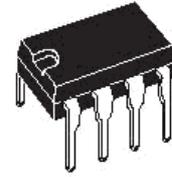


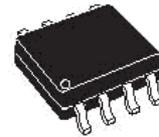
- VERY LOW POWER CONSUMPTION:200 $\mu$ A
- WIDE COMMON-MODE (UP TO  $V_{CC}^+$ ) AND DIFFERENTIAL VOLTAGE RANGES
- LOW INPUT BIAS AND OFFSET CURRENTS
- OUTPUT SHORT-CIRCUIT PROTECTION
- HIGH INPUT IMPEDANCE J-FET INPUT STAGE
- INTERNAL FREQUENCY COMPENSATION
- LATCH UP FREE OPERATION
- HIGH SLEW RATE:3.5V/ $\mu$ s

### DESCRIPTION

The TL062, TL062A and TL062B are high speed J-FET input dual operational amplifier family. Each of these J-FET input operational amplifiers incorporates well matched, high voltage J-FET and bipolar transistors in a monolithic integrated circuit. The devices feature high slew rates, low input bias and offset currents, and low offset voltage temperature coefficient.



N  
DIP8  
(Plastic Package)



D  
SO8  
(Plastic Micropackage)

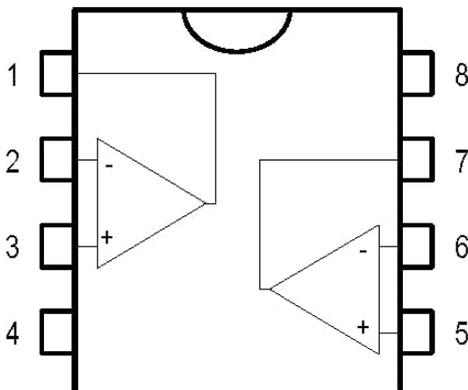
### ORDER CODE

| Part Number      | Temperature Range | Package |   |
|------------------|-------------------|---------|---|
|                  |                   | N       | D |
| TL062M/AM/BM     | -55 , +125        | •       | • |
| TL062I/AI/BI     | -40 , +105        | •       | • |
| TL062C/AC/BC     | 0 , +70           | •       | • |
| Example: TL062IN |                   |         |   |

N=Dual in Line Package (DIP)

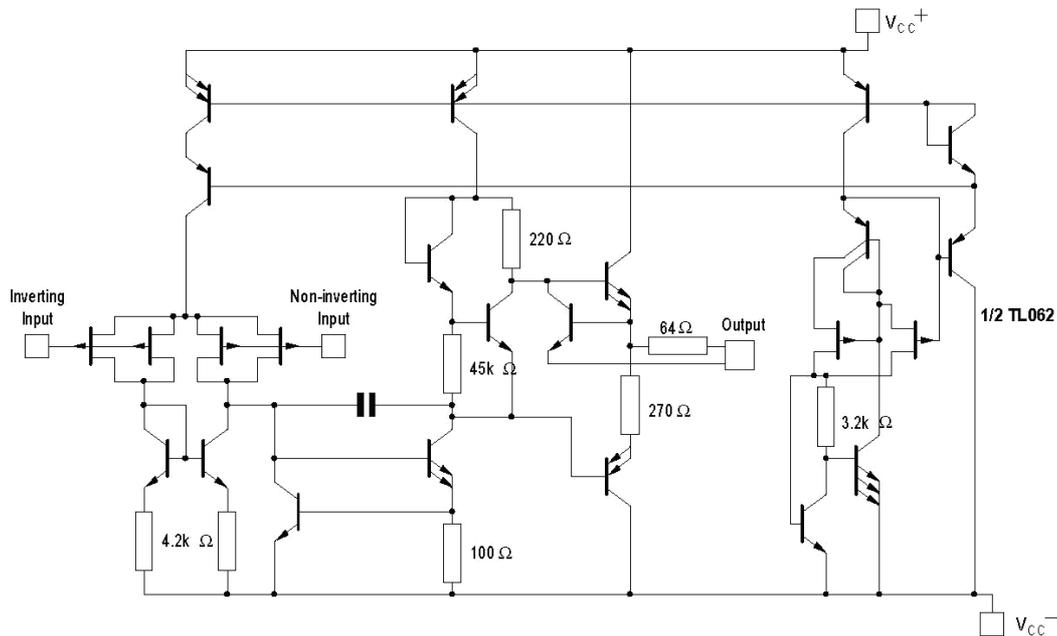
D=Small Outline Package (SO)-also available in Tape & Reel (DT)

### PIN CONNECTIONS (top view)



- 1 - Output 1
- 2 - Inverting input 1
- 3 - Non-inverting input 1
- 4 -  $V_{CC}^-$
- 5 - Non-inverting input 2
- 6 - Inverting input 2
- 7 - Output 2
- 8 -  $V_{CC}^+$

### SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter  | TL062M,AM,BM | TL062I,AI,BI | TL062C,AC,BC | Unit |
|--------|--|--------------|--------------|--------------|------|
| Vcc    | Supply voltage-note <sup>1)</sup>                  | ±18          |              |              | V    |
| Vi     | Input voltage – note <sup>2)</sup>                 | ±15          |              |              | V    |
| Vid    | Differential Input Voltage –note <sup>3)</sup>     | ±30          |              |              | V    |
| Ptot   | Power Dissipation                                  | ±680         |              |              | mW   |
|        | Output Short-circuit Duration – note <sup>4)</sup> | Infinite     |              |              |      |
| Toper  | Operating Free-air Temperature Range               | -55 to +125  | -40 to +105  | 0 to +70     |      |
| Tstg   | Storage Temperature Range                          | -65 to +150  |              |              |      |

1. All voltage values, except differential voltage, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between Vcc<sup>+</sup> and Vcc<sup>-</sup>.
2. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
3. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
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.

### ELECTRICAL CHARACTERISTICS

$V_{cc}=\pm 15V$ ,  $T_{amb}=+25$  (unless otherwise specified)

| Symbol          | Parameter   | TL062M     |            |           | TL0621I    |            |           | TL062C   |            |           | Unit                   |
|-----------------|---|------------|------------|-----------|------------|------------|-----------|----------|------------|-----------|------------------------|
|                 |   | Min.       | Typ.       | Max.      | Min.       | Typ.       | Max.      | Min.     | Typ.       | Max.      |                        |
| $V_{io}$        | Input Offset Voltage ( $R_s=50\Omega$ )<br>$T_{amb}=25$<br>$T_{min} \leq T_{amb} \leq T_{max}$                      |            | 3          | 6<br>15   |            | 3          | 6<br>9    |          | 3          | 15<br>20  | mV                     |
| $DV_{io}$       | Temperature Coefficient of Input Offset Voltage ( $R_s=50\Omega$ )  |            | 10         |           |            | 10         |           |          | 10         |           | $\mu V/$               |
| $i_{io}$        | Input Offset Current – note 1)<br>$T_{amb}=25$<br>$T_{min} \leq T_{amb} \leq T_{max}$                               |            | 5          | 100<br>20 |            | 5          | 100<br>10 |          | 5          | 200<br>5  | pA<br>nA               |
| $i_{ib}$        | Input Bias Current – note 1<br>$T_{amb}=25$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                  |            | 30         | 200<br>50 |            | 30         | 200<br>20 |          | 30         | 400<br>10 | pA<br>nA               |
| $V_{icm}$       | Input Common Mode Voltage Range   | $\pm 11.5$ | +15<br>-12 |           | $\pm 11.5$ | +15<br>-12 |           | $\pm 11$ | +15<br>-12 |           | V                      |
| $V_{opp}$       | Output Voltage Swing ( $R_L=10k\Omega$ )<br>$T_{amb}=25$<br>$T_{min} \leq T_{amb} \leq T_{max}$                     | 20<br>20   | 27         |           | 20<br>20   | 27         |           | 20<br>20 | 27         |           | V                      |
| $A_{vd}$        | Large Signal Voltage Gain<br>$R_L=10k\Omega$ , $V_o=\pm 10V$<br>$T_{amb}=25$<br>$T_{min} \leq T_{amb} \leq T_{max}$ | 4<br>4     | 6          |           | 4<br>4     | 6          |           | 3<br>3   | 6          |           | V/mV                   |
| GBP             | Gain Bandwidth Product<br>$T_{amb}=25$ , $R_L=10k\Omega$<br>$C_L=100pF$   |            | 1          |           |            | 1          |           |          | 1          |           | MHz                    |
| $R_i$           | Input Resistance  |            | $10^{12}$  |           |            | $10^{12}$  |           |          | $10^{12}$  |           | $\Omega$               |
| CMR             | Common Mode Rejection Ratio<br>$R_s=50\Omega$   | 80         | 86         |           | 80         | 86         |           | 70       | 76         |           | dB                     |
| SVR             | Supply Voltage Rejection Ratio<br>$R_s=50\Omega$  | 80         | 95         |           | 80         | 95         |           | 70       | 95         |           | dB                     |
| $I_{CC}$        | Supply Current, Per Amplifier<br>$T_{amb}=25$ , no load, no signal  |            | 200        | 250       |            | 200        | 250       |          | 200        | 250       | $\mu A$                |
| $V_{o1}/V_{o2}$ | Channel Separation<br>$A_v=100$ , $T_{amb}=25$  |            | 120        |           |            | 120        |           |          | 120        |           | dB                     |
| $P_D$           | Total Power Consumption<br>$T_{amb}=25$ , no load, no signal  |            | 6          | 7.5       |            | 6          | 7.5       |          | 6          | 7.5       | mW                     |
| SR              | Slew Rate<br>$V_i=10V$ , $R_L=10k\Omega$<br>$C_L=10pF$ , $A_v=1$  | 1.5        | 3.5        |           | 1.5        | 3.5        |           | 1.5      | 3.5        |           | V/ $\mu S$             |
| $t_r$           | Rise Time<br>$V_i=20mV$ , $R_L=10k\Omega$<br>$C_L=100pF$ , $A_v=1$  |            | 0.2        |           |            | 0.2        |           |          | 0.2        |           | $\mu S$                |
| $K_{ov}$        | Overshoot Factor (see figure 1)<br>$V_i=20mV$ , $R_L=10k\Omega$<br>$C_L=100pF$ , $A_v=1$ (see figure 1)             |            | 10         |           |            | 10         |           |          | 10         |           | %                      |
| $e_n$           | Equivalent Input Noise Voltage<br>$R_s=100\Omega$ , $f=1KHz$  |            | 42         |           |            | 42         |           |          | 42         |           | $\frac{nV}{\sqrt{Hz}}$ |

1. The input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive.

Pulse techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

### ELECTRICAL CHARACTERISTICS

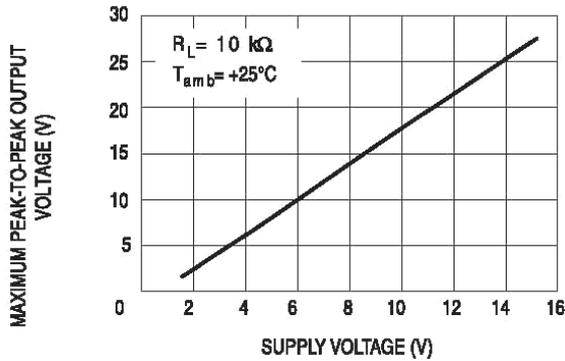
V<sub>cc</sub>=±15V, T<sub>amb</sub>=+25 (unless otherwise specified)

| Symbol                           | Parameter   | TL062AC,AI,AM |                  |          | TL062BC,BI,BM |                  |          | Unit                   |
|----------------------------------|---|---------------|------------------|----------|---------------|------------------|----------|------------------------|
|                                  |   | Min.          | Typ.             | Max.     | Min.          | Typ.             | Max.     |                        |
| V <sub>io</sub>                  | Input Offset Voltage (R <sub>s</sub> =50Ω)<br>T <sub>amb</sub> =25<br>T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub>                              |               | 3                | 6<br>7.5 |               | 2                | 3<br>5   | mV                     |
| DV <sub>io</sub>                 | Temperature Coefficient of Input Offset Voltage (R <sub>s</sub> =50Ω)   |               | 10               |          |               | 10               |          | μV/                    |
| I <sub>io</sub>                  | Input Offset Current – note 1)<br>T <sub>amb</sub> =25<br>T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub>  |               | 5                | 100<br>3 |               | 5                | 100<br>3 | pA<br>nA               |
| I <sub>ib</sub>                  | Input Bias Current – note 1<br>T <sub>amb</sub> =25<br>T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub>   |               | 30               | 200<br>7 |               | 30               | 200<br>7 | nA                     |
| V <sub>icm</sub>                 | Input Common Mode Voltage Range   | ±11.5         | +15<br>-12       |          | ±11.5         | +15<br>-12       |          | V                      |
| V <sub>opp</sub>                 | Output Voltage Swing (R <sub>L</sub> =10kΩ)<br>T <sub>amb</sub> =25<br>T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub>                             | 20<br>20      | 27               |          | 20<br>20      | 27               |          | V                      |
| A <sub>vd</sub>                  | Large Signal Voltage Gain<br>R <sub>L</sub> =10kΩ, V <sub>o</sub> =±10V<br>T <sub>amb</sub> =25<br>T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub> | 4<br>4        | 6                |          | 4<br>4        | 6                |          | V/mV                   |
| GBP                              | Gain Bandwidth Product<br>T <sub>amb</sub> =25, R <sub>L</sub> =10kΩ<br>C <sub>L</sub> =100pF   |               | 1                |          |               | 1                |          | MHz                    |
| R <sub>i</sub>                   | Input Resistance  |               | 10 <sup>12</sup> |          |               | 10 <sup>12</sup> |          | Ω                      |
| CMR                              | Common Mode Rejection Ratio<br>R <sub>s</sub> =50Ω  | 80            | 86               |          | 80            | 86               |          | dB                     |
| SVR                              | Supply Voltage Rejection Ratio<br>R <sub>s</sub> =50Ω   | 80            | 95               |          | 80            | 95               |          | dB                     |
| I <sub>cc</sub>                  | Supply Current, Per Amplifier<br>T <sub>amb</sub> =25, no load, no signal   |               | 200              | 250      |               | 200              | 250      | μA                     |
| V <sub>o1</sub> /V <sub>o2</sub> | Channel Separation<br>A <sub>v</sub> =100, T <sub>amb</sub> =25   |               | 120              |          |               | 120              |          |                        |
| P <sub>D</sub>                   | Total Power Consumption<br>T <sub>amb</sub> =25, no load, no signal   |               | 6                | 7.5      |               | 6                | 7.5      | mW                     |
| SR                               | Slew Rate<br>V <sub>i</sub> =10V, R <sub>L</sub> =10kΩ<br>C <sub>L</sub> =10pF, A <sub>v</sub> =1   | 1.5           | 3.5              |          | 1.5           | 3.5              |          | V/μS                   |
| t <sub>r</sub>                   | Rise Time<br>V <sub>i</sub> =20mV, R <sub>L</sub> =10kΩ<br>C <sub>L</sub> =100pF, A <sub>v</sub> =1   |               | 0.2              |          |               | 0.2              |          | μS                     |
| K <sub>ov</sub>                  | Overshoot Factor (see figure 1)<br>V <sub>i</sub> =20mV, R <sub>L</sub> =10kΩ<br>C <sub>L</sub> =100pF, A <sub>v</sub> =1                                 |               | 10               |          |               | 10               |          | %                      |
| e <sub>n</sub>                   | Equivalent Input Noise Voltage<br>R <sub>s</sub> =100Ω, f =1KHz   |               | 42               |          |               | 42               |          | $\frac{nV}{\sqrt{Hz}}$ |

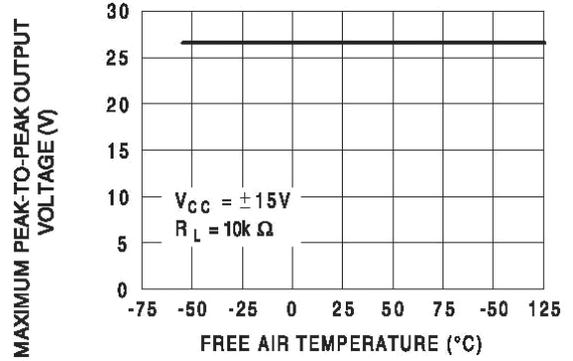
1. The input bias current of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive.

Pulse techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

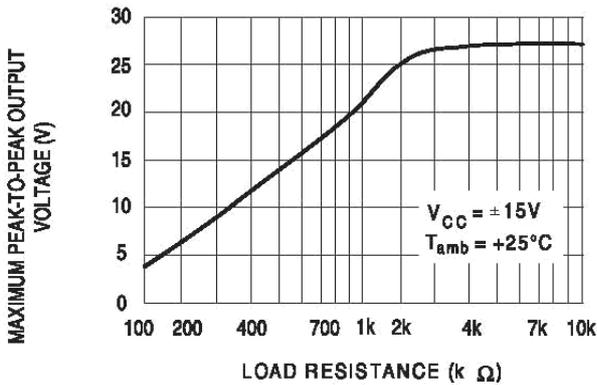
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus SUPPLY VOLTAGE**



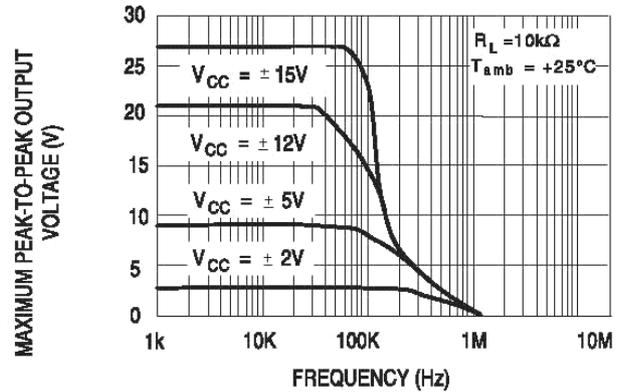
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus FREE AIR TEMP.**



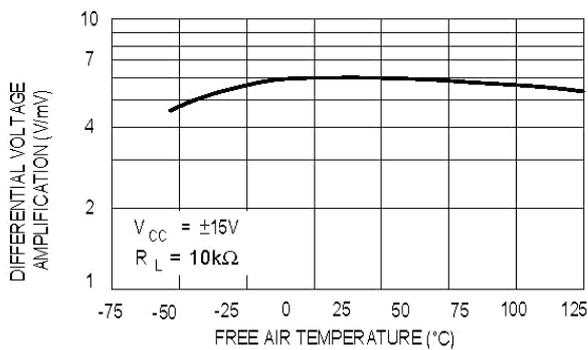
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus LOAD FREQUENCY**



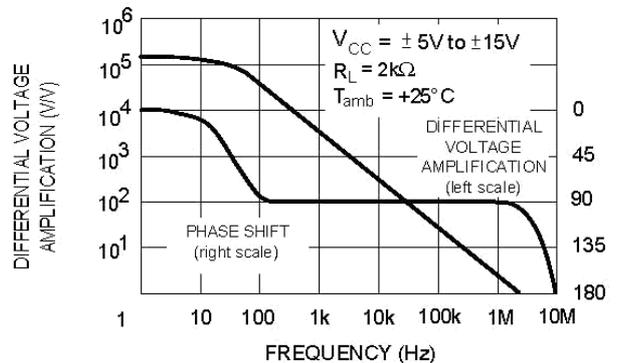
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE versus FREQUENCY**



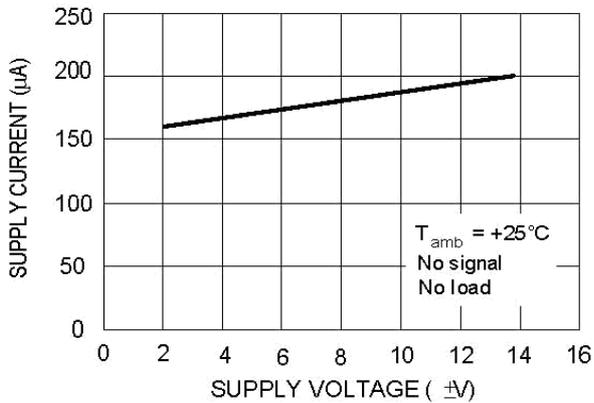
**DIFFERENTIAL VOLTAGE AMPLIFICATION Versus FREE AIR TEMPERATION**



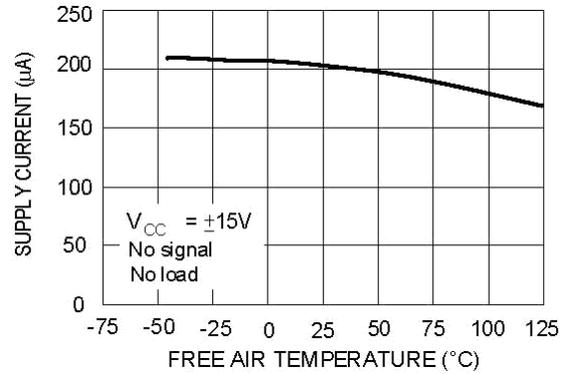
**LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT versus FREQUENCY**



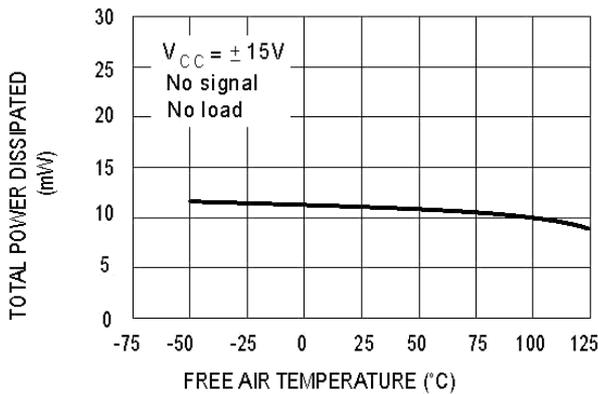
**SUPPLY CURRENT PER AMPLIFIER versus SUPPLY VOLTAGE**



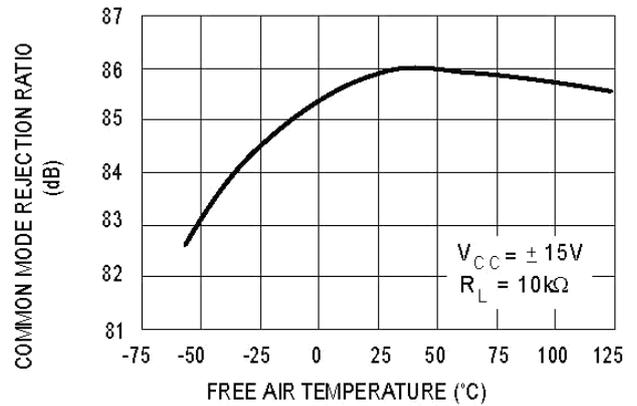
**SUPPLY CURRENT PER AMPLIFIER versus FREE AIR TEMPERATURE**



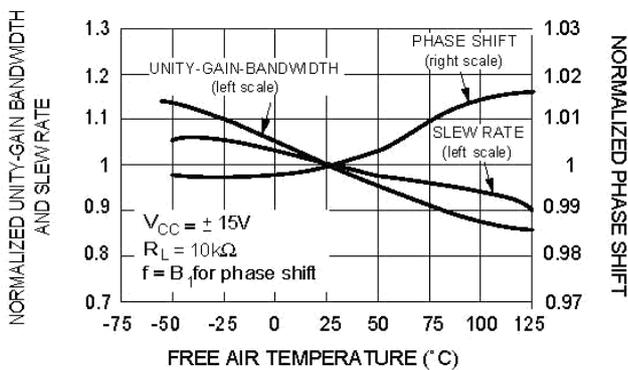
**TOTAL POWER DISSIPATED versus FREE AIR TEMPERATURE**



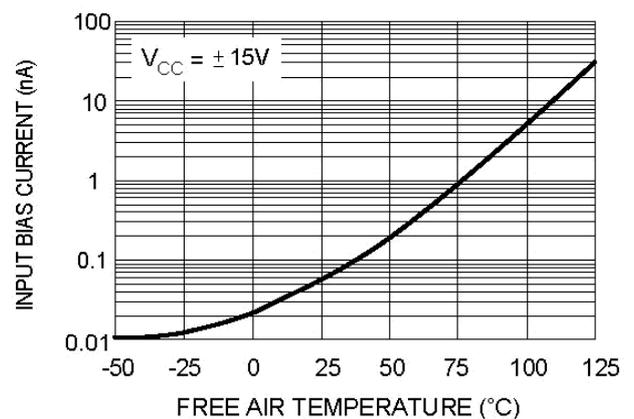
**COMMON MODE REJECTION RATIO versus FREE AIR TEMPERATURE**



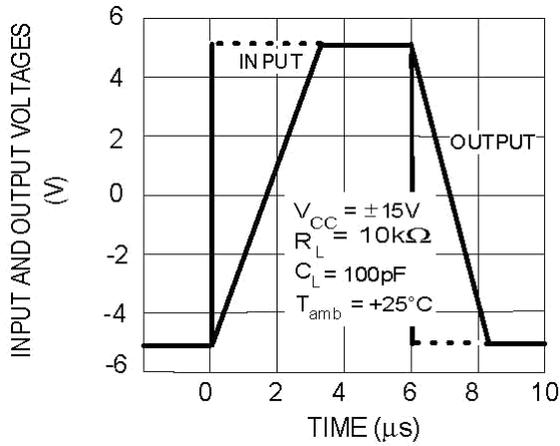
**NORMALIZED UNITY GAIN BANDWIDTH, SLEW RATE, AND PHASE SHIFT versus TEMPERATURE**



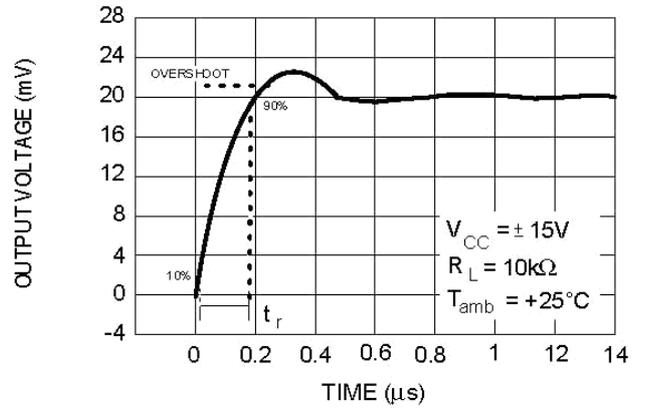
**INPUT BIAS CURRENT versus FREE AIR TEMPERATURE**



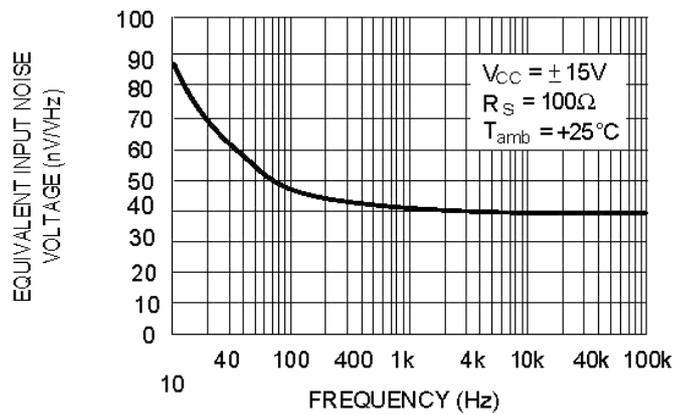
**VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE**



**OUTPUT VOLTAGE versus ELAPSED TIME**

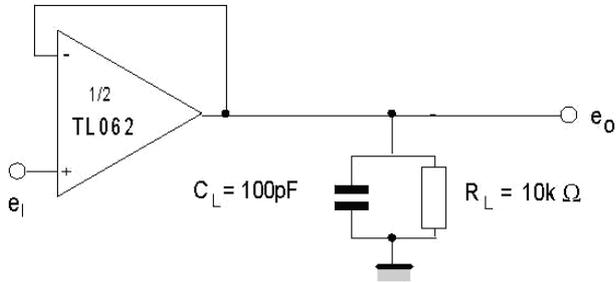


**EQUIVALENT INPUT NOISE VOLTAGE versus FREQUENCY**

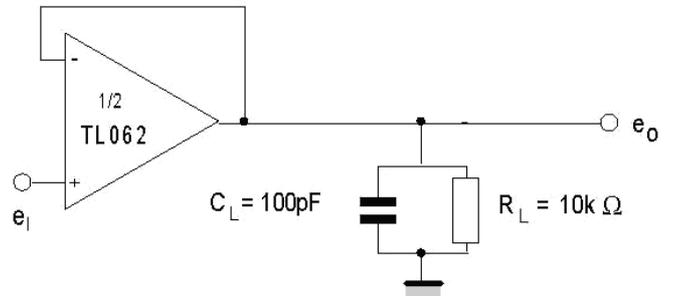


**PARAMETER MEASUREMENT INFORMATION**

**Figure 1: Voltage Follower**

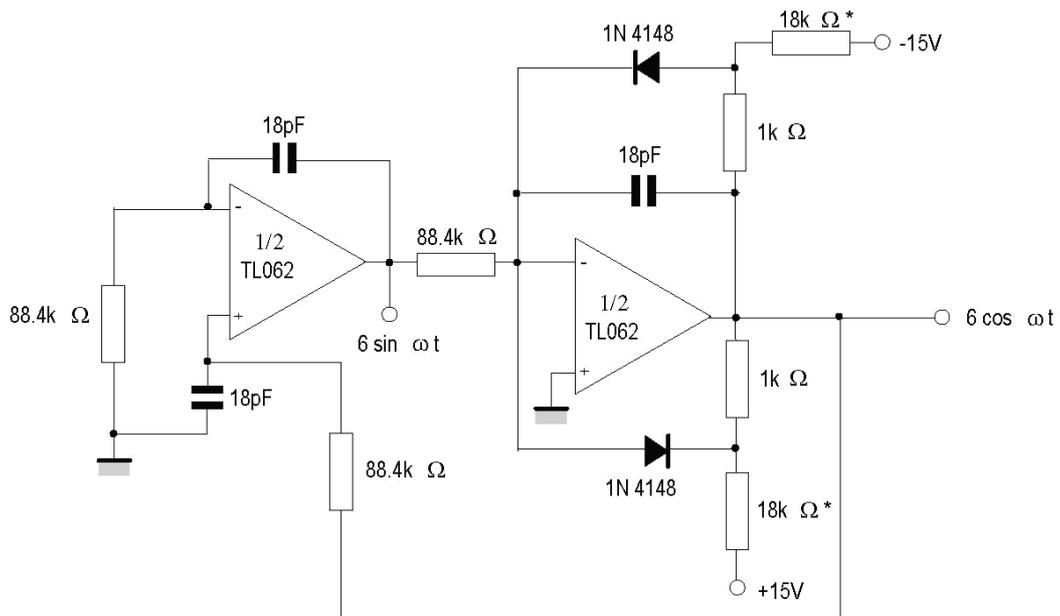


**Figure 2: Gain-of-10 Inverting Amplifier**



**TYPICAL APPLICATIONS**

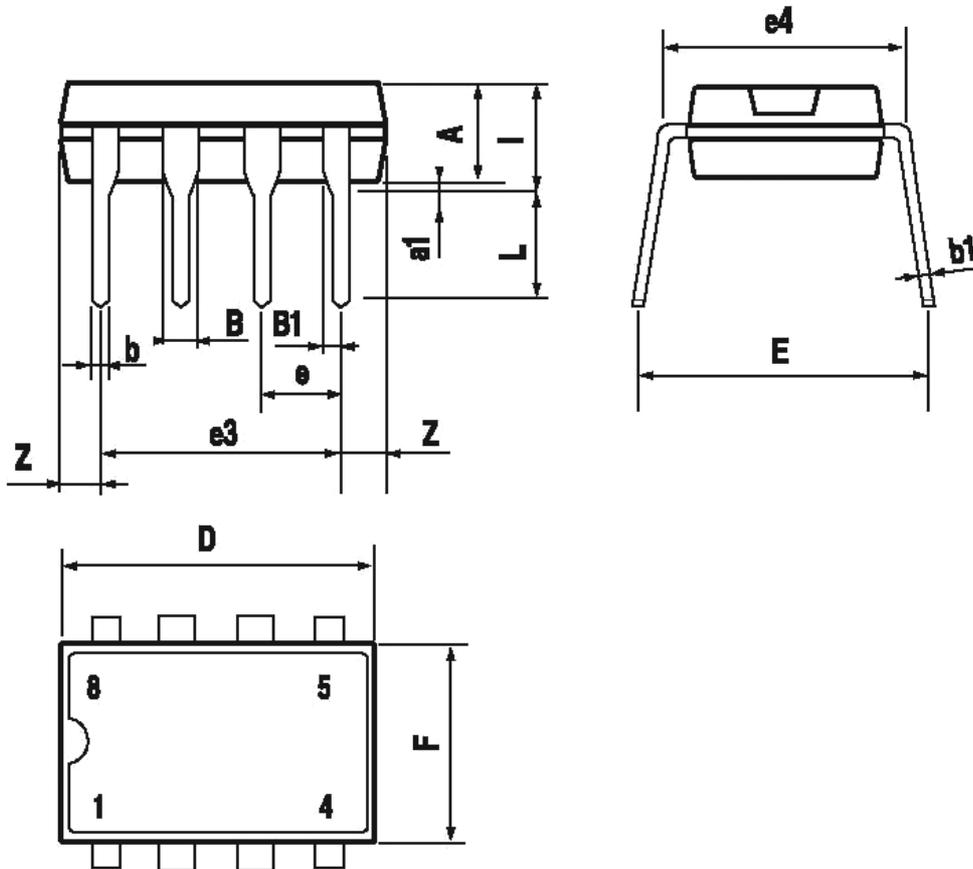
**100KHz QUADRATURE OSCILLATOR**



\*These resistor values may be adjusted for a symmetrical output.

**PACKAGE MECHANICAL DATA**

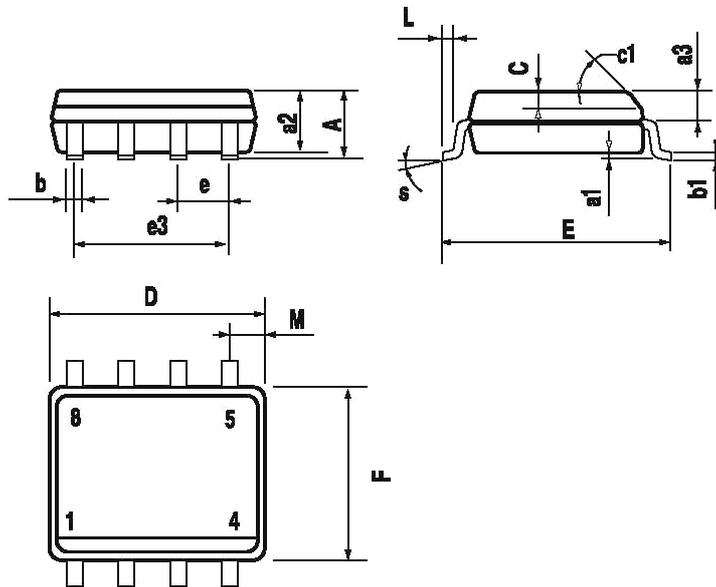
8 PINS –PLASTIC DIP



| Dim. | Millimeters |      |       | Inches |       |       |
|------|-------------|------|-------|--------|-------|-------|
|      | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A    |             | 3.32 |       |        | 0.131 |       |
| a1   | 0.51        |      |       | 0.020  |       |       |
| B    | 1.15        |      | 1.65  | 0.045  |       | 0.065 |
| b    | 0.356       |      | 0.55  | 0.014  |       | 0.022 |
| b1   | 0.204       |      | 0.304 | 0.008  |       | 0.012 |
| D    |             |      | 10.92 |        |       | 0.430 |
| E    | 7.95        |      | 9.75  | 0.313  |       | 0.384 |
| e    |             | 2.54 |       |        | 0.100 |       |
| e3   |             | 7.62 |       |        | 0.300 |       |
| e4   |             | 7.62 |       |        | 0.300 |       |
| F    |             |      | 6.6   |        |       | 0.260 |
| i    |             |      | 5.08  |        |       | 0.200 |
| L    | 3.18        |      | 3.81  | 0.125  |       | 0.150 |
| Z    |             |      | 1.52  |        |       | 0.060 |

**PACKAGE MECHANICAL DATA**

8 PINS – PLASTIC MICROPACKAGE (SO)



| Dim. | Millimeters |      |      | Inches |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    |             |      | 1.75 |        |       | 0.069 |
| a1   | 0.1         |      | 0.25 | 0.004  |       | 0.010 |
| a2   |             |      | 1.65 |        |       | 0.065 |
| a3   | 0.65        |      | 0.85 | 0.026  |       | 0.033 |
| b    | 0.35        |      | 0.48 | 0.014  |       | 0.019 |
| b1   | 0.19        |      | 0.25 | 0.007  |       | 0.010 |
| C    | 0.25        |      | 0.5  | 0.010  |       | 0.020 |
| c1   | 45 (typ.)   |      |      |        |       |       |
| D    | 4.8         |      | 5.0  | 0.189  |       | 0.197 |
| E    | 5.8         |      | 6.2  | 0.228  |       | 0.244 |
| e    |             | 1.27 |      |        | 0.050 |       |
| e3   |             | 3.81 |      |        | 0.150 |       |
| F    | 3.8         |      | 4.0  | 0.150  |       | 0.157 |
| L    | 0.4         |      | 1.27 | 0.016  |       | 0.050 |
| M    |             |      | 0.6  |        |       | 0.024 |
| S    | 8°(max.)    |      |      |        |       |       |