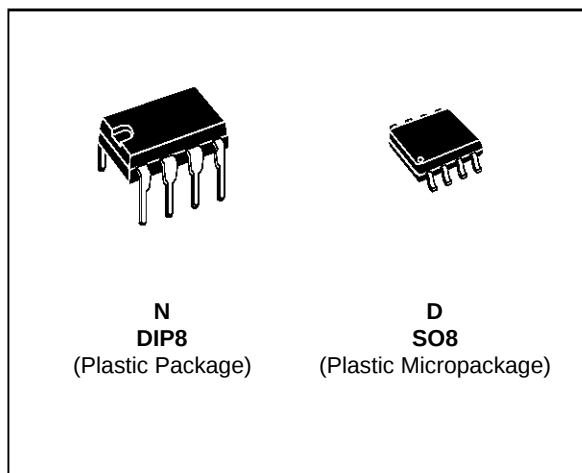


### LOW POWER J-FET DUAL OPERATIONAL AMPLIFIERS

- 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



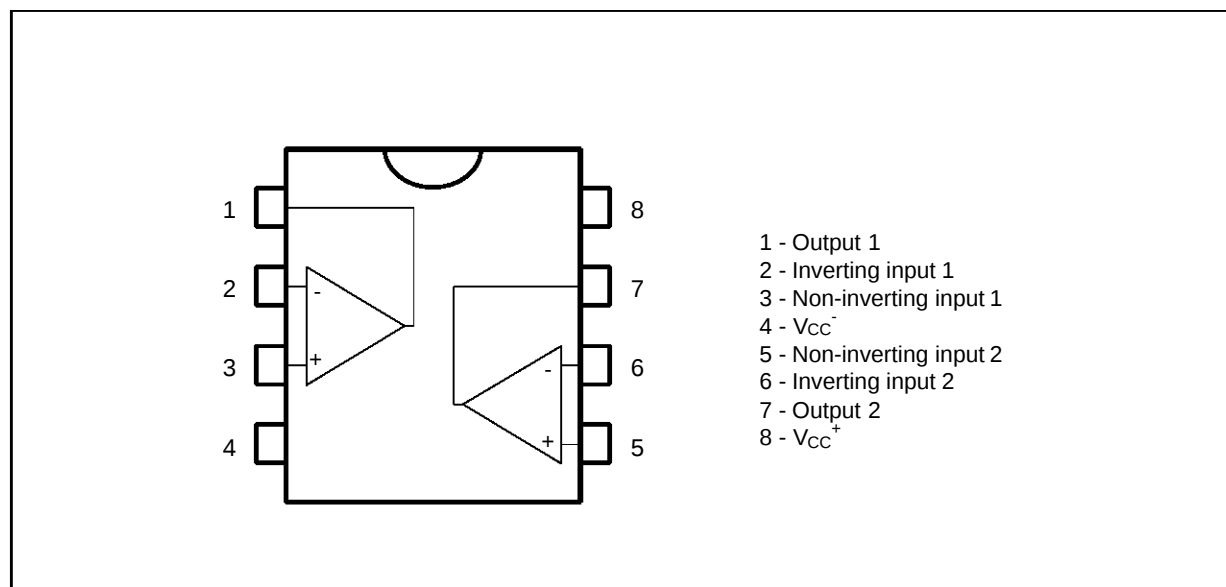
#### DESCRIPTION

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.

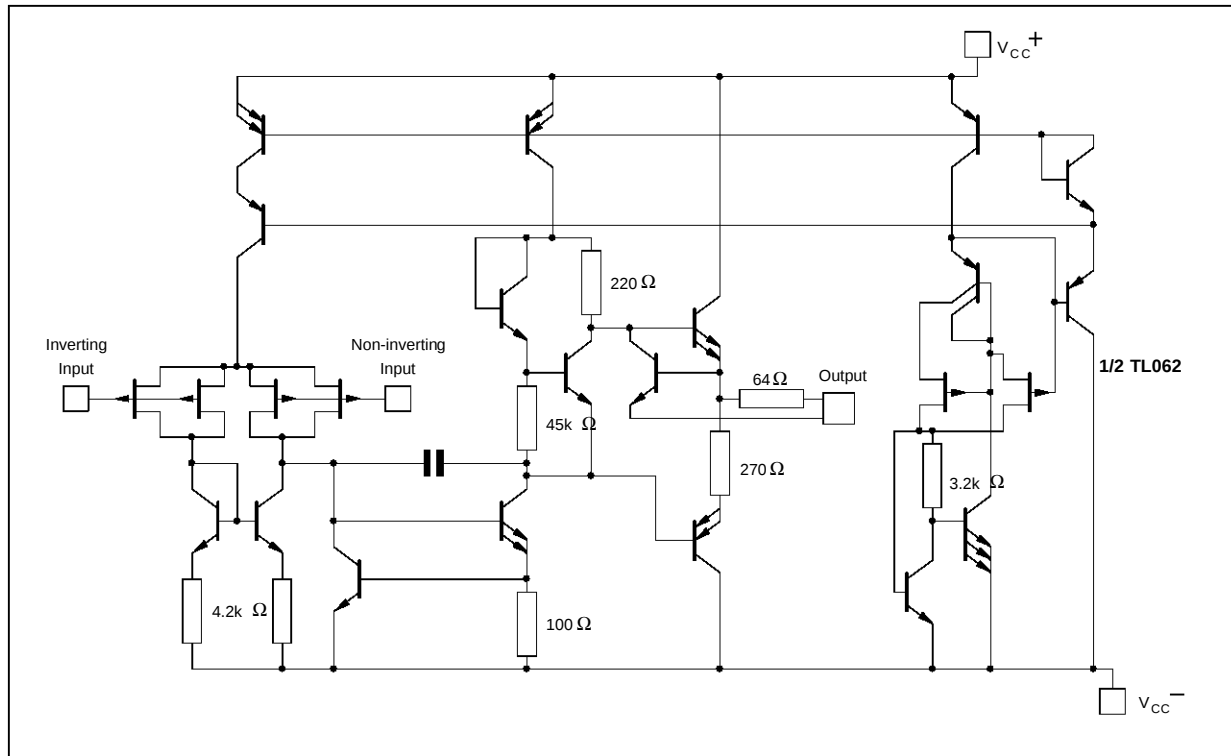
#### ORDER CODES

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

#### PIN CONNECTIONS (top view)



## SCHEMATIC DIAGRAM



## MAXIMUM RATINGS

| Symbol     | Parameter                              | TL062M,AM,BM  | TL062I,AI,BI  | TL062C,AC,BC  | Unit               |
|------------|----------------------------------------|---------------|---------------|---------------|--------------------|
| $V_{CC}$   | Supply Voltage - (note 1)              | $\pm 18$      | $\pm 18$      | $\pm 18$      | V                  |
| $V_i$      | Input Voltage - (note 3)               | $\pm 15$      | $\pm 15$      | $\pm 15$      | V                  |
| $V_{id}$   | Differential Input Voltage - (note 2)  | $\pm 30$      | $\pm 30$      | $\pm 30$      | V                  |
| $P_{tot}$  | Power Dissipation                      | 680           | 680           | 680           | mW                 |
|            | Output Short-Circuit Duration (Note 4) | Infinite      | Infinite      | Infinite      |                    |
| $T_{oper}$ | Operating Free-Air Temperature Range   | -55 to +125   | -40 to +105   | 0 to +70      | $^{\circ}\text{C}$ |
| $T_{stg}$  | Storage Temperature Range              | - 65 to + 150 | - 65 to + 150 | - 65 to + 150 | $^{\circ}\text{C}$ |

**Notes :**

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  $V_{CC}^{+}$  and  $V_{CC}^{-}$ .
2. Differential voltages are at the non-inverting input terminal with respect to the inverting input terminal.
3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
4. The output may be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

## ELECTRICAL CHARACTERISTICS

$V_{CC} = \pm 15V$ ,  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

| Symbol          | Parameter                                                                                                                                | TL062M     |            |           | TL062I     |            |           | TL062C   |            |           | Unit              |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|-----------|------------|------------|-----------|----------|------------|-----------|-------------------|
|                 |                                                                                                                                          | Min.       | Typ.       | Max.      | Min.       | Typ.       | Max.      | Min.     | Typ.       | Max.      |                   |
| $V_{io}$        | Input Offset Voltage ( $R_s = 50\Omega$ )<br>$T_{amb} = 25^{\circ}C$<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         |           | $\mu V/^{\circ}C$ |
| $I_{io}$        | Input Offset Current *<br>$T_{amb} = 25^{\circ}C$<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 *<br>$T_{amb} = 25^{\circ}C$<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>$T_{amb} = 25^{\circ}C$<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>$T_{amb} = 25^{\circ}C$<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>( $T_{amb} = 25^{\circ}C$ , $R_L = 10k\Omega$<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>( $T_{amb} = 25^{\circ}C$ , no load, no signal)                                                        |            | 200        | 250       |            | 200        | 250       |          | 200        | 250       | $\mu A$           |
| $V_{O1}/V_{O2}$ | Channel Separation<br>( $A_v = 100$ , $T_{amb} = 25^{\circ}C$ )                                                                          |            | 120        |           |            | 120        |           |          | 120        |           | dB                |
| $P_D$           | Total Power Consumption<br>(Each Amplifier)<br>( $T_{amb} = 25^{\circ}C$ , no load, no signal)                                           |            | 6          | 7.5       |            | 6          | 7.5       |          | 6          | 7.5       | mW                |

\* 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 (continued)

$V_{CC} = \pm 15V$ ,  $T_{amb} = 25^{\circ}C$

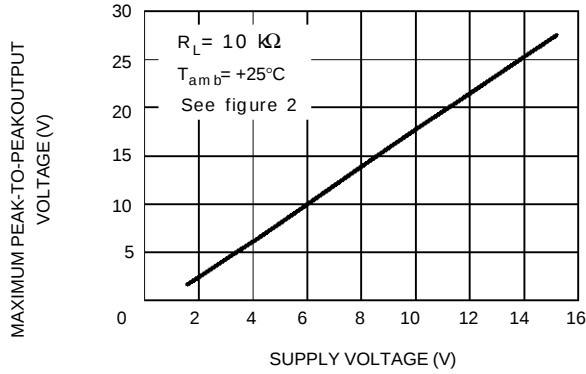
| Symbol   | Parameter                                                                                           | TL062C,I,M |      |      | Unit                   |
|----------|-----------------------------------------------------------------------------------------------------|------------|------|------|------------------------|
|          |                                                                                                     | Min.       | Typ. | Max. |                        |
| SR       | Slew Rate ( $V_i = 10V$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , $A_v = 1$ )                           | 1.5        | 3.5  |      | V/ $\mu s$             |
| $t_r$    | Rise Time ( $V_i = 20mV$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , $A_v = 1$ )                          |            | 0.2  |      | $\mu s$                |
| $K_{OV}$ | Overshoot Factor ( $V_i = 20mV$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , $A_v = 1$ )<br>(see figure 1) |            | 10   |      | %                      |
| $e_n$    | Equivalent Input Noise Voltage<br>( $R_s = 100\Omega$ , $f = 1KHz$ )                                |            | 42   |      | $\frac{nV}{\sqrt{Hz}}$ |

**ELECTRICAL CHARACTERISTICS (continued)**
 $V_{CC} = \pm 15V$ ,  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

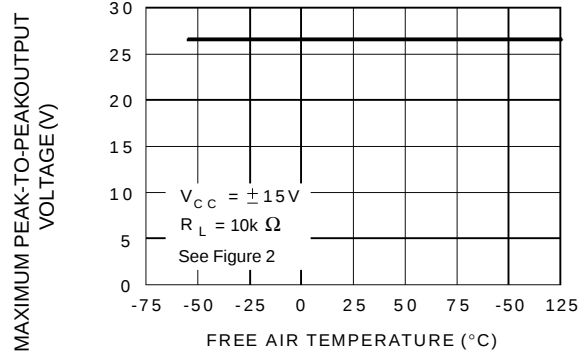
| Symbol          | Parameter                                                                                                                             | TL062AC,AI, AM |            |          | TL062BC,BI,BM |            |          | Unit                   |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------|------------|----------|---------------|------------|----------|------------------------|
|                 |                                                                                                                                       | Min.           | Typ.       | Max.     | Min.          | Typ.       | Max.     |                        |
| $V_{io}$        | Input Offset Voltage ( $R_s = 50\Omega$ )<br>$T_{amb} = 25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                         |                | 3          | 6<br>7.5 |               | 2          | 3<br>5   | mV                     |
| $DV_{io}$       | Temperature Coefficient of Input Offset Voltage ( $R_s = 50\Omega$ )                                                                  |                | 10         |          |               | 10         |          | $\mu V/^{\circ}C$      |
| $I_{io}$        | Input Offset Current *<br>$T_{amb} = 25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                            |                | 5          | 100<br>3 |               | 5          | 100<br>3 | pA<br>nA               |
| $I_{ib}$        | Input Bias Current *<br>$T_{amb} = 25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                              |                | 30         | 200<br>7 |               | 30         | 200<br>7 | pA<br>nA               |
| $V_{icm}$       | Input Common Mode Voltage Range                                                                                                       | $\pm 11.5$     | +15<br>-12 |          | $\pm 11.5$    | +15<br>-12 |          | V                      |
| $V_{OPP}$       | Output Voltage Swing ( $R_L = 10k\Omega$ )<br>$T_{amb} = 25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                        | 20<br>20       | 27         |          | 20<br>20      | 27         |          | V                      |
| $A_{vd}$        | Large Signal Voltage Gain ( $R_L = 10k\Omega$ , $V_o = \pm 10V$ )<br>$T_{amb} = 25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$ | 4<br>4         | 6          |          | 4<br>4        | 6          |          | V/mV                   |
| GBP             | Gain Bandwidth Product<br>( $T_{amb} = 25^{\circ}C$ , $R_L = 10k\Omega$ , $C_L = 100pF$ )                                             |                | 1          |          |               | 1          |          | MHz                    |
| $R_i$           | Input Resistance                                                                                                                      |                | $10^{12}$  |          |               | $10^{12}$  |          | $\Omega$               |
| CMR             | Common Mode Rejection Ratio ( $R_s = 50\Omega$ )                                                                                      | 80             | 86         |          | 80            | 86         |          | dB                     |
| SVR             | Supply Voltage Rejection Ratio ( $R_s = 50\Omega$ )                                                                                   | 80             | 95         |          | 80            | 95         |          | dB                     |
| $I_{cc}$        | Supply Current (Per Amplifier)<br>( $T_{amb} = 25^{\circ}C$ , no load, no signal)                                                     |                | 200        | 250      |               | 200        | 250      | $\mu A$                |
| $V_{O1}/V_{O2}$ | Channel Separation ( $A_v = 100$ , $T_{amb} = 25^{\circ}C$ )                                                                          |                | 120        |          |               | 120        |          |                        |
| $P_d$           | Total Power Consumption (Each Amplifier)<br>( $T_{amb} = 25^{\circ}C$ , no load, no signal)                                           |                | 6          | 7.5      |               | 6          | 7.5      | mW                     |
| SR              | Slew Rate ( $V_i = 10V$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , $A_v = 1$ )                                                             | 1.5            | 3.5        |          | 1.5           | 3.5        |          | V/ $\mu s$             |
| $t_r$           | Rise Time ( $V_i = 20mV$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , $A_v = 1$ )                                                            |                | 0.2        |          |               | 0.2        |          | $\mu s$                |
| $K_{OV}$        | Overshoot Factor ( $V_i = 20mV$ , $R_L = 10k\Omega$ , $C_L = 100pF$ , $A_v = 1$ ) - (see figure 1)                                    |                | 10         |          |               | 10         |          | %                      |
| $e_n$           | Equivalent Input Noise Voltage<br>( $R_s = 100\Omega$ , $f = 1KHz$ )                                                                  |                | 42         |          |               | 42         |          | $\frac{nV}{\sqrt{Hz}}$ |

\* 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.

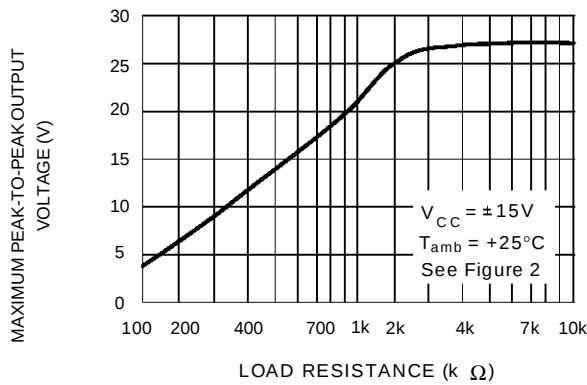
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS SUPPLY VOLTAGE**



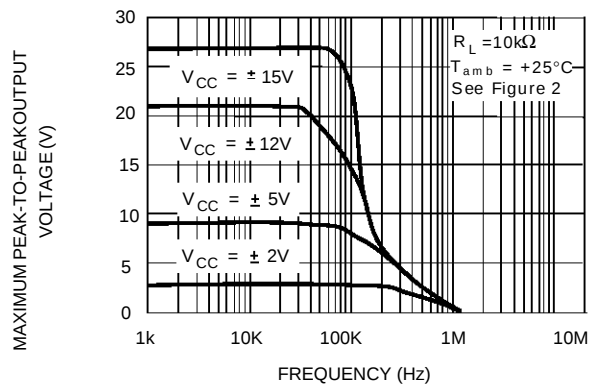
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREE AIR TEMP.**



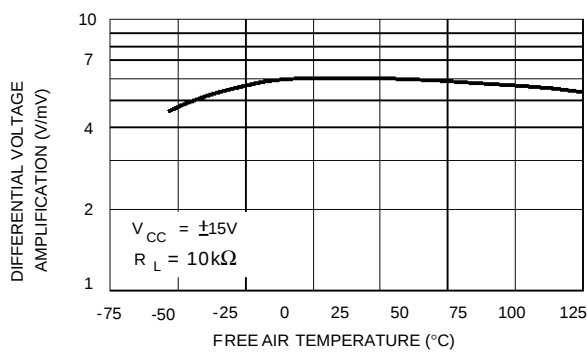
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS LOAD RESISTANCE**



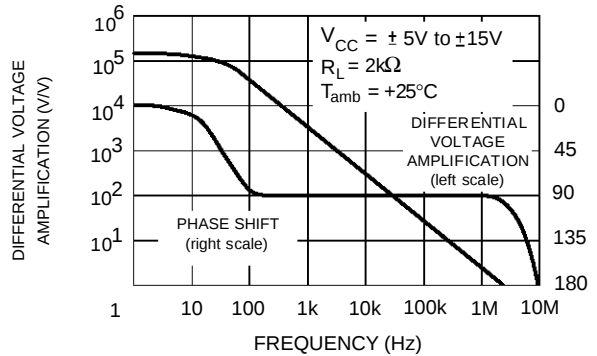
**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY**



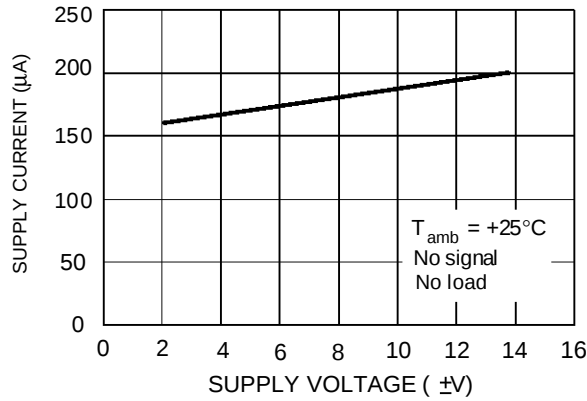
**DIFFERENTIAL VOLTAGE AMPLIFICATION VERSUS FREE AIR TEMPERATURE**



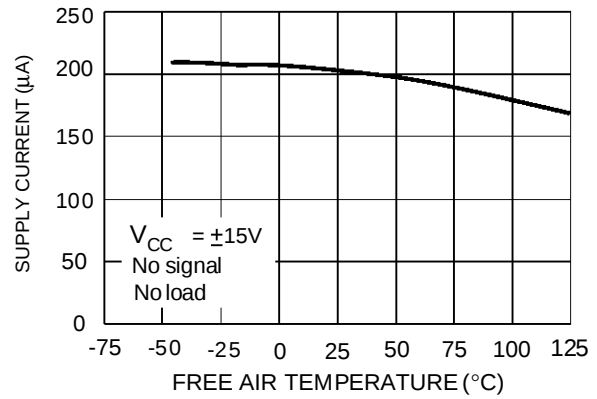
**LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VERSUS FREQUENCY**



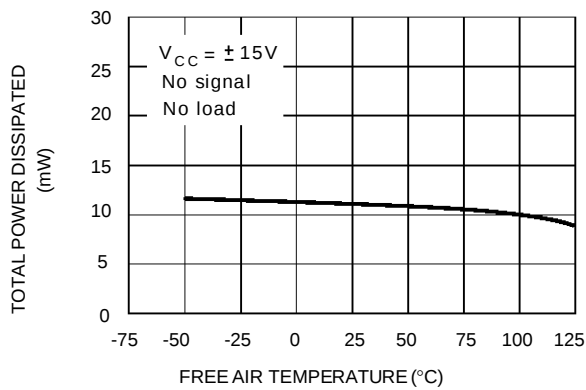
SUPPLY CURRENT PER AMPLIFIER VERSUS  
SUPPLY VOLTAGE



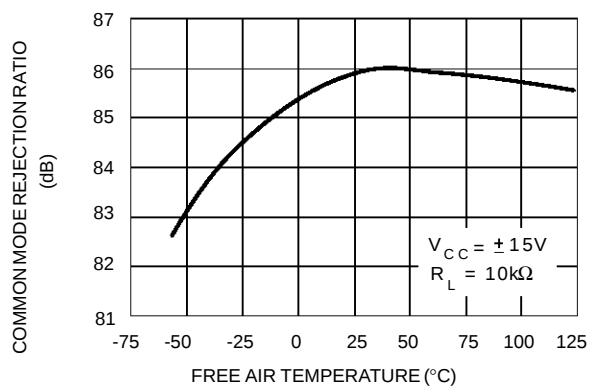
SUPPLY CURRENT PER AMPLIFIER VERSUS  
FREE AIR TEMPERATURE



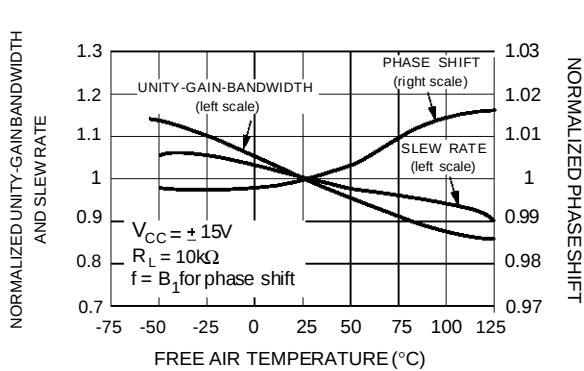
TOTAL POWER DISSIPATED VERSUS  
FREE AIR TEMPERATURE



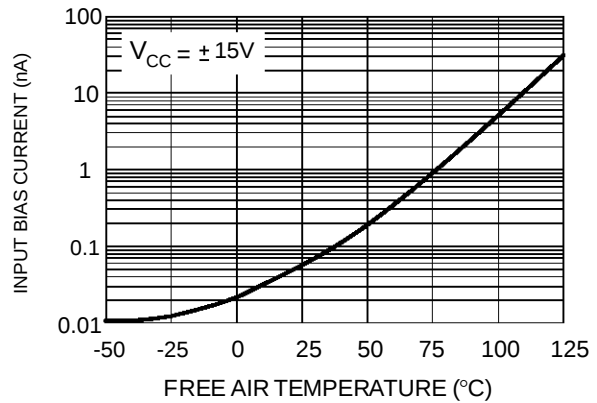
COMMON MODE REJECTION RATIO  
VERSUS FREE AIR TEMPERATURE



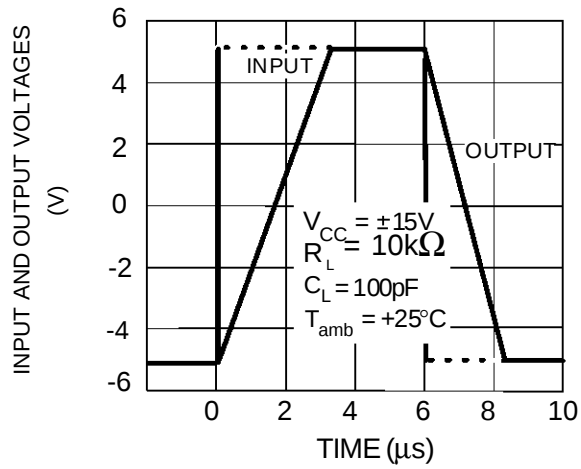
NORMALIZED UNITY GAIN BANDWIDTH  
SLEW RATE, AND PHASE SHIFT VERSUS  
TEMPERATURE



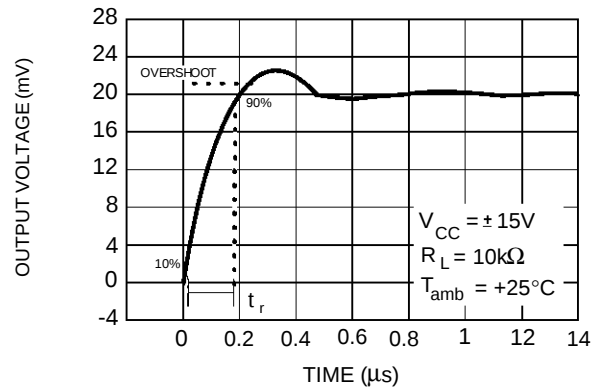
INPUT BIAS CURRENT VERSUS FREE AIR  
TEMPERATURE



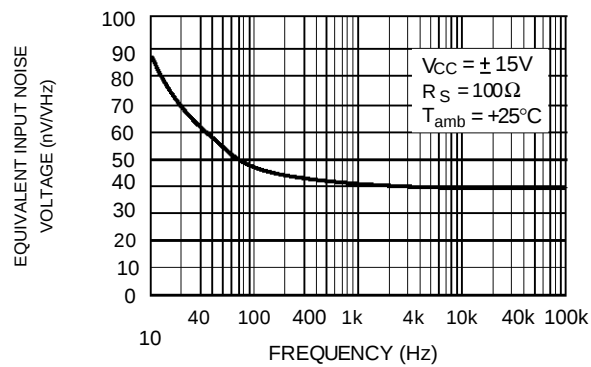
**VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE**



**OUTPUT VOLTAGE VERSUS ELAPSED TIME**

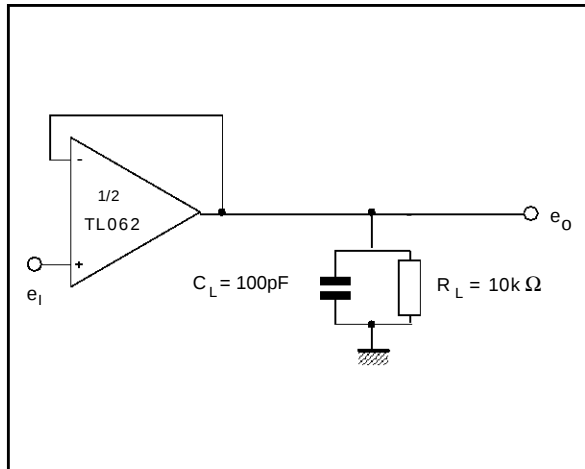


**EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY**

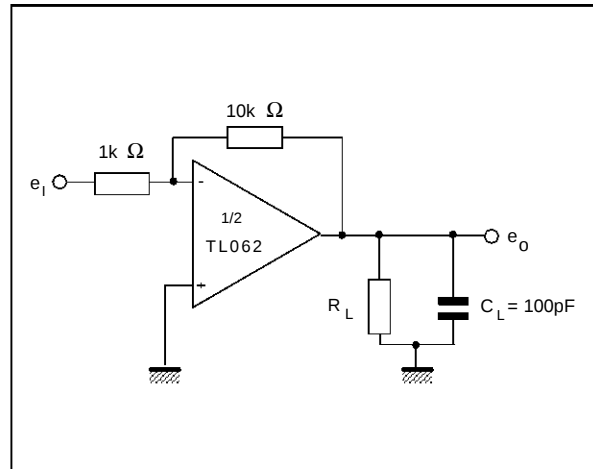


## PARAMETER MEASUREMENT INFORMATION

**Figure 1 :** Voltage follower

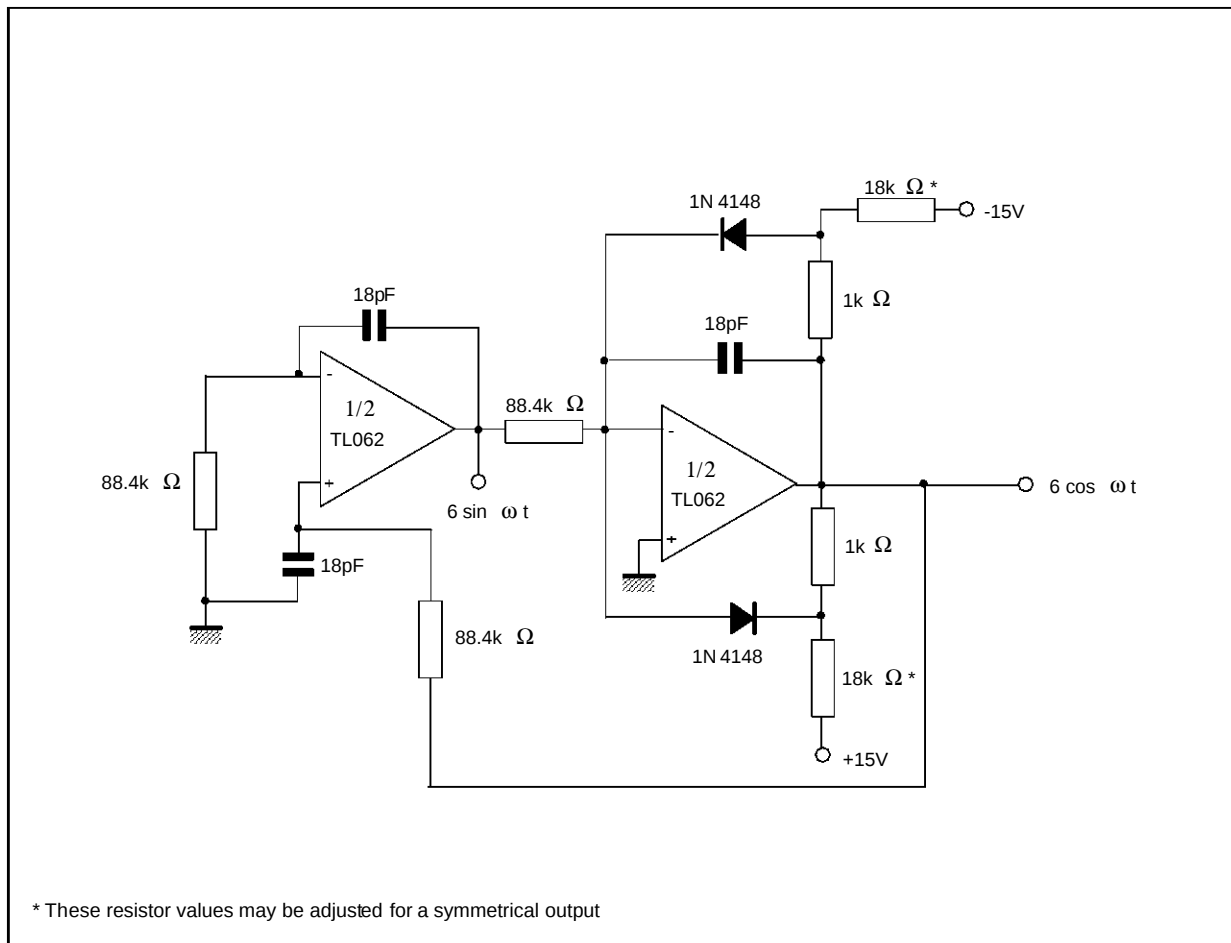


**Figure 2 :** Gain-of-10 inverting amplifier



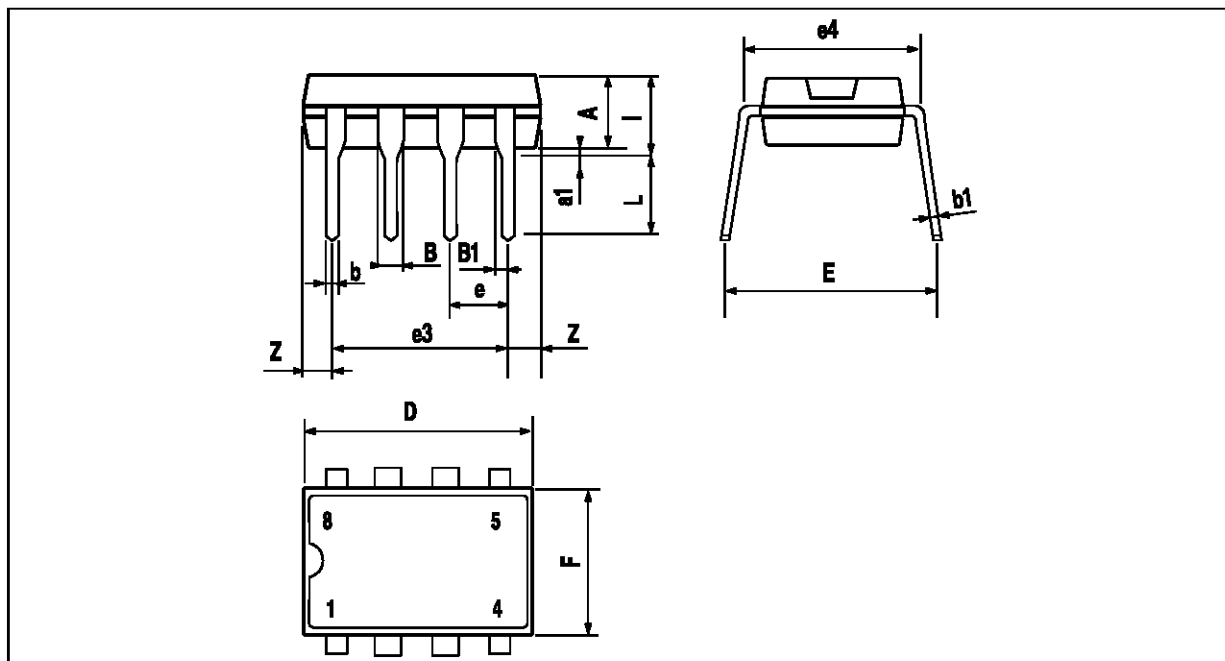
## TYPICAL APPLICATION

### 100KHz QUADRATURE OSCILLATOR



## PACKAGE MECHANICAL DATA

8 PINS - PLASTIC DIP

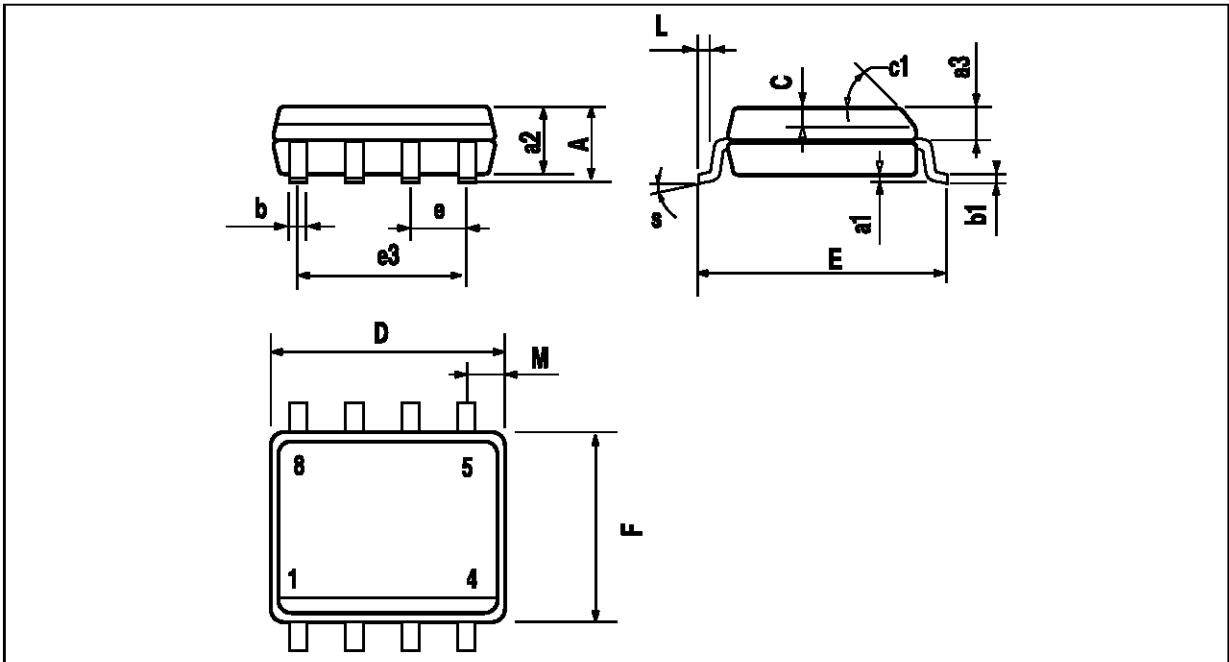


PM-DIP8.EPS

| Dimensions | 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 |

DIP8.TBL

PACKAGE MECHANICAL DATA  
8 PINS - PLASTIC MICROPACKAGE (SO)



| Dimensions | 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.)   |      |      |        |       |       |

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