ \text{V to } \pm 15\ \text{V},$<br>$V_O = 0, R_S = 50\ \Omega,$<br>$T_A = 25^\circ\text{C}$ |     |                           | 70                            | 95              | 80        | 95              | dB                           |
| $P_D$             | Total power dissipation (each amplifier)                            | $V_O = 0,$<br>No load  |     | $T_A = 25^\circ\text{C},$ | 6                             | 7.5             | 6         | 7.5             | mW                           |
| $I_{CC}$          | Supply current (each amplifier)                                     | $V_O = 0,$<br>No load  |     | $T_A = 25^\circ\text{C},$ | 200                           | 250             | 200       | 250             | $\mu\text{A}$                |
| $V_{O1}/V_{O2}$   | Crosstalk attenuation   | $A_{VD} = 100,$  |     | $T_A = 25^\circ\text{C}$  | 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  $0^\circ\text{C}$  to  $70^\circ\text{C}$  for TL06\_C, TL06\_AC, and TL06\_BC and  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  for TL06\_I.

‡ Input bias currents of an 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.



**TL061, TL061A, TL061B, TL062, TL062A  
TL062B, TL064, TL064A, TL064B  
LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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

| PARAMETER         | TEST CONDITION <sup>†</sup>  | TL061BC<br>TL062BC<br>TL064BC   |     |                           | TL061I<br>TL062I<br>TL064I |           |                 | UNIT                         |               |
|-------------------|--|---|-----|---------------------------|----------------------------|-----------|-----------------|------------------------------|---------------|
|                   |  | MIN   | TYP | MAX                       | MIN                        | TYP       | MAX             |                              |               |
| $V_{IO}$          | Input offset voltage   | $V_O = 0,$<br>$R_S = 50 \Omega$   |     | $T_A = 25^\circ\text{C}$  |                            | 2 3       |                 | 3 6                          | mV            |
|                   |  |   |     | $T_A = \text{Full range}$ |                            | 5         |                 | 9                            |               |
| $\alpha_{V_{IO}}$ | Temperature coefficient of input offset voltage                        | $V_O = 0, R_S = 50 \Omega,$<br>$T_A = \text{Full range}$  |     | 10                        |                            | 10        |                 | $\mu\text{V}/^\circ\text{C}$ |               |
| $I_{IO}$          | Input offset current   | $V_O = 0$   |     | $T_A = 25^\circ\text{C}$  |                            | 5 100     |                 | 5 100                        | pA            |
|                   |  |   |     | $T_A = \text{Full range}$ |                            | 3         |                 | 10                           | nA            |
| $I_{IB}$          | Input bias current <sup>‡</sup>  | $V_O = 0$   |     | $T_A = 25^\circ\text{C}$  |                            | 30 200    |                 | 30 200                       | pA            |
|                   |  |   |     | $T_A = \text{Full range}$ |                            | 7         |                 | 20                           | nA            |
| $V_{ICR}$         | Common-mode input voltage range  | $T_A = 25^\circ\text{C}$  |     | $\pm 11$                  | -12<br>to<br>15            | $\pm 11$  | -12<br>to<br>15 | V                            |               |
| $V_{OM}$          | Maximum peak output voltage swing                                      | $R_L = 10 \text{ k}\Omega, T_A = 25^\circ\text{C}$  |     | $\pm 10$                  | $\pm 13.5$                 | $\pm 10$  | $\pm 13.5$      | V                            |               |
|                   |  | $R_L \geq 10 \text{ k}\Omega, T_A = \text{Full range}$  |     | $\pm 10$                  |                            | $\pm 10$  |                 |                              |               |
| $A_{VD}$          | Large-signal differential voltage amplification                        | $V_O = \pm 10 \text{ V},$<br>$R_L \geq 10 \text{ k}\Omega$  |     | $T_A = 25^\circ\text{C}$  |                            | 4 6       |                 | 4 6                          | V/mV          |
|                   |  |   |     | $T_A = \text{Full range}$ |                            | 4         |                 | 4                            |               |
| $B_1$             | Unity-gain bandwidth   | $R_L = 10 \text{ k}\Omega, T_A = 25^\circ\text{C}$  |     | 1                         |                            | 1         |                 | MHz                          |               |
| $r_i$             | Input resistance   | $T_A = 25^\circ\text{C}$  |     | $10^{12}$                 |                            | $10^{12}$ |                 | $\Omega$                     |               |
| CMRR              | Common-mode rejection ratio  | $V_{IC} = V_{ICR\text{min}}, V_O = 0,$<br>$R_S = 50 \Omega, T_A = 25^\circ\text{C}$                         |     | 80 86                     |                            | 80 86     |                 | dB                           |               |
| $k_{SVR}$         | Supply-voltage rejection ratio<br>( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC} = \pm 9 \text{ V to } \pm 15 \text{ V},$<br>$V_O = 0, R_S = 50 \Omega,$<br>$T_A = 25^\circ\text{C}$ |     | 80 95                     |                            | 80 95     |                 | dB                           |               |
| $P_D$             | Total power dissipation<br>(each amplifier)                            | $V_O = 0,$<br>No load   |     | $T_A = 25^\circ\text{C},$ |                            | 6 7.5     |                 | 6 7.5                        | mW            |
| $I_{CC}$          | Supply current<br>(each amplifier)                                     | $V_O = 0,$<br>No load   |     | $T_A = 25^\circ\text{C},$ |                            | 200 250   |                 | 200 250                      | $\mu\text{A}$ |
| $VO_1/VO_2$       | Crosstalk attenuation  | $A_{VD} = 100, T_A = 25^\circ\text{C}$  |     | 120                       |                            | 120       |                 | dB                           |               |

<sup>†</sup> All characteristics are measured under open-loop conditions with zero common-mode input voltage, unless otherwise specified. Full range for  $T_A$  is  $0^\circ\text{C}$  to  $70^\circ\text{C}$  for TL06\_C, TL06\_AC, and TL06\_BC and  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  for TL06\_I.

<sup>‡</sup> Input bias currents of an 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.



**TL061, TL061A, TL061B, TL062, TL062A  
TL062B, TL064, TL064A, TL064B  
LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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

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

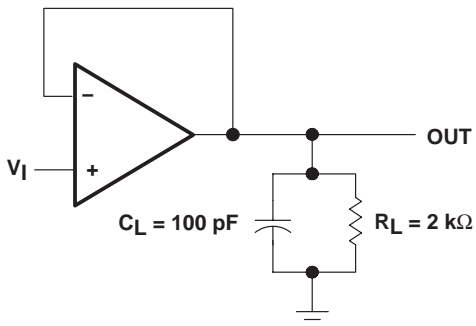
| PARAMETER                               | TEST CONDITIONS  | MIN | TYP | MAX | UNIT                   |
|---|--|-----|-----|-----|------------------------|
| SR Slew rate at unity gain (see Note 5) | $V_I = 10 \text{ V}$ ,<br>$R_L = 10 \text{ k}\Omega$ ,<br>$C_L = 100 \text{ pF}$ ,<br>See Figure 1 | 1.5 | 3.5 |     | V/ $\mu\text{s}$       |
| $t_r$ Rise time                         | $V_I = 20 \text{ mV}$ ,<br>$C_L = 100 \text{ pF}$ ,<br>See Figure 1                                | 0.2 |     |     | $\mu\text{s}$          |
| Overshoot factor                        |  | 10% |     |     |                        |
| $V_n$ Equivalent input noise voltage    | $R_S = 20 \Omega$ ,<br>$f = 1 \text{ kHz}$   | 42  |     |     | nV/ $\sqrt{\text{Hz}}$ |

NOTE 5: Slew rate at  $-55^\circ\text{C to } 125^\circ\text{C}$  is 0.7 V/ $\mu\text{s}$  min.

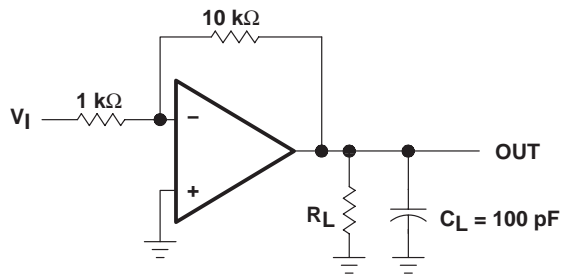




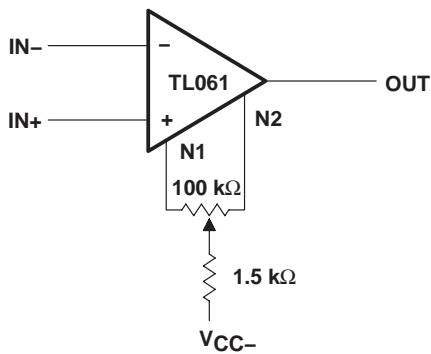
**PARAMETER MEASUREMENT INFORMATION**



**Figure 1. Unity-Gain Amplifier**



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



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

**TYPICAL CHARACTERISTICS**

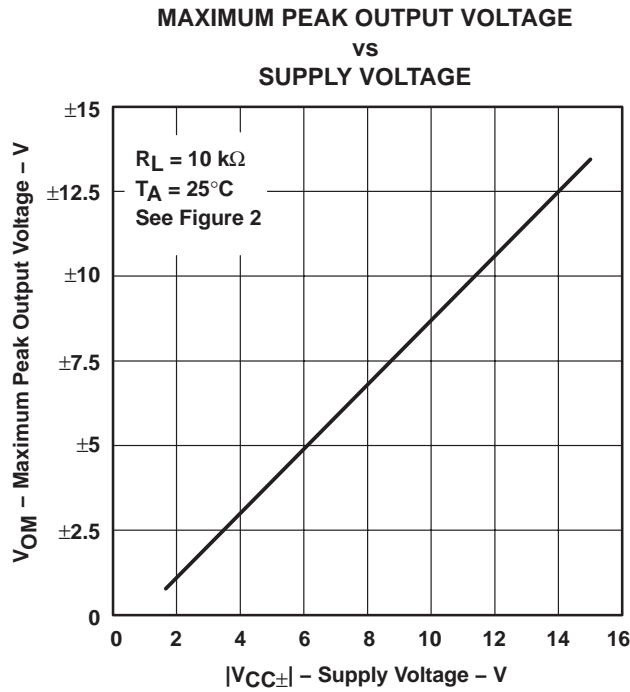
**Table of Graphs**

|  | <b>FIGURE</b> |
|--|---------------|
| 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            |

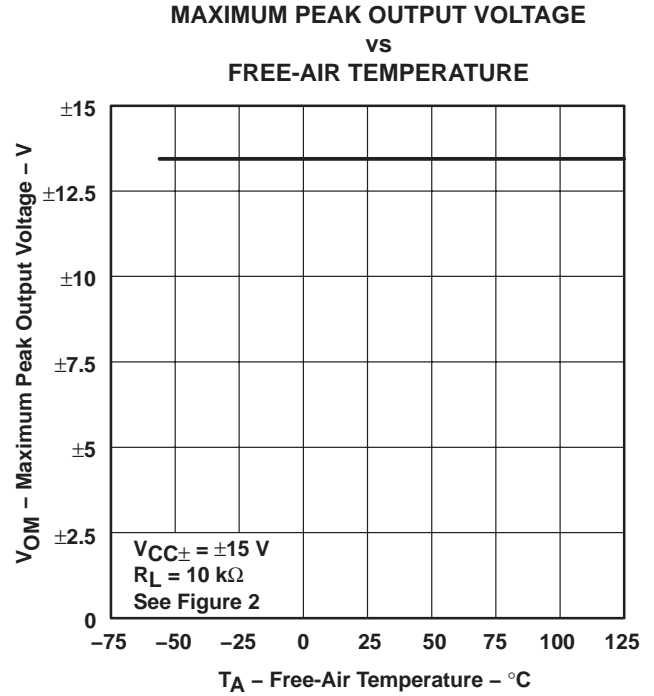
**TL061, TL061A, TL061B, TL062, TL062A  
TL062B, TL064, TL064A, TL064B  
LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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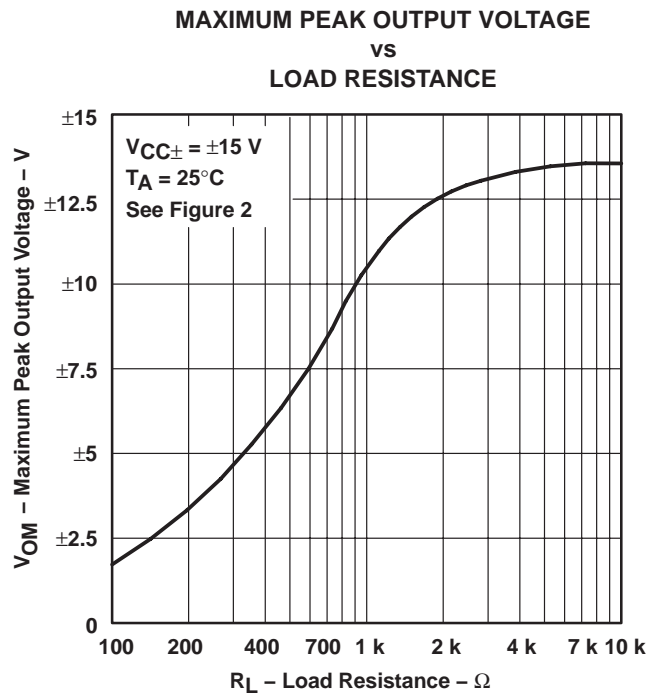
**TYPICAL CHARACTERISTICS†**



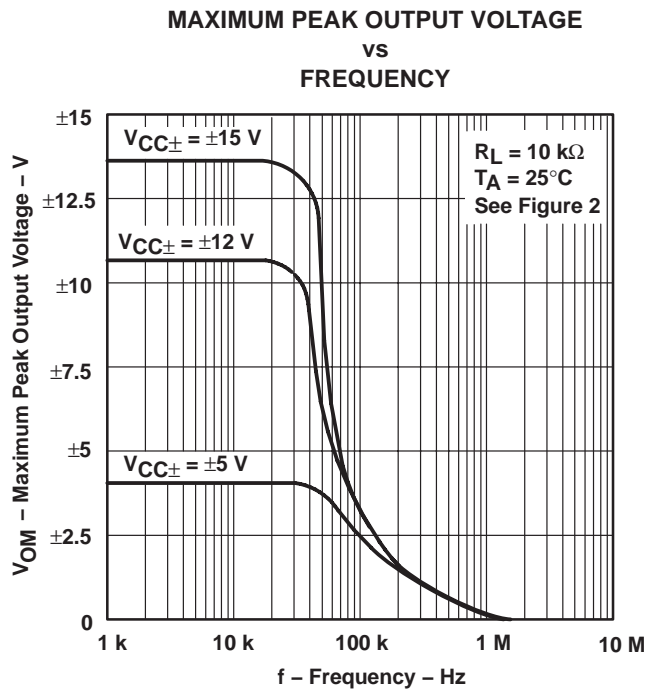
**Figure 4**



**Figure 5**



**Figure 6**



**Figure 7**

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

**TL061, TL061A, TL061B, TL062, TL062A  
 TL062B, TL064, TL064A, TL064B  
 LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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**TYPICAL CHARACTERISTICS†**

**DIFFERENTIAL VOLTAGE AMPLIFICATION  
 vs  
 FREE-AIR TEMPERATURE**

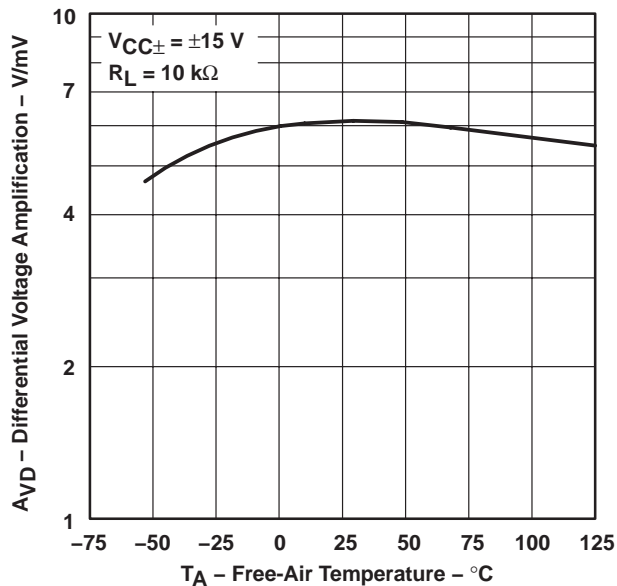


Figure 8

**LARGE-SIGNAL  
 DIFFERENTIAL VOLTAGE  
 AMPLIFICATION AND PHASE SHIFT  
 vs  
 FREQUENCY**

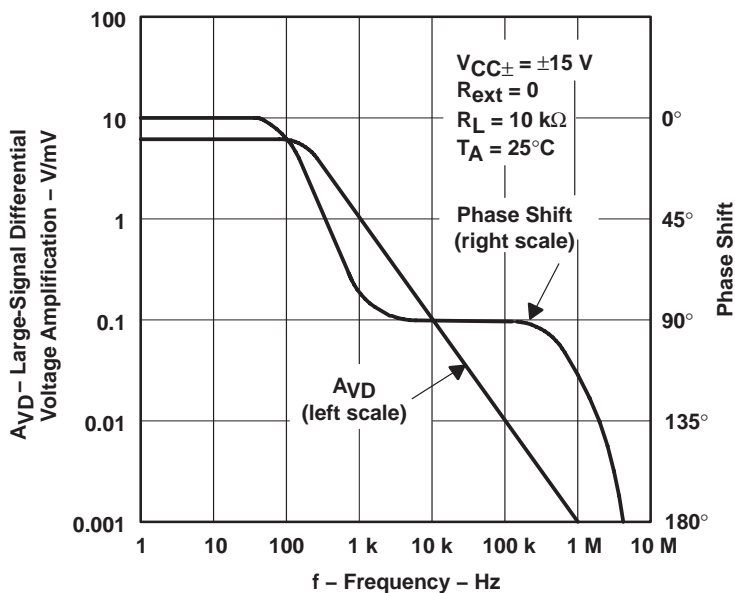


Figure 9

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



**TL061, TL061A, TL061B, TL062, TL062A  
TL062B, TL064, TL064A, TL064B**  
**LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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**TYPICAL CHARACTERISTICS†**

**SUPPLY CURRENT  
vs  
SUPPLY VOLTAGE**

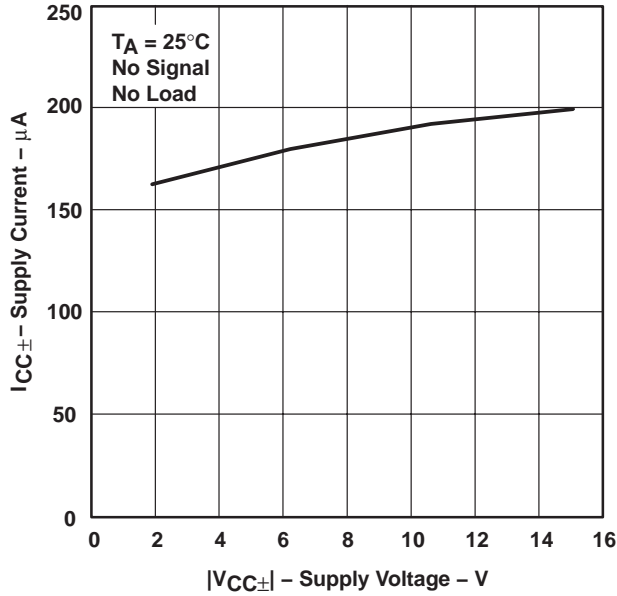


Figure 10

**SUPPLY CURRENT  
vs  
FREE-AIR TEMPERATURE**

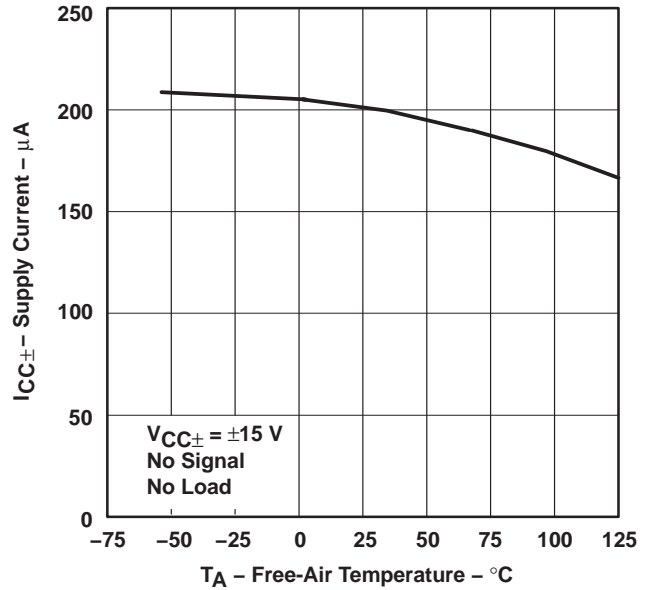


Figure 11

**TOTAL POWER DISSIPATION  
vs  
FREE-AIR TEMPERATURE**

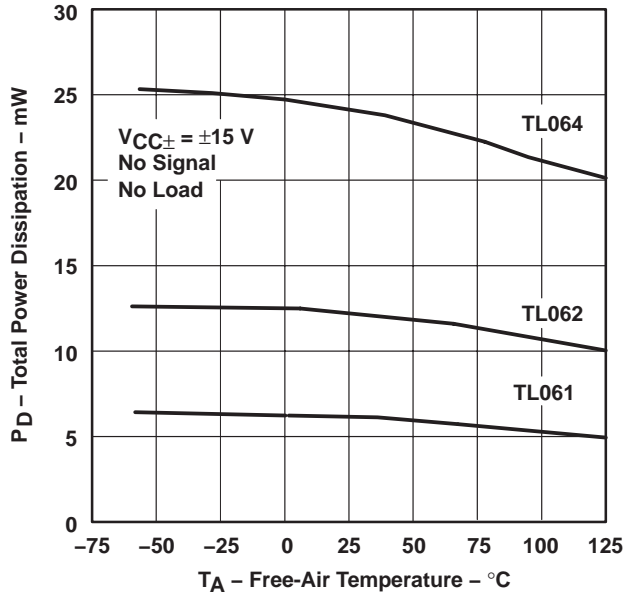


Figure 12

**ALL EXCEPT TL06\_C  
COMMON-MODE REJECTION RATIO  
vs  
FREE-AIR TEMPERATURE**

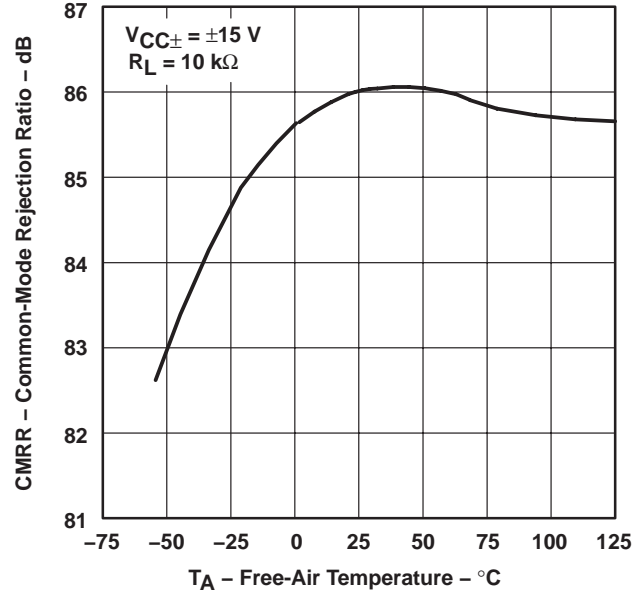


Figure 13

† 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

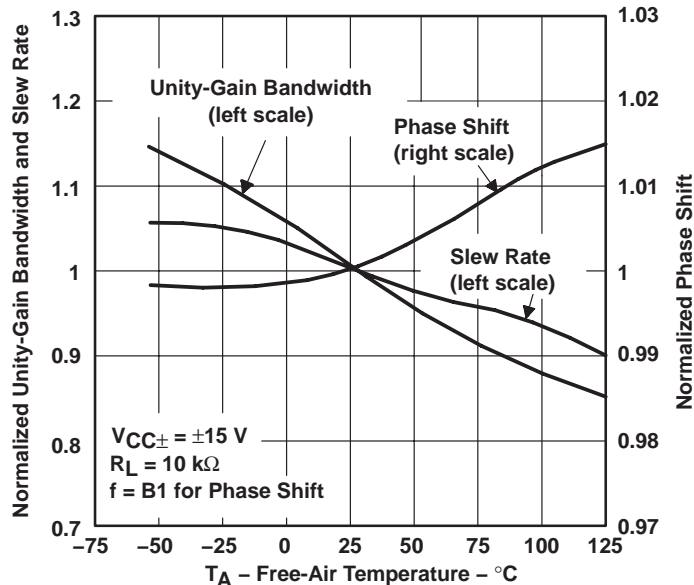


Figure 14

INPUT BIAS CURRENT  
 vs  
 FREE-AIR TEMPERATURE

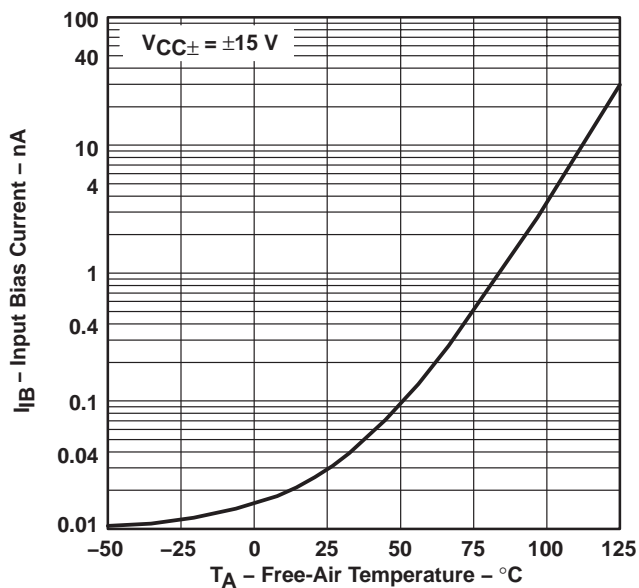


Figure 15

VOLTAGE-FOLLOWER  
 LARGE-SIGNAL PULSE RESPONSE  
 vs  
 TIME

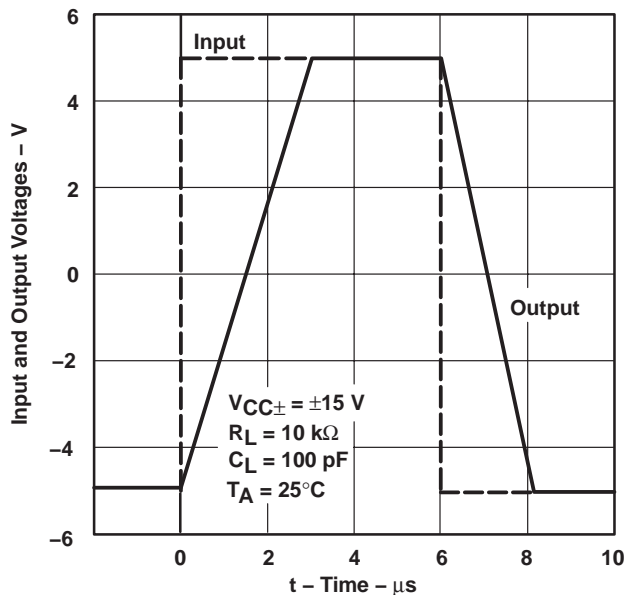
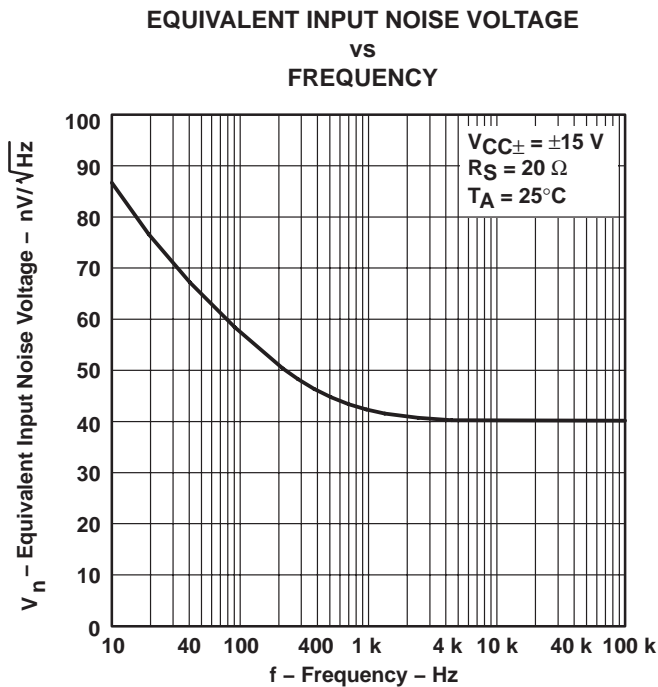
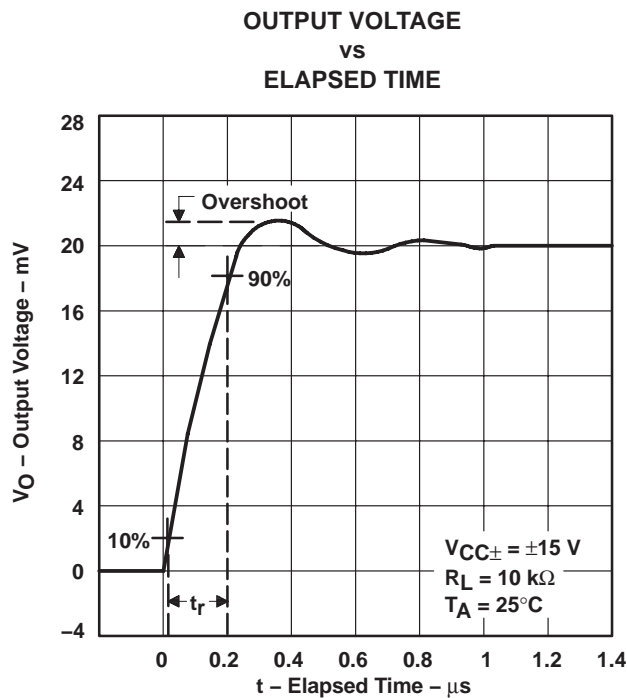


Figure 16

**TL061, TL061A, TL061B, TL062, TL062A  
TL062B, TL064, TL064A, TL064B  
LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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**TYPICAL CHARACTERISTICS**



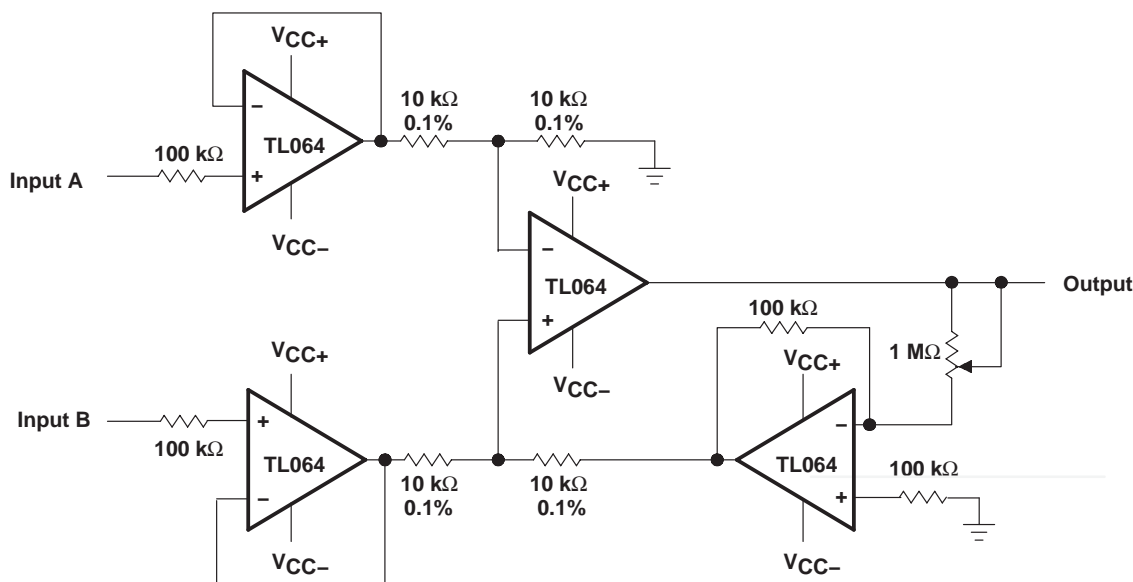
**TL061, TL061A, TL061B, TL062, TL062A  
TL062B, TL064, TL064A, TL064B  
LOW-POWER JFET-INPUT OPERATIONAL AMPLIFIERS**

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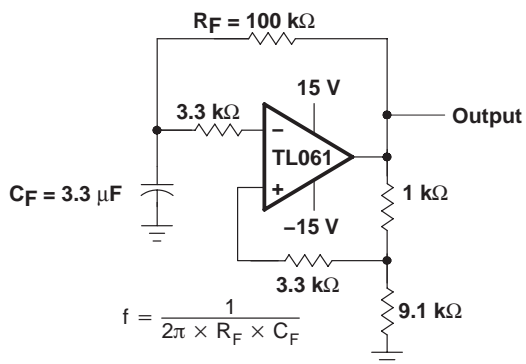
**APPLICATION INFORMATION**

**Table of Application Diagrams**

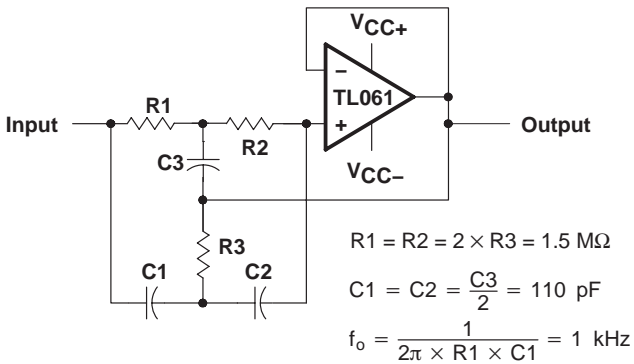
| APPLICATION DIAGRAM                       | PART NUMBER | FIGURE |
|---|-------------|--------|
| Instrumentation amplifier                 | TL064       | 19     |
| 0.5-Hz square-wave oscillator             | TL061       | 20     |
| High-Q notch filter                       | TL061       | 21     |
| 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**



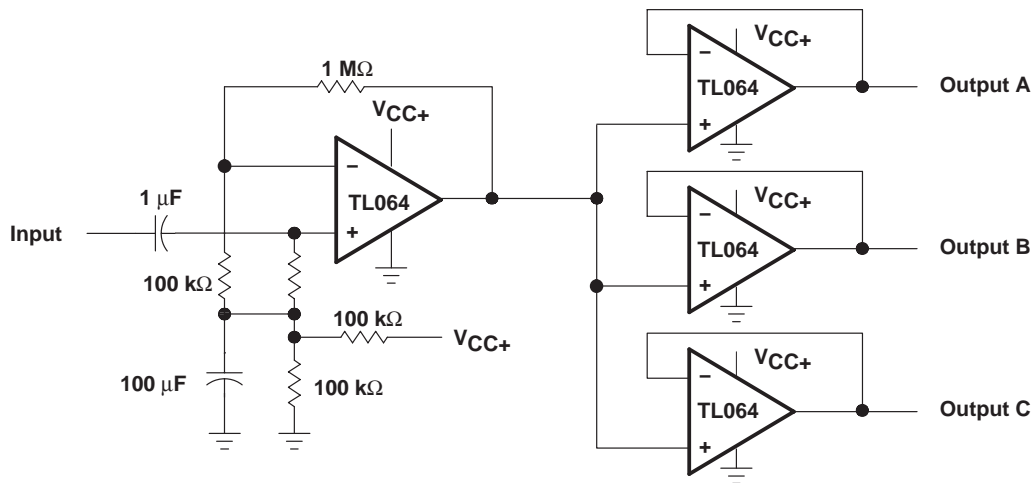
**Figure 20. 0.5-Hz Square-Wave Oscillator**



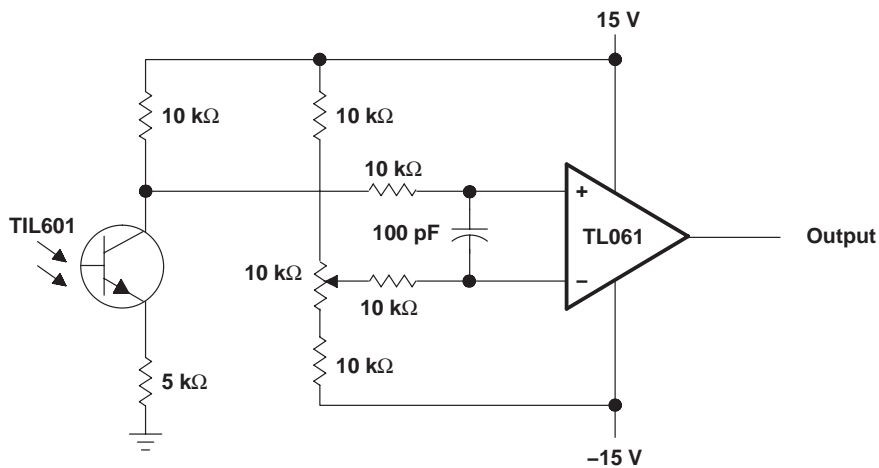
**Figure 21. High-Q Notch Filter**



**APPLICATION INFORMATION**

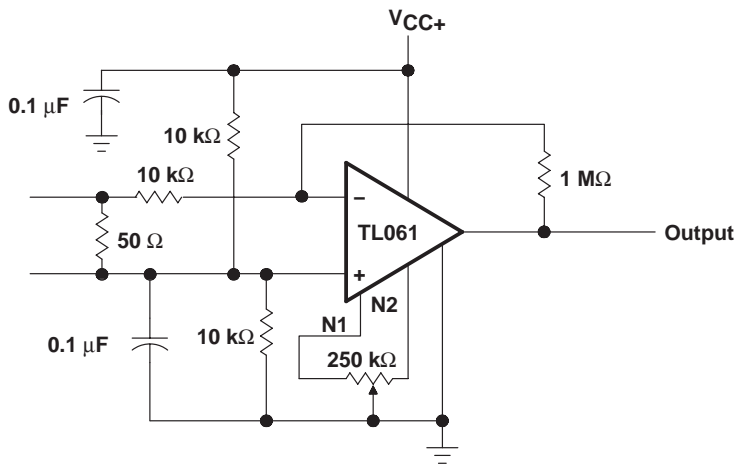


**Figure 22. Audio-Distribution Amplifier**

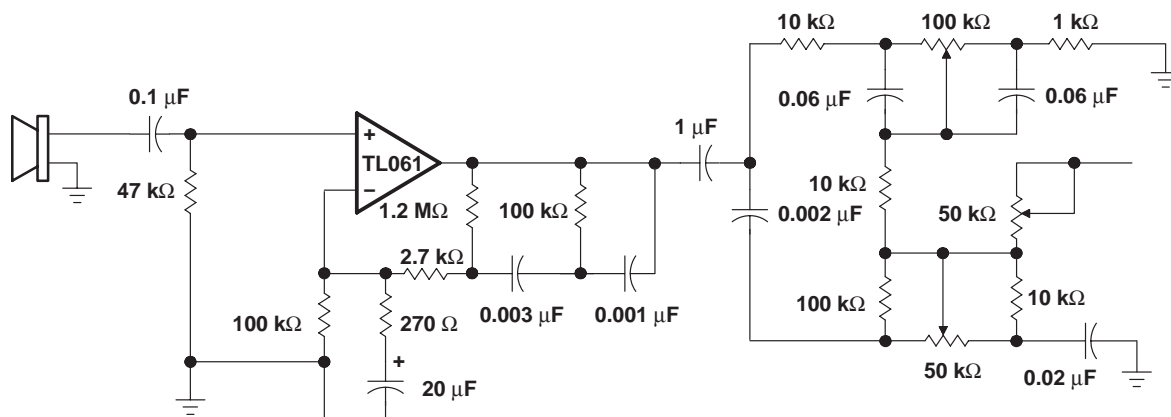


**Figure 23. Low-Level Light Detector Preamplifier**

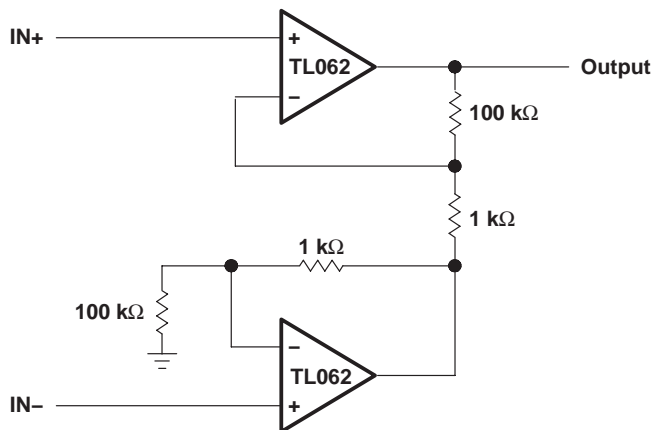
**APPLICATION INFORMATION**



**Figure 24. AC Amplifier**



**Figure 25. Microphone Preamp with Tone Control**



**Figure 26. Instrumentation Amplifier**

APPLICATION INFORMATION

IC PREAMPLIFIER RESPONSE CHARACTERISTICS

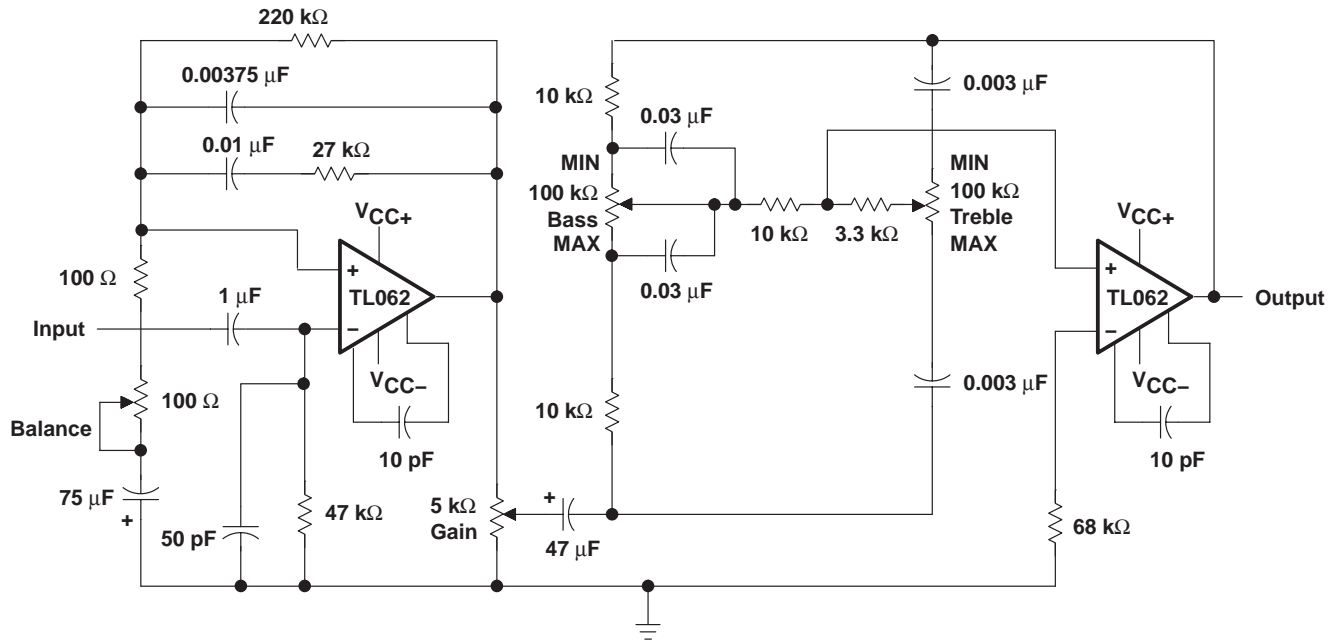
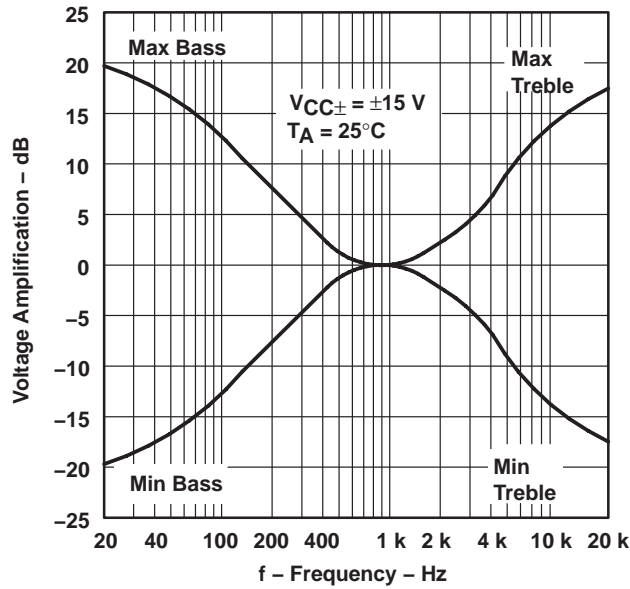


Figure 27. IC Preamplifier

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 81023012A        | OBSOLETE              | LCCC         | FK              | 20   |             | TBD                     | Call TI          | Call TI                      |
| 81023022A        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | Level-NC-NC-NC               |
| 8102302HA        | ACTIVE                | CFP          | U               | 10   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| 8102302PA        | ACTIVE                | CDIP         | JG              | 8    | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| 81023032A        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | Level-NC-NC-NC               |
| 8102303CA        | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| 8102303DA        | ACTIVE                | CFP          | W               | 14   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| TL061ACD         | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061ACDE4       | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061ACDR        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061ACDRE4      | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061ACP         | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL061ACPE4       | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL061ACPSR       | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061ACPSRE4     | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061BCD         | OBSOLETE              | SOIC         | D               | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL061BCP         | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL061CD          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061CDE4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061CDR         | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061CDRE4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061CP          | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL061CPSR        | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061CPSRE4      | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061CPWLE       | OBSOLETE              | TSSOP        | PW              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL061ID          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061IDE4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061IDR         | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL061IDRE4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
|                  |                       |              |                 |      |             | no Sb/Br)               |                  |                              |
| TL061IP          | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL061IPE4        | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL061MJG         | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL061MJGB        | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL062ACD         | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL062ACDE4       | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL062ACDR        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL062ACDRE4      | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL062ACJG        | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL062ACP         | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL062ACPE4       | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL062ACPSR       | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062ACPSRE4     | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062BCD         | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062BCDE4       | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062BCDR        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062BCDRE4      | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062BCP         | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL062BCPE4       | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL062CD          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062CDE4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062CDG4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062CDR         | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062CDRE4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062CDRG4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062CJG         | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL062CP          | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TL062CPE4        | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL062CPSLE       | OBSOLETE              | SO           | PS              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL062CPSR        | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062CPSRE4      | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL062CPW         | ACTIVE                | TSSOP        | PW              | 8    | 150         | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM           |
| TL062CPWE4       | ACTIVE                | TSSOP        | PW              | 8    | 150         | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM           |
| TL062CPWLE       | OBSOLETE              | TSSOP        | PW              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL062CPWR        | ACTIVE                | TSSOP        | PW              | 8    | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM           |
| TL062ID          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL062IDE4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL062IDG4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL062IDR         | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL062IDRE4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL062IDRG4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL062IJG         | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL062IP          | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL062IPE4        | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL062IPWR        | ACTIVE                | TSSOP        | PW              | 8    | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM           |
| TL062IPWRE4      | ACTIVE                | TSSOP        | PW              | 8    | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM           |
| TL062MFKB        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | Level-NC-NC-NC               |
| TL062MJG         | ACTIVE                | CDIP         | JG              | 8    | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| TL062MJGB        | ACTIVE                | CDIP         | JG              | 8    | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| TL064ACD         | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL064ACDE4       | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL064ACDR        | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL064ACDRE4      | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL064ACN         | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL064ACNE4       | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup>               |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|--|
| TL064BCD         | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR                         |
| TL064BCDE4       | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR                         |
| TL064BCDR        | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR                         |
| TL064BCDRE4      | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR                         |
| TL064BCN         | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |
| TL064BCNE4       | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |
| TL064CD          | ACTIVE                | SOIC         | D               | 14   | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| TL064CDBR        | ACTIVE                | SSOP         | DB              | 14   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| TL064CDBRE4      | ACTIVE                | SSOP         | DB              | 14   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| TL064CDE4        | ACTIVE                | SOIC         | D               | 14   | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| TL064CDR         | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM                         |
| TL064CDRE4       | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM                         |
| TL064CN          | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |
| TL064CNSR        | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM                         |
| TL064CNSRE4      | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM                         |
| TL064CPW         | ACTIVE                | TSSOP        | PW              | 14   | 90          | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM                         |
| TL064CPWE4       | ACTIVE                | TSSOP        | PW              | 14   | 90          | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM                         |
| TL064CPWLE       | OBSOLETE              | TSSOP        | PW              | 14   |             | TBD                     | Call TI          | Call TI                                    |
| TL064CPWR        | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM                         |
| TL064CPWRE4      | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM                         |
| TL064ID          | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR                         |
| TL064IDG4        | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR                         |
| TL064IDR         | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR                         |
| TL064IDRG4       | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR                         |
| TL064IN          | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |
| TL064INE4        | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TL064MFK         | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | Level-NC-NC-NC               |
| TL064MFKB        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | Level-NC-NC-NC               |
| TL064MJ          | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| TL064MJB         | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| TL064MWB         | ACTIVE                | CFP          | W               | 14   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. This package can be hermetically sealed with a ceramic lid using glass frit.  
 D. Index point is provided on cap for terminal identification.  
 E. Falls within MIL STD 1835 GDIP1-T8

J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 14                     | 16                     | 18                     | 20                     |
|---------------|------------------------|------------------------|------------------------|------------------------|
| A             | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX         | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN         | —                      | —                      | —                      | —                      |
| C MAX         | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN         | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |

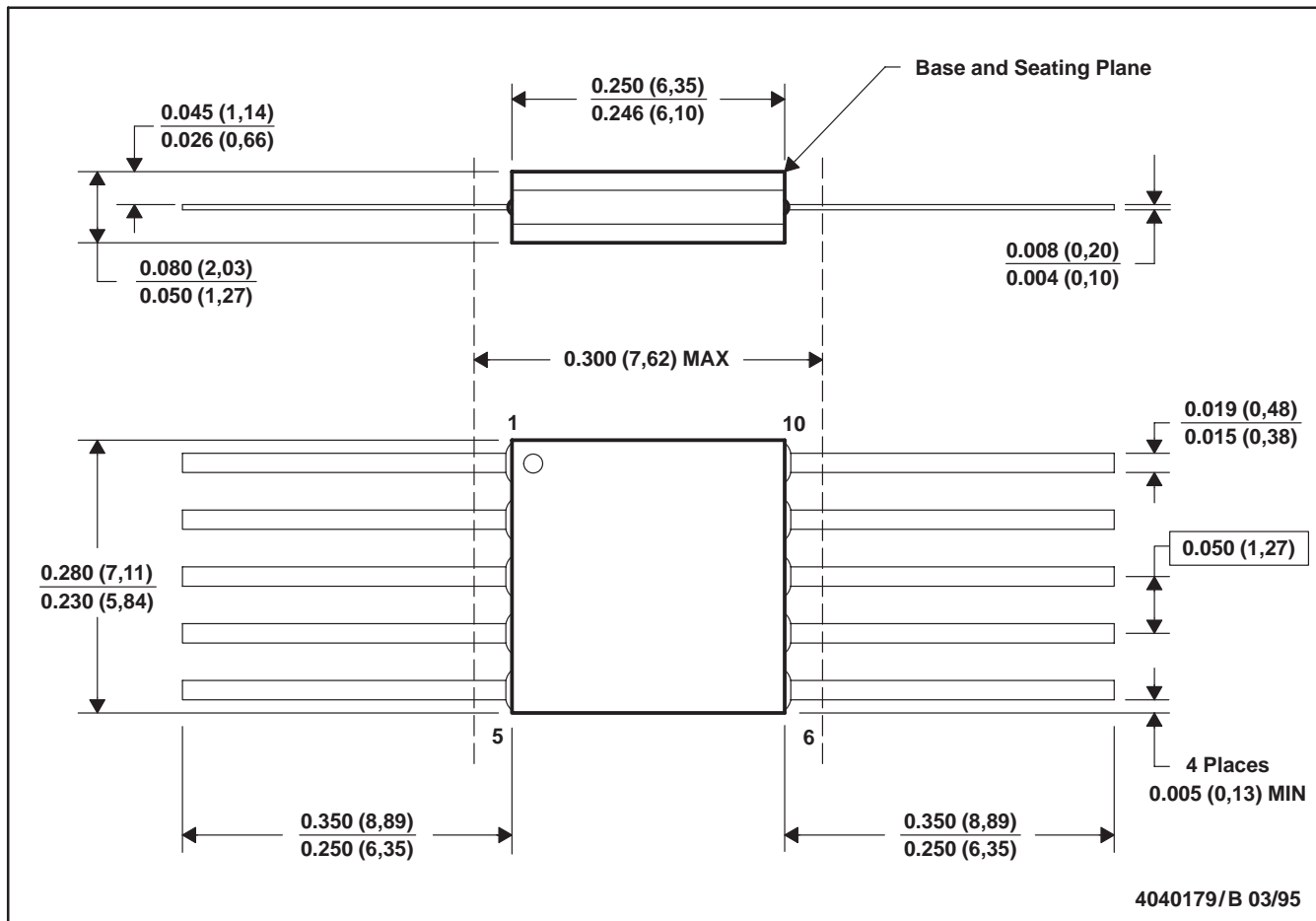


4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

U (S-GDFP-F10)

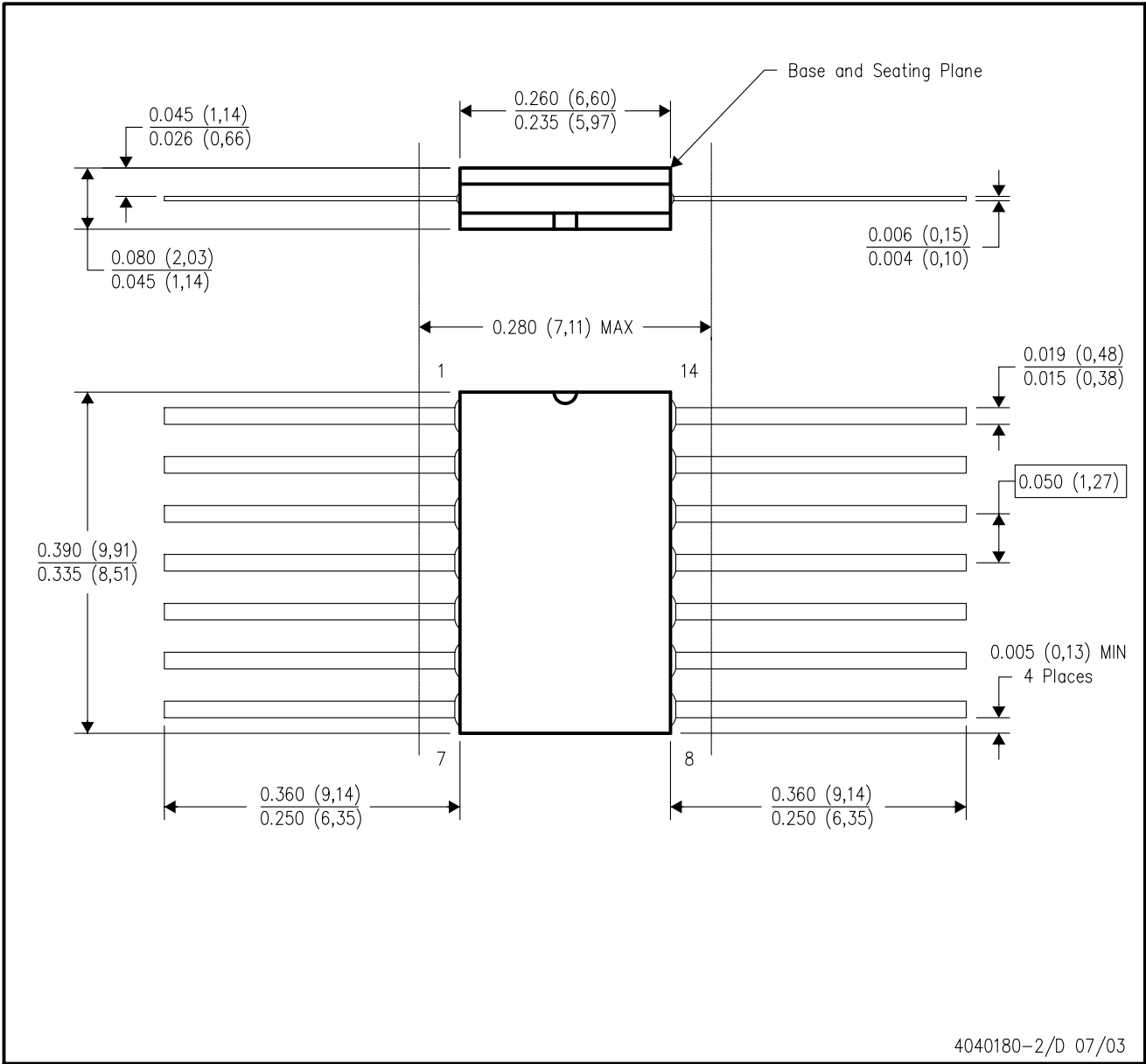
CERAMIC DUAL FLATPACK



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. This package can be hermetically sealed with a ceramic lid using glass frit.  
 D. Index point is provided on cap for terminal identification only.  
 E. Falls within MIL STD 1835 GDFP1-F10 and JEDEC MO-092AA

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



4040180-2/D 07/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within MIL STD 1835 GDFP1-F14 and JEDEC MO-092AB

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)



N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE

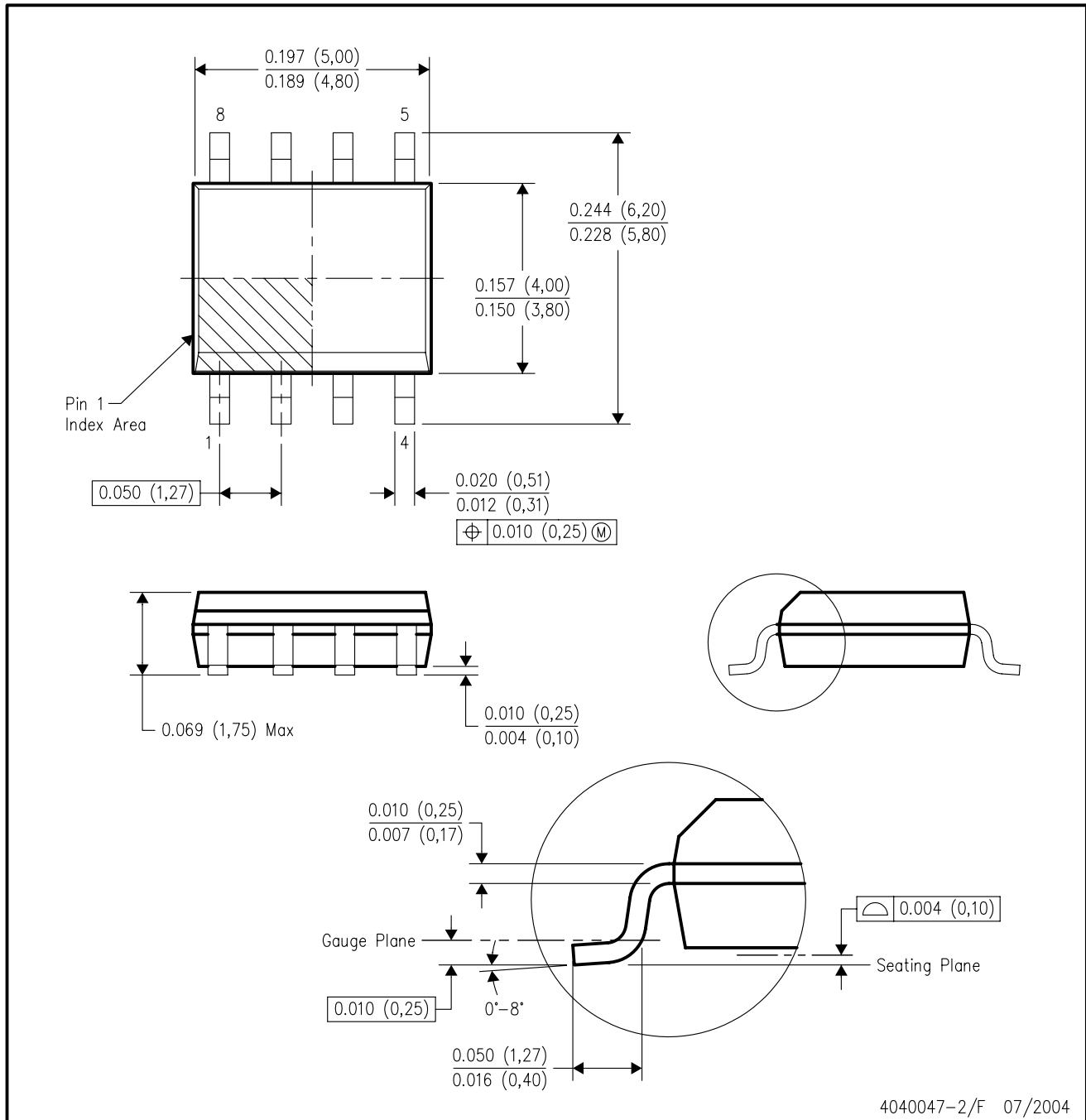


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-012 variation AB.



D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-012 variation AA.

## MECHANICAL DATA

PS (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DB (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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