

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181A – FEBRUARY 1997 – REVISED MARCH 2000

- Direct Upgrades to TL05x, TL07x, and TL08x BiFET Operational Amplifiers
- Greater Than 2× Bandwidth (10 MHz) and 3× Slew Rate (45 V/μs) Than TL07x
- Ensured Maximum Noise Floor 17 nV/√Hz
- On-Chip Offset Voltage Trimming for Improved DC Performance
- Wider Supply Rails Increase Dynamic Signal Range to ±19 V

## description

The TLE207x series of JFET-input operational amplifiers more than double the bandwidth and triple the slew rate of the TL07x and TL08x families of BiFET operational amplifiers. Texas Instruments Excalibur process yields a typical noise floor of 11.6 nV/√Hz, 17-nV/√Hz ensured maximum, offering immediate improvement in noise-sensitive circuits designed using the TL07x. The TLE207x also has wider supply voltage rails, increasing the dynamic signal range for BiFET circuits to ±19 V. On-chip zener trimming of offset voltage yields precision grades for greater accuracy in dc-coupled applications. The TLE207x are pin-compatible with lower performance BiFET operational amplifiers for ease in improving performance in existing designs.

BiFET operational amplifiers offer the inherently higher input impedance of the JFET-input transistors, without sacrificing the output drive associated with bipolar amplifiers. This makes them better suited for interfacing with high-impedance sensors or very low-level ac signals. They also feature inherently better ac response than bipolar or CMOS devices having comparable power consumption.

The TLE207x family of BiFET amplifiers are Texas Instruments highest performance BiFETs, with tighter input offset voltage and ensured maximum noise specifications. Designers requiring less stringent specifications but seeking the improved ac characteristics of the TLE207x should consider the TLE208x operational amplifier family.

Because BiFET operational amplifiers are designed for use with dual power supplies, care must be taken to observe common-mode input voltage limits and output swing when operating from a single supply. DC biasing of the input signal is required and loads should be terminated to a virtual ground node at mid-supply. Texas Instruments TLE2426 integrated virtual ground generator is useful when operating BiFET amplifiers from single supplies.

The TLE207x are fully specified at ±15 V and ±5 V. For operation in low-voltage and/or single-supply systems, Texas Instruments LinCMOS families of operational amplifiers (TLC- and TLV-prefix) are recommended. When moving from BiFET to CMOS amplifiers, particular attention should be paid to slew rate and bandwidth requirements and output loading.



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# TLE207x, TLE207xA, TLE207xY

## EXCALIBUR LOW-NOISE HIGH-SPEED

### JFET-INPUT OPERATIONAL AMPLIFIERS

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#### TLE2071 AVAILABLE OPTIONS

| T <sub>A</sub> | V <sub>IO</sub> max<br>AT 25°C | PACKAGED DEVICES                     |                           |                           |                         | CHIP FORM <sup>‡</sup><br>(Y) |
|----------------|--------------------------------|--------------------------------------|---------------------------|---------------------------|-------------------------|-------------------------------|
|                |                                | SMALL<br>OUTLINE <sup>†</sup><br>(D) | CHIP CARRIER<br>(FK)      | CERAMIC DIP<br>(JG)       | PLASTIC DIP<br>(P)      |                               |
| 0°C to 70°C    | 2 mV<br>4 mV                   | TLE2071ACD<br>TLE2071CD              | —                         | —                         | TLE2071ACP<br>TLE2071CP | —<br>TLE2071Y                 |
| –40°C to 85°C  | 2 mV<br>4 mV                   | TLE2071AID<br>TLE2071ID              | —                         | —                         | TLE2071AIP<br>TLE2071IP | —                             |
| –55°C to 125°C | 2 mV<br>4 mV                   | —<br>—                               | TLE2071AMFK<br>TLE2071MFK | TLE2071AMJG<br>TLE2071MJG | —<br>—                  | —                             |

<sup>†</sup> The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2071ACDR).

<sup>‡</sup> Chip-form versions are tested at T<sub>A</sub> = 25°C.

#### TLE2072 AVAILABLE OPTIONS

| T <sub>A</sub> | V <sub>IO</sub> max<br>AT 25°C | PACKAGED DEVICES                     |                           |                           |                         | CHIP FORM <sup>‡</sup><br>(Y) |
|----------------|--------------------------------|--------------------------------------|---------------------------|---------------------------|-------------------------|-------------------------------|
|                |                                | SMALL<br>OUTLINE <sup>†</sup><br>(D) | CHIP CARRIER<br>(FK)      | CERAMIC DIP<br>(JG)       | PLASTIC DIP<br>(P)      |                               |
| 0°C to 70°C    | 3.5 mV<br>6 mV                 | TLE2072ACD<br>TLE2072CD              | —                         | —                         | TLE2072ACP<br>TLE2072CP | —<br>TLE2072Y                 |
| –40°C to 85°C  | 3.5 mV<br>6 mV                 | TLE2072AID<br>TLE2072ID              | —                         | —                         | TLE2072AIP<br>TLE2072IP | —                             |
| –55°C to 125°C | 3.5 mV<br>6 mV                 | —                                    | TLE2072AMFK<br>TLE2072MFK | TLE2072AMJG<br>TLE2072MJG | —                       | —                             |

<sup>†</sup> The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2072ACDR).

<sup>‡</sup> Chip-form versions are tested at T<sub>A</sub> = 25°C.

#### TLE2074 AVAILABLE OPTIONS

| T <sub>A</sub> | V <sub>IO</sub> max<br>AT 25°C | PACKAGED DEVICES                      |                           |                         |                         | CHIP FORM <sup>‡</sup><br>(Y) |
|----------------|--------------------------------|---------------------------------------|---------------------------|-------------------------|-------------------------|-------------------------------|
|                |                                | SMALL<br>OUTLINE <sup>†</sup><br>(DW) | CHIP CARRIER<br>(FK)      | CERAMIC DIP<br>(J)      | PLASTIC DIP<br>(N)      |                               |
| 0°C to 70°C    | 3 mV<br>5 mV                   | TLE2074ACDW<br>TLE2074CDW             | —                         | —                       | TLE2074ACN<br>TLE2074CN | —<br>TLE2074Y                 |
| –40°C to 85°C  | 3 mV<br>5 mV                   | TLE2074AIDW<br>TLE2074IDW             | —                         | —                       | TLE2074AIN<br>TLE2074IN | —                             |
| –55°C to 125°C | 3 mV<br>5 mV                   | —                                     | TLE2074AMFK<br>TLE2074MFK | TLE2074AMJ<br>TLE2074MJ | —                       | —                             |

<sup>†</sup> The DW packages are available taped and reeled. Add R suffix to device type (e.g., TLE2074ACDWR).

<sup>‡</sup> Chip-form versions are tested at T<sub>A</sub> = 25°C.

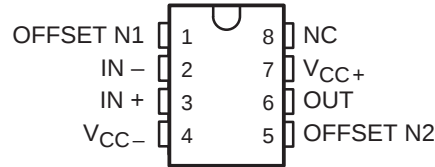


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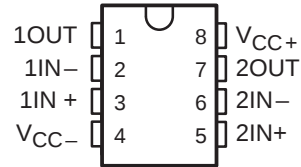
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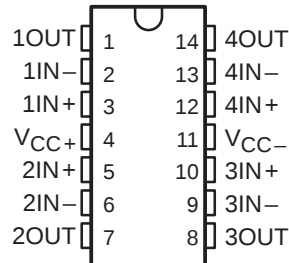
**TLE2071 AND TLE2071A**  
**D, JG, OR P PACKAGE**  
**(TOP VIEW)**



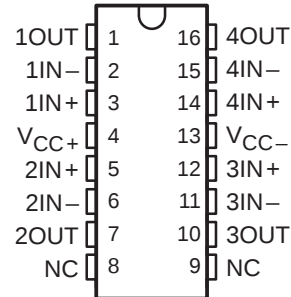
**TLE2072 AND TLE2072A**  
**D, JG, OR P PACKAGE**  
**(TOP VIEW)**



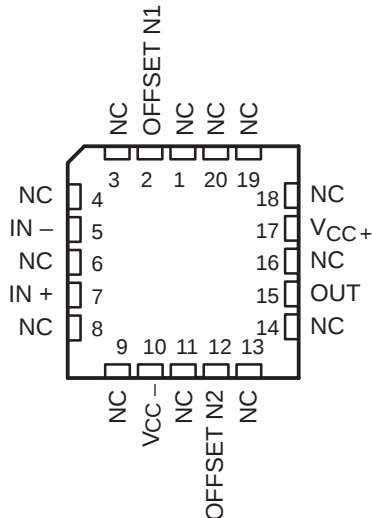
**TLE2074 AND TLE2074A**  
**J OR N PACKAGE**  
**(TOP VIEW)**



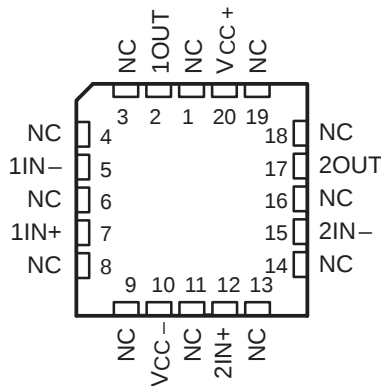
**TLE2074 AND TLE2074A**  
**DW PACKAGE**  
**(TOP VIEW)**



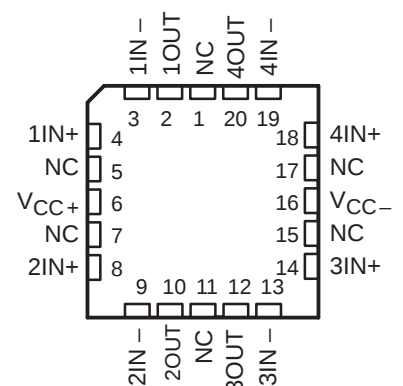
**TLE2071M AND TLE2071AM**  
**FK PACKAGE**  
**(TOP VIEW)**



**TLE2072M AND TLE2072AM**  
**FK PACKAGE**  
**(TOP VIEW)**

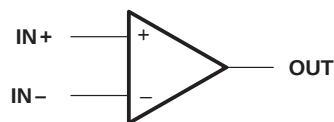


**TLE2074M AND TLE2074AM**  
**FK PACKAGE**  
**(TOP VIEW)**



NC – No internal connection

## symbol



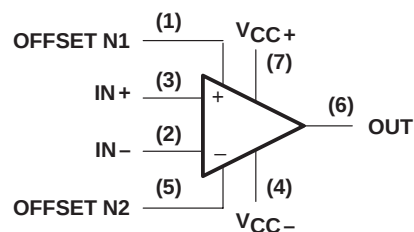
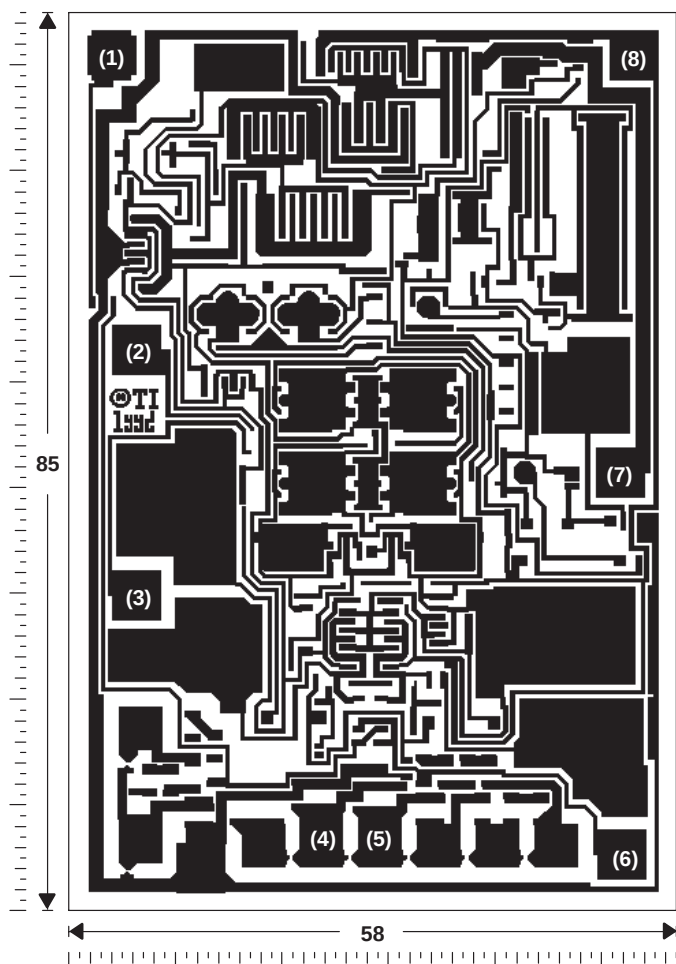
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## TLE2071Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2071C. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.

BONDING PAD ASSIGNMENTS



CHIP THICKNESS: 15 TYPICAL

BONDING PADS:  $4 \times 4$  MINIMUM

$T_{jmax} = 150^{\circ}\text{C}$

TOLERANCES ARE  $\pm 10\%$ .

ALL DIMENSIONS ARE IN MILS.

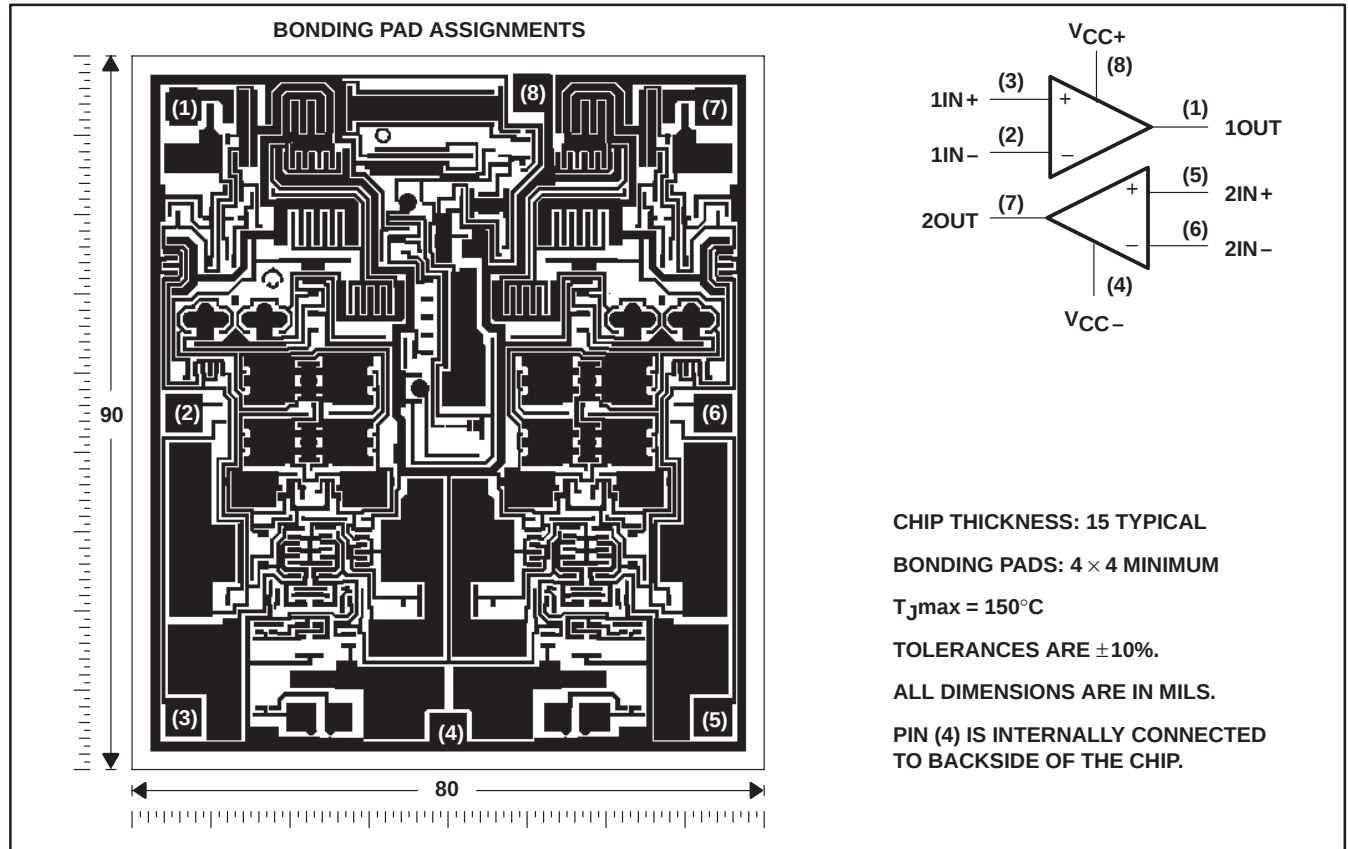
PIN (4) IS INTERNALLY CONNECTED  
TO BACKSIDE OF THE CHIP.

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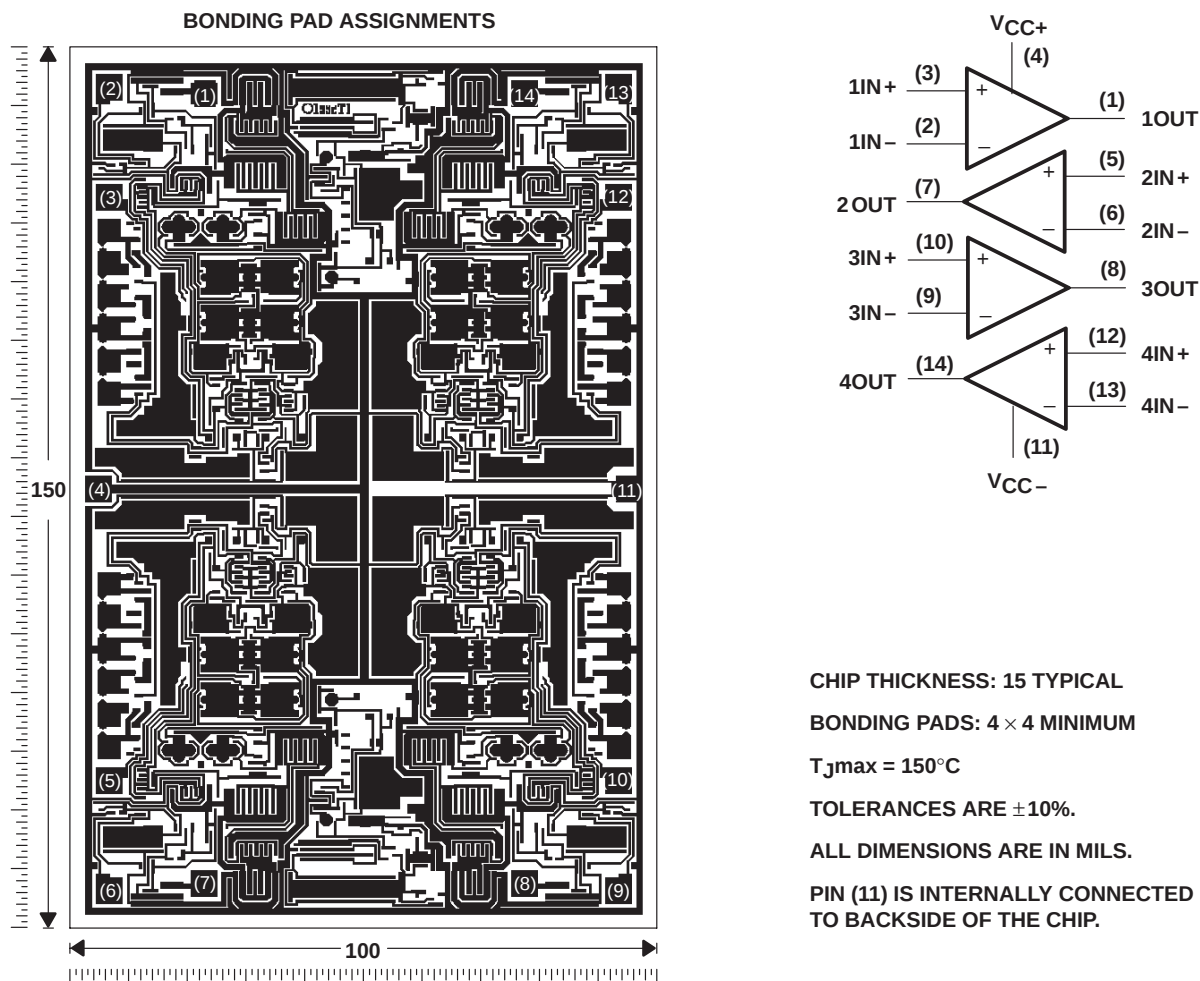


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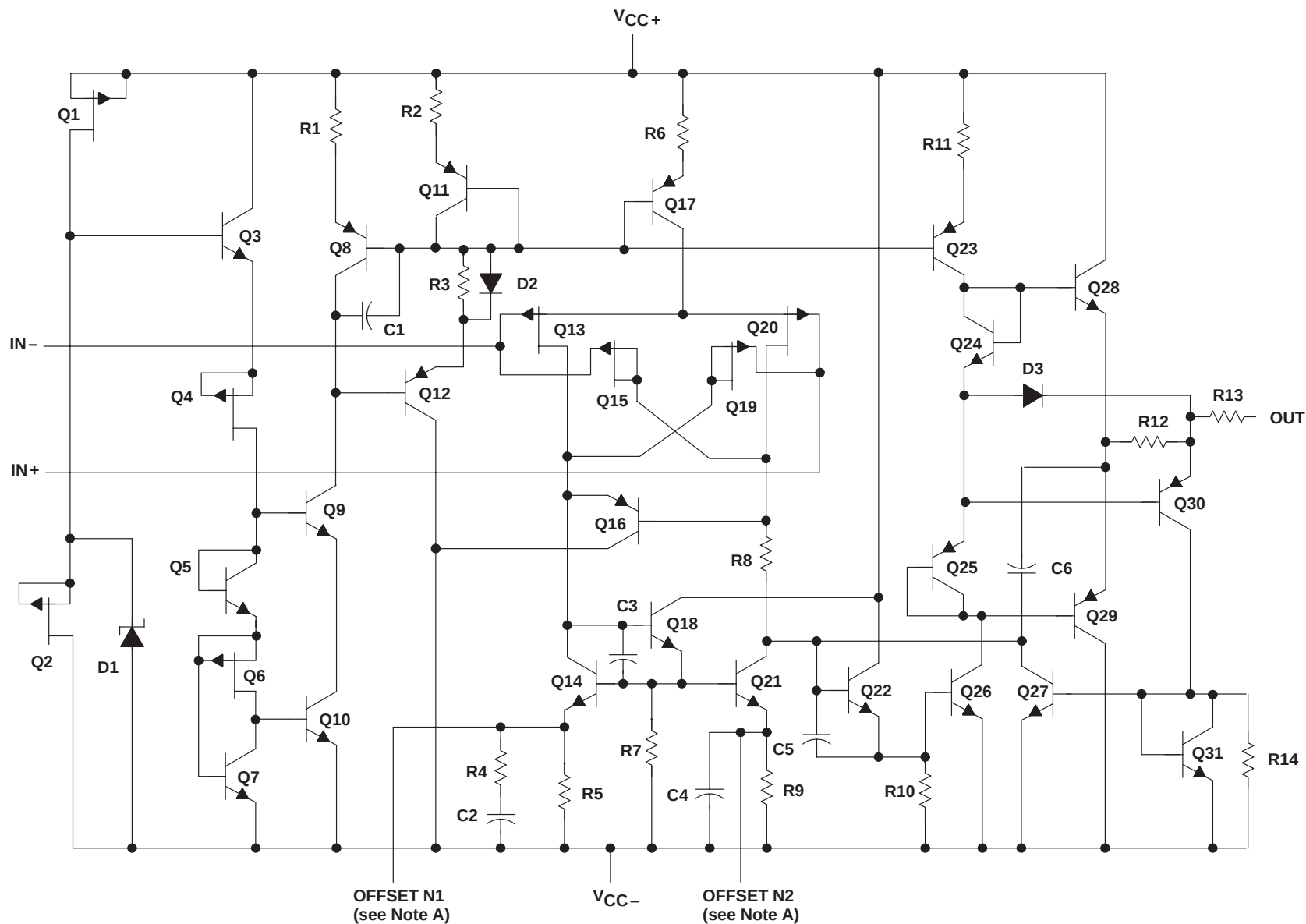
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## TLE2074Y chip information

This chip, when properly assembled, displays characteristics similar to the TLE2074C. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



# equivalent schematic



NOTES: A. OFFSET N1 AND OFFSET N2 are only available on the TLE2071x devices.

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| ACTUAL DEVICE COMPONENT COUNT |         |         |         |
|-------------------------------|---------|---------|---------|
| COMPONENT                     | TLE2071 | TLE2072 | TLE2074 |
| Transistors                   | 33      | 57      | 114     |
| Resistors                     | 25      | 37      | 74      |
| Diodes                        | 8       | 5       | 10      |
| Capacitors                    | 6       | 11      | 22      |

equivalent schematic (continued)

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

|                                                                               |                              |
|-------------------------------------------------------------------------------|------------------------------|
| Supply voltage, $V_{CC+}$ (see Note 1)                                        | 19 V                         |
| Supply voltage, $V_{CC-}$ (see Note 1)                                        | –19 V                        |
| Differential input voltage range, $V_{ID}$ (see Note 2)                       | $V_{CC+}$ to $V_{CC-}$       |
| Input voltage range, $V_I$ (any input)                                        | $V_{CC+}$ to $V_{CC-}$       |
| Input current, $I_I$ (each input)                                             | ±1 mA                        |
| Output current, $I_O$ (each output)                                           | ±80 mA                       |
| Total current into $V_{CC+}$                                                  | 160 mA                       |
| Total current out of $V_{CC-}$                                                | 160 mA                       |
| Duration of short-circuit current at (or below) 25°C (see Note 3)             | unlimited                    |
| Continuous total dissipation                                                  | See Dissipation Rating Table |
| Operating free-air temperature range, $T_A$ : C suffix                        | 0°C to 70°C                  |
| I suffix                                                                      | –40°C to 85°C                |
| M suffix                                                                      | –55°C to 125°C               |
| Storage temperature range                                                     | –65°C to 150°C               |
| Case temperature for 60 seconds: FK package                                   | 260°C                        |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: DW or N package | 260°C                        |
| Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package       | 300°C                        |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values, except differential voltages, are with respect to the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .
  2. Differential voltages are at the noninverting input with respect to the inverting input.
  3. The output may be shorted to either supply. Temperatures and/or supply voltages must be limited to ensure that the maximum dissipation rate is not exceeded.

**DISSIPATION RATING TABLE**

| PACKAGE | $T_A \leq 25^\circ\text{C}$<br>POWER RATING | DERATING FACTOR<br>ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$<br>POWER RATING | $T_A = 85^\circ\text{C}$<br>POWER RATING | $T_A = 125^\circ\text{C}$<br>POWER RATING |
|---------|---------------------------------------------|---------------------------------------------------|------------------------------------------|------------------------------------------|-------------------------------------------|
| D       | 725 mW                                      | 5.8 mW/°C                                         | 464 mW                                   | 377 mW                                   | —                                         |
| DW      | 1025 mW                                     | 8.2 mW/°C                                         | 656 mW                                   | 533 mW                                   | 205 mW                                    |
| FK      | 1375 mW                                     | 11.0 mW/°C                                        | 880 mW                                   | 715 mW                                   | 275 mW                                    |
| J       | 1375 mW                                     | 11.0 mW/°C                                        | 880 mW                                   | 715 mW                                   | 275 mW                                    |
| JG      | 1050 mW                                     | 8.4 mW/°C                                         | 672 mW                                   | 546 mW                                   | 210 mW                                    |
| N       | 1150 mW                                     | 9.2 mW/°C                                         | 736 mW                                   | 598 mW                                   | 230 mW                                    |
| P       | 1000 mW                                     | 8.0 mW/°C                                         | 640 mW                                   | 344 mW                                   | —                                         |

**recommended operating conditions**

|                                       |                               | C SUFFIX |     | I SUFFIX |     | M SUFFIX |     | UNIT |
|---------------------------------------|-------------------------------|----------|-----|----------|-----|----------|-----|------|
|                                       |                               | MIN      | MAX | MIN      | MAX | MIN      | MAX |      |
| Supply voltage, $V_{CC\pm}$           |                               | ±2.25    | ±19 | ±2.25    | ±19 | ±2.25    | ±19 | V    |
| Common-mode input voltage, $V_{IC}$   | $V_{CC\pm} = \pm 5\text{ V}$  | –0.9     | 5   | –0.8     | 5   | –0.8     | 5   | V    |
|                                       | $V_{CC\pm} = \pm 15\text{ V}$ | –10.9    | 15  | –10.8    | 15  | –10.8    | 15  |      |
| Operating free-air temperature, $T_A$ |                               | 0        | 70  | –40      | 85  | –55      | 125 | °C   |

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**TLE2071C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted)**

| PARAMETER                                                                       | TEST CONDITIONS                                                       | $T_A^\dagger$       | TLE2071C   |           |     | TLE2071AC |           |     | UNIT             |
|---------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------|------------|-----------|-----|-----------|-----------|-----|------------------|
|                                                                                 |                                                                       |                     | MIN        | TYP       | MAX | MIN       | TYP       | MAX |                  |
| $V_{IO}$ Input offset voltage                                                   | $V_{IC} = 0, V_O = 0,$<br>$R_S = 50\ \Omega$                          | 25°C                | 0.34       | 4         |     | 0.3       | 2         |     | mV               |
|                                                                                 |                                                                       | Full range          |            |           | 6   |           |           | 4   |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                  |                                                                       | Full range          | 3.2        | 29        |     | 3.2       | 29        |     | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                   | $V_{IC} = 0, V_O = 0,$<br>See Figure 4                                | 25°C                | 5          | 100       |     | 5         | 100       |     | pA               |
|                                                                                 |                                                                       | Full range          |            | 1.4       |     |           | 1.4       |     | nA               |
| $I_{IB}$ Input bias current                                                     |                                                                       | 25°C                | 15         | 175       |     | 15        | 175       |     | pA               |
|                                                                                 |                                                                       | Full range          |            | 5         |     |           | 5         |     | nA               |
| $V_{ICR}$ Common-mode input voltage range                                       | $R_S = 50\ \Omega$                                                    | 25°C                | 5 to -1    | 5 to -1.9 |     | 5 to -1   | 5 to -1.9 |     | V                |
|                                                                                 |                                                                       | Full range          | 5 to -0.9  |           |     | 5 to -0.9 |           |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing                            | $I_O = -200\ \mu A$                                                   | 25°C                | 3.8        | 4.1       |     | 3.8       | 4.1       |     | V                |
|                                                                                 |                                                                       | Full range          | 3.7        |           |     | 3.7       |           |     |                  |
|                                                                                 | $I_O = -2\ mA$                                                        | 25°C                | 3.5        | 3.9       |     | 3.5       | 3.9       |     |                  |
|                                                                                 |                                                                       | Full range          | 3.4        |           |     | 3.4       |           |     |                  |
|                                                                                 | $I_O = -20\ mA$                                                       | 25°C                | 1.5        | 2.3       |     | 1.5       | 2.3       |     |                  |
|                                                                                 |                                                                       | Full range          | 1.5        |           |     | 1.5       |           |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing                            | $I_O = 200\ \mu A$                                                    | 25°C                | -3.5       | -4.2      |     | -3.5      | -4.2      |     | V                |
|                                                                                 |                                                                       | Full range          | -3.4       |           |     | -3.4      |           |     |                  |
|                                                                                 | $I_O = 2\ mA$                                                         | 25°C                | -3.7       | -4.1      |     | -3.7      | -4.1      |     |                  |
|                                                                                 |                                                                       | Full range          | -3.6       |           |     | -3.6      |           |     |                  |
|                                                                                 | $I_O = 20\ mA$                                                        | 25°C                | -1.5       | -2.4      |     | -1.5      | -2.4      |     |                  |
|                                                                                 |                                                                       | Full range          | -1.5       |           |     | -1.5      |           |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                        | $V_O = \pm 2.3\ V$                                                    | $R_L = 600\ \Omega$ | 25°C       | 80        | 91  | 80        | 91        |     | dB               |
|                                                                                 |                                                                       |                     | Full range | 79        |     | 79        |           |     |                  |
|                                                                                 |                                                                       | $R_L = 2\ k\Omega$  | 25°C       | 90        | 100 | 90        | 100       |     |                  |
|                                                                                 |                                                                       |                     | Full range | 89        |     | 89        |           |     |                  |
|                                                                                 |                                                                       | $R_L = 10\ k\Omega$ | 25°C       | 95        | 106 | 95        | 106       |     |                  |
|                                                                                 |                                                                       |                     | Full range | 94        |     | 94        |           |     |                  |
| $r_i$ Input resistance                                                          | $V_{IC} = 0$                                                          | 25°C                | $10^{12}$  |           |     | $10^{12}$ |           |     | $\Omega$         |
| $c_i$ Input capacitance                                                         | $V_{IC} = 0,$<br>See Figure 5                                         | Common mode         | 25°C       | 11        |     | 11        |           |     | pF               |
|                                                                                 |                                                                       | Differential        | 25°C       | 2.5       |     | 2.5       |           |     |                  |
| $z_o$ Open-loop output impedance                                                | $f = 1\ MHz$                                                          | 25°C                | 80         |           |     | 80        |           |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                                | $V_{IC} = V_{ICRmin},$<br>$V_O = 0, R_S = 50\ \Omega$                 | 25°C                | 70         | 89        |     | 70        | 89        |     | dB               |
|                                                                                 |                                                                       | Full range          | 68         |           |     | 68        |           |     |                  |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm} / \Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5\ V$ to $\pm 15\ V,$<br>$V_O = 0, R_S = 50\ \Omega$ | 25°C                | 82         | 99        |     | 82        | 99        |     | dB               |
|                                                                                 |                                                                       | Full range          | 80         |           |     | 80        |           |     |                  |

$^\dagger$  Full range is 0°C to 70°C.



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**TLE2071C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted) (continued)**

| PARAMETER       |                              | TEST CONDITIONS             |                        | T <sub>A</sub> <sup>†</sup> | TLE2071C |     |     | TLE2071AC |     |     | UNIT |
|-----------------|------------------------------|-----------------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
|                 |                              |                             |                        |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub> | Supply current               | V <sub>O</sub> = 0, No load |                        | 25°C                        | 1.35     | 1.6 | 2.2 | 1.35      | 1.6 | 2.2 | mA   |
|                 |                              |                             |                        | Full range                  | 2.2      |     |     | 2.2       |     |     |      |
| I <sub>OS</sub> | Short-circuit output current | V <sub>O</sub> = 0          | V <sub>ID</sub> = 1 V  | 25°C                        | −35      |     |     | −35       |     |     | mA   |
|                 |                              |                             | V <sub>ID</sub> = −1 V |                             | 45       |     |     | 45        |     |     |      |

$^\dagger$  Full range is 0°C to 70°C.

**TLE2071C operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                       |                                              | T <sub>A</sub> <sup>†</sup> | TLE2071C |         |     | TLE2071AC |     |        | UNIT   |
|--------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------|----------|---------|-----|-----------|-----|--------|--------|
|                    |                                             |                                                                                                                       |                                              |                             | MIN      | TYP     | MAX | MIN       | TYP | MAX    |        |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±2.3 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                                              | 25°C                        | 35       |         |     | 35        |     |        | V/μs   |
|                    |                                             |                                                                                                                       |                                              | Full range                  | 23       |         |     | 23        |     |        |        |
| SR −               | Negative slew rate                          |                                                                                                                       |                                              | 25°C                        | 38       |         |     | 38        |     |        | V/μs   |
|                    |                                             |                                                                                                                       |                                              | Full range                  | 23       |         |     | 23        |     |        |        |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 2-V step,<br>R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                     | To 10 mV                                     | 25°C                        | 0.25     |         |     | 0.25      |     |        | μs     |
|                    |                                             |                                                                                                                       | To 1 mV                                      |                             | 0.4      |         |     | 0.4       |     |        |        |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                   | f = 10 Hz                                    | 25°C                        | 28 55    |         |     | 28 55     |     |        | nV/√Hz |
|                    | f = 10 kHz                                  |                                                                                                                       | 11.6 17                                      |                             |          | 11.6 17 |     |           |     |        |        |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                       | f = 10 Hz to 10 kHz                          | 25°C                        | 6        |         |     | 6         |     |        | μV     |
|                    |                                             |                                                                                                                       | f = 0.1 Hz to 10 Hz                          |                             | 0.6      |         |     | 0.6       |     |        |        |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                       | 25°C                                         | 2.8                         |          |         | 2.8 |           |     | fA/√Hz |        |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 5 V, f = 1 kHz, R <sub>S</sub> = 25 Ω                                                            | A <sub>VD</sub> = 10, R <sub>L</sub> = 2 kΩ, | 25°C                        | 0.013%   |         |     | 0.013%    |     |        |        |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                       | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C                        | 9.4      |         |     | 9.4       |     |        | MHz    |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 4 V, R <sub>L</sub> = 2 kΩ ,                                                                     | A <sub>VD</sub> = −1, C <sub>L</sub> = 25 pF | 25°C                        | 2.8      |         |     | 2.8       |     |        | MHz    |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                       | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C                        | 56°      |         |     | 56°       |     |        |        |

$^\dagger$  Full range is 0°C to 70°C.

# TLE207x, TLE207xA, TLE207xY

## EXCALIBUR LOW-NOISE HIGH-SPEED

### JFET-INPUT OPERATIONAL AMPLIFIERS

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**TLE2071C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER                                                                     | TEST CONDITIONS                                                              | $T_A^\dagger$              | TLE2071C    |             |     | TLE2071AC   |             |     | UNIT             |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------|-------------|-------------|-----|-------------|-------------|-----|------------------|
|                                                                               |                                                                              |                            | MIN         | TYP         | MAX | MIN         | TYP         | MAX |                  |
| $V_{IO}$ Input offset voltage                                                 | $V_{IC} = 0, V_O = 0, R_S = 50 \Omega$                                       | 25°C                       | 0.49        | 4           |     | 0.47        | 2           |     | mV               |
|                                                                               |                                                                              | Full range                 |             |             | 6   |             |             | 4   |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                |                                                                              | Full range                 | 3.2         | 29          |     | 3.2         | 29          |     | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                 | $V_{IC} = 0, V_O = 0, \text{See Figure 4}$                                   | 25°C                       | 6           | 100         |     | 6           | 100         |     | pA               |
|                                                                               |                                                                              | Full range                 |             | 1.4         |     |             | 1.4         |     | nA               |
| $I_{IB}$ Input bias current                                                   |                                                                              | 25°C                       | 20          | 175         |     | 20          | 175         |     | pA               |
|                                                                               |                                                                              | Full range                 |             | 5           |     |             | 5           |     | nA               |
| $V_{ICR}$ Common-mode input voltage range                                     | $R_S = 50 \Omega$                                                            | 25°C                       | 15 to -11   | 15 to -11.9 |     | 15 to -11   | 15 to -11.9 |     | V                |
|                                                                               |                                                                              | Full range                 | 15 to -10.9 |             |     | 15 to -10.9 |             |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing                          | $I_O = -200 \mu A$                                                           | 25°C                       | 13.8        | 14.1        |     | 13.8        | 14.1        |     | V                |
|                                                                               |                                                                              | Full range                 | 13.7        |             |     | 13.7        |             |     |                  |
|                                                                               | $I_O = -2 \text{ mA}$                                                        | 25°C                       | 13.5        | 13.9        |     | 13.5        | 13.9        |     |                  |
|                                                                               |                                                                              | Full range                 | 13.4        |             |     | 13.4        |             |     |                  |
|                                                                               | $I_O = -20 \text{ mA}$                                                       | 25°C                       | 11.5        | 12.3        |     | 11.5        | 12.3        |     |                  |
|                                                                               |                                                                              | Full range                 | 11.5        |             |     | 11.5        |             |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing                          | $I_O = 200 \mu A$                                                            | 25°C                       | -13.8       | -14.2       |     | -13.8       | -14.2       |     | V                |
|                                                                               |                                                                              | Full range                 | -13.7       |             |     | -13.7       |             |     |                  |
|                                                                               | $I_O = 2 \text{ mA}$                                                         | 25°C                       | -13.5       | -14         |     | -13.5       | -14         |     |                  |
|                                                                               |                                                                              | Full range                 | -13.4       |             |     | -13.4       |             |     |                  |
|                                                                               | $I_O = 20 \text{ mA}$                                                        | 25°C                       | -11.5       | -12.4       |     | -11.5       | -12.4       |     |                  |
|                                                                               |                                                                              | Full range                 | -11.5       |             |     | -11.5       |             |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10 \text{ V}$                                                     | $R_L = 600 \Omega$         | 25°C        | 80          | 96  | 80          | 96          |     | dB               |
|                                                                               |                                                                              |                            | Full range  | 79          |     | 79          |             |     |                  |
|                                                                               |                                                                              | $R_L = 2 \text{ k}\Omega$  | 25°C        | 90          | 109 | 90          | 109         |     |                  |
|                                                                               |                                                                              |                            | Full range  | 89          |     | 89          |             |     |                  |
|                                                                               |                                                                              | $R_L = 10 \text{ k}\Omega$ | 25°C        | 95          | 118 | 95          | 118         |     |                  |
|                                                                               |                                                                              |                            | Full range  | 94          |     | 94          |             |     |                  |
| $r_i$ Input resistance                                                        | $V_{IC} = 0$                                                                 | 25°C                       |             | $10^{12}$   |     |             | $10^{12}$   |     | $\Omega$         |
| $c_i$ Input capacitance                                                       | $V_{IC} = 0, \text{See Figure 5}$                                            | Common mode                | 25°C        | 7.5         |     | 7.5         |             |     | pF               |
|                                                                               |                                                                              | Differential               | 25°C        | 2.5         |     | 2.5         |             |     |                  |
| $z_o$ Open-loop output impedance                                              | $f = 1 \text{ MHz}$                                                          | 25°C                       |             | 80          |     |             | 80          |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$                              | 25°C                       | 80          | 98          |     | 80          | 98          |     | dB               |
|                                                                               |                                                                              | Full range                 | 79          |             |     | 79          |             |     |                  |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$ | 25°C                       | 82          | 99          |     | 82          | 99          |     | dB               |
|                                                                               |                                                                              | Full range                 | 80          |             |     | 81          |             |     |                  |

$^\dagger$  Full range is 0°C to 70°C.



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**TLE2071C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted) (continued)**

| PARAMETER                             | TEST CONDITIONS     | $T_A^\dagger$   | TLE2071C |     |     | TLE2071AC |     |     | UNIT |
|---------------------------------------|---------------------|-----------------|----------|-----|-----|-----------|-----|-----|------|
|                                       |                     |                 | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| $I_{CC}$ Supply current               | $V_O = 0$ , No load | 25°C            | 1.35     | 1.7 | 2.2 | 1.35      | 1.7 | 2.2 | mA   |
|                                       |                     | Full range      |          |     | 2.2 |           |     | 2.2 |      |
| $I_{OS}$ Short-circuit output current | $V_O = 0$           | $V_{ID} = 1$ V  | –30      | –45 |     | –30       | –45 |     | mA   |
|                                       |                     | $V_{ID} = -1$ V | 30       | 48  |     | 30        | 48  |     |      |

$^\dagger$  Full range is 0°C to 70°C.

**TLE2071C operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                     |                                        | T <sub>A</sub> <sup>†</sup> | TLE2071C |     |      | TLE2071AC |     |     | UNIT  |       |
|--------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------------------------|----------|-----|------|-----------|-----|-----|-------|-------|
|                    |                                             |                                                                                                                     |                                        |                             | MIN      | TYP | MAX  | MIN       | TYP | MAX |       |       |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = 10 V, A <sub>VD</sub> = −1,<br>R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF,<br>See Figure 1 |                                        | 25°C                        | 30       | 40  |      | 30        | 40  |     | V/μs  |       |
|                    |                                             |                                                                                                                     |                                        | Full range                  | 27       |     |      | 27        |     |     |       |       |
| SR −               | Negative slew rate                          |                                                                                                                     |                                        | 25°C                        | 30       | 45  |      | 30        | 45  |     | V/μs  |       |
|                    |                                             |                                                                                                                     |                                        | Full range                  | 27       |     |      | 27        |     |     |       |       |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1,<br>10-V step,<br>R <sub>L</sub> = 1 kΩ,<br>C <sub>L</sub> = 100 pF                            | To 10 mV                               | 25°C                        | 0.4      |     |      | 0.4       |     |     | μs    |       |
|                    |                                             |                                                                                                                     | To 1 mV                                |                             | 1.5      |     |      | 1.5       |     |     |       |       |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω,<br>See Figure 3                                                                              | f = 10 Hz                              | 25°C                        | 28       |     |      | 55        | 28  |     | 55    | nV√Hz |
|                    | f = 10 kHz                                  |                                                                                                                     | 11.6                                   |                             |          | 17  | 11.6 |           | 17  |     |       |       |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                     | f = 10 Hz to 10 kHz                    | 25°C                        | 6        |     |      | 6         |     |     | μV    |       |
|                    |                                             |                                                                                                                     | f = 0.1 Hz to 10 Hz                    |                             | 0.6      |     |      | 0.6       |     |     |       |       |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0,                                                                                                | f = 10 kHz                             | 25°C                        | 2.8      |     |      | 2.8       |     |     | fA√Hz |       |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10,<br>f = 1 kHz, R <sub>L</sub> = 2 kΩ,<br>R <sub>S</sub> = 25 Ω      |                                        | 25°C                        | 0.008%   |     |      | 0.008%    |     |     |       |       |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV,<br>C <sub>L</sub> = 25 pF,                                                                  | R <sub>L</sub> = 2 kΩ,<br>See Figure 2 | 25°C                        | 8        | 10  |      | 8         | 10  |     | MHz   |       |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = −1,<br>R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 25 pF                   |                                        | 25°C                        | 478      | 637 |      | 478       | 637 |     | kHz   |       |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV,<br>C <sub>L</sub> = 25 pF, See Figure 2                                                     |                                        | 25°C                        | 57°      |     |      | 57°       |     |     |       |       |

$^\dagger$  Full range is 0°C to 70°C.



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**TLE2071I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$  (unless otherwise noted)**

| PARAMETER                                                                     | TEST CONDITIONS                                                               | $T_A^\dagger$              | TLE2071I   |           |     | TLE2071AI |           |     | UNIT                         |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------|------------|-----------|-----|-----------|-----------|-----|------------------------------|
|                                                                               |                                                                               |                            | MIN        | TYP       | MAX | MIN       | TYP       | MAX |                              |
| $V_{IO}$ Input offset voltage                                                 | $V_{IC} = 0, V_O = 0, R_S = 50\ \Omega$                                       | 25°C                       | 0.34       |           | 4   | 0.3       |           | 2   | mV                           |
|                                                                               |                                                                               | Full range                 |            |           | 7.6 |           |           | 5.6 |                              |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                |                                                                               | Full range                 |            | 3.2       | 29  |           | 3.2       | 29  | $\mu\text{V}/^\circ\text{C}$ |
| $I_{IO}$ Input offset current                                                 | $V_{IC} = 0, V_O = 0, \text{See Figure 4}$                                    | 25°C                       | 5          |           | 100 | 5         |           | 100 | pA                           |
|                                                                               |                                                                               | Full range                 |            |           | 5   |           |           | 5   | nA                           |
| $I_{IB}$ Input bias current                                                   |                                                                               | 25°C                       | 15         |           | 175 | 15        |           | 175 | pA                           |
|                                                                               |                                                                               | Full range                 |            |           | 10  |           |           | 10  | nA                           |
| $V_{ICR}$ Common-mode input voltage range                                     | $R_S = 50\ \Omega$                                                            | 25°C                       | 5 to -1    | 5 to -1.9 |     | 5 to -1   | 5 to -1.9 |     | V                            |
|                                                                               |                                                                               | Full range                 | 5 to -0.8  |           |     | 5 to -0.8 |           |     |                              |
| $V_{OM+}$ Maximum positive peak output voltage swing                          | $I_O = -200\ \mu\text{A}$                                                     | 25°C                       | 3.8        | 4.1       |     | 3.8       | 4.1       |     | V                            |
|                                                                               |                                                                               | Full range                 | 3.7        |           |     | 3.7       |           |     |                              |
|                                                                               | $I_O = -2\ \text{mA}$                                                         | 25°C                       | 3.5        | 3.9       |     | 3.5       | 3.9       |     |                              |
|                                                                               |                                                                               | Full range                 | 3.4        |           |     | 3.4       |           |     |                              |
|                                                                               | $I_O = -20\ \text{mA}$                                                        | 25°C                       | 1.5        | 2.3       |     | 1.5       | 2.3       |     |                              |
|                                                                               |                                                                               | Full range                 | 1.5        |           |     | 1.5       |           |     |                              |
| $V_{OM-}$ Maximum negative peak output voltage swing                          | $I_O = 200\ \mu\text{A}$                                                      | 25°C                       | -3.8       | -4.2      |     | -3.8      | -4.2      |     | V                            |
|                                                                               |                                                                               | Full range                 | -3.7       |           |     | -3.7      |           |     |                              |
|                                                                               | $I_O = 2\ \text{mA}$                                                          | 25°C                       | -3.5       | -4.1      |     | -3.5      | -4.1      |     |                              |
|                                                                               |                                                                               | Full range                 | -3.4       |           |     | -3.4      |           |     |                              |
|                                                                               | $I_O = 20\ \text{mA}$                                                         | 25°C                       | -1.5       | -2.4      |     | -1.5      | -2.4      |     |                              |
|                                                                               |                                                                               | Full range                 | -1.5       |           |     | -1.5      |           |     |                              |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 2.3\ \text{V}$                                                     | $R_L = 600\ \Omega$        | 25°C       | 80        | 91  | 80        | 91        |     | dB                           |
|                                                                               |                                                                               |                            | Full range | 79        |     | 79        |           |     |                              |
|                                                                               |                                                                               | $R_L = 2\ \text{k}\Omega$  | 25°C       | 90        | 100 | 90        | 100       |     |                              |
|                                                                               |                                                                               |                            | Full range | 89        |     | 89        |           |     |                              |
|                                                                               |                                                                               | $R_L = 10\ \text{k}\Omega$ | 25°C       | 95        | 106 | 95        | 106       |     |                              |
|                                                                               |                                                                               |                            | Full range | 94        |     | 94        |           |     |                              |
| $r_i$ Input resistance                                                        | $V_{IC} = 0$                                                                  | 25°C                       |            | $10^{12}$ |     |           | $10^{12}$ |     | $\Omega$                     |
| $c_i$ Input capacitance                                                       | $V_{IC} = 0, \text{See Figure 5}$                                             | Common mode                | 25°C       | 11        |     | 11        |           |     | pF                           |
|                                                                               |                                                                               | Differential               | 25°C       | 2.5       |     | 2.5       |           |     |                              |
| $z_o$ Open-loop output impedance                                              | $f = 1\ \text{MHz}$                                                           | 25°C                       |            | 80        |     |           | 80        |     | $\Omega$                     |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50\ \Omega$                              | 25°C                       | 70         | 89        |     | 70        | 89        |     | dB                           |
|                                                                               |                                                                               | Full range                 | 68         |           |     | 68        |           |     |                              |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5\ \text{V to } \pm 15\ \text{V}, V_O = 0, R_S = 50\ \Omega$ | 25°C                       | 82         | 99        |     | 82        | 99        |     | dB                           |
|                                                                               |                                                                               | Full range                 | 80         |           |     | 80        |           |     |                              |

$^\dagger$  Full range is  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .



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**TLE2071I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$  (unless otherwise noted) (continued)**

| PARAMETER       |                              | TEST CONDITIONS             |                        | T <sub>A</sub> <sup>†</sup> | TLE2071I |     |     | TLE2071AI |     |     | UNIT |
|-----------------|------------------------------|-----------------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
|                 |                              |                             |                        |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub> | Supply current               | V <sub>O</sub> = 0, No load |                        | 25°C                        | 1.35     | 1.6 | 2.2 | 1.35      | 1.6 | 2.2 | mA   |
|                 |                              |                             |                        | Full range                  | 2.2      |     |     | 2.2       |     |     |      |
| I <sub>OS</sub> | Short-circuit output current | V <sub>O</sub> = 0          | V <sub>ID</sub> = 1 V  | 25°C                        | −35      |     |     | −35       |     |     | mA   |
|                 |                              |                             | V <sub>ID</sub> = −1 V |                             | 45       |     |     | 45        |     |     |      |

$^\dagger$  Full range is –40°C to 85°C.

**TLE2071I operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                       |                                     | T <sub>A</sub> <sup>†</sup> | TLE2071I |     |      | TLE2071AI |        |     | UNIT   |
|--------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------|----------|-----|------|-----------|--------|-----|--------|
|                    |                                             |                                                                                                                       |                                     |                             | MIN      | TYP | MAX  | MIN       | TYP    | MAX |        |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±2.3 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                                     | 25°C                        | 35       |     |      | 35        |        |     | V/μs   |
|                    |                                             |                                                                                                                       |                                     | Full range                  | 22       |     |      | 22        |        |     |        |
| SR −               | Negative slew rate                          |                                                                                                                       |                                     | 25°C                        | 38       |     |      | 38        |        |     | V/μs   |
|                    |                                             |                                                                                                                       |                                     | Full range                  | 22       |     |      | 22        |        |     |        |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 2-V step,<br>R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                     | To 10 mV                            | 25°C                        | 0.25     |     |      | 0.25      |        |     | μs     |
|                    |                                             |                                                                                                                       | To 1 mV                             |                             | 0.4      |     |      | 0.4       |        |     |        |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                   | f = 10 Hz                           | 25°C                        | 28       | 55  | 28   | 55        | nV/√Hz |     |        |
|                    |                                             |                                                                                                                       | f = 10 kHz                          |                             | 11.6     | 17  | 11.6 | 17        |        |     |        |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                       | f = 10 Hz to 10 kHz                 | 25°C                        | 6        |     |      | 6         |        |     | μV     |
|                    |                                             |                                                                                                                       | f = 0.1 Hz to 10 Hz                 |                             | 0.6      |     |      | 0.6       |        |     |        |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                       |                                     | 25°C                        | 2.8      |     |      | 2.8       |        |     | fA/√Hz |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 5 V, A <sub>VD</sub> = 10, f = 1 kHz, R <sub>L</sub> = 2 kΩ, R <sub>S</sub> = 25 Ω               |                                     | 25°C                        | 0.013%   |     |      | 0.013%    |        |     |        |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                       | R <sub>L</sub> = 2 kΩ, See Figure 2 | 25°C                        | 9.4      |     |      | 9.4       |        |     | MHz    |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 4 V, A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ , C <sub>L</sub> = 25 pF                        |                                     | 25°C                        | 2.8      |     |      | 2.8       |        |     | MHz    |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                       | R <sub>L</sub> = 2 kΩ, See Figure 2 | 25°C                        | 56°      |     |      | 56°       |        |     |        |

$^\dagger$  Full range is –40°C to 85°C.



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**TLE2071I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER                                                                     | TEST CONDITIONS                                                              | $T_A^\dagger$              | TLE2071I    |             |     | TLE2071AI   |             |     | UNIT             |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------|-------------|-------------|-----|-------------|-------------|-----|------------------|
|                                                                               |                                                                              |                            | MIN         | TYP         | MAX | MIN         | TYP         | MAX |                  |
| $V_{IO}$ Input offset voltage                                                 | $V_{IC} = 0, V_O = 0, R_S = 50 \Omega$                                       | 25°C                       | 0.49        | 4           |     | 0.47        | 2           |     | mV               |
|                                                                               |                                                                              | Full range                 |             | 7.6         |     |             | 5.6         |     |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                |                                                                              | Full range                 | 3.2         | 29          |     | 3.2         | 29          |     | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                 | $V_{IC} = 0, V_O = 0, \text{See Figure 4}$                                   | 25°C                       | 6           | 100         |     | 6           | 100         |     | pA               |
|                                                                               |                                                                              | Full range                 |             | 5           |     |             | 5           |     | nA               |
| $I_{IB}$ Input bias current                                                   |                                                                              | 25°C                       | 20          | 175         |     | 20          | 175         |     | pA               |
|                                                                               |                                                                              | Full range                 |             | 10          |     |             | 10          |     | nA               |
| $V_{ICR}$ Common-mode input voltage range                                     | $R_S = 50 \Omega$                                                            | 25°C                       | 15 to –11   | 15 to –11.9 |     | 15 to –11   | 15 to –11.9 |     | V                |
|                                                                               |                                                                              | Full range                 | 15 to –10.8 |             |     | 15 to –10.8 |             |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing                          | $I_O = -200 \mu A$                                                           | 25°C                       | 13.8        | 14.1        |     | 13.8        | 14.1        |     | V                |
|                                                                               |                                                                              | Full range                 | 13.7        |             |     | 13.7        |             |     |                  |
|                                                                               | $I_O = -2 \text{ mA}$                                                        | 25°C                       | 13.5        | 13.9        |     | 13.5        | 13.9        |     |                  |
|                                                                               |                                                                              | Full range                 | 13.4        |             |     | 13.4        |             |     |                  |
|                                                                               | $I_O = -20 \text{ mA}$                                                       | 25°C                       | 11.5        | 12.3        |     | 11.5        | 12.3        |     |                  |
|                                                                               |                                                                              | Full range                 | 11.5        |             |     | 11.5        |             |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing                          | $I_O = 200 \mu A$                                                            | 25°C                       | –13.8       | –14.2       |     | –13.8       | –14.2       |     | V                |
|                                                                               |                                                                              | Full range                 | –13.7       |             |     | –13.7       |             |     |                  |
|                                                                               | $I_O = 2 \text{ mA}$                                                         | 25°C                       | –13.5       | –14         |     | –13.5       | –14         |     |                  |
|                                                                               |                                                                              | Full range                 | –13.4       |             |     | –13.4       |             |     |                  |
|                                                                               | $I_O = 20 \text{ mA}$                                                        | 25°C                       | –11.5       | –12.4       |     | –11.5       | –12.4       |     |                  |
|                                                                               |                                                                              | Full range                 | –11.5       |             |     | –11.5       |             |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10 \text{ V}$                                                     | $R_L = 600 \Omega$         | 25°C        | 80          | 96  | 80          | 96          |     | dB               |
|                                                                               |                                                                              |                            | Full range  | 79          |     | 79          |             |     |                  |
|                                                                               |                                                                              | $R_L = 2 \text{ k}\Omega$  | 25°C        | 90          | 109 | 90          | 109         |     |                  |
|                                                                               |                                                                              |                            | Full range  | 89          |     | 89          |             |     |                  |
|                                                                               |                                                                              | $R_L = 10 \text{ k}\Omega$ | 25°C        | 95          | 118 | 95          | 118         |     |                  |
|                                                                               |                                                                              |                            | Full range  | 94          |     | 94          |             |     |                  |
| $r_i$ Input resistance                                                        | $V_{IC} = 0$                                                                 | 25°C                       | $10^{12}$   |             |     | $10^{12}$   |             |     | $\Omega$         |
| $c_i$ Input capacitance                                                       | $V_{IC} = 0, \text{See Figure 5}$                                            | Common mode                | 25°C        | 7.5         |     | 7.5         |             |     | pF               |
|                                                                               |                                                                              | Differential               | 25°C        | 2.5         |     | 2.5         |             |     |                  |
| $z_o$ Open-loop output impedance                                              | $f = 1 \text{ MHz}$                                                          | 25°C                       | 80          |             |     | 80          |             |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$                              | 25°C                       | 80          | 98          |     | 80          | 98          |     | dB               |
|                                                                               |                                                                              | Full range                 | 79          |             |     | 79          |             |     |                  |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$ | 25°C                       | 82          | 99          |     | 82          | 99          |     | dB               |
|                                                                               |                                                                              | Full range                 | 80          |             |     | 80          |             |     |                  |

$^\dagger$  Full range is  $-40^\circ C$  to  $85^\circ C$ .



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**TLE2071I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted) (continued)**

| PARAMETER       |                              | TEST CONDITIONS             |                        | T <sub>A</sub> <sup>†</sup> | TLE2071I |     |     | TLE2071AI |     |     | UNIT |
|-----------------|------------------------------|-----------------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
|                 |                              |                             |                        |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub> | Supply current               | V <sub>O</sub> = 0, No load |                        | 25°C                        | 1.35     | 1.7 | 2.2 | 1.35      | 1.7 | 2.2 | mA   |
|                 |                              |                             |                        | Full range                  | 2.2      |     |     | 2.2       |     |     |      |
| I <sub>OS</sub> | Short-circuit output current | V <sub>O</sub> = 0          | V <sub>ID</sub> = 1 V  | 25°C                        | –30      | –45 |     | –30       | –45 | mA  |      |
|                 |                              |                             | V <sub>ID</sub> = –1 V |                             | 30       | 48  |     | 30        | 48  |     |      |

$^\dagger$  Full range is –40°C to 85°C.

**TLE2071I operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                      |                                     | T <sub>A</sub> <sup>†</sup> | TLE2071I |     |     | TLE2071AI |     |     | UNIT   |
|--------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|--------|
|                    |                                             |                                                                                                                      |                                     |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |        |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±10 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                                     | 25°C                        | 30       | 40  |     | 30        | 40  |     | V/μs   |
|                    |                                             |                                                                                                                      |                                     | Full range                  | 24       |     |     | 24        |     |     |        |
| SR −               | Negative slew rate                          |                                                                                                                      |                                     | 25°C                        | 30       | 45  |     | 30        | 45  |     | V/μs   |
|                    |                                             |                                                                                                                      |                                     | Full range                  | 24       |     |     | 24        |     |     |        |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 10-V step, R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                      | To 10 mV                            | 25°C                        | 0.4      |     |     | 0.4       |     |     | μs     |
|                    |                                             | To 1 mV                                                                                                              | 1.5                                 |                             |          | 1.5 |     |           |     |     |        |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                  | f = 10 Hz                           | 25°C                        | 28       | 55  |     | 28        | 55  |     | nV/√Hz |
|                    |                                             |                                                                                                                      | f = 10 kHz                          |                             | 11.6     | 17  |     | 11.6      | 17  |     |        |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                      | f = 10 Hz to 10 kHz                 | 25°C                        | 6        |     |     | 6         |     |     | μV     |
|                    |                                             |                                                                                                                      | f = 0.1 Hz to 10 Hz                 |                             | 0.6      |     |     | 0.6       |     |     |        |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                      |                                     | 25°C                        | 2.8      |     |     | 2.8       |     |     | fA/√Hz |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10, f = 1 kHz, R <sub>L</sub> = 2 kΩ, R <sub>S</sub> = 25 Ω             |                                     | 25°C                        | 0.008%   |     |     | 0.008%    |     |     |        |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                      | R <sub>L</sub> = 2 kΩ, See Figure 2 | 25°C                        | 8        | 10  |     | 8         | 10  |     | MHz    |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 25 pF                       |                                     | 25°C                        | 478      | 637 |     | 478       | 637 |     | kHz    |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                      | R <sub>L</sub> = 2 kΩ, See Figure 2 | 25°C                        | 57°      |     |     | 57°       |     |     |        |

$^\dagger$  Full range is –40°C to 85°C.



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**TLE2071M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted)**

| PARAMETER                                                                       | TEST CONDITIONS                                                                   | $T_A^\dagger$              | TLE2071M   |           |     | TLE2071AM |           |     | UNIT             |
|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------|------------|-----------|-----|-----------|-----------|-----|------------------|
|                                                                                 |                                                                                   |                            | MIN        | TYP       | MAX | MIN       | TYP       | MAX |                  |
| $V_{IO}$ Input offset voltage                                                   | $V_{IC} = 0, V_O = 0,$<br>$R_S = 50 \Omega,$                                      | 25°C                       | 0.34       | 4         |     | 0.3       | 2         |     | mV               |
|                                                                                 |                                                                                   | Full range                 |            | 9.2       |     |           | 7.2       |     |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                  |                                                                                   | Full range                 | 3.2        | 29*       |     | 3.2       | 29*       |     | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                   | $V_{IC} = 0, V_O = 0,$<br>See Figure 4                                            | 25°C                       | 5          | 100       |     | 5         | 100       |     | pA               |
|                                                                                 |                                                                                   | Full range                 |            | 20        |     |           | 20        |     | nA               |
| $I_{IB}$ Input bias current                                                     |                                                                                   | 25°C                       | 15         | 175       |     | 15        | 175       |     | pA               |
|                                                                                 |                                                                                   | Full range                 |            | 60        |     |           | 60        |     | nA               |
| $V_{ICR}$ Common-mode input voltage range                                       | $R_S = 50 \Omega$                                                                 | 25°C                       | 5 to -1    | 5 to -1.9 |     | 5 to -1   | 5 to -1.9 |     | V                |
|                                                                                 |                                                                                   | Full range                 | 5 to -0.8  |           |     | 5 to -0.8 |           |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing                            | $I_O = -200 \mu A$                                                                | 25°C                       | 3.8        | 4.1       |     | 3.8       | 4.1       |     | V                |
|                                                                                 |                                                                                   | Full range                 | 3.6        |           |     | 3.6       |           |     |                  |
|                                                                                 | $I_O = -2 \text{ mA}$                                                             | 25°C                       | 3.5        | 3.9       |     | 3.5       | 3.9       |     |                  |
|                                                                                 |                                                                                   | Full range                 | 3.3        |           |     | 3.3       |           |     |                  |
|                                                                                 | $I_O = -20 \text{ mA}$                                                            | 25°C                       | 1.5        | 2.3       |     | 1.5       | 2.3       |     |                  |
|                                                                                 |                                                                                   | Full range                 | 1.4        |           |     | 1.4       |           |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing                            | $I_O = 200 \mu A$                                                                 | 25°C                       | -3.8       | -4.2      |     | -3.8      | -4.2      |     | V                |
|                                                                                 |                                                                                   | Full range                 | -3.6       |           |     | -3.6      |           |     |                  |
|                                                                                 | $I_O = 2 \text{ mA}$                                                              | 25°C                       | -3.5       | -4.1      |     | -3.5      | -4.1      |     |                  |
|                                                                                 |                                                                                   | Full range                 | -3.3       |           |     | -3.3      |           |     |                  |
|                                                                                 | $I_O = 20 \text{ mA}$                                                             | 25°C                       | -1.5       | -2.4      |     | -1.5      | -2.4      |     |                  |
|                                                                                 |                                                                                   | Full range                 | -1.4       |           |     | -1.4      |           |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                        | $V_O = \pm 2.3 \text{ V}$                                                         | $R_L = 600 \Omega$         | 25°C       | 80        | 91  | 80        | 91        |     | dB               |
|                                                                                 |                                                                                   |                            | Full range | 78        |     | 78        |           |     |                  |
|                                                                                 |                                                                                   | $R_L = 2 \text{ k}\Omega$  | 25°C       | 90        | 100 | 90        | 100       |     |                  |
|                                                                                 |                                                                                   |                            | Full range | 88        |     | 88        |           |     |                  |
|                                                                                 |                                                                                   | $R_L = 10 \text{ k}\Omega$ | 25°C       | 95        | 106 | 95        | 106       |     |                  |
|                                                                                 |                                                                                   |                            | Full range | 93        |     | 93        |           |     |                  |
| $r_i$ Input resistance                                                          | $V_{IC} = 0$                                                                      | 25°C                       | $10^{12}$  |           |     | $10^{12}$ |           |     | $\Omega$         |
| $c_i$ Input capacitance                                                         | $V_{IC} = 0,$<br>See Figure 5                                                     | Common mode                | 25°C       | 11        |     | 11        |           |     | pF               |
|                                                                                 |                                                                                   | Differential               | 25°C       | 2.5       |     | 2.5       |           |     |                  |
| $z_o$ Open-loop output impedance                                                | $f = 1 \text{ MHz}$                                                               | 25°C                       | 80         |           |     | 80        |           |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                                | $V_{IC} = V_{ICRmin},$<br>$V_O = 0, R_S = 50 \Omega$                              | 25°C                       | 70         | 89        |     | 70        | 89        |     | dB               |
|                                                                                 |                                                                                   | Full range                 | 68         |           |     | 68        |           |     |                  |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm} / \Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V},$<br>$V_O = 0, R_S = 50 \Omega$ | 25°C                       | 82         | 99        |     | 82        | 99        |     | dB               |
|                                                                                 |                                                                                   | Full range                 | 80         |           |     | 80        |           |     |                  |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

$^\dagger$  Full range is  $-55^\circ C$  to  $125^\circ C$ .



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**TLE2071M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted)**

| PARAMETER       |                              | TEST CONDITIONS     |                        | T <sub>A</sub> <sup>†</sup> | TLE2071M |     |     | TLE2071AM |     |     | UNIT |
|-----------------|------------------------------|---------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
|                 |                              |                     |                        |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub> | Supply current               | V <sub>O</sub> = 0, | No load                | 25°C                        | 1.35     | 1.6 | 2.2 | 1.35      | 1.6 | 2.2 | mA   |
|                 |                              |                     |                        | Full range                  | 2.2      |     |     | 2.2       |     |     |      |
| I <sub>OS</sub> | Short-circuit output current | V <sub>O</sub> = 0  | V <sub>ID</sub> = 1 V  | 25°C                        | −35      |     |     | −35       |     |     | mA   |
|                 |                              |                     | V <sub>ID</sub> = −1 V |                             | 45       |     |     | 45        |     |     |      |

$^\dagger$  Full range is –55°C to 125°C.

**TLE2071M operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                       |                                              | T <sub>A</sub> <sup>†</sup> | TLE2071M |     |      | TLE2071AM |        |        | UNIT |
|--------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------|----------|-----|------|-----------|--------|--------|------|
|                    |                                             |                                                                                                                       |                                              |                             | MIN      | TYP | MAX  | MIN       | TYP    | MAX    |      |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±2.3 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                                              | 25°C                        | 35       |     |      | 35        |        |        | V/μs |
|                    |                                             |                                                                                                                       |                                              | Full range                  | 20*      |     |      | 20*       |        |        |      |
| SR −               | Negative slew rate                          |                                                                                                                       |                                              | 25°C                        | 38       |     |      | 38        |        |        | V/μs |
|                    |                                             |                                                                                                                       |                                              | Full range                  | 20*      |     |      | 20*       |        |        |      |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 2-V step,<br>R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                     | To 10 mV                                     | 25°C                        | 0.25     |     |      | 0.25      |        |        | μs   |
|                    |                                             |                                                                                                                       | To 1 mV                                      |                             | 0.4      |     |      | 0.4       |        |        |      |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                   | f = 10 Hz                                    | 25°C                        | 28       | 55* | 28   | 55*       | nV/√Hz |        |      |
|                    |                                             |                                                                                                                       | f = 10 kHz                                   |                             | 11.6     | 17* | 11.6 | 17*       |        |        |      |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                       | f = 10 Hz to 10 kHz                          | 25°C                        | 6        |     |      | 6         |        |        | μV   |
|                    |                                             |                                                                                                                       | f = 0.1 Hz to 10 Hz                          |                             | 0.6      |     |      | 0.6       |        |        |      |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                       | 25°C                                         | 2.8                         |          |     | 2.8  |           |        | fA/√Hz |      |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 5 V, f = 1 kHz, R <sub>S</sub> = 25 Ω                                                            | A <sub>VD</sub> = 10, R <sub>L</sub> = 2 kΩ, | 25°C                        | 0.013%   |     |      | 0.013%    |        |        |      |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                       | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C                        | 9.4      |     |      | 9.4       |        |        | MHz  |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 4 V, R <sub>L</sub> = 2 kΩ ,                                                                     | A <sub>VD</sub> = −1, C <sub>L</sub> = 25 pF | 25°C                        | 2.8      |     |      | 2.8       |        |        | MHz  |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                       | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C                        | 56°      |     |      | 56°       |        |        |      |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

$^\dagger$  Full range is –55°C to 125°C.

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**TLE2071M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER                                                                     | TEST CONDITIONS                                                              | $T_A^\dagger$              | TLE2071M    |             |     | TLE2071AM   |             |     | UNIT             |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------|-------------|-------------|-----|-------------|-------------|-----|------------------|
|                                                                               |                                                                              |                            | MIN         | TYP         | MAX | MIN         | TYP         | MAX |                  |
| $V_{IO}$ Input offset voltage                                                 | $V_{IC} = 0, V_O = 0, R_S = 50 \Omega$                                       | 25°C                       | 0.49        | 4           |     | 0.47        | 2           |     | mV               |
|                                                                               |                                                                              | Full range                 |             | 9.2         |     | 7.2         |             |     |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                |                                                                              | Full range                 | 3.2         | 29*         |     | 3.2         | 29*         |     | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                 | $V_{IC} = 0, V_O = 0, \text{See Figure 4}$                                   | 25°C                       | 6           | 100         |     | 6           | 100         |     | pA               |
|                                                                               |                                                                              | Full range                 |             | 20          |     | 20          |             |     | nA               |
| $I_{IB}$ Input bias current                                                   |                                                                              | 25°C                       | 20          | 175         |     | 20          | 175         |     | pA               |
|                                                                               |                                                                              | Full range                 |             | 60          |     | 60          |             |     | nA               |
| $V_{ICR}$ Common-mode input voltage range                                     | $R_S = 50 \Omega$                                                            | 25°C                       | 15 to –11   | 15 to –11.9 |     | 15 to –11   | 15 to –11.9 |     | V                |
|                                                                               |                                                                              | Full range                 | 15 to –10.9 |             |     | 15 to –10.9 |             |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing                          | $I_O = -200 \mu A$                                                           | 25°C                       | 13.8        | 14.1        |     | 13.8        | 14.1        |     | V                |
|                                                                               |                                                                              | Full range                 | 13.6        |             |     | 13.6        |             |     |                  |
|                                                                               | $I_O = -2 \text{ mA}$                                                        | 25°C                       | 13.5        | 13.9        |     | 13.5        | 13.9        |     |                  |
|                                                                               |                                                                              | Full range                 | 13.3        |             |     | 13.3        |             |     |                  |
|                                                                               | $I_O = -20 \text{ mA}$                                                       | 25°C                       | 11.5        | 12.3        |     | 11.5        | 12.3        |     |                  |
|                                                                               |                                                                              | Full range                 | 11.4        |             |     | 11.4        |             |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing                          | $I_O = 200 \mu A$                                                            | 25°C                       | –13.8       | –14.2       |     | –13.8       | –14.2       |     | V                |
|                                                                               |                                                                              | Full range                 | –13.6       |             |     | –13.6       |             |     |                  |
|                                                                               | $I_O = 2 \text{ mA}$                                                         | 25°C                       | –13.5       | –14         |     | –13.5       | –14         |     |                  |
|                                                                               |                                                                              | Full range                 | –13.3       |             |     | –13.3       |             |     |                  |
|                                                                               | $I_O = 20 \text{ mA}$                                                        | 25°C                       | –11.5       | –12.4       |     | –11.5       | –12.4       |     |                  |
|                                                                               |                                                                              | Full range                 | –11.4       |             |     | –11.4       |             |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10 \text{ V}$                                                     | $R_L = 600 \Omega$         | 25°C        | 80          | 96  | 80          | 96          |     | dB               |
|                                                                               |                                                                              |                            | Full range  | 78          |     | 78          |             |     |                  |
|                                                                               |                                                                              | $R_L = 2 \text{ k}\Omega$  | 25°C        | 90          | 109 | 90          | 109         |     |                  |
|                                                                               |                                                                              |                            | Full range  | 88          |     | 88          |             |     |                  |
|                                                                               |                                                                              | $R_L = 10 \text{ k}\Omega$ | 25°C        | 95          | 118 | 95          | 118         |     |                  |
|                                                                               |                                                                              |                            | Full range  | 93          |     | 93          |             |     |                  |
| $r_i$ Input resistance                                                        | $V_{IC} = 0$                                                                 | 25°C                       | $10^{12}$   |             |     | $10^{12}$   |             |     | $\Omega$         |
| $c_i$ Input capacitance                                                       | $V_{IC} = 0, \text{See Figure 5}$                                            | Common mode                | 25°C        | 7.5         |     | 7.5         |             |     | pF               |
|                                                                               |                                                                              | Differential               | 25°C        | 2.5         |     | 2.5         |             |     |                  |
| $z_o$ Open-loop output impedance                                              | $f = 1 \text{ MHz}$                                                          | 25°C                       | 80          |             |     | 80          |             |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$                              | 25°C                       | 80          | 98          |     | 80          | 98          |     | dB               |
|                                                                               |                                                                              | Full range                 | 78          |             |     | 78          |             |     |                  |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$ | 25°C                       | 82          | 99          |     | 82          | 99          |     | dB               |
|                                                                               |                                                                              | Full range                 | 80          |             |     | 80          |             |     |                  |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

$^\dagger$  Full range is  $-55^\circ C$  to  $125^\circ C$ .



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**TLE2071M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted) (continued)**

| PARAMETER       |                              | TEST CONDITIONS             |                        | T <sub>A</sub> <sup>†</sup> | TLE2071M |     |     | TLE2071AM |     |     | UNIT |
|-----------------|------------------------------|-----------------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
|                 |                              |                             |                        |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub> | Supply current               | V <sub>O</sub> = 0, No load |                        | 25°C                        | 1.35     | 1.7 | 2.2 | 1.35      | 1.7 | 2.2 | mA   |
|                 |                              |                             |                        | Full range                  | 2.2      |     |     | 2.2       |     |     |      |
| I <sub>OS</sub> | Short-circuit output current | V <sub>O</sub> = 0          | V <sub>ID</sub> = 1 V  | 25°C                        | −30      | −45 |     | −30       | −45 | mA  |      |
|                 |                              |                             | V <sub>ID</sub> = −1 V |                             | 30       | 48  |     | 30        | 48  |     |      |

$^\dagger$  Full range is –55°C to 125°C.

**TLE2071M operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                        |                                              | T <sub>A</sub> <sup>†</sup> | TLE2071M |     |      | TLE2071AM |     |     | UNIT   |
|--------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------|----------|-----|------|-----------|-----|-----|--------|
|                    |                                             |                                                                                                                        |                                              |                             | MIN      | TYP | MAX  | MIN       | TYP | MAX |        |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = 10 V, A <sub>VD</sub> = −1,<br>R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF,<br>See Figure 1 |                                              | 25°C                        | 30       | 40  |      | 30        | 40  |     | V/μs   |
|                    | Full range                                  |                                                                                                                        |                                              | 22                          |          |     | 22   |           |     |     |        |
| SR −               | Negative slew rate                          |                                                                                                                        |                                              | 25°C                        | 30       | 45  |      | 30        | 45  |     | V/μs   |
|                    | Full range                                  |                                                                                                                        |                                              | 22                          |          |     | 22   |           |     |     |        |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1,<br>10-V step,<br>R <sub>L</sub> = 1 kΩ,<br>C <sub>L</sub> = 100 pF                               | To 10 mV                                     | 25°C                        | 0.4      |     |      | 0.4       |     |     | μs     |
|                    |                                             | To 1 mV                                                                                                                | 1.5                                          |                             |          | 1.5 |      |           |     |     |        |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω,<br>See Figure 3                                                                                 | f = 10 Hz                                    | 25°C                        | 28       | 55* |      | 28        | 55* |     | nV/√Hz |
|                    | f = 10 kHz                                  |                                                                                                                        | 11.6                                         |                             | 17*      |     | 11.6 | 17*       |     |     |        |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                        | f = 10 Hz to 10 kHz                          | 25°C                        | 6        |     |      | 6         |     |     | μV     |
|                    |                                             |                                                                                                                        | f = 0.1 Hz to 10 Hz                          |                             | 0.6      |     |      | 0.6       |     |     |        |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                        |                                              | 25°C                        | 2.8      |     |      | 2.8       |     |     | fA/√Hz |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10,<br>f = 1 kHz, R <sub>L</sub> = 2 kΩ,<br>R <sub>S</sub> = 25 Ω         |                                              | 25°C                        | 0.008%   |     |      | 0.008%    |     |     |        |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                        | R <sub>L</sub> = 2 kΩ,<br>See Figure 2       | 25°C                        | 8*       | 10  |      | 8*        | 10  |     | MHz    |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 20 V, R <sub>L</sub> = 2 kΩ,                                                                      | A <sub>VD</sub> = −1, C <sub>L</sub> = 25 pF | 25°C                        | 478*     | 637 |      | 478*      | 637 |     | kHz    |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                        | R <sub>L</sub> = 2 kΩ,<br>See Figure 2       | 25°C                        | 57°      |     |      | 57°       |     |     |        |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

$^\dagger$  Full range is –55°C to 125°C.

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**TLE2071Y electrical characteristics at  $V_{CC\pm} = \pm 15$  V,  $T_A = 25^\circ\text{C}$**

| PARAMETER                                                                     | TEST CONDITIONS                                                                      | TLE2071Y                   |                  |     | UNIT     |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------|------------------|-----|----------|
|                                                                               |                                                                                      | MIN                        | TYP              | MAX |          |
| $V_{IO}$ Input offset voltage                                                 | $V_{IC} = 0$ , $V_O = 0$ , $R_S = 50\ \Omega$                                        |                            | 0.49             | 4   | mV       |
| $I_{IO}$ Input offset current                                                 | $V_{IC} = 0$ , $V_O = 0$ , See Figure 4                                              |                            | 6                | 100 | pA       |
| $I_{IB}$ Input bias current                                                   |                                                                                      |                            | 20               | 175 | pA       |
| $V_{ICR}$ Common-mode input voltage range                                     | $R_S = 50\ \Omega$                                                                   | 15<br>to<br>–11            | 15<br>to<br>11.9 |     | V        |
| $V_{OM+}$ Maximum positive peak output voltage swing                          | $I_O = -200\ \mu\text{A}$                                                            | 13.8                       | 14.1             |     | V        |
|                                                                               | $I_O = -2\ \text{mA}$                                                                | 13.5                       | 13.9             |     |          |
|                                                                               | $I_O = -20\ \text{mA}$                                                               | 11.5                       | 12.3             |     |          |
| $V_{OM-}$ Maximum negative peak output voltage swing                          | $I_O = 200\ \mu\text{A}$                                                             | –13.8                      | –14.2            |     | V        |
|                                                                               | $I_O = 2\ \text{mA}$                                                                 | –13.5                      | –14              |     |          |
|                                                                               | $I_O = 20\ \text{mA}$                                                                | –11.5                      | –12.4            |     |          |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10\ \text{V}$                                                             | $R_L = 600\ \Omega$        | 80               | 96  | dB       |
|                                                                               |                                                                                      | $R_L = 2\ \text{k}\Omega$  | 90               | 109 |          |
|                                                                               |                                                                                      | $R_L = 10\ \text{k}\Omega$ | 95               | 118 |          |
| $r_i$ Input resistance                                                        | $V_{IC} = 0$                                                                         |                            | 10 <sup>12</sup> |     | $\Omega$ |
| $c_i$ Input capacitance                                                       | $V_O = 0$ ,<br>See Figure 5                                                          | Common mode                |                  | 7.5 | pF       |
|                                                                               |                                                                                      | Differential               |                  | 2.5 |          |
| $z_o$ Open-loop output impedance                                              | $f = 1\ \text{MHz}$                                                                  |                            | 80               |     | $\Omega$ |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICR\min}$ , $R_S = 50\ \Omega$ , $V_O = 0$                              | 80                         | 98               |     | dB       |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5\ \text{V}$ to $\pm 15\ \text{V}$ , $R_S = 50\ \Omega$ , $V_O = 0$ | 82                         | 99               |     | dB       |
| $I_{CC}$ Supply current                                                       | $V_O = 0$ , No load                                                                  | 1.35                       | 1.7              | 2.2 | mA       |
| $I_{OS}$ Short-circuit output current                                         | $V_O = 0$                                                                            | $V_{ID} = 1\ \text{V}$     | –30              | –45 | mA       |
|                                                                               |                                                                                      | $V_{ID} = -1\ \text{V}$    | 30               | 48  |          |

**TLE2072C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted)**

| PARAMETER                                                                       | TEST CONDITIONS                                                              | $T_A^\dagger$              | TLE2072C   |           |     | TLE2072AC |           |     | UNIT             |
|---------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------|------------|-----------|-----|-----------|-----------|-----|------------------|
|                                                                                 |                                                                              |                            | MIN        | TYP       | MAX | MIN       | TYP       | MAX |                  |
| $V_{IO}$ Input offset voltage                                                   | $V_{IC} = 0, V_O = 0, R_S = 50 \Omega$                                       | 25°C                       |            | 0.9       | 6   |           | 0.65      | 3.5 | mV               |
|                                                                                 |                                                                              | Full range                 |            |           | 7.8 |           |           | 5.3 |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                  |                                                                              | Full range                 |            | 2.3       | 25  |           | 2.3       | 25  | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                   | $V_{IC} = 0, V_O = 0,$<br>See Figure 4                                       | 25°C                       |            | 5         | 100 |           | 5         | 100 | pA               |
|                                                                                 |                                                                              | Full range                 |            |           | 1.4 |           |           | 1.4 | nA               |
| $I_{IB}$ Input bias current                                                     |                                                                              | 25°C                       |            | 15        | 175 |           | 15        | 175 | pA               |
|                                                                                 |                                                                              | Full range                 |            |           | 5   |           |           | 5   | nA               |
| $V_{ICR}$ Common-mode input voltage range                                       | $R_S = 50 \Omega$                                                            | 25°C                       | 5 to -1    | 5 to -1.9 |     | 5 to -1   | 5 to -1.9 |     | V                |
|                                                                                 |                                                                              | Full range                 | 5 to -0.9  |           |     | 5 to -0.9 |           |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing                            | $I_O = -200 \mu A$                                                           | 25°C                       | 3.8        | 4.1       |     | 3.8       | 4.1       |     | V                |
|                                                                                 |                                                                              | Full range                 | 3.7        |           |     | 3.7       |           |     |                  |
|                                                                                 | $I_O = -2 \text{ mA}$                                                        | 25°C                       | 3.5        | 3.9       |     | 3.5       | 3.9       |     |                  |
|                                                                                 |                                                                              | Full range                 | 3.4        |           |     | 3.4       |           |     |                  |
|                                                                                 | $I_O = -20 \text{ mA}$                                                       | 25°C                       | 1.5        | 2.3       |     | 1.5       | 2.3       |     |                  |
|                                                                                 |                                                                              | Full range                 | 1.5        |           |     | 1.5       |           |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing                            | $I_O = 200 \mu A$                                                            | 25°C                       | -3.8       | -4.2      |     | -3.8      | -4.2      |     | V                |
|                                                                                 |                                                                              | Full range                 | -3.7       |           |     | -3.7      |           |     |                  |
|                                                                                 | $I_O = 2 \text{ mA}$                                                         | 25°C                       | -3.5       | -4.1      |     | -3.5      | -4.1      |     |                  |
|                                                                                 |                                                                              | Full range                 | -3.4       |           |     | -3.4      |           |     |                  |
|                                                                                 | $I_O = 20 \text{ mA}$                                                        | 25°C                       | -1.5       | -2.4      |     | -1.5      | -2.4      |     |                  |
|                                                                                 |                                                                              | Full range                 | -1.5       |           |     | -1.5      |           |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                        | $V_O = \pm 2.3 \text{ V}$                                                    | $R_L = 600 \Omega$         | 25°C       | 80        | 91  | 80        | 91        |     | dB               |
|                                                                                 |                                                                              |                            | Full range | 79        |     | 79        |           |     |                  |
|                                                                                 |                                                                              | $R_L = 2 \text{ k}\Omega$  | 25°C       | 90        | 100 | 90        | 100       |     |                  |
|                                                                                 |                                                                              |                            | Full range | 89        |     | 89        |           |     |                  |
|                                                                                 |                                                                              | $R_L = 10 \text{ k}\Omega$ | 25°C       | 95        | 106 | 95        | 106       |     |                  |
|                                                                                 |                                                                              |                            | Full range | 94        |     | 94        |           |     |                  |
| $r_i$ Input resistance                                                          | $V_{IC} = 0$                                                                 | 25°C                       |            | $10^{12}$ |     | $10^{12}$ |           |     | $\Omega$         |
| $c_i$ Input capacitance                                                         | $V_{IC} = 0,$<br>See Figure 5                                                | Common mode                | 25°C       | 11        |     | 11        |           |     | pF               |
|                                                                                 |                                                                              | Differential               | 25°C       | 2.5       |     | 2.5       |           |     |                  |
| $z_o$ Open-loop output impedance                                                | $f = 1 \text{ MHz}$                                                          | 25°C                       |            | 80        |     | 80        |           |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                                | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$                              | 25°C                       | 70         | 89        |     | 70        | 89        |     | dB               |
|                                                                                 |                                                                              | Full range                 | 68         |           |     | 68        |           |     |                  |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm} / \Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$ | 25°C                       | 82         | 99        |     | 82        | 99        |     | dB               |
|                                                                                 |                                                                              | Full range                 | 80         |           |     | 80        |           |     |                  |

$^\dagger$  Full range is 0°C to 70°C.

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**TLE2072C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$  (unless otherwise noted)**  
**(continued)**

| PARAMETER                               | TEST CONDITIONS                         | $T_A$      | TLE2072C |     |     | TLE2072AC |     |     | UNIT |
|-----------------------------------------|-----------------------------------------|------------|----------|-----|-----|-----------|-----|-----|------|
|                                         |                                         |            | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| $I_{CC}$ Supply current (both channels) | $V_O = 0$ , No load                     | 25°C       | 2.7      | 2.9 | 3.9 | 2.7       | 2.9 | 3.9 | mA   |
|                                         |                                         | Full range |          |     | 3.9 |           |     | 3.9 |      |
| $a_x$ Crosstalk attenuation             | $V_{IC} = 0$ , $R_L = 2\text{ k}\Omega$ | 25°C       |          | 120 |     |           | 120 |     | dB   |
| $I_{OS}$ Short-circuit output current   | $V_O = 0$                               | 25°C       |          | –35 |     |           | –35 |     | mA   |
|                                         |                                         |            |          | 45  |     |           | 45  |     |      |

**TLE2072C operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                       |                                                   | T <sub>A</sub> <sup>†</sup> | TLE2072C |      |        | TLE2072AC |        |        | UNIT |
|--------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------|----------|------|--------|-----------|--------|--------|------|
|                    |                                             |                                                                                                                       |                                                   |                             | MIN      | TYP  | MAX    | MIN       | TYP    | MAX    |      |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±2.3 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                                                   | 25°C                        | 35       |      |        | 35        |        |        | V/μs |
|                    | Full range                                  |                                                                                                                       |                                                   | 22                          |          |      | 22     |           |        |        |      |
| SR −               | Negative slew rate                          |                                                                                                                       |                                                   | 25°C                        | 38       |      |        | 38        |        |        | V/μs |
|                    |                                             |                                                                                                                       |                                                   | Full range                  | 22       |      |        | 22        |        |        |      |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 2-V step,<br>R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                     | To 10 mV                                          | 25°C                        | 0.25     |      |        | 0.25      |        |        | μs   |
|                    |                                             |                                                                                                                       | To 1 mV                                           |                             | 0.4      |      |        | 0.4       |        |        |      |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                   | f = 10 Hz                                         | 25°C                        | 28       | 55   | 28     | 55        | nV/√Hz |        |      |
|                    | f = 10 kHz                                  |                                                                                                                       | 11.6                                              |                             | 17       | 11.6 | 17     |           |        |        |      |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                       | f = 10 Hz to 10 kHz                               | 25°C                        | 6        |      |        | 6         |        |        | μV   |
|                    |                                             |                                                                                                                       | f = 0.1 Hz to 10 Hz                               |                             | 0.6      |      |        | 0.6       |        |        |      |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                       | 25°C                                              | 2.8                         |          |      | 2.8    |           |        | fA/√Hz |      |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 5 V, f = 1 kHz, R <sub>S</sub> = 25 Ω                                                            | A <sub>VD</sub> = 10, R <sub>L</sub> = 2 kΩ, 25°C | 0.013%                      |          |      | 0.013% |           |        |        |      |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF, R <sub>L</sub> = 2 kΩ, See Figure 2                                   | 25°C                                              | 9.4                         |          |      | 9.4    |           |        | MHz    |      |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 4 V, R <sub>L</sub> = 2 kΩ, A <sub>VD</sub> = −1, C <sub>L</sub> = 25 pF                         | 25°C                                              | 2.8                         |          |      | 2.8    |           |        | MHz    |      |
| ϕ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF, R <sub>L</sub> = 2 kΩ, See Figure 2                                   | 25°C                                              | 56°                         |          |      | 56°    |           |        |        |      |

$^\dagger$  Full range is 0°C to 70°C.



**TLE2072C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER                                                                     | TEST CONDITIONS                                                              | $T_A^\dagger$              | TLE2072C    |             |     | TLE2072AC   |             |     | UNIT             |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------|-------------|-------------|-----|-------------|-------------|-----|------------------|
|                                                                               |                                                                              |                            | MIN         | TYP         | MAX | MIN         | TYP         | MAX |                  |
| $V_{IO}$ Input offset voltage                                                 | $V_{IC} = 0, V_O = 0, R_S = 50 \Omega$                                       | 25°C                       |             | 1.1         | 6   |             | 0.7         | 3.5 | mV               |
|                                                                               |                                                                              | Full range                 |             |             | 7.8 |             |             | 5.3 |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                |                                                                              | Full range                 |             | 2.4         | 25  |             | 2.4         | 25  | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                 | $V_{IC} = 0, V_O = 0, \text{See Figure 4}$                                   | 25°C                       |             | 6           | 100 |             | 6           | 100 | pA               |
|                                                                               |                                                                              | Full range                 |             |             | 1.4 |             |             | 1.4 | nA               |
| $I_{IB}$ Input bias current                                                   |                                                                              | 25°C                       |             | 20          | 175 |             | 20          | 175 | pA               |
|                                                                               |                                                                              | Full range                 |             |             | 5   |             |             | 5   | nA               |
| $V_{ICR}$ Common-mode input voltage range                                     | $R_S = 50 \Omega$                                                            | 25°C                       | 15 to –11   | 15 to –11.9 |     | 15 to –11   | 15 to –11.9 |     | V                |
|                                                                               |                                                                              | Full range                 | 15 to –10.9 |             |     | 15 to –10.9 |             |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing                          | $I_O = -200 \mu A$                                                           | 25°C                       | 13.8        | 14.1        |     | 13.8        | 14.1        |     | V                |
|                                                                               |                                                                              | Full range                 | 13.6        |             |     | 13.6        |             |     |                  |
|                                                                               | $I_O = -2 \text{ mA}$                                                        | 25°C                       | 13.5        | 13.9        |     | 13.5        | 13.9        |     |                  |
|                                                                               |                                                                              | Full range                 | 13.4        |             |     | 13.4        |             |     |                  |
|                                                                               | $I_O = -20 \text{ mA}$                                                       | 25°C                       | 11.5        | 12.3        |     | 11.5        | 12.3        |     |                  |
|                                                                               |                                                                              | Full range                 | 11.5        |             |     | 11.5        |             |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing                          | $I_O = 200 \mu A$                                                            | 25°C                       | –13.8       | –14.2       |     | –13.8       | –14.2       |     | V                |
|                                                                               |                                                                              | Full range                 | –13.7       |             |     | –13.7       |             |     |                  |
|                                                                               | $I_O = 2 \text{ mA}$                                                         | 25°C                       | –13.5       | –14         |     | –13.5       | –14         |     |                  |
|                                                                               |                                                                              | Full range                 | –13.4       |             |     | –13.4       |             |     |                  |
|                                                                               | $I_O = 20 \text{ mA}$                                                        | 25°C                       | –11.5       | –12.4       |     | –11.5       | –12.4       |     |                  |
|                                                                               |                                                                              | Full range                 | –11.5       |             |     | –11.5       |             |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10 \text{ V}$                                                     | $R_L = 600 \Omega$         | 25°C        | 80          | 96  | 80          | 96          |     | dB               |
|                                                                               |                                                                              |                            | Full range  | 79          |     | 79          |             |     |                  |
|                                                                               |                                                                              | $R_L = 2 \text{ k}\Omega$  | 25°C        | 90          | 109 | 90          | 109         |     |                  |
|                                                                               |                                                                              |                            | Full range  | 89          |     | 89          |             |     |                  |
|                                                                               |                                                                              | $R_L = 10 \text{ k}\Omega$ | 25°C        | 95          | 118 | 95          | 118         |     |                  |
|                                                                               |                                                                              |                            | Full range  | 94          |     | 94          |             |     |                  |
| $r_i$ Input resistance                                                        | $V_{IC} = 0$                                                                 | 25°C                       |             | $10^{12}$   |     |             | $10^{12}$   |     | $\Omega$         |
| $c_i$ Input capacitance                                                       | $V_{IC} = 0, \text{See Figure 5}$                                            | Common mode                | 25°C        | 7.5         |     | 7.5         |             |     | pF               |
|                                                                               |                                                                              | Differential               | 25°C        | 2.5         |     | 2.5         |             |     |                  |
| $z_o$ Open-loop output impedance                                              | $f = 1 \text{ MHz}$                                                          | 25°C                       |             | 80          |     | 80          |             |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$                              | 25°C                       | 80          | 98          |     | 80          | 98          |     | dB               |
|                                                                               |                                                                              | Full range                 | 79          |             |     | 79          |             |     |                  |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$ | 25°C                       | 82          | 99          |     | 82          | 99          |     | dB               |
|                                                                               |                                                                              | Full range                 | 81          |             |     | 81          |             |     |                  |

$^\dagger$  Full range is 0°C to 70°C.

**TLE207x, TLE207xA, TLE207xY**  
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**TLE2072C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted) (continued)**

| PARAMETER       |                                   | TEST CONDITIONS      |                        | T <sub>A</sub> | TLE2072C |     |     | TLE2072AC |     |     | UNIT |
|-----------------|-----------------------------------|----------------------|------------------------|----------------|----------|-----|-----|-----------|-----|-----|------|
|                 |                                   |                      |                        |                | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub> | Supply current<br>(both channels) | V <sub>O</sub> = 0,  | No load                | 25°C           | 2.7      | 3.1 | 3.9 | 2.7       | 3.1 | 3.9 | mA   |
|                 |                                   |                      |                        | Full range     | 3.9      |     |     | 3.9       |     |     |      |
| a <sub>x</sub>  | Crosstalk attenuation             | V <sub>IC</sub> = 0, | R <sub>L</sub> = 2 kΩ  | 25°C           | 120      |     |     | 120       |     |     | dB   |
| I <sub>OS</sub> | Short-circuit output current      | V <sub>O</sub> = 0   | V <sub>ID</sub> = 1 V  | 25°C           | −30      | −45 |     | −30       | −45 |     | mA   |
|                 |                                   |                      | V <sub>ID</sub> = −1 V |                | 30       | 48  |     | 30        | 48  |     |      |

**TLE2072C operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                           |                                                 | T <sub>A</sub> <sup>†</sup> | TLE2072C |      |     | TLE2072AC |     |     | UNIT   |
|--------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------|----------|------|-----|-----------|-----|-----|--------|
|                    |                                             |                                                                                                                           |                                                 |                             | MIN      | TYP  | MAX | MIN       | TYP | MAX |        |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = 10 V,<br>A <sub>VD</sub> = −1,<br>C <sub>L</sub> = 100 pF,<br>R <sub>L</sub> = 2 kΩ,<br>See Figure 1 |                                                 | 25°C                        | 28       | 40   |     | 28        | 40  |     | V/μs   |
|                    | Full range                                  |                                                                                                                           |                                                 | 25                          |          |      | 25  |           |     |     |        |
| SR −               | Negative slew rate                          |                                                                                                                           |                                                 | 25°C                        | 30       | 45   |     | 30        | 45  |     | V/μs   |
|                    |                                             |                                                                                                                           |                                                 | Full range                  | 25       |      |     | 25        |     |     |        |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1,<br>10-V step,<br>R <sub>L</sub> = 1 kΩ,<br>C <sub>L</sub> = 100 pF                                  | To 10 mV                                        | 25°C                        | 0.4      |      |     | 0.4       |     |     | μs     |
|                    |                                             |                                                                                                                           | To 1 mV                                         |                             | 1.5      |      |     | 1.5       |     |     |        |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω,<br>See Figure 3                                                                                    | f = 10 Hz                                       | 25°C                        | 28       |      |     | 28        |     |     | nV/√Hz |
|                    | f = 10 kHz                                  |                                                                                                                           | 11.6                                            |                             |          | 11.6 |     |           |     |     |        |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                           | f = 10 Hz to 10 kHz                             | 25°C                        | 6        |      |     | 6         |     |     | μV     |
|                    |                                             |                                                                                                                           | f = 0.1 Hz to 10 Hz                             |                             | 0.6      |      |     | 0.6       |     |     |        |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0,                                                                                                      | f = 10 kHz                                      | 25°C                        | 2.8      |      |     | 2.8       |     |     | fA/√Hz |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 20 V,<br>f = 1 kHz,<br>R <sub>S</sub> = 25 Ω                                                         | A <sub>VD</sub> = 10,<br>R <sub>L</sub> = 2 kΩ, | 25°C                        | 0.008%   |      |     | 0.008%    |     |     |        |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV,<br>C <sub>L</sub> = 25 pF,                                                                        | R <sub>L</sub> = 2 kΩ,<br>See Figure 2          | 25°C                        | 8        | 10   |     | 8         | 10  |     | MHz    |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 20 V,<br>R <sub>L</sub> = 2 kΩ,                                                                      | A <sub>VD</sub> = −1,<br>C <sub>L</sub> = 25 pF | 25°C                        | 478      | 637  |     | 478       | 637 |     | kHz    |
| ϕ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV,<br>C <sub>L</sub> = 25 pF,                                                                        | R <sub>L</sub> = 2 kΩ,<br>See Figure 2          | 25°C                        | 57°      |      |     | 57°       |     |     |        |

$^\dagger$  Full range is 0°C to 70°C.



**TLE2072I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$  (unless otherwise noted)**

| PARAMETER                                                                     | TEST CONDITIONS                                                                  | $T_A^\dagger$             | TLE2072I   |           |     | TLE2072AI |           |     | UNIT                         |
|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------|------------|-----------|-----|-----------|-----------|-----|------------------------------|
|                                                                               |                                                                                  |                           | MIN        | TYP       | MAX | MIN       | TYP       | MAX |                              |
| $V_{IO}$ Input offset voltage                                                 | $V_{IC} = 0, V_O = 0,$<br>$R_S = 50\ \Omega,$                                    | 25°C                      |            | 0.9       | 6   |           | 0.65      | 3.5 | mV                           |
|                                                                               |                                                                                  | Full range                |            |           | 9.1 |           |           | 6.4 |                              |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                |                                                                                  | Full range                |            | 2.4       | 25  |           | 2.4       | 25  | $\mu\text{V}/^\circ\text{C}$ |
| $I_{IO}$ Input offset current                                                 | $V_{IC} = 0, V_O = 0,$<br>See Figure 4                                           | 25°C                      |            | 5         | 100 |           | 5         | 100 | pA                           |
|                                                                               |                                                                                  | Full range                |            |           | 5   |           |           | 5   | nA                           |
| $I_{IB}$ Input bias current                                                   |                                                                                  | 25°C                      |            | 15        | 175 |           | 15        | 175 | pA                           |
|                                                                               |                                                                                  | Full range                |            |           | 10  |           |           | 10  | nA                           |
| $V_{ICR}$ Common-mode input voltage range                                     | $R_S = 50\ \Omega$                                                               | 25°C                      | 5 to -1    | 5 to -1.9 |     | 5 to -1   | 5 to -1.9 |     | V                            |
|                                                                               |                                                                                  | Full range                | 5 to -0.8  |           |     | 5 to -0.8 |           |     |                              |
| $V_{OM+}$ Maximum positive peak output voltage swing                          | $I_O = -200\ \mu\text{A}$                                                        | 25°C                      | 3.8        | 4.1       |     | 3.8       | 4.1       |     | V                            |
|                                                                               |                                                                                  | Full range                | 3.7        |           |     | 3.7       |           |     |                              |
|                                                                               | $I_O = -2\text{ mA}$                                                             | 25°C                      | 3.5        | 3.9       |     | 3.5       | 3.9       |     |                              |
|                                                                               |                                                                                  | Full range                | 3.4        |           |     | 3.4       |           |     |                              |
|                                                                               | $I_O = -20\text{ mA}$                                                            | 25°C                      | 1.5        | 2.3       |     | 1.5       | 2.3       |     |                              |
|                                                                               |                                                                                  | Full range                | 1.5        |           |     | 1.5       |           |     |                              |
| $V_{OM-}$ Maximum negative peak output voltage swing                          | $I_O = 200\ \mu\text{A}$                                                         | 25°C                      | -3.8       | -4.2      |     | -3.8      | -4.2      |     | V                            |
|                                                                               |                                                                                  | Full range                | -3.7       |           |     | -3.7      |           |     |                              |
|                                                                               | $I_O = 2\text{ mA}$                                                              | 25°C                      | -3.5       | -4.1      |     | -3.5      | -4.1      |     |                              |
|                                                                               |                                                                                  | Full range                | -3.4       |           |     | -3.4      |           |     |                              |
|                                                                               | $I_O = 20\text{ mA}$                                                             | 25°C                      | -1.5       | -2.4      |     | -1.5      | -2.4      |     |                              |
|                                                                               |                                                                                  | Full range                | -1.5       |           |     | -1.5      |           |     |                              |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 2.3\text{ V}$                                                         | $R_L = 600\ \Omega$       | 25°C       | 80        | 91  | 80        | 91        |     | dB                           |
|                                                                               |                                                                                  |                           | Full range | 79        |     | 79        |           |     |                              |
|                                                                               |                                                                                  | $R_L = 2\text{ k}\Omega$  | 25°C       | 90        | 100 | 90        | 100       |     |                              |
|                                                                               |                                                                                  |                           | Full range | 89        |     | 89        |           |     |                              |
|                                                                               |                                                                                  | $R_L = 10\text{ k}\Omega$ | 25°C       | 95        | 106 | 95        | 106       |     |                              |
|                                                                               |                                                                                  |                           | Full range | 94        |     | 94        |           |     |                              |
| $r_i$ Input resistance                                                        | $V_{IC} = 0$                                                                     | 25°C                      |            | $10^{12}$ |     | $10^{12}$ |           |     | $\Omega$                     |
| $c_i$ Input capacitance                                                       | $V_{IC} = 0,$<br>See Figure 5                                                    | Common mode               | 25°C       | 11        |     | 11        |           |     | pF                           |
|                                                                               |                                                                                  | Differential              | 25°C       | 2.5       |     | 2.5       |           |     |                              |
| $z_o$ Open-loop output impedance                                              | $f = 1\text{ MHz}$                                                               | 25°C                      |            | 80        |     | 80        |           |     | $\Omega$                     |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICRmin},$<br>$V_O = 0, R_S = 50\ \Omega$                            | 25°C                      | 70         | 89        |     | 70        | 89        |     | dB                           |
|                                                                               |                                                                                  | Full range                | 68         |           |     | 68        |           |     |                              |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5\text{ V to } \pm 15\text{ V},$<br>$V_O = 0, R_S = 50\ \Omega$ | 25°C                      | 82         | 99        |     | 82        | 99        |     | dB                           |
|                                                                               |                                                                                  | Full range                | 80         |           |     | 80        |           |     |                              |

$^\dagger$  Full range is  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

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**TLE2072I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$  (unless otherwise noted) (continued)**

| PARAMETER                               | TEST CONDITIONS                         | $T_A$      | TLE2072I |     |     | TLE2072AI |     |     | UNIT |
|-----------------------------------------|-----------------------------------------|------------|----------|-----|-----|-----------|-----|-----|------|
|                                         |                                         |            | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| $I_{CC}$ Supply current (both channels) | $V_O = 0$ , No load                     | 25°C       | 2.7      | 2.9 | 3.9 | 2.7       | 2.9 | 3.9 | mA   |
|                                         |                                         | Full range |          |     | 3.9 |           |     | 3.9 |      |
| $a_x$ Crosstalk attenuation             | $V_{IC} = 0$ , $R_L = 2\text{ k}\Omega$ | 25°C       |          | 120 |     |           | 120 |     | dB   |
| $I_{OS}$ Short-circuit output current   | $V_O = 0$                               | 25°C       |          | –35 |     |           | –35 |     | mA   |
|                                         |                                         |            |          | 45  |     |           | 45  |     |      |

**TLE2072I operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                               |                     | T <sub>A</sub> <sup>†</sup> | TLE2072I |     |        | TLE2072AI |        |        | UNIT |
|--------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------|----------|-----|--------|-----------|--------|--------|------|
|                    |                                             |                                                                                                                               |                     |                             | MIN      | TYP | MAX    | MIN       | TYP    | MAX    |      |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±2.3 V,<br>A <sub>VD</sub> = −1,<br>C <sub>L</sub> = 100 pF,      R <sub>L</sub> = 2 kΩ,<br>See Figure 1 |                     | 25°C                        | 35       |     |        | 35        |        |        | V/μs |
|                    |                                             |                                                                                                                               |                     | Full range                  | 20       |     |        | 20        |        |        |      |
| SR −               | Negative slew rate                          |                                                                                                                               |                     | 25°C                        | 38       |     |        | 38        |        |        | V/μs |
|                    |                                             |                                                                                                                               |                     | Full range                  | 20       |     |        | 20        |        |        |      |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1,<br>2-V step,<br>R <sub>L</sub> = 1 kΩ,<br>C <sub>L</sub> = 100 pF                                       | To 10 mV            | 25°C                        | 0.25     |     |        | 0.25      |        |        | μs   |
|                    |                                             |                                                                                                                               | To 1 mV             |                             | 0.4      |     |        | 0.4       |        |        |      |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω,<br>See Figure 3                                                                                        | f = 10 Hz           | 25°C                        | 28       | 55  | 28     | 55        | nV/√Hz |        |      |
|                    |                                             |                                                                                                                               | f = 10 kHz          |                             | 11.6     | 17  | 11.6   | 17        |        |        |      |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                               | f = 10 Hz to 10 kHz | 25°C                        | 6        |     |        | 6         |        |        | μV   |
|                    |                                             |                                                                                                                               | f = 0.1 Hz to 10 Hz |                             | 0.6      |     |        | 0.6       |        |        |      |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0,      f = 10 kHz                                                                                          | 25°C                | 2.8                         |          |     | 2.8    |           |        | fA/√Hz |      |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 5 V,      A <sub>VD</sub> = 10,<br>f = 1 kHz,      R <sub>L</sub> = 2 kΩ,<br>R <sub>S</sub> = 25 Ω       | 25°C                | 0.013%                      |          |     | 0.013% |           |        |        |      |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV,      R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 25 pF,      See Figure 2                              | 25°C                | 9.4                         |          |     | 9.4    |           |        | MHz    |      |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 4 V,      A <sub>VD</sub> = −1,<br>R <sub>L</sub> = 2 kΩ,      C <sub>L</sub> = 25 pF                    | 25°C                | 2.8                         |          |     | 2.8    |           |        | MHz    |      |
| ϕ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV,      R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 25 pF,      See Figure 2                              | 25°C                | 56°                         |          |     | 56°    |           |        |        |      |

$^\dagger$  Full range is 40°C to 85°C.



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**TLE2072I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER                                                                     | TEST CONDITIONS                                                       | $T_A^\dagger$       | TLE2072I    |             |     | TLE2072AI   |             |     | UNIT             |
|-------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------|-------------|-------------|-----|-------------|-------------|-----|------------------|
|                                                                               |                                                                       |                     | MIN         | TYP         | MAX | MIN         | TYP         | MAX |                  |
| $V_{IO}$ Input offset voltage                                                 | $V_{IC} = 0, V_O = 0,$<br>$R_S = 50\ \Omega,$                         | 25°C                | 1.1         | 6           |     | 0.7         | 3.5         |     | mV               |
|                                                                               |                                                                       | Full range          |             |             | 9.1 |             |             | 6.4 |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                |                                                                       | Full range          | 2.4         | 25          |     | 2.4         | 25          |     | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                 | $V_{IC} = 0, V_O = 0,$<br>See Figure 4                                | 25°C                | 6           | 100         |     | 6           | 100         |     | pA               |
|                                                                               |                                                                       | Full range          |             | 5           |     |             | 5           |     | nA               |
| $I_{IB}$ Input bias current                                                   |                                                                       | 25°C                | 20          | 175         |     | 20          | 175         |     | pA               |
|                                                                               |                                                                       | Full range          |             | 10          |     |             | 10          |     | nA               |
| $V_{ICR}$ Common-mode input voltage range                                     | $R_S = 50\ \Omega$                                                    | 25°C                | 15 to –11   | 15 to –11.9 |     | 15 to –11   | 15 to –11.9 |     | V                |
|                                                                               |                                                                       | Full range          | 15 to –10.8 |             |     | 15 to –10.8 |             |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing                          | $I_O = -200\ \mu A$                                                   | 25°C                | 13.8        | 14.1        |     | 13.8        | 14.1        |     | V                |
|                                                                               |                                                                       | Full range          | 13.7        |             |     | 13.7        |             |     |                  |
|                                                                               | $I_O = -2\ mA$                                                        | 25°C                | 13.5        | 13.9        |     | 13.5        | 13.9        |     |                  |
|                                                                               |                                                                       | Full range          | 13.4        |             |     | 13.4        |             |     |                  |
|                                                                               | $I_O = -20\ mA$                                                       | 25°C                | 11.5        | 12.3        |     | 11.5        | 12.3        |     |                  |
|                                                                               |                                                                       | Full range          | 11.5        |             |     | 11.5        |             |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing                          | $I_O = 200\ \mu A$                                                    | 25°C                | –13.8       | –14.2       |     | –13.8       | –14.2       |     | V                |
|                                                                               |                                                                       | Full range          | –13.7       |             |     | –13.7       |             |     |                  |
|                                                                               | $I_O = 2\ mA$                                                         | 25°C                | –13.5       | –14         |     | –13.5       | –14         |     |                  |
|                                                                               |                                                                       | Full range          | –13.4       |             |     | –13.4       |             |     |                  |
|                                                                               | $I_O = 20\ mA$                                                        | 25°C                | –11.5       | –12.4       |     | –11.5       | –12.4       |     |                  |
|                                                                               |                                                                       | Full range          | –11.5       |             |     | –11.5       |             |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10\ V$                                                     | $R_L = 600\ \Omega$ | 25°C        | 80          | 96  | 80          | 96          |     | dB               |
|                                                                               |                                                                       |                     | Full range  | 79          |     | 79          |             |     |                  |
|                                                                               |                                                                       | $R_L = 2\ k\Omega$  | 25°C        | 90          | 109 | 90          | 109         |     |                  |
|                                                                               |                                                                       |                     | Full range  | 89          |     | 89          |             |     |                  |
|                                                                               |                                                                       | $R_L = 10\ k\Omega$ | 25°C        | 95          | 118 | 95          | 118         |     |                  |
|                                                                               |                                                                       |                     | Full range  | 94          |     | 94          |             |     |                  |
| $r_i$ Input resistance                                                        | $V_{IC} = 0$                                                          | 25°C                | $10^{12}$   |             |     | $10^{12}$   |             |     | $\Omega$         |
| $c_i$ Input capacitance                                                       | $V_{IC} = 0,$<br>See Figure 5                                         | Common mode         | 25°C        | 7.5         |     | 7.5         |             |     | pF               |
|                                                                               |                                                                       | Differential        | 25°C        | 2.5         |     | 2.5         |             |     |                  |
| $z_o$ Open-loop output impedance                                              | $f = 1\ MHz$                                                          | 25°C                | 80          |             |     | 80          |             |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICRmin},$<br>$V_O = 0, R_S = 50\ \Omega$                 | 25°C                | 80          | 98          |     | 80          | 98          |     | dB               |
|                                                                               |                                                                       | Full range          | 79          |             |     | 79          |             |     |                  |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5\ V$ to $\pm 15\ V,$<br>$V_O = 0, R_S = 50\ \Omega$ | 25°C                | 82          | 99          |     | 82          | 99          |     | dB               |
|                                                                               |                                                                       | Full range          | 80          |             |     | 80          |             |     |                  |

$^\dagger$  Full range is  $-40^\circ C$  to  $85^\circ C$ .

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**TLE2072I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**  
**(continued)**

| PARAMETER       |                                   | TEST CONDITIONS      |                        | T <sub>A</sub> | TLE2072I |     |     | TLE2072AI |     |     | UNIT |
|-----------------|-----------------------------------|----------------------|------------------------|----------------|----------|-----|-----|-----------|-----|-----|------|
|                 |                                   |                      |                        |                | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub> | Supply current<br>(both channels) | V <sub>O</sub> = 0,  | No load                | 25°C           | 2.7      | 3.1 | 3.9 | 2.7       | 3.1 | 3.9 | mA   |
|                 |                                   |                      |                        | Full range     | 3.9      |     |     | 3.9       |     |     |      |
| a <sub>x</sub>  | Crosstalk attenuation             | V <sub>IC</sub> = 0, | R <sub>L</sub> = 2 kΩ  | 25°C           | 120      |     |     | 120       |     |     | dB   |
| I <sub>OS</sub> | Short-circuit output current      | V <sub>O</sub> = 0   | V <sub>ID</sub> = 1 V  | 25°C           | -30      | -45 |     | -30       | -45 |     | mA   |
|                 |                                   |                      | V <sub>ID</sub> = -1 V |                | 30       | 48  |     | 30        | 48  |     |      |

**TLE2072I operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                      |                     | T <sub>A</sub> <sup>†</sup> | TLE2072I |        |      | TLE2072AI |        |     | UNIT |
|--------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------|----------|--------|------|-----------|--------|-----|------|
|                    |                                             |                                                                                                                      |                     |                             | MIN      | TYP    | MAX  | MIN       | TYP    | MAX |      |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±10 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                     | 25°C                        | 28       | 40     |      | 28        | 40     |     | V/μs |
|                    | Full range                                  |                                                                                                                      |                     | 22                          |          |        | 22   |           |        |     |      |
| SR −               | Negative slew rate                          |                                                                                                                      |                     | 25°C                        | 30       | 45     |      | 30        | 45     |     | V/μs |
|                    |                                             |                                                                                                                      |                     | Full range                  | 22       |        |      | 22        |        |     |      |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 10-V step,<br>R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                   | To 10 mV            | 25°C                        | 0.4      |        | 0.4  |           | μs     |     |      |
|                    |                                             |                                                                                                                      | To 1 mV             |                             | 1.5      |        | 1.5  |           |        |     |      |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                  | f = 10 Hz           | 25°C                        | 28       | 55     | 28   | 55        | nV/√Hz |     |      |
|                    |                                             |                                                                                                                      | f = 10 kHz          |                             | 11.6     | 17     | 11.6 | 17        |        |     |      |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                      | f = 0 Hz to 10 kHz  | 25°C                        | 6        |        | 6    |           | μV     |     |      |
|                    |                                             |                                                                                                                      | f = 0.1 Hz to 10 Hz |                             | 0.6      |        | 0.6  |           |        |     |      |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                      | 25°C                | 2.8                         |          | 2.8    |      | fA/√Hz    |        |     |      |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10, f = 1 kHz, R <sub>L</sub> = 2 kΩ, R <sub>S</sub> = 25 Ω             | 25°C                | 0.008%                      |          | 0.008% |      |           |        |     |      |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 25 pF, See Figure 2                                  | 25°C                | 8                           | 10       | 8      | 10   | MHz       |        |     |      |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 25 pF                       | 25°C                | 478                         | 637      | 478    | 637  | kHz       |        |     |      |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 25 pF, See Figure 2                                  | 25°C                | 57°                         |          | 57°    |      |           |        |     |      |

$^\dagger$  Full range is -40°C to 85°C.



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**TLE2072M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted)**

| PARAMETER                                                      | TEST CONDITIONS                                      | $T_A^\dagger$         | TLE2072M   |           |      | TLE2072AM |           |     | UNIT             |
|----------------------------------------------------------------|------------------------------------------------------|-----------------------|------------|-----------|------|-----------|-----------|-----|------------------|
|                                                                |                                                      |                       | MIN        | TYP       | MAX  | MIN       | TYP       | MAX |                  |
| $V_{IO}$ Input offset voltage                                  | $V_{IC} = 0, V_O = 0,$<br>$R_S = 50 \Omega,$         | 25°C                  | 0.9        | 6         |      | 0.65      | 3.5       |     | mV               |
|                                                                |                                                      | Full range            |            |           | 10.5 |           |           | 8   |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage |                                                      | Full range            | 2.3        | 25*       |      | 2.3       | 25*       |     | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                  | $V_{IC} = 0, V_O = 0,$<br>See Figure 4               | 25°C                  | 5          | 100       |      | 5         | 100       |     | pA               |
|                                                                |                                                      | Full range            |            | 20        |      |           | 20        |     | nA               |
| $I_{IB}$ Input bias current                                    |                                                      | 25°C                  | 15         | 175       |      | 15        | 175       |     | pA               |
|                                                                |                                                      | Full range            |            | 60        |      |           | 60        |     | nA               |
| $V_{ICR}$ Common-mode input voltage range                      | $R_S = 50 \Omega$                                    | 25°C                  | 5 to -1    | 5 to -1.9 |      | 5 to -1   | 5 to -1.9 |     | V                |
|                                                                |                                                      | Full range            | 5 to -0.8  |           |      | 5 to -0.8 |           |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing           | $I_O = -200 \mu A$                                   | 25°C                  | 3.8        | 4.1       |      | 3.8       | 4.1       |     | V                |
|                                                                |                                                      | Full range            | 3.6        |           |      | 3.6       |           |     |                  |
|                                                                | $I_O = -2$ mA                                        | 25°C                  | 3.5        | 3.9       |      | 3.5       | 3.9       |     |                  |
|                                                                |                                                      | Full range            | 3.3        |           |      | 3.3       |           |     |                  |
|                                                                | $I_O = -20$ mA                                       | 25°C                  | 1.5        | 2.3       |      | 1.5       | 2.3       |     |                  |
|                                                                |                                                      | Full range            | 1.4        |           |      | 1.4       |           |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing           | $I_O = 200 \mu A$                                    | 25°C                  | -3.8       | -4.2      |      | -3.8      | -4.2      |     | V                |
|                                                                |                                                      | Full range            | -3.6       |           |      | -3.6      |           |     |                  |
|                                                                | $I_O = 2$ mA                                         | 25°C                  | -3.5       | -4.1      |      | -3.5      | -4.1      |     |                  |
|                                                                |                                                      | Full range            | -3.3       |           |      | -3.3      |           |     |                  |
|                                                                | $I_O = 20$ mA                                        | 25°C                  | -1.5       | -2.4      |      | -1.5      | -2.4      |     |                  |
|                                                                |                                                      | Full range            | -1.4       |           |      | -1.4      |           |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification       | $V_O = \pm 2.3$ V                                    | $R_L = 600 \Omega$    | 25°C       | 80        | 91   | 80        | 91        |     | dB               |
|                                                                |                                                      |                       | Full range | 78        |      | 78        |           |     |                  |
|                                                                |                                                      | $R_L = 2$ k $\Omega$  | 25°C       | 90        | 100  | 90        | 100       |     |                  |
|                                                                |                                                      |                       | Full range | 88        |      | 88        |           |     |                  |
|                                                                |                                                      | $R_L = 10$ k $\Omega$ | 25°C       | 95        | 106  | 95        | 106       |     |                  |
|                                                                |                                                      |                       | Full range | 93        |      | 93        |           |     |                  |
| $r_i$ Input resistance                                         | $V_{IC} = 0$                                         | 25°C                  |            | $10^{12}$ |      |           | $10^{12}$ |     | $\Omega$         |
| $c_i$ Input capacitance                                        | $V_{IC} = 0,$<br>See Figure 5                        | Common mode           | 25°C       | 11        |      | 11        |           |     | pF               |
|                                                                |                                                      | Differential          | 25°C       | 2.5       |      | 2.5       |           |     |                  |
| $z_o$ Open-loop output impedance                               | $f = 1$ MHz                                          | 25°C                  |            | 80        |      |           | 80        |     | $\Omega$         |
| CMRR Common-mode rejection ratio                               | $V_{IC} = V_{ICRmin},$<br>$V_O = 0, R_S = 50 \Omega$ | 25°C                  | 70         | 89        |      | 70        | 89        |     | dB               |
|                                                                |                                                      | Full range            | 68         |           |      | 68        |           |     |                  |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

† Full range is -55°C to 125°C.

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**TLE2072M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted) (continued)**

| PARAMETER        |                                                                       | TEST CONDITIONS                                                             |                        | T <sub>A</sub> <sup>†</sup> | TLE2072M |     |     | TLE2072AM |     |     | UNIT |
|------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
|                  |                                                                       |                                                                             |                        |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| k <sub>SVR</sub> | Supply-voltage rejection ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> ) | V <sub>CC±</sub> = ±5 V to ±15 V, V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω |                        | Full range                  | 80       |     |     | 80        |     |     | dB   |
| I <sub>CC</sub>  | Supply current (both channels)                                        | V <sub>O</sub> = 0,                                                         | No load                | 25°C                        | 2.7      | 2.9 | 3.6 | 2.7       | 2.9 | 3.6 | mA   |
|                  |                                                                       |                                                                             |                        | Full range                  | 3.6      |     |     | 3.6       |     |     |      |
| a <sub>x</sub>   | Crosstalk attenuation                                                 | V <sub>IC</sub> = 0,                                                        | R <sub>L</sub> = 2 kΩ  | 25°C                        | 120      |     |     | 120       |     |     | dB   |
| I <sub>OS</sub>  | Short-circuit output current                                          | V <sub>O</sub> = 0                                                          | V <sub>ID</sub> = 1 V  | 25°C                        | −35      |     |     | −35       |     |     | mA   |
|                  |                                                                       |                                                                             | V <sub>ID</sub> = −1 V |                             | 45       |     |     | 45        |     |     |      |

$^\dagger$  Full range is –55°C to 125°C.

**TLE2072M operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                       |                                              | T <sub>A</sub> <sup>†</sup> | TLE2072M   |      |     | TLE2072AM |        |     | UNIT   |      |
|--------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------|------------|------|-----|-----------|--------|-----|--------|------|
|                    |                                             |                                                                                                                       |                                              |                             | MIN        | TYP  | MAX | MIN       | TYP    | MAX |        |      |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±2.3 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                                              | 25°C                        | 35         |      |     | 35        |        |     | V/μs   |      |
|                    | Full range                                  |                                                                                                                       |                                              | 18*                         |            |      | 18* |           |        |     |        |      |
| SR −               | Negative slew rate                          |                                                                                                                       |                                              |                             | 25°C       | 38   |     |           | 38     |     |        | V/μs |
|                    |                                             |                                                                                                                       |                                              |                             | Full range | 18*  |     |           | 18*    |     |        |      |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 2-V step,<br>R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                     | To 10 mV                                     | 25°C                        | 0.25       |      |     | 0.25      |        |     | μs     |      |
|                    |                                             |                                                                                                                       | To 1 mV                                      |                             | 0.4        |      |     | 0.4       |        |     |        |      |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                   | f = 10 Hz                                    | 25°C                        | 28         | 55*  | 28  | 55*       | nV/√Hz |     |        |      |
|                    | f = 10 kHz                                  |                                                                                                                       | 11.6                                         |                             | 17*        | 11.6 | 17* |           |        |     |        |      |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                       |                                              | f = 10 Hz to 10 kHz         | 25°C       | 6    |     |           | 6      |     |        | μV   |
|                    |                                             |                                                                                                                       |                                              | f = 0.1 Hz to 10 Hz         |            | 0.6  |     |           | 0.6    |     |        |      |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                       |                                              | 25°C                        | 2.8        |      |     | 2.8       |        |     | fA/√Hz |      |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 5 V, f = 1 kHz, R <sub>S</sub> = 25 Ω                                                            | A <sub>VD</sub> = 10, R <sub>L</sub> = 2 kΩ, | 25°C                        | 0.013%     |      |     | 0.013%    |        |     |        |      |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                       | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C                        | 9.4        |      |     | 9.4       |        |     | MHz    |      |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 4 V, R <sub>L</sub> = 2 kΩ ,                                                                     | A <sub>VD</sub> = −1, C <sub>L</sub> = 25 pF | 25°C                        | 2.8        |      |     | 2.8       |        |     | MHz    |      |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                       | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C                        | 56°        |      |     | 56°       |        |     |        |      |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

$^\dagger$  Full range is –55°C to 125°C.



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**TLE2072M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER                                                                     | TEST CONDITIONS                                                              | $T_A^\dagger$              | TLE2072M    |             |      | TLE2072AM   |             |     | UNIT             |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------|-------------|-------------|------|-------------|-------------|-----|------------------|
|                                                                               |                                                                              |                            | MIN         | TYP         | MAX  | MIN         | TYP         | MAX |                  |
| $V_{IO}$ Input offset voltage                                                 | $V_{IC} = 0, V_O = 0, R_S = 50 \Omega$                                       | 25°C                       |             | 1.1         | 6    |             | 0.7         | 3.5 | mV               |
|                                                                               |                                                                              | Full range                 |             |             | 10.5 |             |             | 8   |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                |                                                                              | Full range                 |             | 2.4         | 25*  |             | 2.4         | 25* | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                 | $V_{IC} = 0, V_O = 0, \text{See Figure 4}$                                   | 25°C                       |             | 6           | 100  |             | 6           | 100 | pA               |
|                                                                               |                                                                              | Full range                 |             |             | 20   |             |             | 20  | nA               |
| $I_{IB}$ Input bias current                                                   |                                                                              | 25°C                       |             | 20          | 175  |             | 20          | 175 | pA               |
|                                                                               |                                                                              | Full range                 |             |             | 60   |             |             | 60  | nA               |
| $V_{ICR}$ Common-mode input voltage range                                     | $R_S = 50 \Omega$                                                            | 25°C                       | 15 to -11   | 15 to -11.9 |      | 15 to -11   | 15 to -11.9 |     | V                |
|                                                                               |                                                                              | Full range                 | 15 to -10.8 |             |      | 15 to -10.8 |             |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing                          | $I_O = -200 \mu A$                                                           | 25°C                       | 13.8        | 14.1        |      | 13.8        | 14.1        |     | V                |
|                                                                               |                                                                              | Full range                 | 13.6        |             |      | 13.6        |             |     |                  |
|                                                                               | $I_O = -2 \text{ mA}$                                                        | 25°C                       | 13.5        | 13.9        |      | 13.5        | 13.9        |     |                  |
|                                                                               |                                                                              | Full range                 | 13.3        |             |      | 13.3        |             |     |                  |
|                                                                               | $I_O = -20 \text{ mA}$                                                       | 25°C                       | 11.5        | 12.3        |      | 11.5        | 12.3        |     |                  |
|                                                                               |                                                                              | Full range                 | 11.4        |             |      | 11.4        |             |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing                          | $I_O = 200 \mu A$                                                            | 25°C                       | -13.8       | -14.2       |      | -13.8       | -14.2       |     | V                |
|                                                                               |                                                                              | Full range                 | -13.6       |             |      | -13.6       |             |     |                  |
|                                                                               | $I_O = 2 \text{ mA}$                                                         | 25°C                       | -13.5       | -14         |      | -13.5       | -14         |     |                  |
|                                                                               |                                                                              | Full range                 | -13.3       |             |      | -13.3       |             |     |                  |
|                                                                               | $I_O = 20 \text{ mA}$                                                        | 25°C                       | -11.5       | -12.4       |      | -11.5       | -12.4       |     |                  |
|                                                                               |                                                                              | Full range                 | -11.4       |             |      | -11.4       |             |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10 \text{ V}$                                                     | $R_L = 600 \Omega$         | 25°C        | 80          | 96   | 80          | 96          |     | dB               |
|                                                                               |                                                                              |                            | Full range  | 78          |      | 78          |             |     |                  |
|                                                                               |                                                                              | $R_L = 2 \text{ k}\Omega$  | 25°C        | 90          | 109  | 90          | 109         |     |                  |
|                                                                               |                                                                              |                            | Full range  | 89          |      | 89          |             |     |                  |
|                                                                               |                                                                              | $R_L = 10 \text{ k}\Omega$ | 25°C        | 95          | 118  | 95          | 118         |     |                  |
|                                                                               |                                                                              |                            | Full range  | 93          |      | 93          |             |     |                  |
| $r_i$ Input resistance                                                        | $V_{IC} = 0$                                                                 | 25°C                       |             | $10^{12}$   |      | $10^{12}$   |             |     | $\Omega$         |
| $c_i$ Input capacitance                                                       | $V_{IC} = 0, \text{See Figure 5}$                                            | Common mode                | 25°C        | 7.5         |      | 7.5         |             |     | pF               |
|                                                                               |                                                                              | Differential               | 25°C        | 2.5         |      | 2.5         |             |     |                  |
| $z_o$ Open-loop output impedance                                              | $f = 1 \text{ MHz}$                                                          | 25°C                       |             | 80          |      | 80          |             |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$                              | 25°C                       | 80          | 98          |      | 80          | 98          |     | dB               |
|                                                                               |                                                                              | Full range                 | 78          |             |      | 78          |             |     |                  |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$ | 25°C                       | 82          | 99          |      | 82          | 99          |     | dB               |
|                                                                               |                                                                              | Full range                 | 80          |             |      | 80          |             |     |                  |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

$^\dagger$  Full range is  $-55^\circ C$  to  $125^\circ C$ .

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**TLE2072M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER                               | TEST CONDITIONS                     | $T_A^\dagger$   | TLE2072M |     |     | TLE2072AM |     |     | UNIT |
|-----------------------------------------|-------------------------------------|-----------------|----------|-----|-----|-----------|-----|-----|------|
|                                         |                                     |                 | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| $I_{CC}$ Supply current (both channels) | $V_O = 0$ , No load                 | 25°C            | 2.7      | 3.1 | 3.6 | 2.7       | 3.1 | 3.6 | mA   |
|                                         |                                     | Full range      |          |     | 3.6 |           |     | 3.6 |      |
| $a_x$ Crosstalk attenuation             | $V_{IC} = 0$ , $R_L = 2$ k $\Omega$ | 25°C            | 120      |     |     | 120       |     |     | dB   |
| $I_{OS}$ Short-circuit output current   | $V_O = 0$                           | $V_{ID} = 1$ V  | –30      | –45 |     | –30       | –45 |     | mA   |
|                                         |                                     | $V_{ID} = -1$ V | 30       | 48  |     | 30        | 48  |     |      |

$^\dagger$  Full range is –55°C to 125°C.

**TLE2072M operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                               |                                              | T <sub>A</sub> <sup>†</sup> | TLE2072M |     |     | TLE2072AM |      |     | UNIT   |        |
|--------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------|----------|-----|-----|-----------|------|-----|--------|--------|
|                    |                                             |                                                                                                               |                                              |                             | MIN      | TYP | MAX | MIN       | TYP  | MAX |        |        |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = 10 V, A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF, See Figure 1 |                                              | 25°C                        | 28       | 40  |     | 28        | 40   |     | V/μs   |        |
|                    | Full range                                  |                                                                                                               |                                              | 20                          |          |     | 20  |           |      |     |        |        |
| SR −               | Negative slew rate                          |                                                                                                               |                                              | 25°C                        | 30       | 45  |     | 30        | 45   |     | V/μs   |        |
|                    |                                             |                                                                                                               |                                              | Full range                  | 20       |     |     | 20        |      |     |        |        |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 10-V step, R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                               | To 10 mV                                     | 25°C                        | 0.4      |     |     | 0.4       |      |     | μs     |        |
|                    |                                             |                                                                                                               | To 1 mV                                      |                             | 1.5      |     |     | 1.5       |      |     |        |        |
| V <sub>n</sub>     | Equivalent input noise voltage              |                                                                                                               | f = 10 Hz                                    | 25°C                        | 28       |     |     | 55*       | 28   |     | 55*    | nV/√Hz |
|                    |                                             |                                                                                                               | f = 10 kHz                                   |                             | 11.6     |     |     | 17*       | 11.6 |     | 17*    |        |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage | R <sub>S</sub> = 20 Ω, See Figure 3                                                                           | f = 10 Hz to 10 kHz                          | 25°C                        | 6        |     |     | 6         |      |     | μV     |        |
|                    |                                             |                                                                                                               | f = 0.1 Hz to 10 Hz                          |                             | 0.6      |     |     | 0.6       |      |     |        |        |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                               |                                              | 25°C                        | 2.8      |     |     | 2.8       |      |     | fA/√Hz |        |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10, f = 1 kHz, R <sub>L</sub> = 2 kΩ, R <sub>S</sub> = 25 Ω      |                                              | 25°C                        | 0.008%   |     |     | 0.008%    |      |     |        |        |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                               | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C                        | 8*       | 10  |     | 8*        | 10   |     | MHz    |        |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 20 V, R <sub>L</sub> = 2 kΩ,                                                             | A <sub>VD</sub> = −1, C <sub>L</sub> = 25 pF | 25°C                        | 478*     | 637 |     | 478*      | 637  |     | kHz    |        |
| ϕ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                               | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C                        | 57°      |     |     | 57°       |      |     |        |        |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

$^\dagger$  Full range is –55°C to 125°C.

**TLE2072Y electrical characteristics at  $V_{CC\pm} = \pm 15\text{ V}$ ,  $T_A = 25^\circ\text{C}$**

| PARAMETER                                                                     | TEST CONDITIONS                                                                      | TLE2072Y                  |                  |     | UNIT     |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------|------------------|-----|----------|
|                                                                               |                                                                                      | MIN                       | TYP              | MAX |          |
| $V_{IO}$ Input offset voltage                                                 | $V_{IC} = 0$ , $V_O = 0$ , $R_S = 50\ \Omega$                                        |                           | 1.1              | 6   | mV       |
| $I_{IO}$ Input offset current                                                 | $V_{IC} = 0$ , $V_O = 0$ , See Figure 4                                              |                           | 6                | 100 | pA       |
| $I_{IB}$ Input bias current                                                   |                                                                                      |                           | 20               | 175 | pA       |
| $V_{ICR}$ Common-mode input voltage range                                     | $R_S = 50\ \Omega$                                                                   | 15<br>to<br>–11           | 15<br>to<br>11.9 |     | V        |
| $V_{OM+}$ Maximum positive peak output voltage swing                          | $I_O = -200\ \mu\text{A}$                                                            | 13.8                      | 14.1             |     | V        |
|                                                                               | $I_O = -2\text{ mA}$                                                                 | 13.5                      | 13.9             |     |          |
|                                                                               | $I_O = -20\text{ mA}$                                                                | 11.5                      | 12.3             |     |          |
| $V_{OM-}$ Maximum negative peak output voltage swing                          | $I_O = 200\ \mu\text{A}$                                                             | –13.8                     | –14.2            |     | V        |
|                                                                               | $I_O = 2\text{ mA}$                                                                  | –13.5                     | –14              |     |          |
|                                                                               | $I_O = 20\text{ mA}$                                                                 | –11.5                     | –12.4            |     |          |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10\text{ V}$                                                              | $R_L = 600\ \Omega$       | 80               | 96  | dB       |
|                                                                               |                                                                                      | $R_L = 2\text{ k}\Omega$  | 90               | 109 |          |
|                                                                               |                                                                                      | $R_L = 10\text{ k}\Omega$ | 95               | 118 |          |
| $r_i$ Input resistance                                                        | $V_{IC} = 0$                                                                         |                           | $10^{12}$        |     | $\Omega$ |
| $c_i$ Input capacitance                                                       | $V_{IC} = 0$ ,<br>See Figure 5                                                       | Common mode               | 7.5              |     | pF       |
|                                                                               |                                                                                      | Differential              | 2.5              |     |          |
| $z_o$ Open-loop output impedance                                              | $f = 1\text{ MHz}$                                                                   |                           | 80               |     | $\Omega$ |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICR\text{min}}$ , $V_O = 0$ , $R_S = 50\ \Omega$                        | 80                        | 98               |     | dB       |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5\text{ V to } \pm 15\text{ V}$ , $V_O = 0$ ,<br>$R_S = 50\ \Omega$ | 82                        | 99               |     | dB       |
| $I_{CC}$ Supply current (both channels)                                       | $V_O = 0$ , No load                                                                  | 2.7                       | 3.1              | 3.9 | mA       |
| $I_{OS}$ Short-circuit output current                                         | $V_O = 0$                                                                            | $V_{ID} = 1\text{ V}$     | –30              | –45 | mA       |
|                                                                               |                                                                                      | $V_{ID} = -1\text{ V}$    | 30               | 48  |          |

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**TLE2074C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted)**

| PARAMETER                                                                       | TEST CONDITIONS                                                              | $T_A^\dagger$              | TLE2074C   |           |     | TLE2074AC |           |     | UNIT             |
|---------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------|------------|-----------|-----|-----------|-----------|-----|------------------|
|                                                                                 |                                                                              |                            | MIN        | TYP       | MAX | MIN       | TYP       | MAX |                  |
| $V_{IO}$ Input offset voltage                                                   | $V_{IC} = 0, V_O = 0, R_S = 50 \Omega$                                       | 25°C                       | -1.6       | 5         |     | -0.5      | 3         |     | mV               |
|                                                                                 |                                                                              | Full range                 |            | 7.1       |     |           | 5.1       |     |                  |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                  |                                                                              | Full range                 | 10.1       | 30        |     | 10.1      | 30        |     | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                   | $V_{IC} = 0, V_O = 0, \text{See Figure 4}$                                   | 25°C                       | 15         | 100       |     | 15        | 100       |     | pA               |
|                                                                                 |                                                                              | Full range                 |            | 1400      |     |           | 1400      |     |                  |
| $I_{IB}$ Input bias current                                                     |                                                                              | 25°C                       | 20         | 175       |     | 20        | 175       |     | pA               |
|                                                                                 |                                                                              | Full range                 |            | 5000      |     |           | 5000      |     |                  |
| $V_{ICR}$ Common-mode input voltage range                                       | $R_S = 50 \Omega$                                                            | 25°C                       | 5 to -1    | 5 to -1.9 |     | 5 to -1   | 5 to -1.9 |     | V                |
|                                                                                 |                                                                              | Full range                 | 5 to -0.9  |           |     | 5 to -0.9 |           |     |                  |
| $V_{OM+}$ Maximum positive peak output voltage swing                            | $I_O = -200 \mu A$                                                           | 25°C                       | 3.8        | 4.1       |     | 3.8       | 4.1       |     | V                |
|                                                                                 |                                                                              | Full range                 | 3.7        |           |     | 3.7       |           |     |                  |
|                                                                                 | $I_O = -2 \text{ mA}$                                                        | 25°C                       | 3.5        | 3.9       |     | 3.5       | 3.9       |     |                  |
|                                                                                 |                                                                              | Full range                 | 3.4        |           |     | 3.4       |           |     |                  |
|                                                                                 | $I_O = -20 \text{ mA}$                                                       | 25°C                       | 1.5        | 2.3       |     | 1.5       | 2.3       |     |                  |
|                                                                                 |                                                                              | Full range                 | 1.5        |           |     | 1.5       |           |     |                  |
| $V_{OM-}$ Maximum negative peak output voltage swing                            | $I_O = 200 \mu A$                                                            | 25°C                       | -3.8       | -4.2      |     | -3.8      | -4.2      |     | V                |
|                                                                                 |                                                                              | Full range                 | -3.7       |           |     | -3.7      |           |     |                  |
|                                                                                 | $I_O = 2 \text{ mA}$                                                         | 25°C                       | -3.5       | -4.1      |     | -3.5      | -4.1      |     |                  |
|                                                                                 |                                                                              | Full range                 | -3.4       |           |     | -3.4      |           |     |                  |
|                                                                                 | $I_O = 20 \text{ mA}$                                                        | 25°C                       | -1.5       | -2.4      |     | -1.5      | -2.4      |     |                  |
|                                                                                 |                                                                              | Full range                 | -1.5       |           |     | -1.5      |           |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                        | $V_O = \pm 2.3 \text{ V}$                                                    | $R_L = 600 \Omega$         | 25°C       | 80        | 91  | 80        | 91        |     | dB               |
|                                                                                 |                                                                              |                            | Full range | 79        |     | 79        |           |     |                  |
|                                                                                 |                                                                              | $R_L = 2 \text{ k}\Omega$  | 25°C       | 90        | 100 | 90        | 100       |     |                  |
|                                                                                 |                                                                              |                            | Full range | 89        |     | 89        |           |     |                  |
|                                                                                 |                                                                              | $R_L = 10 \text{ k}\Omega$ | 25°C       | 95        | 106 | 95        | 106       |     |                  |
|                                                                                 |                                                                              |                            | Full range | 94        |     | 94        |           |     |                  |
| $r_i$ Input resistance                                                          | $V_{IC} = 0$                                                                 | 25°C                       |            | $10^{12}$ |     |           | $10^{12}$ |     | $\Omega$         |
| $c_i$ Input capacitance                                                         | Common mode                                                                  | 25°C                       |            | 11        |     |           | 11        |     | pF               |
|                                                                                 | Differential                                                                 | 25°C                       |            | 2.5       |     |           | 2.5       |     |                  |
| $z_o$ Open-loop output impedance                                                | $f = 1 \text{ MHz}$                                                          | 25°C                       |            | 80        |     |           | 80        |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                                | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$                              | 25°C                       | 70         | 89        |     | 70        | 89        |     | dB               |
|                                                                                 |                                                                              | Full range                 | 68         |           |     | 68        |           |     |                  |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm} / \Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$ | 25°C                       | 82         | 99        |     | 82        | 99        |     | dB               |
|                                                                                 |                                                                              | Full range                 | 80         |           |     | 80        |           |     |                  |

$^\dagger$  Full range is 0°C to 70°C.

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**TLE2074C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted) (continued)**

| PARAMETER             |                                     | TEST CONDITIONS      |                        | T <sub>A</sub> <sup>†</sup> | TLE2074C |     |     | TLE2074AC |     |     | UNIT |
|-----------------------|-------------------------------------|----------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
|                       |                                     |                      |                        |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub>       | Supply current<br>(four amplifiers) | V <sub>O</sub> = 0,  | No load                | 25°C                        | 5.2      | 6.3 | 7.5 | 5.2       | 6.3 | 7.5 | mA   |
|                       |                                     |                      |                        | Full range                  | 7.5      |     |     | 7.5       |     |     |      |
| Crosstalk attenuation |                                     | V <sub>IC</sub> = 0, | R <sub>L</sub> = 2 kΩ  | 25°C                        | 120      |     |     | 120       |     |     | dB   |
| I <sub>OS</sub>       | Short-circuit output<br>current     | V <sub>O</sub> = 0   | V <sub>ID</sub> = 1 V  | 25°C                        | −35      |     |     | −35       |     |     | mA   |
|                       |                                     |                      | V <sub>ID</sub> = −1 V |                             | 45       |     |     | 45        |     |     |      |

$^\dagger$  Full range is 0°C to 70°C.

**TLE2074C operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                       |                                              | T <sub>A</sub> † | TLE2074C |     |      | TLE2074AC |        |     | UNIT   |
|--------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------------------|----------|-----|------|-----------|--------|-----|--------|
|                    |                                             |                                                                                                                       |                                              |                  | MIN      | TYP | MAX  | MIN       | TYP    | MAX |        |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±2.3 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                                              | 25°C             | 35       |     |      | 35        |        |     | V/μs   |
|                    |                                             |                                                                                                                       |                                              | Full range       | 22       |     |      | 22        |        |     |        |
| SR −               | Negative slew rate                          |                                                                                                                       |                                              | 25°C             | 38       |     |      | 38        |        |     | V/μs   |
|                    |                                             |                                                                                                                       |                                              | Full range       | 22       |     |      | 22        |        |     |        |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 2-V step,<br>R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                     | To 10 mV                                     | 25°C             | 0.25     |     |      | 0.25      |        |     | μs     |
|                    |                                             |                                                                                                                       | To 1 mV                                      |                  | 0.4      |     |      | 0.4       |        |     |        |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                   | f = 10 Hz                                    | 25°C             | 28       | 55  | 28   | 55        | nV/√Hz |     |        |
|                    |                                             |                                                                                                                       | f = 10 kHz                                   |                  | 11.6     | 17  | 11.6 | 17        |        |     |        |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                       | f = 10 Hz to 10 kHz                          | 25°C             | 6        |     |      | 6         |        |     | μV     |
|                    |                                             |                                                                                                                       | f = 0.1Hz to 10 Hz                           |                  | 0.6      |     |      | 0.6       |        |     |        |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0,                                                                                                  | f = 10 kHz                                   | 25°C             | 2.8      |     |      | 2.8       |        |     | fA/√Hz |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 5 V, f = 1 kHz, R <sub>S</sub> = 25 Ω                                                            | A <sub>VD</sub> = 10, R <sub>L</sub> = 2 kΩ, | 25°C             | 0.013%   |     |      | 0.013%    |        |     |        |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                       | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C             | 9.4      |     |      | 9.4       |        |     | MHz    |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 4 V, R <sub>L</sub> = 2 kΩ ,                                                                     | A <sub>VD</sub> = −1, C <sub>L</sub> = 25 pF | 25°C             | 2.8      |     |      | 2.8       |        |     | MHz    |
| ϕ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                                       | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C             | 56°      |     |      | 56°       |        |     |        |

$^\dagger$  Full range is 0°C to 70°C.

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**TLE2074C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER      |                                                                     | TEST CONDITIONS                                                              | $T_A^\dagger$              | TLE2074C   |             |             | TLE2074AC |             |             | UNIT             |
|----------------|---------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------|------------|-------------|-------------|-----------|-------------|-------------|------------------|
|                |                                                                     |                                                                              |                            | MIN        | TYP         | MAX         | MIN       | TYP         | MAX         |                  |
| $V_{IO}$       | Input offset voltage                                                | $V_{IC} = 0, V_O = 0, R_S = 50 \Omega$                                       | 25°C                       | -1.6       | 5           |             | -0.5      | 3           |             | mV               |
|                |                                                                     |                                                                              | Full range                 |            |             | 7.1         |           |             | 5.1         |                  |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage                     |                                                                              | Full range                 |            | 10.1        | 30          |           | 10.1        | 30          | $\mu V/^\circ C$ |
| $I_{IO}$       | Input offset current                                                | $V_{IC} = 0, V_O = 0, \text{See Figure 4}$                                   | 25°C                       | 15         | 100         |             | 15        | 100         |             | pA               |
|                |                                                                     |                                                                              | Full range                 |            |             | 1400        |           |             | 1400        |                  |
| $I_{IB}$       | Input bias current                                                  |                                                                              | 25°C                       | 25         | 175         |             | 25        | 175         |             | pA               |
|                |                                                                     |                                                                              | Full range                 |            |             | 5000        |           |             | 5000        |                  |
| $V_{ICR}$      | Common-mode input voltage range                                     | $R_S = 50 \Omega$                                                            | 25°C                       | 15 to -11  | 15 to -11.9 |             | 15 to -11 | 15 to -11.9 |             | V                |
|                |                                                                     |                                                                              | Full range                 |            |             | 15 to -10.9 |           |             | 15 to -10.9 |                  |
| $V_{OM+}$      | Maximum positive peak output voltage swing                          | $I_O = -200 \mu A$                                                           | 25°C                       | 13.8       | 14.1        |             | 13.8      | 14.1        |             | V                |
|                |                                                                     |                                                                              | Full range                 |            |             | 13.7        |           |             | 13.7        |                  |
|                |                                                                     | $I_O = -2 \text{ mA}$                                                        | 25°C                       | 13.5       | 13.9        |             | 13.5      | 13.9        |             |                  |
|                |                                                                     |                                                                              | Full range                 |            |             | 13.4        |           |             | 13.4        |                  |
|                |                                                                     | $I_O = -20 \text{ mA}$                                                       | 25°C                       | 11.5       | 12.3        |             | 11.5      | 12.3        |             |                  |
|                |                                                                     |                                                                              | Full range                 |            |             | 11.5        |           |             | 11.5        |                  |
| $V_{OM-}$      | Maximum negative peak output voltage swing                          | $I_O = 200 \mu A$                                                            | 25°C                       | -13.8      | -14.2       |             | -13.8     | -14.2       |             | V                |
|                |                                                                     |                                                                              | Full range                 |            |             | -13.7       |           |             | -13.7       |                  |
|                |                                                                     | $I_O = 2 \text{ mA}$                                                         | 25°C                       | -13.7      | -14         |             | -13.7     | -14         |             |                  |
|                |                                                                     |                                                                              | Full range                 |            |             | -13.6       |           |             | -13.6       |                  |
|                |                                                                     | $I_O = 20 \text{ mA}$                                                        | 25°C                       | -11.5      | -12.4       |             | -11.5     | -12.4       |             |                  |
|                |                                                                     |                                                                              | Full range                 |            |             | -11.5       |           |             | -11.5       |                  |
| $A_{VD}$       | Large-signal differential voltage amplification                     | $V_O = \pm 10 \text{ V}$                                                     | $R_L = 600 \Omega$         | 25°C       | 80          | 96          | 80        | 96          |             | dB               |
|                |                                                                     |                                                                              |                            | Full range |             | 79          |           |             | 79          |                  |
|                |                                                                     |                                                                              | $R_L = 2 \text{ k}\Omega$  | 25°C       | 90          | 109         | 90        | 109         |             |                  |
|                |                                                                     |                                                                              |                            | Full range |             | 89          |           |             | 89          |                  |
|                |                                                                     |                                                                              | $R_L = 10 \text{ k}\Omega$ | 25°C       | 95          | 118         | 95        | 118         |             |                  |
|                |                                                                     |                                                                              |                            | Full range |             | 94          |           |             | 94          |                  |
| $r_i$          | Input resistance                                                    | $V_{IC} = 0$                                                                 | 25°C                       |            | $10^{12}$   |             |           | $10^{12}$   |             | $\Omega$         |
| $C_i$          | Input capacitance                                                   | Common mode                                                                  | 25°C                       |            | 7.5         |             |           | 7.5         |             | pF               |
|                |                                                                     | Differential                                                                 | 25°C                       |            | 2.5         |             |           | 2.5         |             |                  |
| $z_o$          | Open-loop output impedance                                          | $f = 1 \text{ MHz}$                                                          | 25°C                       |            | 80          |             |           | 80          |             | $\Omega$         |
| CMRR           | Common-mode rejection ratio                                         | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$                              | 25°C                       | 80         | 98          |             | 80        | 98          |             | dB               |
|                |                                                                     |                                                                              | Full range                 |            |             | 79          |           |             | 79          |                  |
| $k_{SVR}$      | Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5 \text{ V to } \pm 15 \text{ V}, V_O = 0, R_S = 50 \Omega$ | 25°C                       | 82         | 99          |             | 82        | 99          |             | dB               |
|                |                                                                     |                                                                              | Full range                 |            |             | 81          |           |             | 81          |                  |

$^\dagger$  Full range is 0°C to 70°C.



**TLE2074C electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted) (continued)**

| PARAMETER             |                                     | TEST CONDITIONS      |                        | T <sub>A</sub> <sup>†</sup> | TLE2074C |     |     | TLE2074AC |     |     | UNIT |
|-----------------------|-------------------------------------|----------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
|                       |                                     |                      |                        |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub>       | Supply current<br>(four amplifiers) | V <sub>O</sub> = 0,  | No load                | 25°C                        | 5.2      | 6.5 | 7.5 | 5.2       | 6.5 | 7.5 | mA   |
|                       |                                     |                      |                        | Full range                  | 7.5      |     |     | 7.5       |     |     |      |
| Crosstalk attenuation |                                     | V <sub>IC</sub> = 0, | R <sub>L</sub> = 2 kΩ  | 25°C                        | 120      |     |     | 120       |     |     | dB   |
| I <sub>OS</sub>       | Short-circuit output<br>current     | V <sub>O</sub> = 0   | V <sub>ID</sub> = 1 V  | 25°C                        | −30      | −45 |     | −30       | −45 |     | mA   |
|                       |                                     |                      | V <sub>ID</sub> = −1 V |                             | 30       | 48  |     | 30        | 48  |     |      |

$^\dagger$  Full range is 0°C to 70°C.

**TLE2074C operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                               |                                              | T <sub>A</sub> <sup>†</sup> | TLE2074C |     |     | TLE2074AC |     |     | UNIT   |
|--------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|--------|
|                    |                                             |                                                                                                               |                                              |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |        |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = 10 V, A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 100 pF, See Figure 1 |                                              | 25°C                        | 25       | 40  |     | 25        | 40  |     | V/μs   |
|                    |                                             |                                                                                                               |                                              | Full range                  | 22       |     |     | 22        |     |     |        |
| SR −               | Negative slew rate                          |                                                                                                               |                                              | 25°C                        | 30       | 45  |     | 30        | 45  |     | V/μs   |
|                    |                                             |                                                                                                               |                                              | Full range                  | 25       |     |     | 25        |     |     |        |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 10-V step, R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                               | To 10 mV                                     | 25°C                        | 0.4      |     |     | 0.4       |     |     | μs     |
|                    |                                             |                                                                                                               | To 1 mV                                      |                             | 1.5      |     |     | 1.5       |     |     |        |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                           | f = 10 Hz                                    | 25°C                        | 28       | 55  |     | 28        | 55  |     | nV/√Hz |
|                    |                                             |                                                                                                               | f = 10 kHz                                   |                             | 11.6     | 17  |     | 11.6      | 17  |     |        |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                               | f = 10 Hz to 10 kHz                          | 25°C                        | 6        |     |     | 6         |     |     | μV     |
|                    |                                             |                                                                                                               | f = 0.1 Hz to 10 Hz                          |                             | 0.6      |     |     | 0.6       |     |     |        |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                               |                                              | 25°C                        | 2.8      |     |     | 2.8       |     |     | fA/√Hz |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10, f = 1 kHz, R <sub>L</sub> = 2 kΩ, R <sub>S</sub> = 25 Ω      |                                              | 25°C                        | 0.008%   |     |     | 0.008%    |     |     |        |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                               | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C                        | 8        | 10  |     | 8         | 10  |     | MHz    |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 20 V, R <sub>L</sub> = 2 kΩ,                                                             | A <sub>VD</sub> = −1, C <sub>L</sub> = 25 pF | 25°C                        | 478      | 637 |     | 478       | 637 |     | kHz    |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF,                                                               | R <sub>L</sub> = 2 kΩ, See Figure 2          | 25°C                        | 57°      |     |     | 57°       |     |     |        |

$^\dagger$  Full range is 0°C to 70°C.

**TLE207x, TLE207xA, TLE207xY**  
**EXCALIBUR LOW-NOISE HIGH-SPEED**  
**JFET-INPUT OPERATIONAL AMPLIFIERS**

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**TLE2074I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$  (unless otherwise noted)**

| PARAMETER        |                                                                       |              | TEST CONDITIONS                                                                   | T <sub>A</sub> <sup>†</sup> | TLE2074I         |           |                  | TLE2074AI |           |     | UNIT  |
|------------------|-----------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------|-----------------------------|------------------|-----------|------------------|-----------|-----------|-----|-------|
|                  |                                                                       |              |                                                                                   |                             | MIN              | TYP       | MAX              | MIN       | TYP       | MAX |       |
| V <sub>IO</sub>  | Input offset voltage                                                  |              | V <sub>IC</sub> = 0, V <sub>O</sub> = 0,<br>R <sub>S</sub> = 50 Ω                 | 25°C                        | −1.6             |           | 5                | −0.5      |           | 3   | mV    |
|                  |                                                                       |              |                                                                                   | Full range                  |                  |           | 9                |           |           | 7   |       |
| α <sub>VIO</sub> | Temperature coefficient of input offset voltage                       |              |                                                                                   | Full range                  | 10.1             |           | 30               | 10.1      |           | 30  | μV/°C |
| I <sub>IO</sub>  | Input offset current                                                  |              | V <sub>IC</sub> = 0, V <sub>O</sub> = 0,<br>See Figure 4                          | 25°C                        | 15               |           | 100              | 15        |           | 100 | pA    |
|                  |                                                                       |              |                                                                                   | Full range                  |                  |           | 5                |           |           | 5   | nA    |
| I <sub>IB</sub>  | Input bias current                                                    |              |                                                                                   | 25°C                        | 20               |           | 175              | 20        |           | 175 | pA    |
|                  |                                                                       |              |                                                                                   | Full range                  |                  |           | 10               |           |           | 10  | nA    |
| V <sub>ICR</sub> | Common-mode input voltage range                                       |              | R <sub>S</sub> = 50 Ω                                                             | 25°C                        | 5 to −1          | 5 to −1.9 | 5 to −1          |           | 5 to −1.9 | V   |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 5 to −0.8        | 5 to −0.8 |                  |           |           |     |       |
| V <sub>OM+</sub> | Maximum positive peak output voltage swing                            |              | I <sub>O</sub> = −200 μA                                                          | 25°C                        | 3.8              | 4.1       | 3.8              |           | 4.1       | V   |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 3.7              |           | 3.7              |           |           |     |       |
|                  |                                                                       |              | I <sub>O</sub> = −2 mA                                                            | 25°C                        | 3.5              | 3.9       | 3.5              |           | 3.9       |     |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 3.4              |           | 3.4              |           |           |     |       |
|                  |                                                                       |              | I <sub>O</sub> = −20 mA                                                           | 25°C                        | 1.5              | 2.3       | 1.5              |           | 2.3       |     |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 1.5              |           | 1.5              |           |           |     |       |
| V <sub>OM−</sub> | Maximum negative peak output voltage swing                            |              | I <sub>O</sub> = 200 μA                                                           | 25°C                        | −3.8             | −4.2      | −3.8             |           | −4.2      | V   |       |
|                  |                                                                       |              |                                                                                   | Full range                  | −3.7             |           | −3.7             |           |           |     |       |
|                  |                                                                       |              | I <sub>O</sub> = 2 mA                                                             | 25°C                        | −3.5             | −4.1      | −3.5             |           | −4.1      |     |       |
|                  |                                                                       |              |                                                                                   | Full range                  | −3.4             |           | −3.4             |           |           |     |       |
|                  |                                                                       |              | I <sub>O</sub> = 20 mA                                                            | 25°C                        | −1.5             | −2.4      | −1.5             |           | −2.4      |     |       |
|                  |                                                                       |              |                                                                                   | Full range                  | −1.5             |           | −1.5             |           |           |     |       |
| A <sub>VD</sub>  | Large-signal differential voltage amplification                       |              | V <sub>O</sub> = ± 2.3 V                                                          | R <sub>L</sub> = 600 Ω      | 25°C             | 80        | 91               | 80        |           | 91  | dB    |
|                  |                                                                       |              |                                                                                   |                             | Full range       | 79        |                  | 79        |           |     |       |
|                  |                                                                       |              |                                                                                   | R <sub>L</sub> = 2 kΩ       | 25°C             | 90        | 100              | 90        |           | 100 |       |
|                  |                                                                       |              |                                                                                   |                             | Full range       | 89        |                  | 89        |           |     |       |
|                  |                                                                       |              |                                                                                   | R <sub>L</sub> = 10 kΩ      | 25°C             | 95        | 106              | 95        |           | 106 |       |
|                  |                                                                       |              |                                                                                   |                             | Full range       | 94        |                  | 94        |           |     |       |
| r <sub>i</sub>   | Input resistance                                                      |              | V <sub>IC</sub> = 0                                                               | 25°C                        | 10 <sup>12</sup> |           | 10 <sup>12</sup> |           | Ω         |     |       |
| c <sub>i</sub>   | Input capacitance                                                     | Common mode  | V <sub>IC</sub> = 0, See Figure 5                                                 | 25°C                        | 11               |           | 11               |           | pF        |     |       |
|                  |                                                                       | Differential |                                                                                   | 25°C                        | 2.5              |           | 2.5              |           |           |     |       |
| z <sub>O</sub>   | Open-loop output impedance                                            |              | f = 1 MHz                                                                         | 25°C                        | 80               |           | 80               |           | Ω         |     |       |
| CMRR             | Common-mode rejection ratio                                           |              | V <sub>IC</sub> = V <sub>ICRmin</sub> , V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω | 25°C                        | 70               | 89        | 70               |           | 89        | dB  |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 68               |           | 68               |           |           |     |       |
| k <sub>SVR</sub> | Supply-voltage rejection ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> ) |              | V <sub>CC±</sub> = ±5 V to ±15 V, V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω       | 25°C                        | 82               | 99        | 82               |           | 99        | dB  |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 80               |           | 80               |           |           |     |       |

$^\dagger$  Full range is  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

**TLE2074I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$  (unless otherwise noted) (continued)**

| PARAMETER                                 | TEST CONDITIONS                         | $T_A^\dagger$ | TLE2074I |     |     | TLE2074AI |     |     | UNIT |
|-------------------------------------------|-----------------------------------------|---------------|----------|-----|-----|-----------|-----|-----|------|
|                                           |                                         |               | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| $I_{CC}$ Supply current (four amplifiers) | $V_O = 0$ , No load                     | 25°C          | 5.2      | 6.3 | 7.5 | 5.2       | 6.3 | 7.5 | mA   |
|                                           |                                         | Full range    |          |     | 7.5 |           |     | 7.5 |      |
| Crosstalk attenuation                     | $V_{IC} = 0$ , $R_L = 2\text{ k}\Omega$ | 25°C          |          | 120 |     |           | 120 |     | dB   |
| $I_{OS}$ Short-circuit output current     | $V_O = 0$                               | 25°C          |          | –35 |     |           | –35 |     | mA   |
|                                           |                                         |               |          | 45  |     |           | 45  |     |      |

$^\dagger$  Full range is –40°C to 85°C.

**TLE2074I operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5\text{ V}$**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                       |                                                            | T <sub>A</sub> <sup>†</sup>                       | TLE2074I |     |     | TLE2074AI |     |     | UNIT   |
|--------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------|----------|-----|-----|-----------|-----|-----|--------|
|                    |                                             |                                                                                                                       |                                                            |                                                   | MIN      | TYP | MAX | MIN       | TYP | MAX |        |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±2.3 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                                                            | 25°C                                              | 35       |     |     | 35        |     |     | V/μs   |
|                    |                                             |                                                                                                                       |                                                            | Full range                                        | 20       |     |     | 20        |     |     |        |
| SR −               | Negative slew rate                          |                                                                                                                       |                                                            | 25°C                                              | 38       |     |     | 38        |     |     | V/μs   |
|                    |                                             |                                                                                                                       |                                                            | Full range                                        | 20       |     |     | 20        |     |     |        |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 2-V step,<br>R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                     | To 10 mV                                                   | 25°C                                              | 0.25     |     |     | 0.25      |     |     | μs     |
|                    |                                             |                                                                                                                       | To 1 mV                                                    |                                                   | 0.4      |     |     | 0.4       |     |     |        |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                   | f = 10 Hz                                                  | 25°C                                              | 28 55    |     |     | 28 55     |     |     | nV/√Hz |
|                    |                                             |                                                                                                                       | f = 10 kHz                                                 |                                                   | 11.6 17  |     |     | 11.6 17   |     |     |        |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                       | f = 10 Hz to 10 kHz                                        | 25°C                                              | 6        |     |     | 6         |     |     | μV     |
|                    |                                             |                                                                                                                       | f = 0.1 Hz to 10 Hz                                        |                                                   | 0.6      |     |     | 0.6       |     |     |        |
| I <sub>n</sub>     | Equivalent input noise current              |                                                                                                                       | V <sub>IC</sub> = 0, f = 10 kHz                            | 25°C                                              | 2.8      |     |     | 2.8       |     |     | fA/√Hz |
| THD + N            | Total harmonic distortion plus noise        |                                                                                                                       | V <sub>O(PP)</sub> = 5 V, f = 1 kHz, R <sub>S</sub> = 25 Ω | A <sub>VD</sub> = 10, R <sub>L</sub> = 2 kΩ, 25°C | 0.013%   |     |     | 0.013%    |     |     |        |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF, R <sub>L</sub> = 2 kΩ, See Figure 2                                   | 25°C                                                       | 9.4                                               |          |     | 9.4 |           |     | MHz |        |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 4 V, R <sub>L</sub> = 2 kΩ , A <sub>VD</sub> = −1, C <sub>L</sub> = 25 pF                        | 25°C                                                       | 2.8                                               |          |     | 2.8 |           |     | MHz |        |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF, R <sub>L</sub> = 2 kΩ, See Figure 2                                   | 25°C                                                       | 56°                                               |          |     | 56° |           |     |     |        |

$^\dagger$  Full range is –40°C to 85°C.

**TLE207x, TLE207xA, TLE207xY**  
**EXCALIBUR LOW-NOISE HIGH-SPEED**  
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**TLE2074I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER        |                                                                       |              | TEST CONDITIONS                                                                   | T <sub>A</sub> <sup>†</sup> | TLE2074I         |     |             | TLE2074AI        |             |             | UNIT  |    |
|------------------|-----------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------|-----------------------------|------------------|-----|-------------|------------------|-------------|-------------|-------|----|
|                  |                                                                       |              |                                                                                   |                             | MIN              | TYP | MAX         | MIN              | TYP         | MAX         |       |    |
| V <sub>IO</sub>  | Input offset voltage                                                  |              | V <sub>IC</sub> = 0, V <sub>O</sub> = 0,<br>R <sub>S</sub> = 50 Ω                 | 25°C                        | −1.6             |     | 5           | −0.5             |             | 3           | mV    |    |
|                  |                                                                       |              |                                                                                   | Full range                  |                  |     | 9           |                  |             | 7           |       |    |
| α <sub>VIO</sub> | Temperature coefficient of input offset voltage                       |              |                                                                                   | Full range                  | 10.1             |     | 30          | 10.1             |             | 30          | μV/°C |    |
| I <sub>IO</sub>  | Input offset current                                                  |              | V <sub>IC</sub> = 0, V <sub>O</sub> = 0,<br>See Figure 4                          | 25°C                        | 15               |     | 100         | 15               |             | 100         | pA    |    |
|                  |                                                                       |              |                                                                                   | Full range                  |                  |     | 5           |                  |             | 5           | nA    |    |
| I <sub>IB</sub>  | Input bias current                                                    |              |                                                                                   | 25°C                        | 25               |     | 175         | 25               |             | 175         | pA    |    |
|                  |                                                                       |              |                                                                                   | Full range                  |                  |     | 10          |                  |             | 10          | nA    |    |
| V <sub>ICR</sub> | Common-mode input voltage range                                       |              | R <sub>S</sub> = 50 Ω                                                             | 25°C                        | 15 to −11        |     | 15 to −11.9 | 15 to −11        |             | 15 to −11.9 | V     |    |
|                  |                                                                       |              |                                                                                   | Full range                  | 15 to −10.8      |     |             |                  | 15 to −10.8 |             |       |    |
| V <sub>OM+</sub> | Maximum positive peak output voltage swing                            |              | I <sub>O</sub> = −200 μA                                                          | 25°C                        | 13.8             |     | 14.1        | 13.8             |             | 14.1        | V     |    |
|                  |                                                                       |              |                                                                                   | Full range                  | 13.7             |     | 13.7        |                  |             |             |       |    |
|                  |                                                                       |              | I <sub>O</sub> = −2 mA                                                            | 25°C                        | 13.5             |     | 13.9        | 13.5             |             | 13.9        |       |    |
|                  |                                                                       |              |                                                                                   | Full range                  | 13.4             |     | 13.4        |                  |             |             |       |    |
|                  |                                                                       |              | I <sub>O</sub> = −20 mA                                                           | 25°C                        | 11.5             |     | 12.3        | 11.5             |             | 12.3        |       |    |
|                  |                                                                       |              |                                                                                   | Full range                  | 11.5             |     | 11.5        |                  |             |             |       |    |
| V <sub>OM−</sub> | Maximum negative peak output voltage swing                            |              | I <sub>O</sub> = 200 μA                                                           | 25°C                        | −13.8            |     | −14.2       | −13.8            |             | −14.2       | V     |    |
|                  |                                                                       |              |                                                                                   | Full range                  | −13.7            |     | −13.7       |                  |             |             |       |    |
|                  |                                                                       |              | I <sub>O</sub> = 2 mA                                                             | 25°C                        | −13.5            |     | −14         | −13.5            |             | −14         |       |    |
|                  |                                                                       |              |                                                                                   | Full range                  | −13.4            |     | −13.4       |                  |             |             |       |    |
|                  |                                                                       |              | I <sub>O</sub> = 20 mA                                                            | 25°C                        | −11.5            |     | −12.4       | −11.5            |             | −12.4       |       |    |
|                  |                                                                       |              |                                                                                   | Full range                  | −11.5            |     | −11.5       |                  |             |             |       |    |
| A <sub>VD</sub>  | Large-signal differential voltage amplification                       |              | V <sub>O</sub> = ± 10 V                                                           | R <sub>L</sub> = 600 Ω      | 25°C             | 80  |             | 96               | 80          |             | 96    | dB |
|                  |                                                                       |              |                                                                                   |                             | Full range       | 79  |             | 79               |             |             |       |    |
|                  |                                                                       |              |                                                                                   | R <sub>L</sub> = 2 kΩ       | 25°C             | 90  |             | 109              | 90          |             | 109   |    |
|                  |                                                                       |              |                                                                                   |                             | Full range       | 89  |             | 89               |             |             |       |    |
|                  |                                                                       |              |                                                                                   | R <sub>L</sub> = 10 kΩ      | 25°C             | 95  |             | 118              | 95          |             | 118   |    |
|                  |                                                                       |              |                                                                                   |                             | Full range       | 94  |             | 94               |             |             |       |    |
| r <sub>i</sub>   | Input resistance                                                      |              | V <sub>IC</sub> = 0                                                               | 25°C                        | 10 <sup>12</sup> |     |             | 10 <sup>12</sup> |             |             | Ω     |    |
| c <sub>i</sub>   | Input capacitance                                                     | Common mode  | V <sub>IC</sub> = 0, See Figure 5                                                 | 25°C                        | 7.5              |     |             | 7.5              |             |             | pF    |    |
|                  |                                                                       | Differential |                                                                                   | 25°C                        | 2.5              |     |             | 2.5              |             |             |       |    |
| z <sub>o</sub>   | Open-loop output impedance                                            |              | f = 1 MHz                                                                         | 25°C                        | 80               |     |             | 80               |             |             | Ω     |    |
| CMRR             | Common-mode rejection ratio                                           |              | V <sub>IC</sub> = V <sub>ICRmin</sub> , V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω | 25°C                        | 80               |     | 98          | 80               |             | 98          | dB    |    |
|                  |                                                                       |              |                                                                                   | Full range                  | 79               |     | 79          |                  |             |             |       |    |
| k <sub>SVR</sub> | Supply-voltage rejection ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> ) |              | V <sub>CC±</sub> = ±5 V to ±15 V, V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω       | 25°C                        | 82               |     | 99          | 82               |             | 99          | dB    |    |
|                  |                                                                       |              |                                                                                   | Full range                  | 80               |     | 80          |                  |             |             |       |    |

$^\dagger$  Full range is  $-40^\circ C$  to  $85^\circ C$ .



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**TLE2074I electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted) (continued)**

| PARAMETER             |                                     | TEST CONDITIONS       |                        | T <sub>A</sub> <sup>†</sup> | TLE2074I |     |     | TLE2074AI |     |     | UNIT |
|-----------------------|-------------------------------------|-----------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
|                       |                                     |                       |                        |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub>       | Supply current<br>(four amplifiers) | V <sub>O</sub> = 0,   | No load                | 25°C                        | 5.2      | 6.5 | 7.5 | 5.2       | 6.5 | 7.5 | mA   |
|                       |                                     |                       |                        | Full range                  | 7.5      |     |     | 7.5       |     |     |      |
| Crosstalk attenuation |                                     | V <sub>I</sub> C = 0, | R <sub>L</sub> = 2 kΩ  | 25°C                        | 120      |     |     | 120       |     |     | dB   |
| I <sub>OS</sub>       | Short-circuit output<br>current     | V <sub>O</sub> = 0    | V <sub>ID</sub> = 1 V  | 25°C                        | −30      | −45 |     | −30       | −45 |     | mA   |
|                       |                                     |                       | V <sub>ID</sub> = −1 V |                             | 30       | 48  |     | 30        | 48  |     |      |

† Full range is –40°C to 85°C.

**TLE2074I operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                      |                     | T <sub>A</sub> † | TLE2074I |     |        | TLE2074AI |     |        | UNIT   |
|--------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------|---------------------|------------------|----------|-----|--------|-----------|-----|--------|--------|
|                    |                                             |                                                                                                                      |                     |                  | MIN      | TYP | MAX    | MIN       | TYP | MAX    |        |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±10 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                     | 25°C             | 25       | 40  |        | 25        | 40  |        | V/μs   |
|                    |                                             |                                                                                                                      |                     | Full range       | 19       |     |        | 19        |     |        |        |
| SR −               | Negative slew rate                          |                                                                                                                      |                     | 25°C             | 30       | 45  |        | 30        | 45  |        | V/μs   |
|                    |                                             |                                                                                                                      |                     | Full range       | 22       |     |        | 22        |     |        |        |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 10-V step,<br>R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                   | To 10 mV            | 25°C             | 0.4      |     |        | 0.4       |     |        | μs     |
|                    |                                             |                                                                                                                      | To 1 mV             |                  | 1.5      |     |        | 1.5       |     |        |        |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                  | f = 10 Hz           | 25°C             | 28       | 55  |        | 28        | 55  |        | nV/√Hz |
|                    |                                             |                                                                                                                      | f = 10 kHz          |                  | 11.6     | 17  |        | 11.6      | 17  |        |        |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                      | f = 10 Hz to 10 kHz | 25°C             | 6        |     |        | 6         |     |        | μV     |
|                    |                                             |                                                                                                                      | f = 0.1 Hz to 10 Hz |                  | 0.6      |     |        | 0.6       |     |        |        |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                      | 25°C                | 2.8              |          |     | 2.8    |           |     | fA/√Hz |        |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10, f = 1 kHz, R <sub>L</sub> = 2 kΩ, R <sub>S</sub> = 25 Ω             | 25°C                | 0.008%           |          |     | 0.008% |           |     |        |        |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 25 pF, See Figure 2                                  | 25°C                | 8                | 10       |     | 8      | 10        |     | MHz    |        |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 25 pF                       | 25°C                | 478              | 637      |     | 478    | 637       |     | kHz    |        |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 25 pF, See Figure 2                                  | 25°C                | 57°              |          |     | 57°    |           |     |        |        |

† Full range is –40°C to 85°C.

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**TLE2074M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted)**

| PARAMETER      |                                                                       | TEST CONDITIONS                                                                       | $T_A$ †                   | TLE2074M   |           |      | TLE2074AM |           |     | UNIT             |
|----------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------|------------|-----------|------|-----------|-----------|-----|------------------|
|                |                                                                       |                                                                                       |                           | MIN        | TYP       | MAX  | MIN       | TYP       | MAX |                  |
| $V_{IO}$       | Input offset voltage                                                  | $V_{IC} = 0$ ,<br>$R_S = 50\Omega$ ,<br>$V_O = 0$ ,                                   | 25°C                      | -1.6       |           | 5    | -0.5      |           | 3   | mV               |
|                |                                                                       |                                                                                       | Full range                |            |           | 10.5 |           |           | 8.5 |                  |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage                       |                                                                                       | Full range                |            | 10.1      | 30*  |           | 10.1      | 30* | $\mu V/^\circ C$ |
| $I_{IO}$       | Input offset current                                                  | $V_{IC} = 0$ ,<br>$V_O = 0$ ,<br>See Figure 4                                         | 25°C                      |            | 15        | 100  |           | 15        | 100 | pA               |
|                |                                                                       |                                                                                       | Full range                |            |           | 20   |           |           | 20  | nA               |
| $I_{IB}$       | Input bias current                                                    |                                                                                       | 25°C                      |            | 20        | 175  |           | 20        | 175 | pA               |
|                |                                                                       |                                                                                       | Full range                |            |           | 60   |           |           | 60  | nA               |
| $V_{ICR}$      | Common-mode input voltage range                                       | $R_S = 50\Omega$                                                                      | 25°C                      | 5 to -1    | 5 to -1.9 |      | 5 to -1   | 5 to -1.9 |     | V                |
|                |                                                                       |                                                                                       | Full range                | 5 to -0.8  |           |      | 5 to -0.8 |           |     |                  |
| $V_{OM+}$      | Maximum positive peak output voltage swing                            | $I_O = -200\mu A$                                                                     | 25°C                      | 3.8        | 4.1       |      | 3.8       | 4.1       |     | V                |
|                |                                                                       |                                                                                       | Full range                | 3.6        |           |      | 3.6       |           |     |                  |
|                |                                                                       | $I_O = -2\text{ mA}$                                                                  | 25°C                      | 3.5        | 3.9       |      | 3.5       | 3.9       |     |                  |
|                |                                                                       |                                                                                       | Full range                | 3.3        |           |      | 3.3       |           |     |                  |
|                |                                                                       | $I_O = -20\text{ mA}$                                                                 | 25°C                      | 1.5        | 2.3       |      | 1.5       | 2.3       |     |                  |
|                |                                                                       |                                                                                       | Full range                | 1.4        |           |      | 1.4       |           |     |                  |
| $V_{OM-}$      | Maximum negative peak output voltage swing                            | $I_O = 200\mu A$                                                                      | 25°C                      | -3.8       | -4.2      |      | -3.8      | -4.2      |     | V                |
|                |                                                                       |                                                                                       | Full range                | -3.6       |           |      | -3.6      |           |     |                  |
|                |                                                                       | $I_O = 2\text{ mA}$                                                                   | 25°C                      | -3.5       | -4.1      |      | -3.5      | -4.1      |     |                  |
|                |                                                                       |                                                                                       | Full range                | -3.3       |           |      | -3.3      |           |     |                  |
|                |                                                                       | $I_O = 20\text{ mA}$                                                                  | 25°C                      | -1.5       | -2.4      |      | -1.5      | -2.4      |     |                  |
|                |                                                                       |                                                                                       | Full range                | -1.4       |           |      | -1.4      |           |     |                  |
| $A_{VD}$       | Large-signal differential voltage amplification                       | $V_O = \pm 2.3\text{ V}$                                                              | $R_L = 600\Omega$         | 25°C       | 80        | 91   | 80        | 91        |     | dB               |
|                |                                                                       |                                                                                       |                           | Full range | 78        |      | 78        |           |     |                  |
|                |                                                                       |                                                                                       | $R_L = 2\text{ k}\Omega$  | 25°C       | 90        | 100  | 90        | 100       |     |                  |
|                |                                                                       |                                                                                       |                           | Full range | 88        |      | 88        |           |     |                  |
|                |                                                                       |                                                                                       | $R_L = 10\text{ k}\Omega$ | 25°C       | 95        | 106  | 95        | 106       |     |                  |
|                |                                                                       |                                                                                       |                           | Full range | 93        |      | 93        |           |     |                  |
| $r_i$          | Input resistance                                                      | $V_{IC} = 0$                                                                          | 25°C                      |            | $10^{12}$ |      | $10^{12}$ |           |     | $\Omega$         |
| $C_i$          | Input capacitance                                                     | Common mode                                                                           | 25°C                      |            | 11        |      | 11        |           |     | pF               |
|                |                                                                       | Differential                                                                          | 25°C                      |            | 2.5       |      | 2.5       |           |     |                  |
| $Z_O$          | Open-loop output impedance                                            | $f = 1\text{ MHz}$                                                                    | 25°C                      |            | 80        |      | 80        |           |     | $\Omega$         |
| CMRR           | Common-mode rejection ratio                                           | $V_{IC} = V_{ICRmin}$ ,<br>$V_O = 0$ ,<br>$R_S = 50\Omega$                            | 25°C                      | 70         | 89        |      | 70        | 89        |     | dB               |
|                |                                                                       |                                                                                       | Full range                | 68         |           |      | 68        |           |     |                  |
| $k_{SVR}$      | Supply-voltage rejection ratio ( $\Delta V_{CC\pm} / \Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5\text{ V to } \pm 15\text{ V}$ ,<br>$V_O = 0$ ,<br>$R_S = 50\Omega$ | 25°C                      | 82         | 99        |      | 82        | 99        |     | dB               |
|                |                                                                       |                                                                                       | Full range                | 80         |           |      | 80        |           |     |                  |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

† Full range is  $-55^\circ C$  to  $125^\circ C$ .

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**TLE2074M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V (unless otherwise noted) (continued)**

| PARAMETER                                 | TEST CONDITIONS                     | $T_A^\dagger$   | TLE2074M |     |     | TLE2074AM |     |     | UNIT |
|-------------------------------------------|-------------------------------------|-----------------|----------|-----|-----|-----------|-----|-----|------|
|                                           |                                     |                 | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| $I_{CC}$ Supply current (four amplifiers) | $V_O = 0$ , No load                 | 25°C            | 5.2      | 6.3 | 7.5 | 5.2       | 6.3 | 7.5 | mA   |
|                                           |                                     | Full range      |          |     | 7.5 |           |     | 7.5 |      |
| Crosstalk attenuation                     | $V_{IC} = 0$ , $R_L = 2$ k $\Omega$ | 25°C            |          | 120 |     |           | 120 |     | dB   |
| $I_{OS}$ Short-circuit output current     | $V_O = 0$                           | $V_{ID} = 1$ V  |          | –35 |     |           | –35 |     | mA   |
|                                           |                                     | $V_{ID} = -1$ V |          | 45  |     |           | 45  |     |      |

$^\dagger$  Full range is –55°C to 125°C.

**TLE2074M operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 5$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                       |                                                   | T <sub>A</sub> <sup>†</sup> | TLE2074M |     |        | TLE2074AM |        |        | UNIT |
|--------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------|----------|-----|--------|-----------|--------|--------|------|
|                    |                                             |                                                                                                                       |                                                   |                             | MIN      | TYP | MAX    | MIN       | TYP    | MAX    |      |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = ±2.3 V,<br>A <sub>VD</sub> = −1, R <sub>L</sub> = 2 kΩ,<br>C <sub>L</sub> = 100 pF, See Figure 1 |                                                   | 25°C                        | 35       |     |        | 35        |        |        | V/μs |
|                    |                                             |                                                                                                                       |                                                   | Full range                  | 18*      |     |        | 18*       |        |        |      |
| SR −               | Negative slew rate                          |                                                                                                                       |                                                   | 25°C                        | 38       |     |        | 38        |        |        | V/μs |
|                    |                                             |                                                                                                                       |                                                   | Full range                  | 18*      |     |        | 18*       |        |        |      |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1, 2-V step,<br>R <sub>L</sub> = 1 kΩ, C <sub>L</sub> = 100 pF                                     | To 10 mV                                          | 25°C                        | 0.25     |     |        | 0.25      |        |        | μs   |
|                    |                                             |                                                                                                                       | To 1 mV                                           |                             | 0.4      |     |        | 0.4       |        |        |      |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω, See Figure 3                                                                                   | f = 10 Hz                                         | 25°C                        | 28       | 55* | 28     | 55*       | nV/√Hz |        |      |
|                    |                                             |                                                                                                                       | f = 10 kHz                                        |                             | 11.6     | 17* | 11.6   | 17*       |        |        |      |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                       | f = 10 Hz to 10 kHz                               | 25°C                        | 6        |     |        | 6         |        |        | μV   |
|                    |                                             |                                                                                                                       | f = 0.1 Hz to 10 Hz                               |                             | 0.6      |     |        | 0.6       |        |        |      |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                       | 25°C                                              | 2.8                         |          |     | 2.8    |           |        | fA/√Hz |      |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 5 V, f = 1 kHz, R <sub>S</sub> = 25 Ω                                                            | A <sub>VD</sub> = 10, R <sub>L</sub> = 2 kΩ, 25°C | 0.013%                      |          |     | 0.013% |           |        |        |      |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF, R <sub>L</sub> = 2 kΩ, See Figure 2                                   | 25°C                                              | 9.4                         |          |     | 9.4    |           |        | MHz    |      |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 4 V, R <sub>L</sub> = 2 kΩ, A <sub>VD</sub> = −1, C <sub>L</sub> = 25 pF                         | 25°C                                              | 2.8                         |          |     | 2.8    |           |        | MHz    |      |
| f <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV, C <sub>L</sub> = 25 pF, R <sub>L</sub> = 2 kΩ, See Figure 2                                   | 25°C                                              | 56°                         |          |     | 56°    |           |        |        |      |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

$^\dagger$  Full range is –55°C to 125°C.

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**TLE2074M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER        |                                                                       |              | TEST CONDITIONS                                                                   | T <sub>A</sub> <sup>†</sup> | TLE2074M         |             |           | TLE2074AM        |             |     | UNIT  |
|------------------|-----------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------|-----------------------------|------------------|-------------|-----------|------------------|-------------|-----|-------|
|                  |                                                                       |              |                                                                                   |                             | MIN              | TYP         | MAX       | MIN              | TYP         | MAX |       |
| V <sub>IO</sub>  | Input offset voltage                                                  |              | V <sub>IC</sub> = 0, V <sub>O</sub> = 0,<br>R <sub>S</sub> = 50 Ω                 | 25°C                        | −1.6             |             | 5         | −0.5             |             | 3   | mV    |
|                  |                                                                       |              |                                                                                   | Full range                  |                  |             | 10.5      |                  |             | 8.5 |       |
| α <sub>VIO</sub> | Temperature coefficient of input offset voltage                       |              |                                                                                   | Full range                  | 10.1             |             | 30*       | 10.1             |             | 30* | μV/°C |
| I <sub>IO</sub>  | Input offset current                                                  |              | V <sub>IC</sub> = 0, V <sub>O</sub> = 0,<br>See Figure 4                          | 25°C                        | 15               | 100         | 15        |                  | 100         | pA  |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 20               |             | 20        |                  | nA          |     |       |
| I <sub>IB</sub>  | Input bias current                                                    |              |                                                                                   | 25°C                        | 25               | 175         | 25        |                  | 175         | pA  |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 60               |             | 60        |                  | nA          |     |       |
| V <sub>ICR</sub> | Common-mode input voltage range                                       |              | R <sub>S</sub> = 50 Ω                                                             | 25°C                        | 15 to −11        | 15 to −11.9 | 15 to −11 |                  | 15 to −11.9 | V   |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 15 to −10.8      | 15 to −10.8 |           |                  |             |     |       |
| V <sub>OM+</sub> | Maximum positive peak output voltage swing                            |              | I <sub>O</sub> = −200 μA                                                          | 25°C                        | 13.8             | 14.1        | 13.8      |                  | 14.1        | V   |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 13.6             |             | 13.6      |                  |             |     |       |
|                  |                                                                       |              | I <sub>O</sub> = −2 mA                                                            | 25°C                        | 13.5             | 13.9        | 13.5      |                  | 13.9        |     |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 13.3             |             | 13.3      |                  |             |     |       |
|                  |                                                                       |              | I <sub>O</sub> = −20 mA                                                           | 25°C                        | 11.5             | 12.3        | 11.5      |                  | 12.3        |     |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 11.4             |             | 11.4      |                  |             |     |       |
| V <sub>OM−</sub> | Maximum negative peak output voltage swing                            |              | I <sub>O</sub> = 200 μA                                                           | 25°C                        | −13.8            | −14.2       | −13.8     |                  | −14.2       | V   |       |
|                  |                                                                       |              |                                                                                   | Full range                  | −13.6            |             | −13.6     |                  |             |     |       |
|                  |                                                                       |              | I <sub>O</sub> = 2 mA                                                             | 25°C                        | −13.5            | −14         | −13.5     |                  | −14         |     |       |
|                  |                                                                       |              |                                                                                   | Full range                  | −13.3            |             | −13.3     |                  |             |     |       |
|                  |                                                                       |              | I <sub>O</sub> = 20 mA                                                            | 25°C                        | −11.5            | −12.4       | −11.5     |                  | −12.4       |     |       |
|                  |                                                                       |              |                                                                                   | Full range                  | −11.4            |             | −11.4     |                  |             |     |       |
| A <sub>VD</sub>  | Large-signal differential voltage amplification                       |              | V <sub>O</sub> = ± 10 V                                                           | R <sub>L</sub> = 600 Ω      | 25°C             | 80          | 96        | 80               |             | 96  | dB    |
|                  |                                                                       |              |                                                                                   |                             | Full range       | 78          |           | 78               |             |     |       |
|                  |                                                                       |              |                                                                                   | R <sub>L</sub> = 2 kΩ       | 25°C             | 90          | 109       | 90               |             | 109 |       |
|                  |                                                                       |              |                                                                                   |                             | Full range       | 88          |           | 88               |             |     |       |
|                  |                                                                       |              |                                                                                   | R <sub>L</sub> = 10 kΩ      | 25°C             | 95          | 118       | 95               |             | 118 |       |
|                  |                                                                       |              |                                                                                   |                             | Full range       | 93          |           | 93               |             |     |       |
| r <sub>i</sub>   | Input resistance                                                      |              | V <sub>IC</sub> = 0                                                               | 25°C                        | 10 <sup>12</sup> |             |           | 10 <sup>12</sup> |             | Ω   |       |
| c <sub>i</sub>   | Input capacitance                                                     | Common mode  | V <sub>IC</sub> = 0, See Figure 5                                                 | 25°C                        | 7.5              |             |           | 7.5              |             | pF  |       |
|                  |                                                                       | Differential |                                                                                   | 25°C                        | 2.5              |             |           | 2.5              |             |     |       |
| z <sub>O</sub>   | Open-loop output impedance                                            |              | f = 1 MHz                                                                         | 25°C                        | 80               |             |           | 80               |             | Ω   |       |
| CMRR             | Common-mode rejection ratio                                           |              | V <sub>IC</sub> = V <sub>ICRmin</sub> , V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω | 25°C                        | 80               | 98          | 80        |                  | 98          | dB  |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 78               |             | 78        |                  |             |     |       |
| k <sub>SVR</sub> | Supply-voltage rejection ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> ) |              | V <sub>CC±</sub> = ±5 V to ±15 V, V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω       | 25°C                        | 82               | 99          | 82        |                  | 99          | dB  |       |
|                  |                                                                       |              |                                                                                   | Full range                  | 80               |             | 80        |                  |             |     |       |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

† Full range is  $-55^\circ C$  to  $125^\circ C$ .



**TLE2074M electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted) (continued)**

| PARAMETER             |                                     | TEST CONDITIONS      |                        | T <sub>A</sub> <sup>†</sup> | TLE2074M |     |     | TLE2074AM |     |     | UNIT |
|-----------------------|-------------------------------------|----------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
|                       |                                     |                      |                        |                             | MIN      | TYP | MAX | MIN       | TYP | MAX |      |
| I <sub>CC</sub>       | Supply current<br>(four amplifiers) | V <sub>O</sub> = 0,  | No load                | 25°C                        | 5.2      | 6.5 | 7.5 | 5.2       | 6.5 | 7.5 | mA   |
|                       |                                     |                      |                        | Full range                  | 7.5      |     |     | 7.5       |     |     |      |
| Crosstalk attenuation |                                     | V <sub>IC</sub> = 0, | R <sub>L</sub> = 2 kΩ  | 25°C                        | 120      |     |     | 120       |     |     | dB   |
| I <sub>OS</sub>       | Short-circuit output current        | V <sub>O</sub> = 0   | V <sub>ID</sub> = 1 V  | 25°C                        | −30      | −45 |     | −30       | −45 |     | mA   |
|                       |                                     |                      | V <sub>ID</sub> = −1 V |                             | 30       | 48  |     | 30        | 48  |     |      |

$^\dagger$  Full range is –55°C to 125°C.

**TLE2074M operating characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V**

| PARAMETER          |                                             | TEST CONDITIONS                                                                                                |                                                 | T <sub>A</sub> <sup>†</sup> | TLE2074M |     |        | TLE2074AM |        |        | UNIT |
|--------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------|----------|-----|--------|-----------|--------|--------|------|
|                    |                                             |                                                                                                                |                                                 |                             | MIN      | TYP | MAX    | MIN       | TYP    | MAX    |      |
| SR +               | Positive slew rate                          | V <sub>O(PP)</sub> = 10 V, A <sub>VD</sub> = −1,<br>R <sub>L</sub> = 2 kΩ,<br>See Figure 1                     |                                                 | 25°C                        | 25       | 40  |        | 25        | 40     |        | V/μs |
|                    | Full range                                  |                                                                                                                |                                                 | 17                          |          |     | 17     |           |        |        |      |
| SR −               | Negative slew rate                          |                                                                                                                |                                                 | 25°C                        | 30       | 45  |        | 30        | 45     |        | V/μs |
|                    | Full range                                  |                                                                                                                |                                                 | 20                          |          |     | 20     |           |        |        |      |
| t <sub>s</sub>     | Settling time                               | A <sub>VD</sub> = −1,<br>10-V step,<br>R <sub>L</sub> = 1 kΩ,<br>C <sub>L</sub> = 100 pF                       | To 10 mV                                        | 25°C                        | 0.4      |     | 0.4    |           | μs     |        |      |
|                    |                                             |                                                                                                                | To 1 mV                                         |                             | 1.5      |     | 1.5    |           |        |        |      |
| V <sub>n</sub>     | Equivalent input noise voltage              | R <sub>S</sub> = 20 Ω,<br>See Figure 3                                                                         | f = 10 Hz                                       | 25°C                        | 28       | 55* |        | 28        | 55*    | nV/√Hz |      |
|                    | f = 10 kHz                                  |                                                                                                                | 11.6                                            |                             | 17*      |     | 11.6   | 17*       |        |        |      |
| V <sub>N(PP)</sub> | Peak-to-peak equivalent input noise voltage |                                                                                                                | f = 10 Hz to 10 kHz                             | 25°C                        | 6        |     | 6      |           | μV     |        |      |
|                    |                                             |                                                                                                                | f = 0.1 Hz to 10 Hz                             |                             | 0.6      |     | 0.6    |           |        |        |      |
| I <sub>n</sub>     | Equivalent input noise current              | V <sub>IC</sub> = 0, f = 10 kHz                                                                                |                                                 | 25°C                        | 2.8      |     | 2.8    |           | fA/√Hz |        |      |
| THD + N            | Total harmonic distortion plus noise        | V <sub>O(PP)</sub> = 20 V, A <sub>VD</sub> = 10,<br>f = 1 kHz, R <sub>L</sub> = 2 kΩ,<br>R <sub>S</sub> = 25 Ω |                                                 | 25°C                        | 0.008%   |     | 0.008% |           |        |        |      |
| B <sub>1</sub>     | Unity-gain bandwidth                        | V <sub>I</sub> = 10 mV,<br>C <sub>L</sub> = 25 pF,                                                             | R <sub>L</sub> = 2 kΩ,<br>See Figure 2          | 25°C                        | 8*       | 10  |        | 8*        | 10     | MHz    |      |
| B <sub>OM</sub>    | Maximum output-swing bandwidth              | V <sub>O(PP)</sub> = 20 V,<br>R <sub>L</sub> = 2 kΩ,                                                           | A <sub>VD</sub> = −1,<br>C <sub>L</sub> = 25 pF | 25°C                        | 478*     | 637 |        | 478*      | 637    | kHz    |      |
| φ <sub>m</sub>     | Phase margin at unity gain                  | V <sub>I</sub> = 10 mV,<br>C <sub>L</sub> = 25 pF,                                                             | R <sub>L</sub> = 2 kΩ,<br>See Figure 2          | 25°C                        | 57°      |     | 57°    |           |        |        |      |

\*On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

$^\dagger$  Full range is –55°C to 125°C.

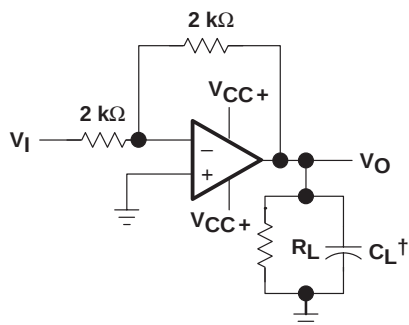
# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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**TLE2074Y electrical characteristics at  $V_{CC\pm} = \pm 15$  V,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)**

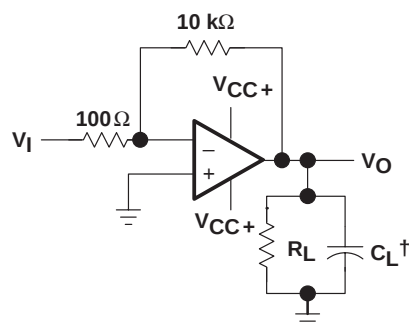
| PARAMETER |                                                                     | TEST CONDITIONS                                                      |                             | TLE2074Y        |                  |     | UNIT     |
|-----------|---------------------------------------------------------------------|----------------------------------------------------------------------|-----------------------------|-----------------|------------------|-----|----------|
|           |                                                                     |                                                                      |                             | MIN             | TYP              | MAX |          |
| $V_{IO}$  | Input offset voltage                                                | $V_{IC} = 0$ ,<br>$R_S = 50\ \Omega$                                 | $V_O = 0$ ,                 |                 |                  | 5   | mV       |
| $I_{IO}$  | Input offset current                                                | $V_{IC} = 0$ ,                                                       | $V_O = 0$ ,                 |                 | 15               | 100 | pA       |
| $I_{IB}$  | Input bias current                                                  | See Figure 4                                                         |                             |                 | 25               | 175 | pA       |
| $V_{ICR}$ | Common-mode input voltage range                                     | $R_S = 50\ \Omega$                                                   |                             | 15<br>to<br>-11 | 15<br>to<br>11.9 |     | V        |
| $V_{OM+}$ | Maximum positive peak output voltage swing                          | $I_O = -200\ \mu\text{A}$                                            |                             | 13.8            | 14.1             |     | V        |
|           |                                                                     | $I_O = -2\ \text{mA}$                                                |                             | 13.5            | 13.9             |     |          |
|           |                                                                     | $I_O = -20\ \text{mA}$                                               |                             | 11.5            | 12.3             |     |          |
| $V_{OM-}$ | Maximum negative peak output voltage swing                          | $I_O = 200\ \mu\text{A}$                                             |                             | -13.8           | -14.2            |     | V        |
|           |                                                                     | $I_O = 2\ \text{mA}$                                                 |                             | -13.5           | -14              |     |          |
|           |                                                                     | $I_O = 20\ \text{mA}$                                                |                             | -11.5           | -12.4            |     |          |
| $A_{VD}$  | Large-signal differential voltage amplification                     | $V_O = \pm 10\ \text{V}$                                             | $R_L = 600\ \Omega$         | 80              | 96               |     | dB       |
|           |                                                                     |                                                                      | $R_L = 2\ \text{k}\Omega$   | 90              | 109              |     |          |
|           |                                                                     |                                                                      | $R_L = 10\ \text{k}\Omega$  | 95              | 118              |     |          |
| $r_i$     | Input resistance                                                    | $V_{IC} = 0$                                                         |                             | 10              | 12               |     | $\Omega$ |
| $c_i$     | Input capacitance                                                   | Common mode                                                          | $V_O = 0$ ,<br>See Figure 5 | 7.5             |                  |     | pF       |
|           |                                                                     | Differential                                                         |                             | 2.5             |                  |     |          |
| $z_o$     | Open-loop output impedance                                          | $f = 1\ \text{MHz}$                                                  |                             | 80              |                  |     | $\Omega$ |
| CMRR      | Common-mode rejection ratio                                         | $V_{IC} = V_{ICRmin}$ ,<br>$R_S = 50\ \Omega$                        | $V_O = 0$ ,                 | 80              | 98               |     | dB       |
| $k_{SVR}$ | Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC\pm} = \pm 5\ \text{V}$ to $\pm 15\ \text{V}$ ,<br>$V_O = 0$ , | $R_S = 50\ \Omega$          | 82              | 99               |     | dB       |
| $I_{CC}$  | Supply current (four amplifiers)                                    | $V_O = 0$ ,                                                          | No load                     | 5.2             | 6.5              | 7.5 | mA       |
| $I_{OS}$  | Short-circuit output current                                        | $V_O = 0$                                                            | $V_{ID} = 1\ \text{V}$      | -30             | -45              |     | mA       |
|           |                                                                     |                                                                      | $V_{ID} = -1\ \text{V}$     | 30              | 48               |     |          |

## PARAMETER MEASUREMENT INFORMATION



† Includes fixture capacitance

**Figure 1. Slew-Rate Test Circuit**



† Includes fixture capacitance

**Figure 2. Unity-Gain Bandwidth and Phase-Margin Test Circuit**

## PARAMETER MEASUREMENT INFORMATION

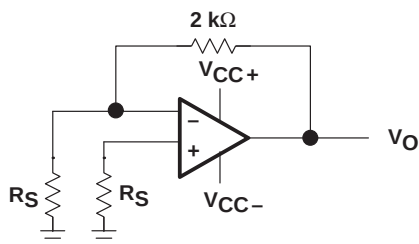


Figure 3. Noise-Voltage Test Circuit

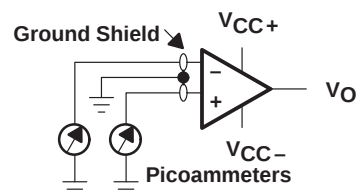


Figure 4. Input-Bias and Offset-Current Test Circuit

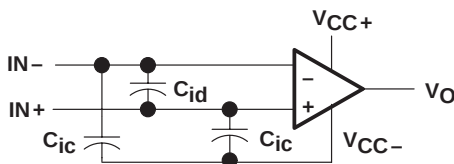


Figure 5. Internal Input Capacitance

### typical values

Typical values presented in this data sheet represent the median (50% point) of device parametric performance.

### input bias and offset current

At the picoampere bias current level typical of the TLE207x and TLE207xA, accurate measurement of the bias current becomes difficult. Not only does this measurement require a picoammeter but test socket leakages can easily exceed the actual device bias currents. To accurately measure these small currents, Texas Instruments uses a two-step process. The socket leakage is measured using picoammeters with bias voltages applied but with no device in the socket. The device is then inserted in the socket and a second test is performed that measures both the socket leakage and the device input bias current. The two measurements are then subtracted algebraically to determine the bias current of the device.

# TLE207x, TLE207xA, TLE207xY

## EXCALIBUR LOW-NOISE HIGH-SPEED

### JFET-INPUT OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

Table of Graphs

|                |                                                   |                                                                                | FIGURE                              |
|----------------|---------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------|
| $V_{IO}$       | Input offset voltage                              | Distribution                                                                   | 6, 7, 8                             |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage   | Distribution                                                                   | 9, 10, 11                           |
| $I_{IO}$       | Input offset current                              | vs Free-air temperature                                                        | 12, 13                              |
| $I_{IB}$       | Input bias current                                | vs Free-air temperature<br>vs Total supply voltage                             | 12, 13<br>14                        |
| $V_{ICR}$      | Common-mode input voltage range                   | vs Free-air temperature                                                        | 15                                  |
| $V_O$          | Output voltage                                    | vs Differential input voltage                                                  | 16, 17                              |
| $V_{OM+}$      | Maximum positive peak output voltage              | vs Output current                                                              | 18                                  |
| $V_{OM-}$      | Maximum negative peak output voltage              | vs Output current                                                              | 19                                  |
| $V_{OM}$       | Maximum peak output voltage                       | vs Free-air temperature<br>vs Supply voltage                                   | 20, 21<br>22                        |
| $V_{O(PP)}$    | Maximum peak-to-peak output voltage               | vs Frequency                                                                   | 23                                  |
| $V_O$          | Output voltage                                    | vs Settling time                                                               | 24                                  |
| $A_{VD}$       | Large-signal differential voltage amplification   | vs Load resistance<br>vs Free-air temperature                                  | 25<br>26, 27                        |
| $A_{VD}$       | Small-signal differential voltage amplification   | vs Frequency                                                                   | 28, 29                              |
| CMRR           | Common-mode rejection ratio                       | vs Frequency<br>vs Free-air temperature                                        | 30<br>31                            |
| $k_{SVR}$      | Supply-voltage rejection ratio                    | vs Frequency<br>vs Free-air temperature                                        | 32<br>33                            |
| $I_{CC}$       | Supply current                                    | vs Supply voltage<br>vs Free-air temperature<br>vs Differential input voltage  | 34, 35, 36<br>37, 38, 39<br>40 – 45 |
| $I_{OS}$       | Short-circuit output current                      | vs Supply voltage<br>vs Elapsed time<br>vs Free-air temperature                | 46<br>47<br>48                      |
| SR             | Slew rate                                         | vs Free-air temperature<br>vs Load resistance<br>vs Differential input voltage | 49, 50<br>51<br>52                  |
| $V_n$          | Equivalent Input noise voltage (spectral density) | vs Frequency                                                                   | 53                                  |
| $V_n$          | Input referred noise voltage                      | vs Noise bandwidth<br>Over a 10-second time interval                           | 54<br>55                            |
|                | Third-octave spectral noise density               | vs Frequency bands                                                             | 56                                  |
| THD + N        | Total harmonic distortion plus noise              | vs Frequency                                                                   | 57, 58                              |
| $B_1$          | Unity-gain bandwidth                              | vs Load capacitance                                                            | 59                                  |
|                | Gain-bandwidth product                            | vs Free-air temperature<br>vs Supply voltage                                   | 60<br>61                            |
|                | Gain margin                                       | vs Load capacitance                                                            | 62                                  |
| $\phi_m$       | Phase margin                                      | vs Free-air temperature<br>vs Supply voltage<br>vs Load capacitance            | 63<br>64<br>65                      |
|                | Phase shift                                       | vs Frequency                                                                   | 28, 29                              |
|                | Noninverting large-signal pulse response          | vs Time                                                                        | 66                                  |
|                | Small-signal pulse response                       | vs Time                                                                        | 67                                  |
| $z_o$          | Closed-loop output impedance                      | vs Frequency                                                                   | 68                                  |
|                | Crosstalk attenuation                             | vs Frequency                                                                   | 69                                  |

## TYPICAL CHARACTERISTICS

DISTRIBUTION OF TLE2071  
INPUT OFFSET VOLTAGE

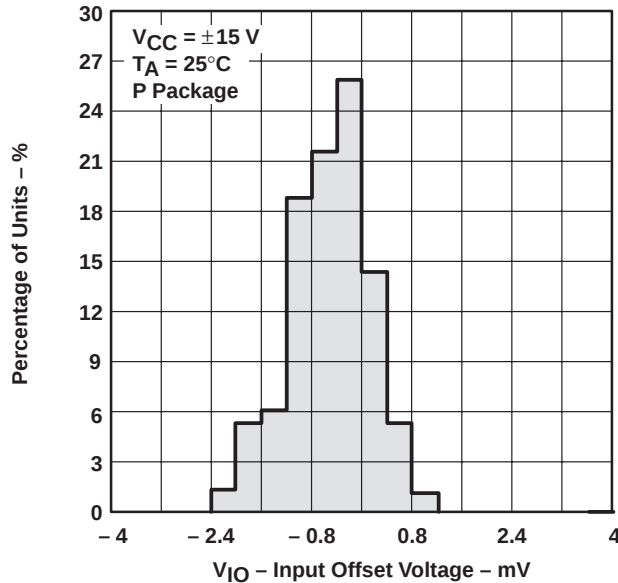


Figure 6

DISTRIBUTION OF TLE2072  
INPUT OFFSET VOLTAGE

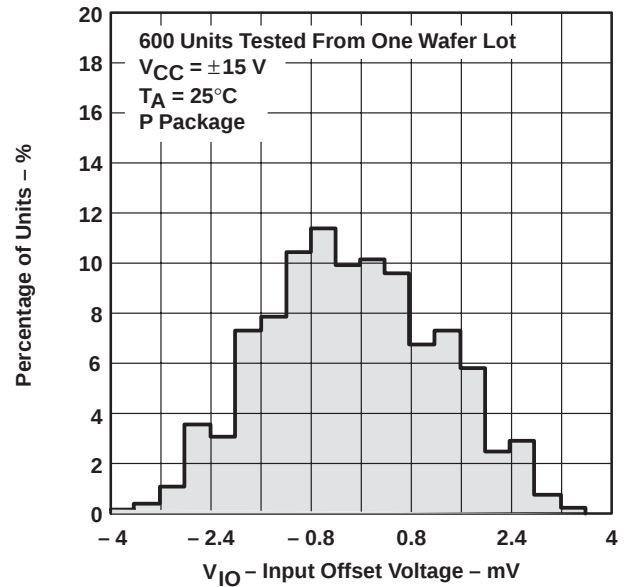


Figure 7

DISTRIBUTION OF TLE2074  
INPUT OFFSET VOLTAGE

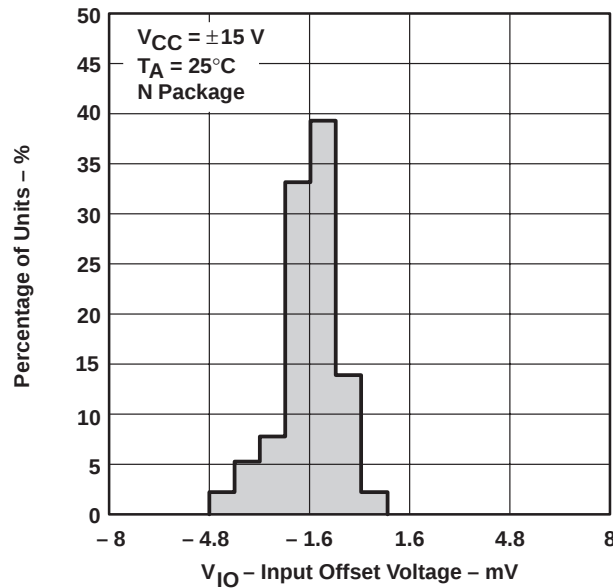


Figure 8

DISTRIBUTION OF TLE2071 INPUT OFFSET  
VOLTAGE TEMPERATURE COEFFICIENT

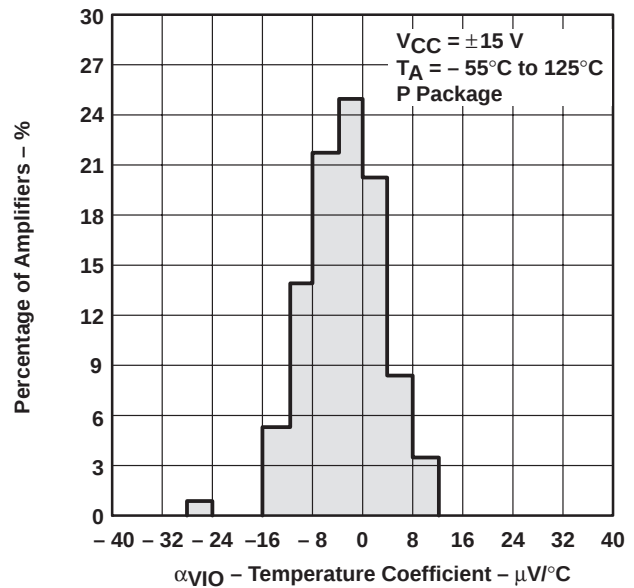


Figure 9

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

DISTRIBUTION OF TLE2072 INPUT OFFSET  
VOLTAGE TEMPERATURE COEFFICIENT

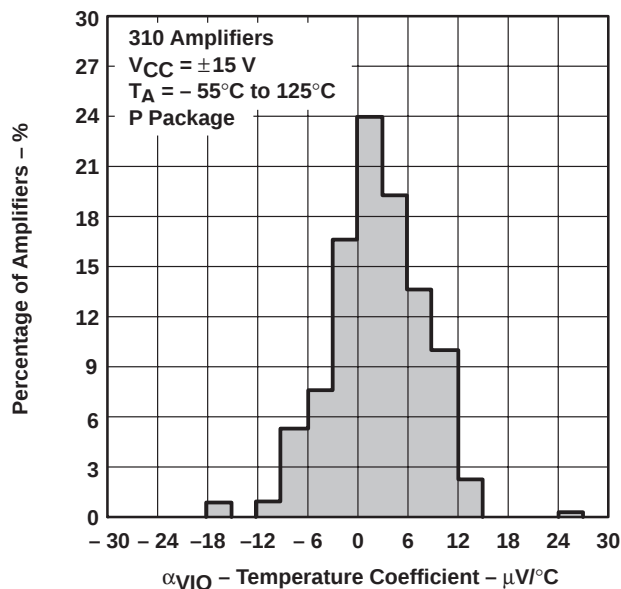


Figure 10

DISTRIBUTION OF TLE2074 INPUT OFFSET  
VOLTAGE TEMPERATURE COEFFICIENT

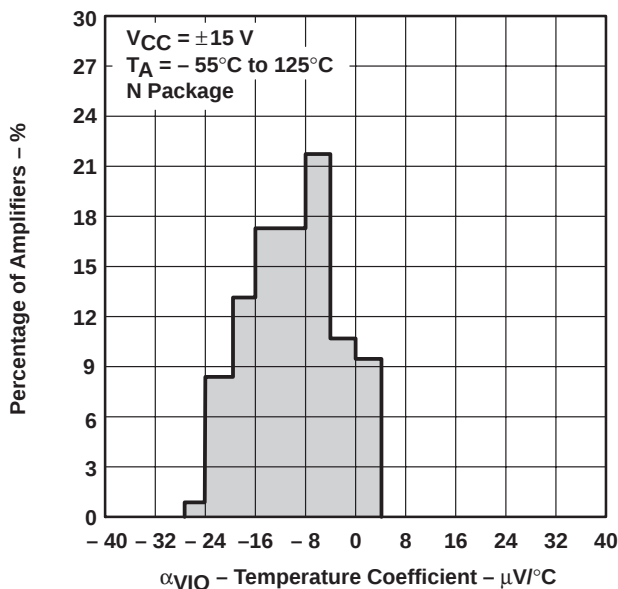


Figure 11

INPUT BIAS CURRENT AND  
INPUT OFFSET CURRENT†  
VS  
FREE-AIR TEMPERATURE

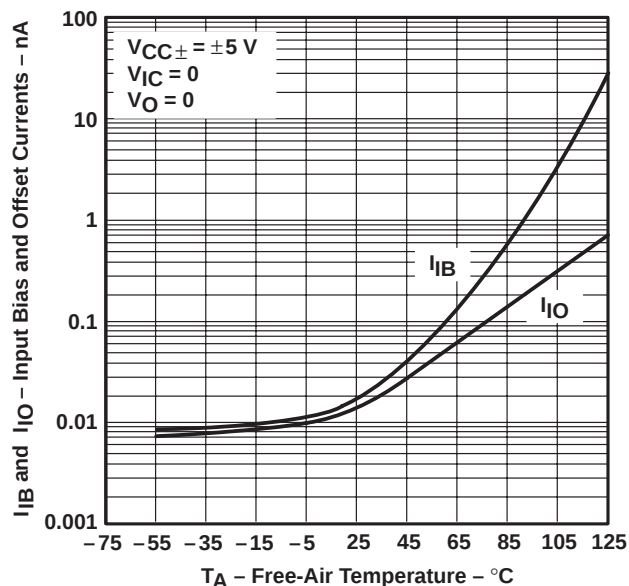


Figure 12

INPUT BIAS CURRENT AND  
INPUT OFFSET CURRENT†  
VS  
FREE-AIR TEMPERATURE

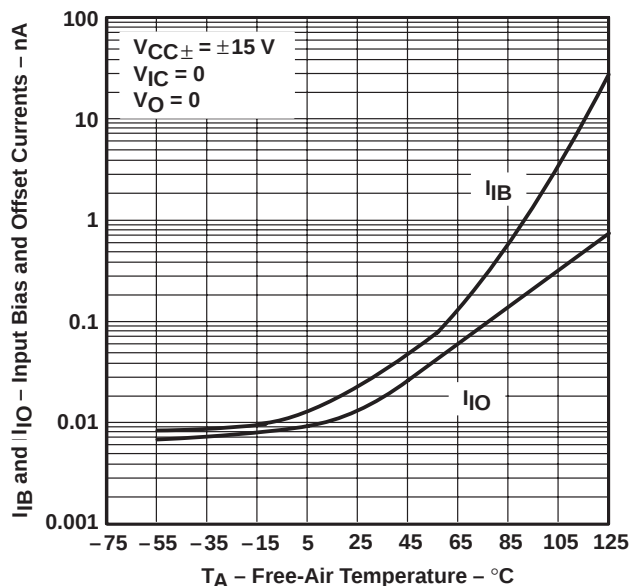
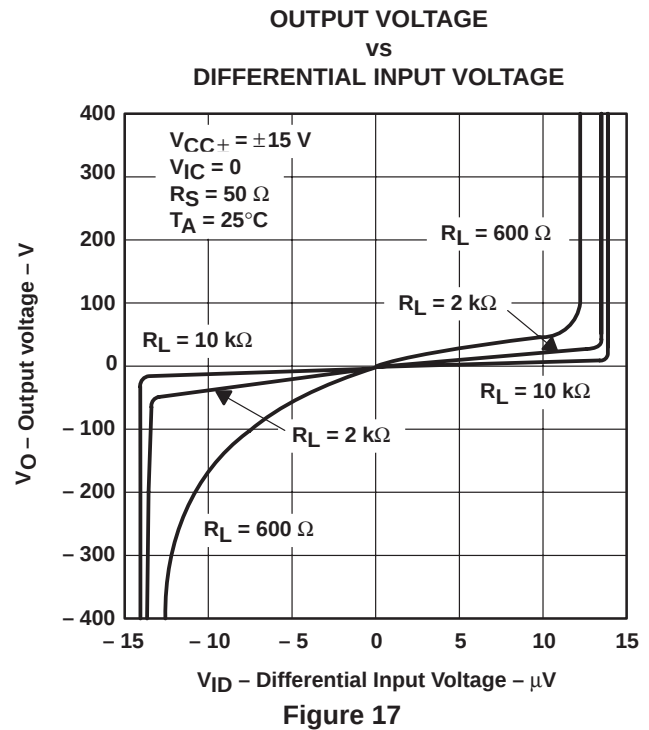
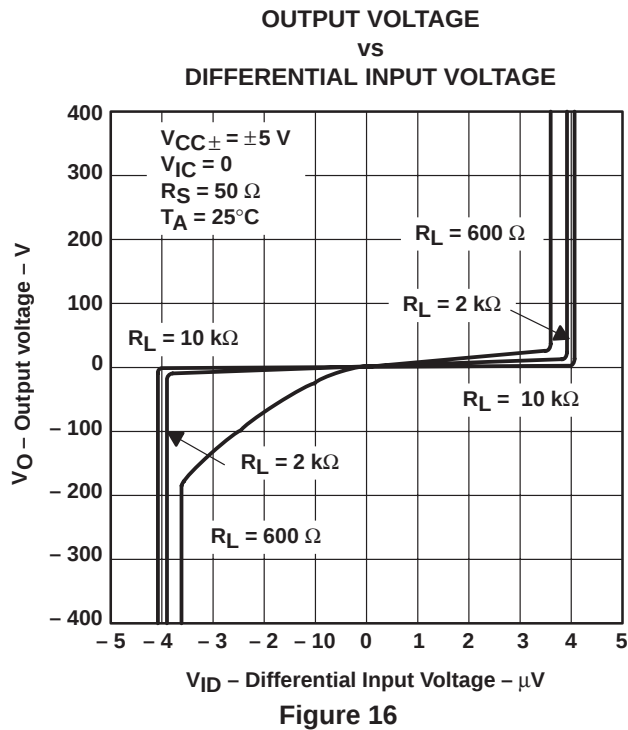
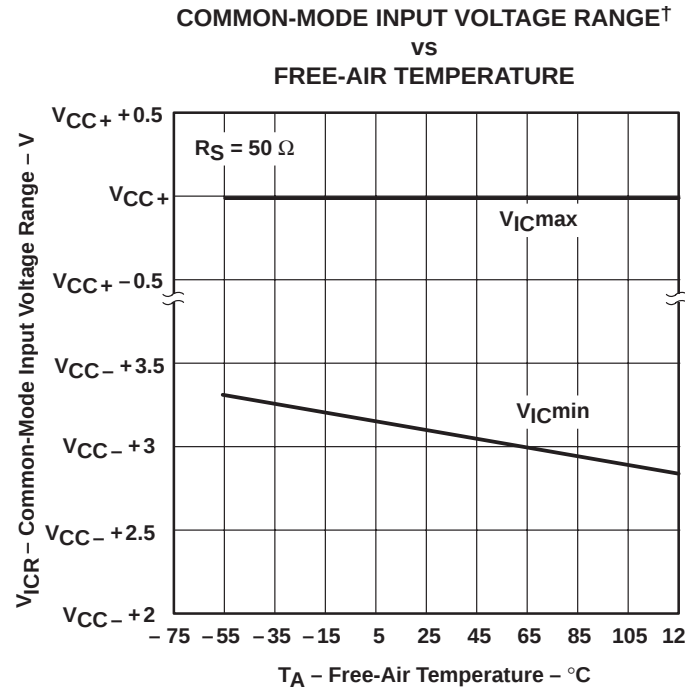
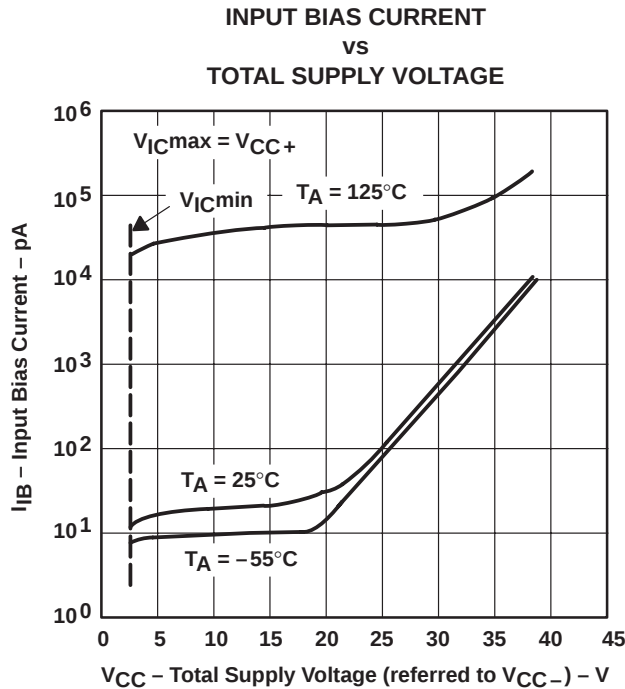


Figure 13

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

## TYPICAL CHARACTERISTICS



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

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

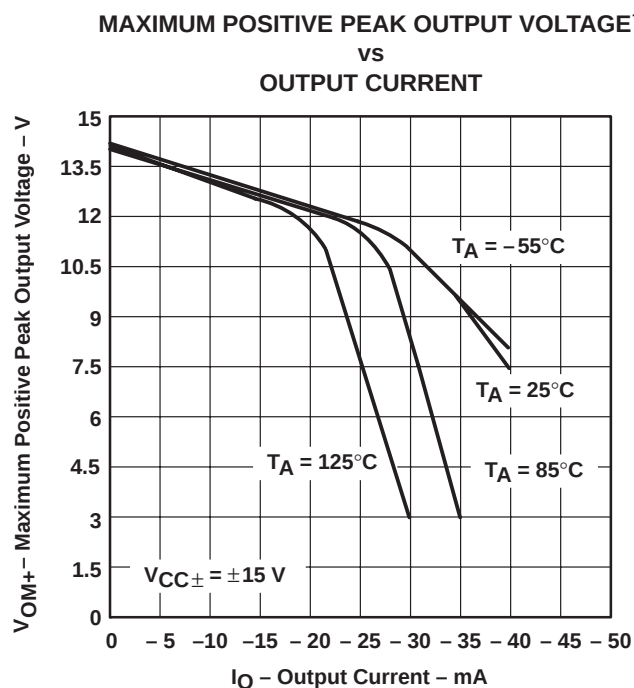


Figure 18

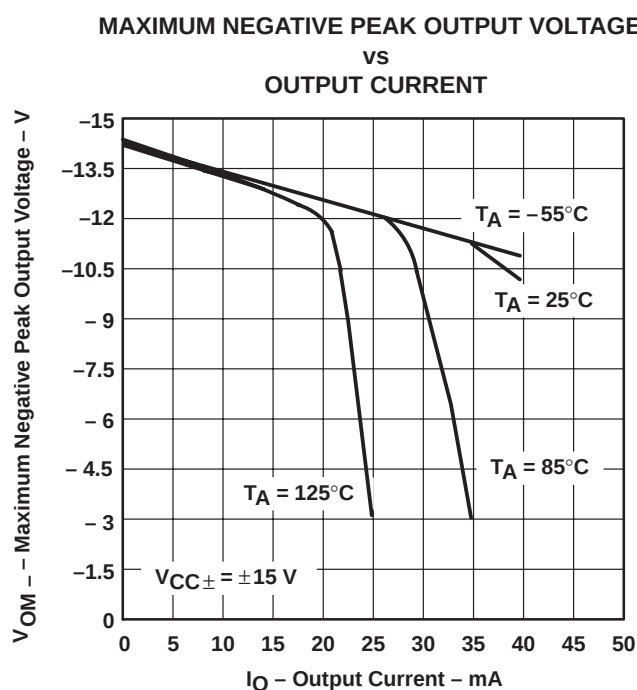


Figure 19

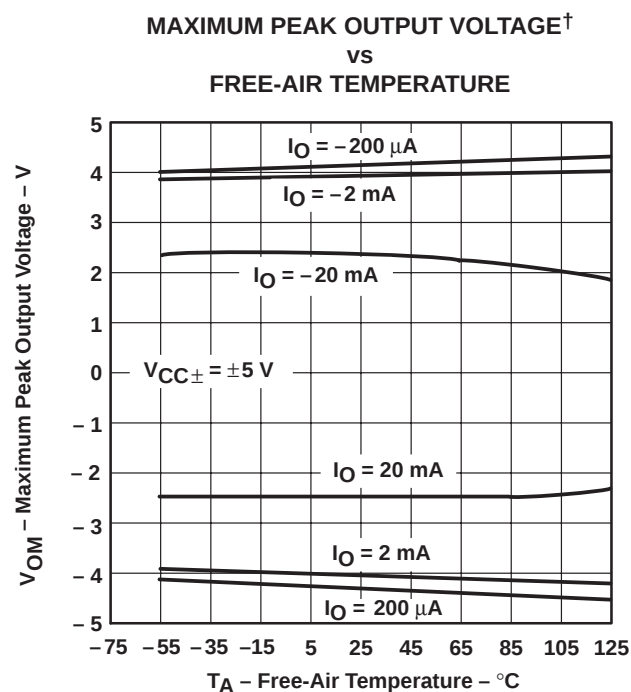


Figure 20

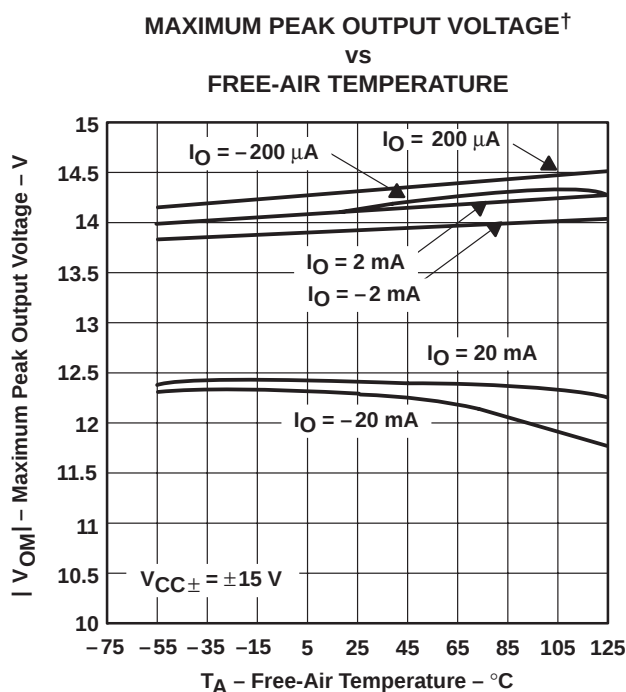


Figure 21

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

## TYPICAL CHARACTERISTICS

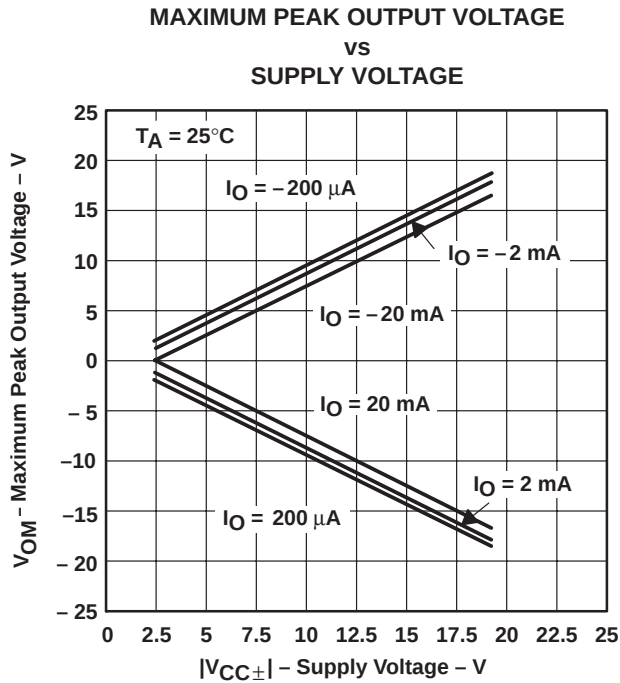


Figure 22

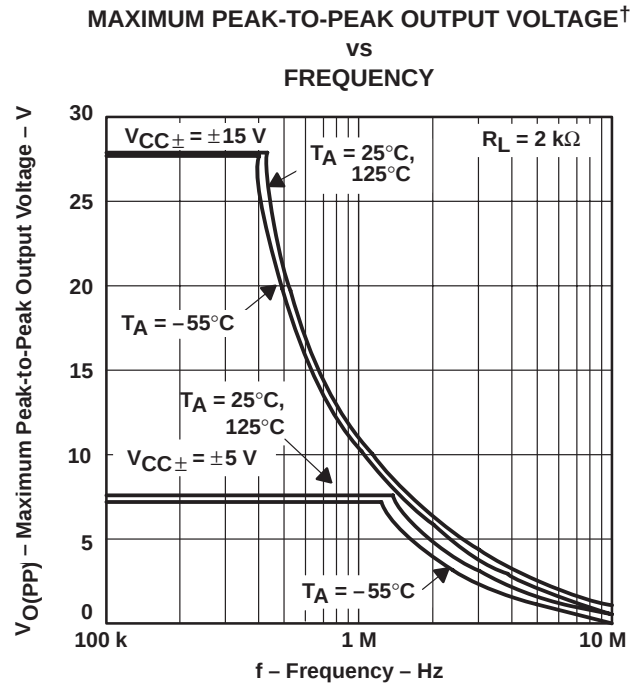


Figure 23

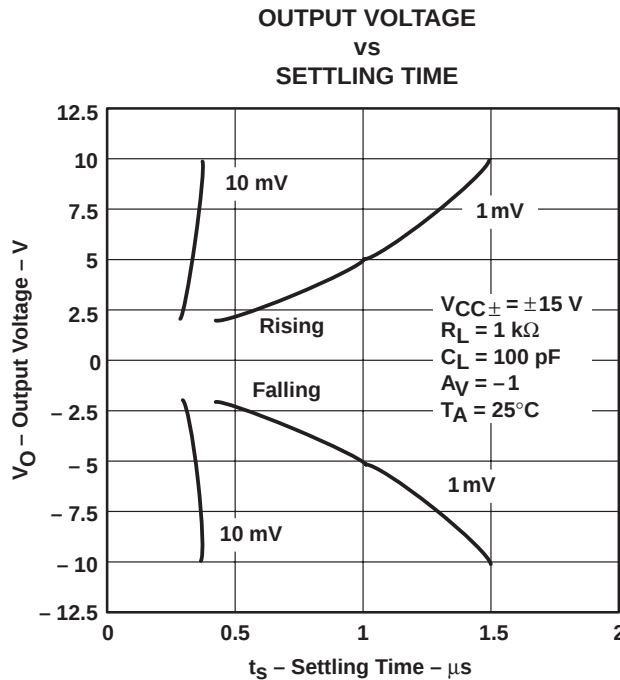


Figure 24

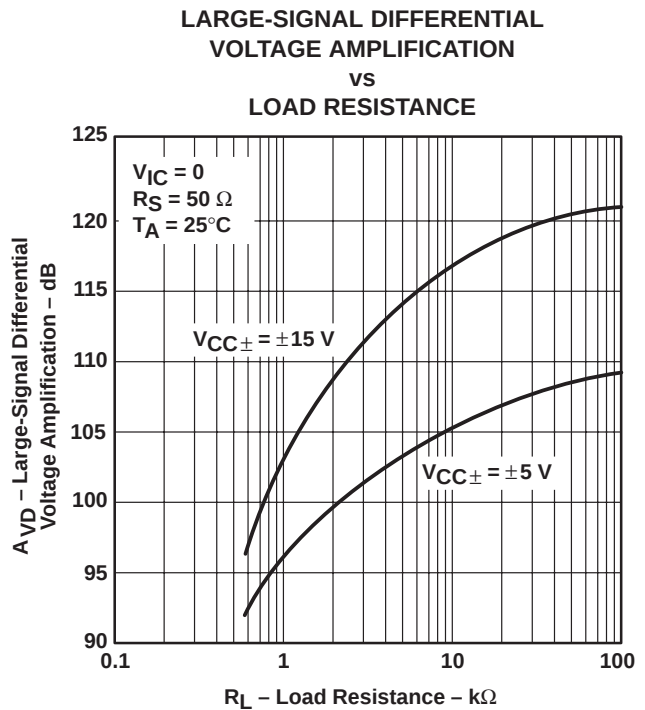


Figure 25

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

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181A – FEBRUARY 1997 – REVISED MARCH 2000

## TYPICAL CHARACTERISTICS

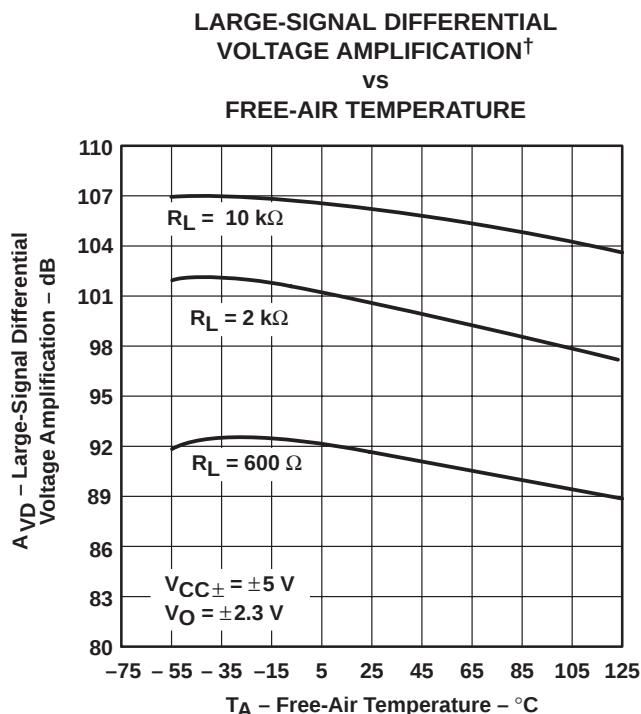


Figure 26

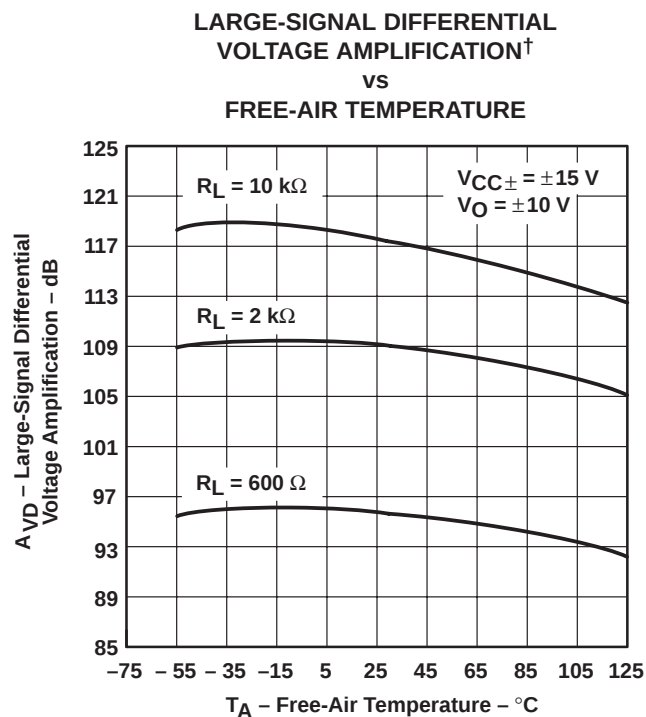


Figure 27

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

## TYPICAL CHARACTERISTICS

### SMALL-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT vs FREQUENCY

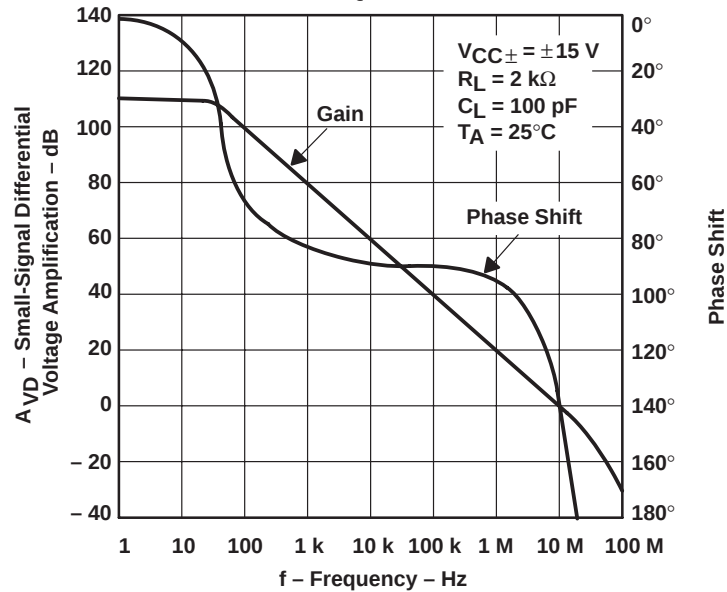


Figure 28

### SMALL-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT vs FREQUENCY

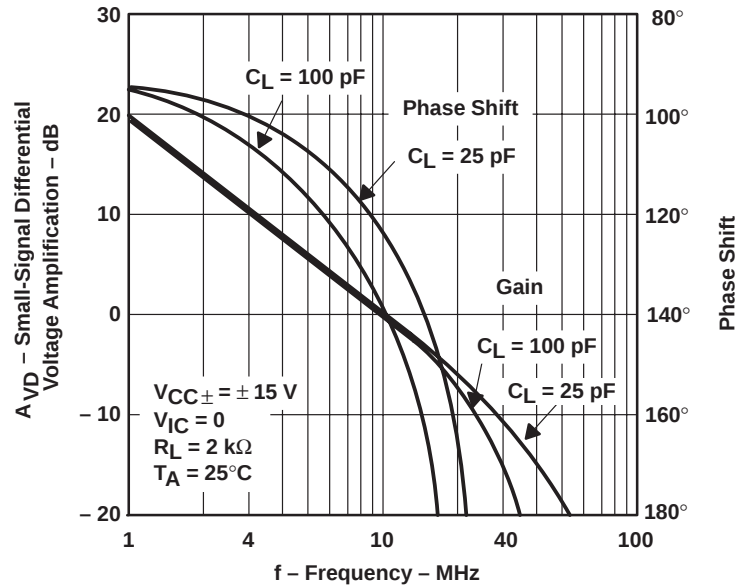


Figure 29

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

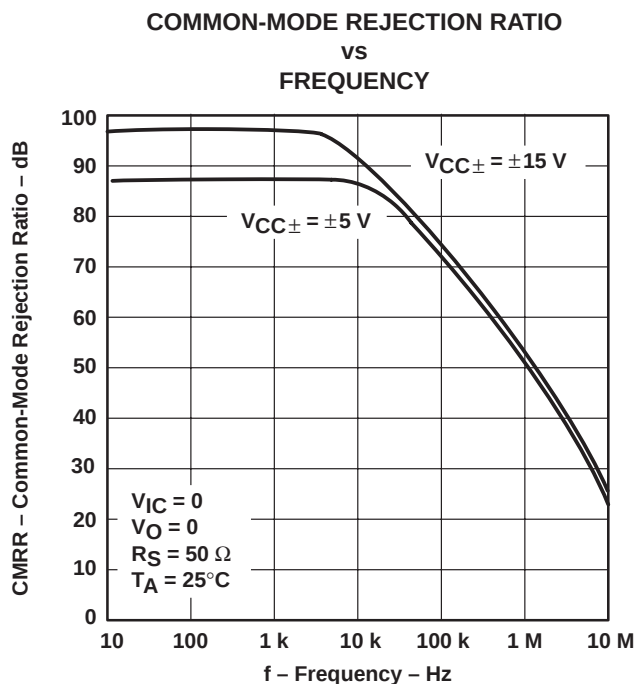


Figure 30

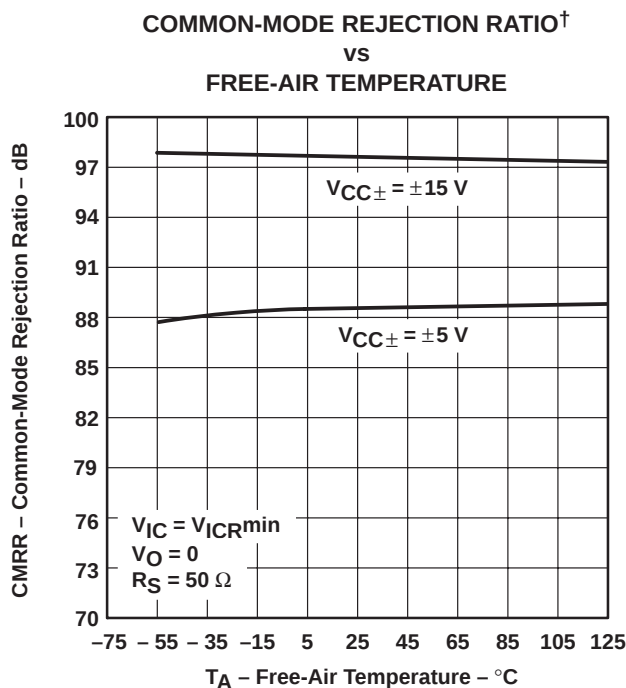


Figure 31

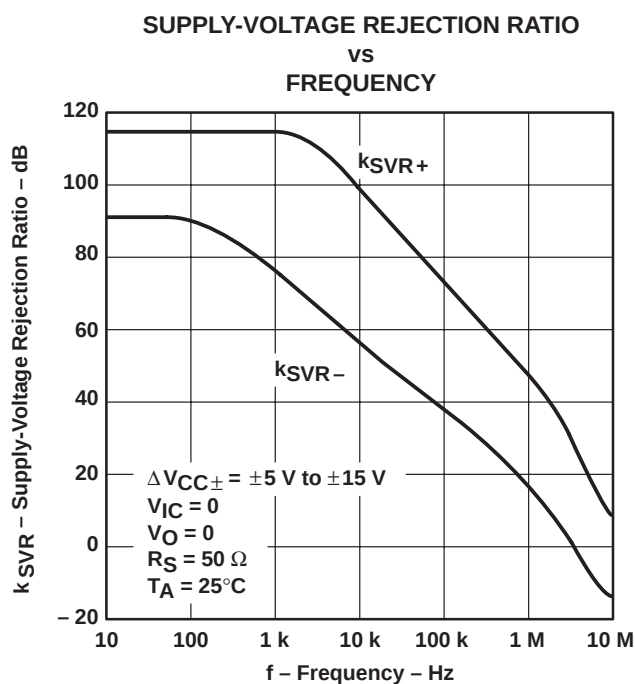


Figure 32

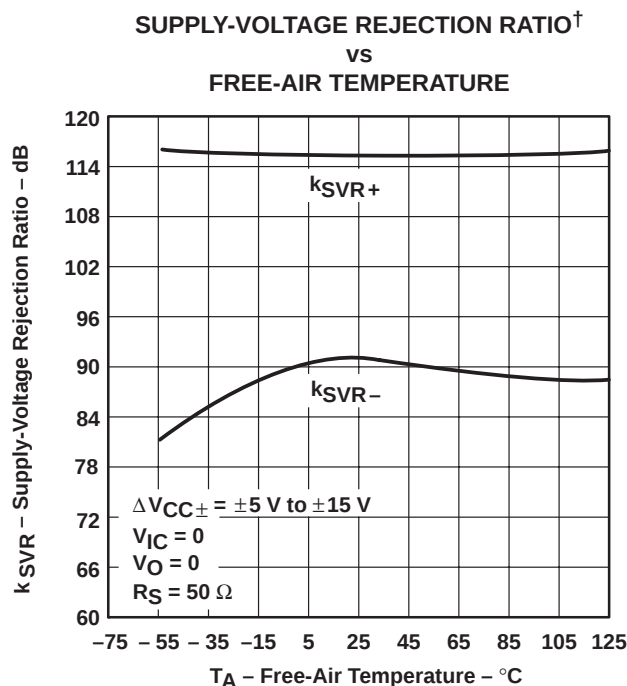


Figure 33

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

## TYPICAL CHARACTERISTICS

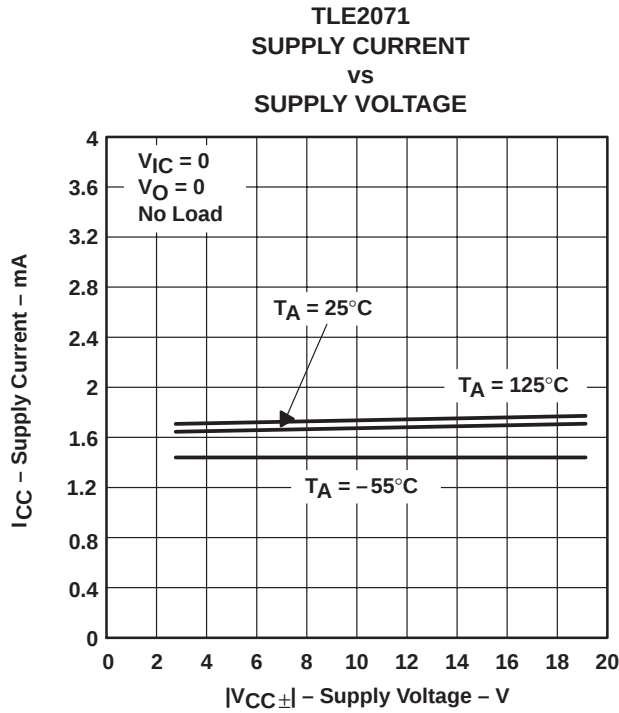


Figure 34

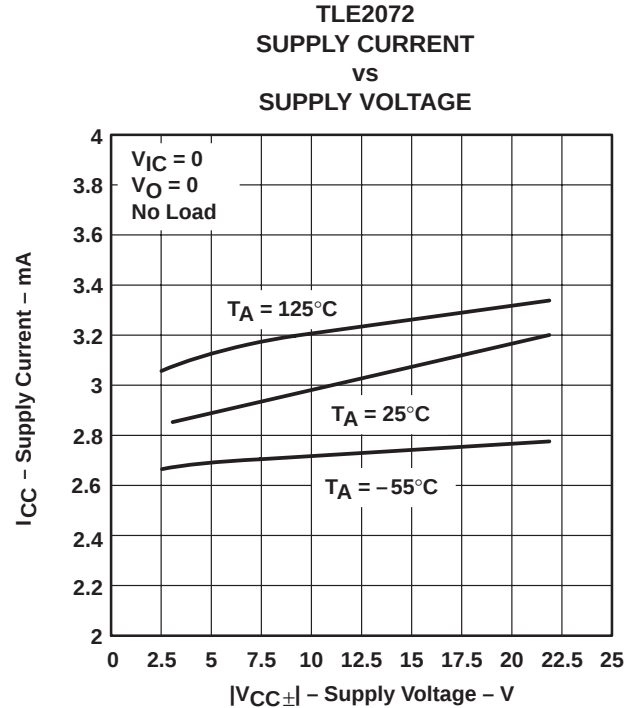


Figure 35

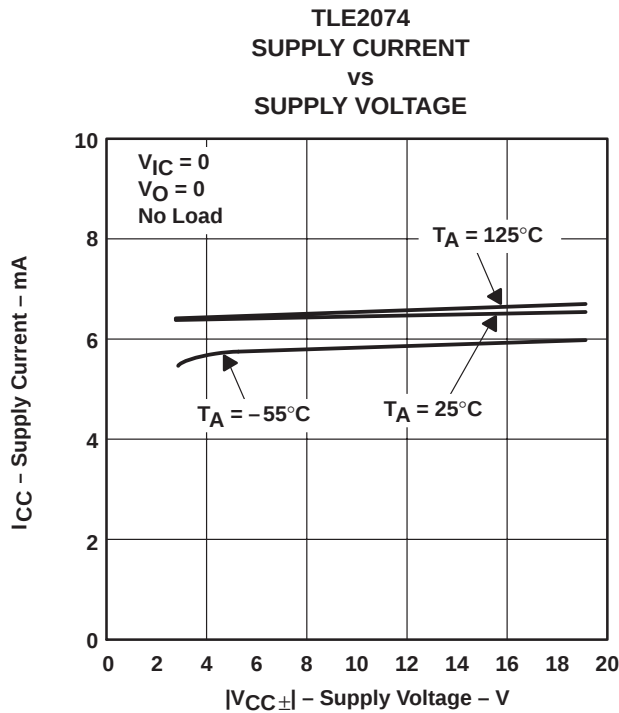


Figure 36

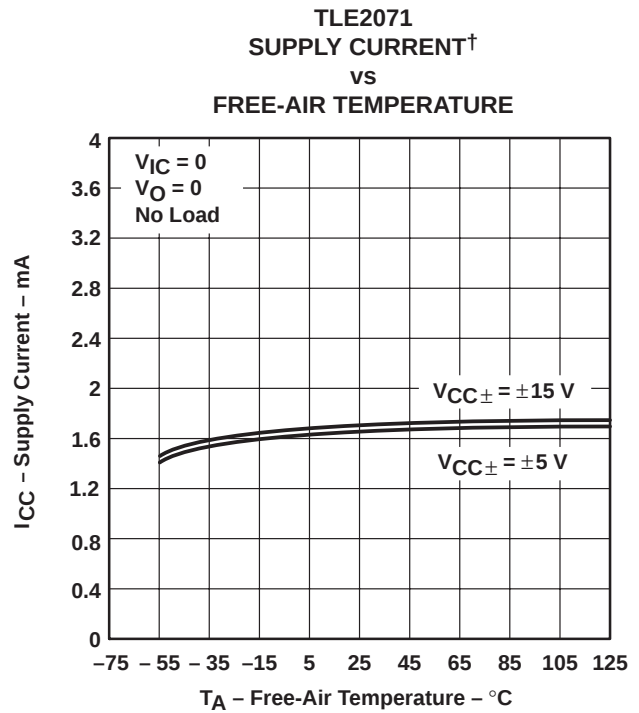


Figure 37

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

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

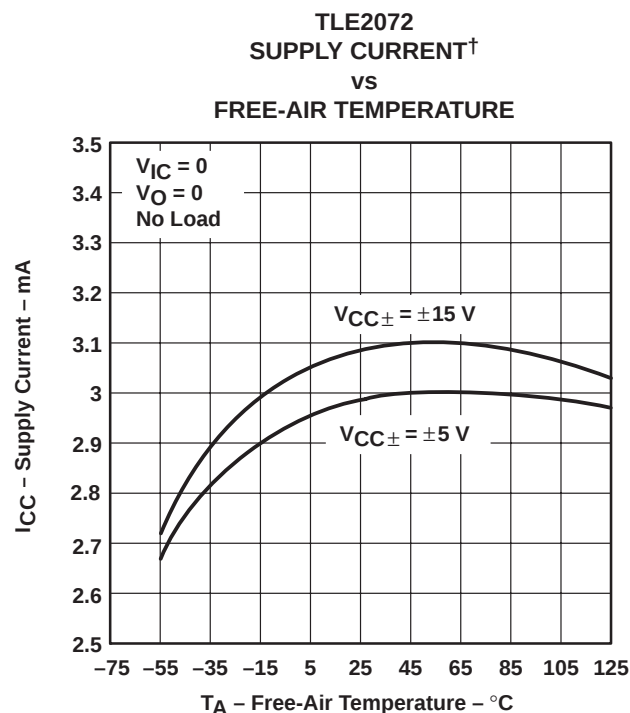


Figure 38

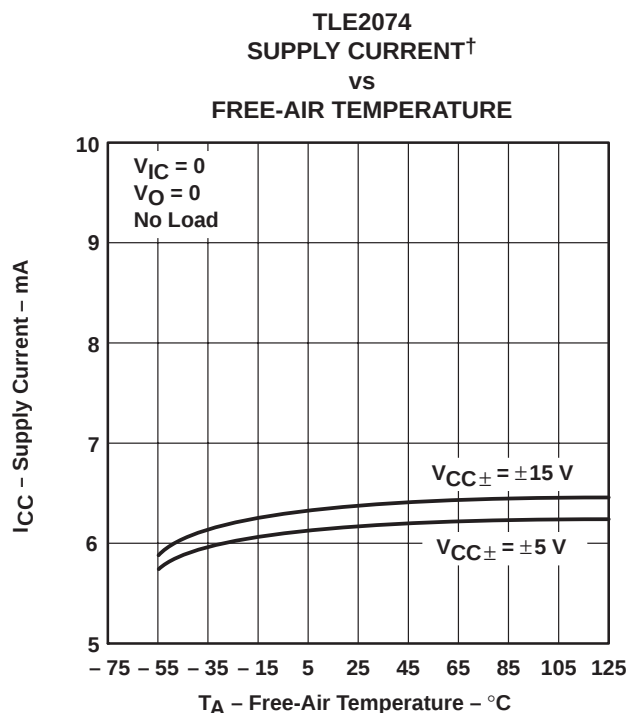


Figure 39

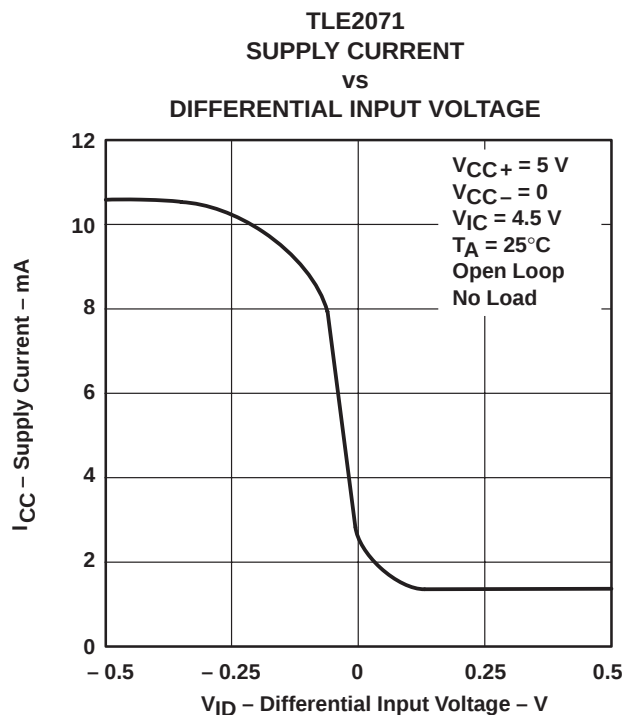


Figure 40

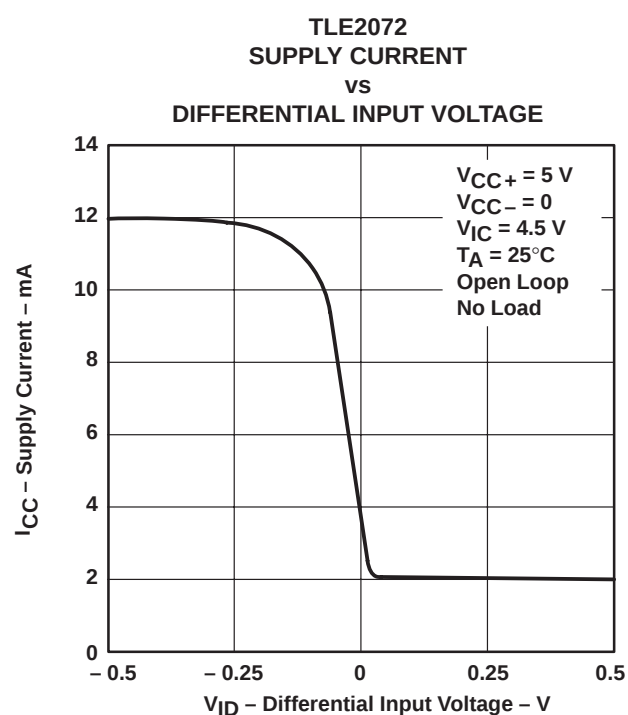


Figure 41

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

## TYPICAL CHARACTERISTICS

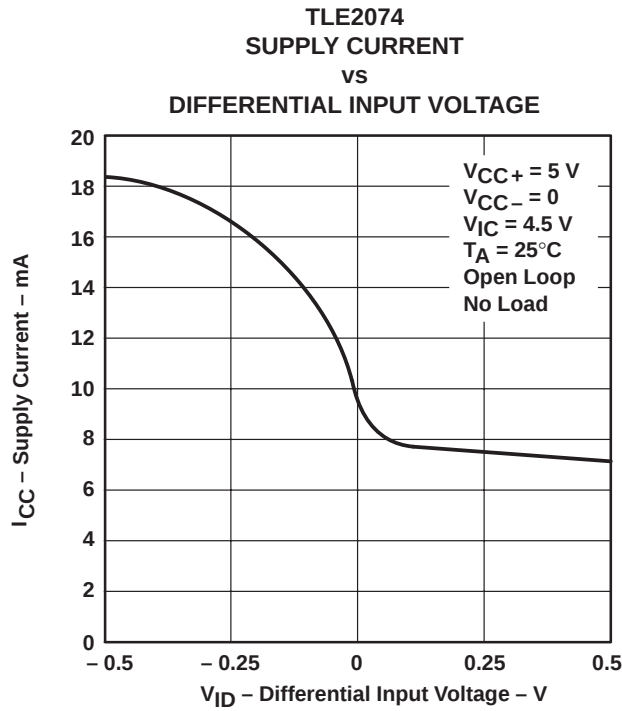


Figure 42

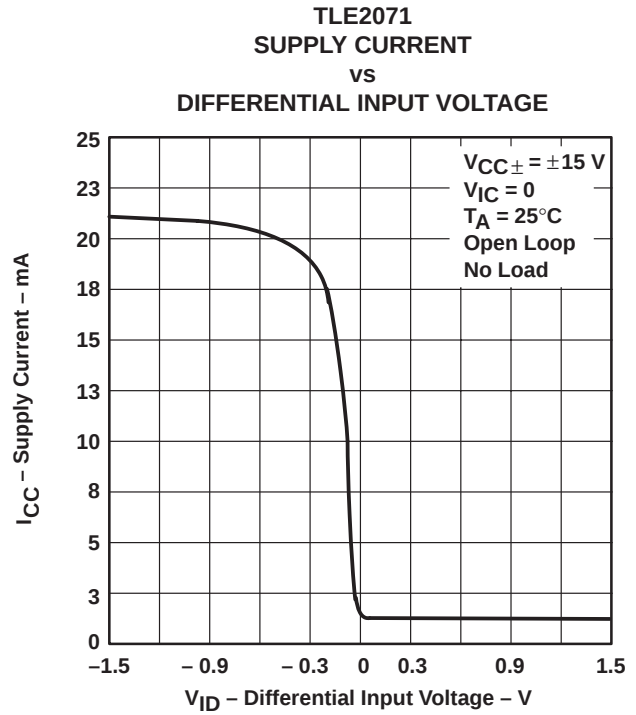


Figure 43

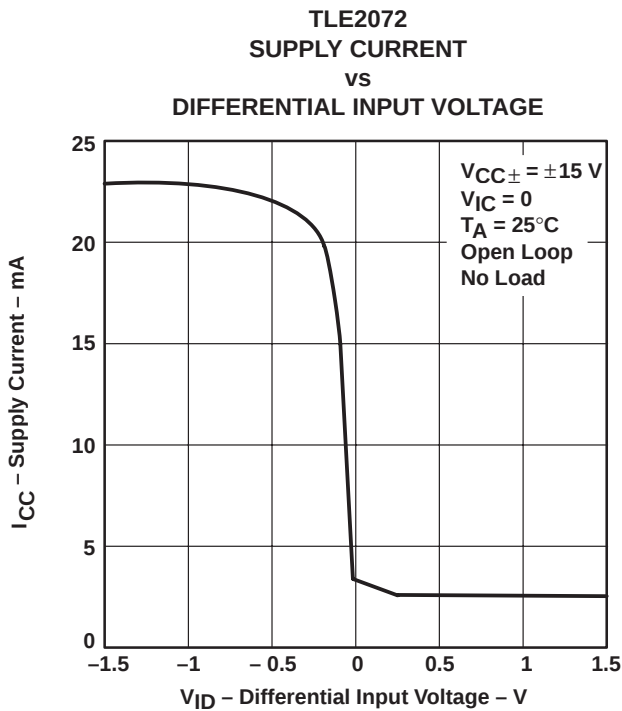


Figure 44

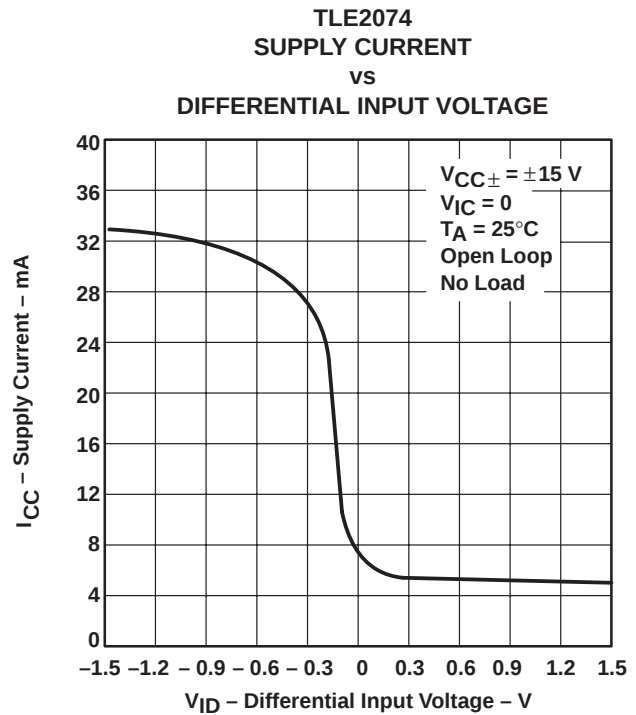


Figure 45

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181A – FEBRUARY 1997 – REVISED MARCH 2000

## TYPICAL CHARACTERISTICS

SHORT-CIRCUIT OUTPUT CURRENT  
VS  
SUPPLY VOLTAGE

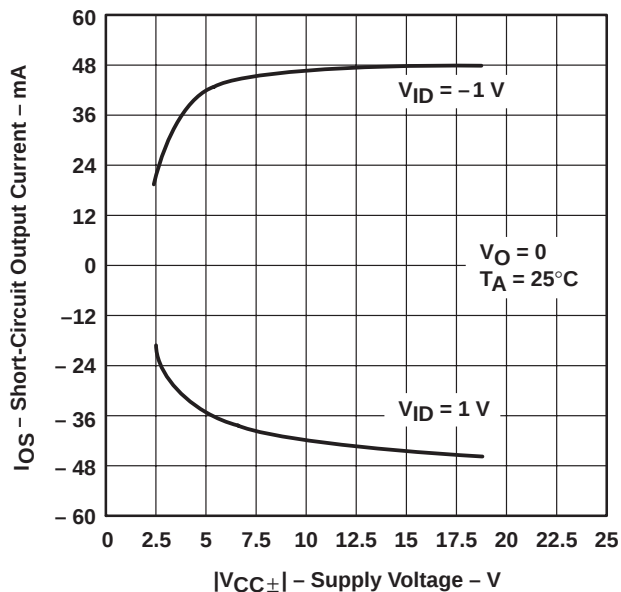


Figure 46

SHORT-CIRCUIT OUTPUT CURRENT  
VS  
ELAPSED TIME

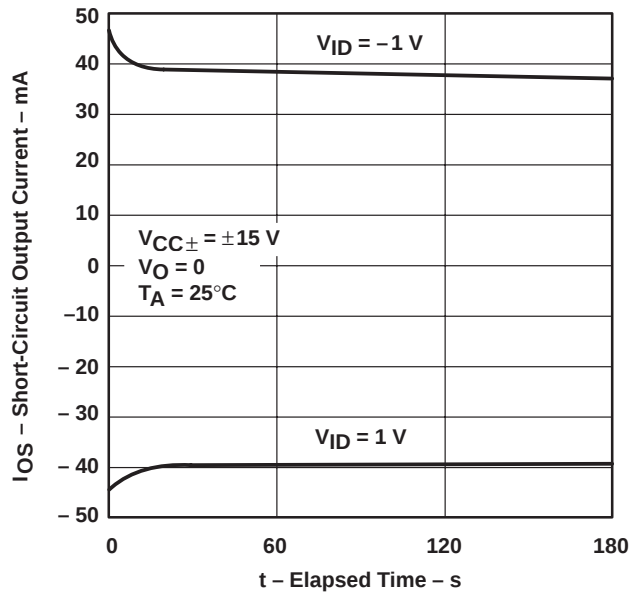


Figure 47

SHORT-CIRCUIT OUTPUT CURRENT†  
VS  
FREE-AIR TEMPERATURE

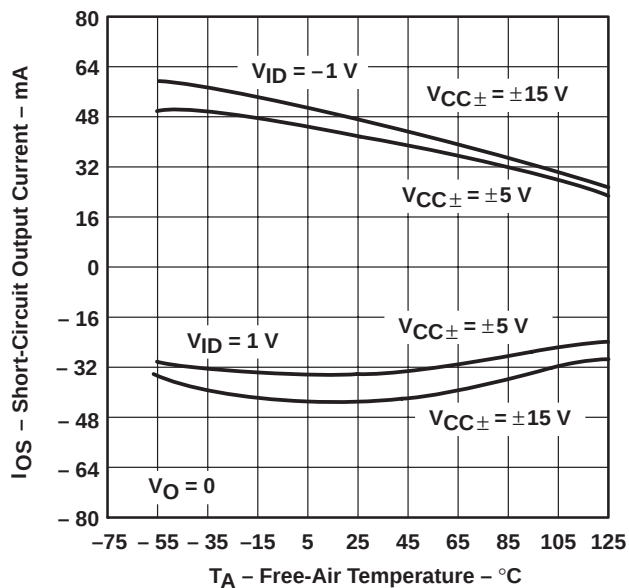


Figure 48

SLEW RATE†  
VS  
FREE-AIR TEMPERATURE

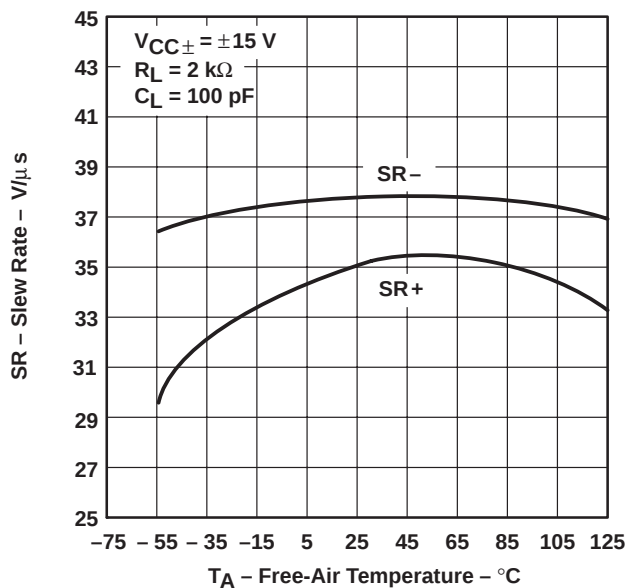


Figure 49

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

## TYPICAL CHARACTERISTICS

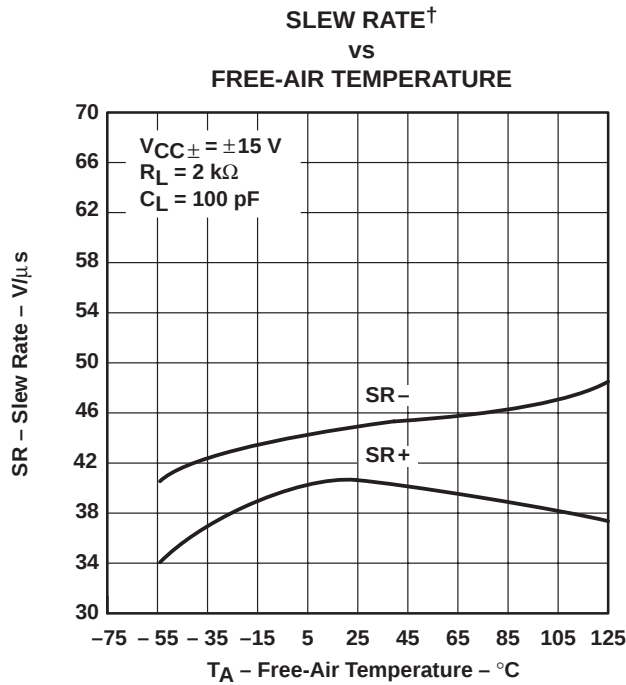


Figure 50

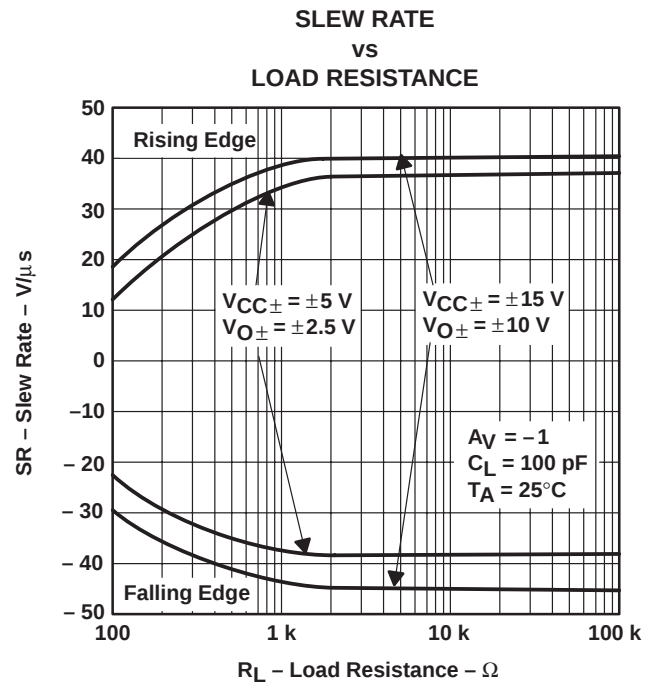


Figure 51

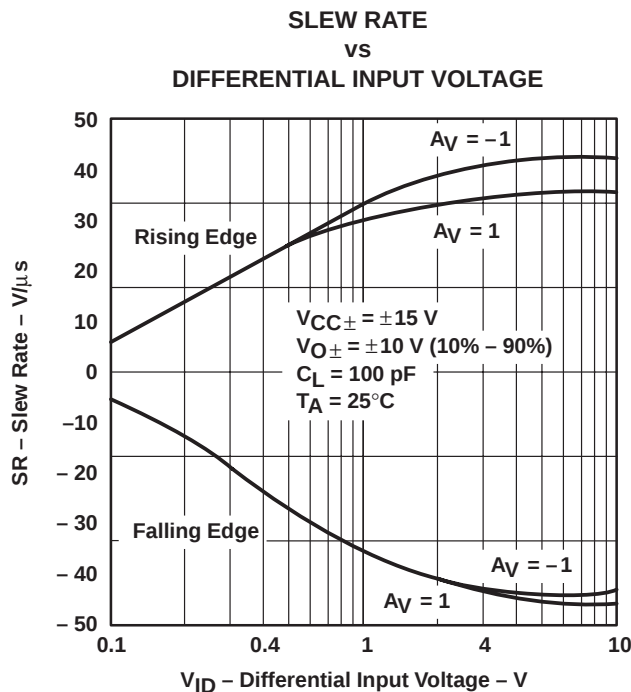


Figure 52

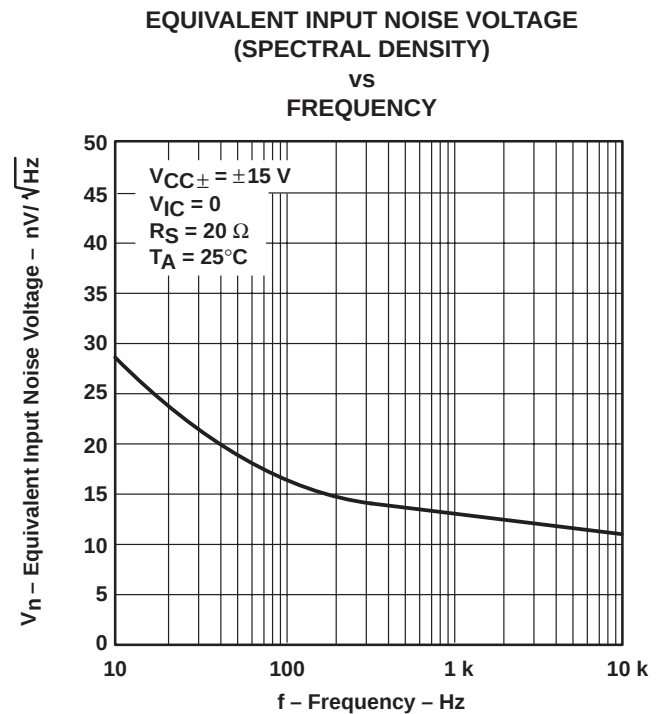


Figure 53

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

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

INPUT-REFERRED NOISE VOLTAGE  
VS  
NOISE BANDWIDTH

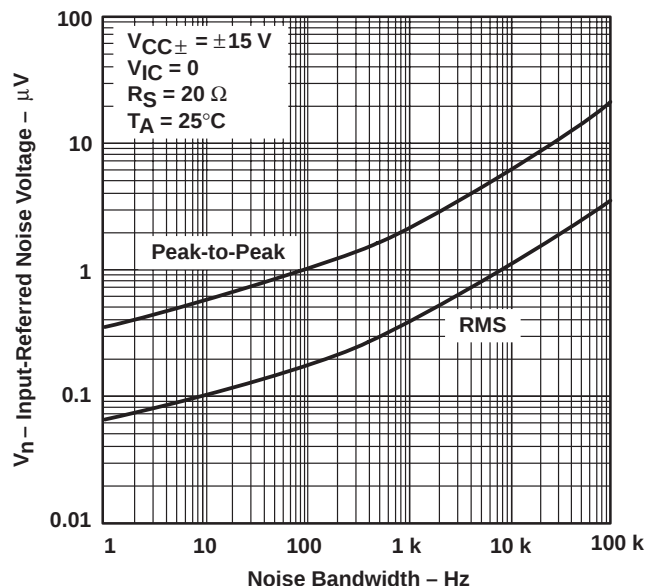


Figure 54

INPUT-REFERRED NOISE VOLTAGE  
OVER A 10-SECOND TIME INTERVAL

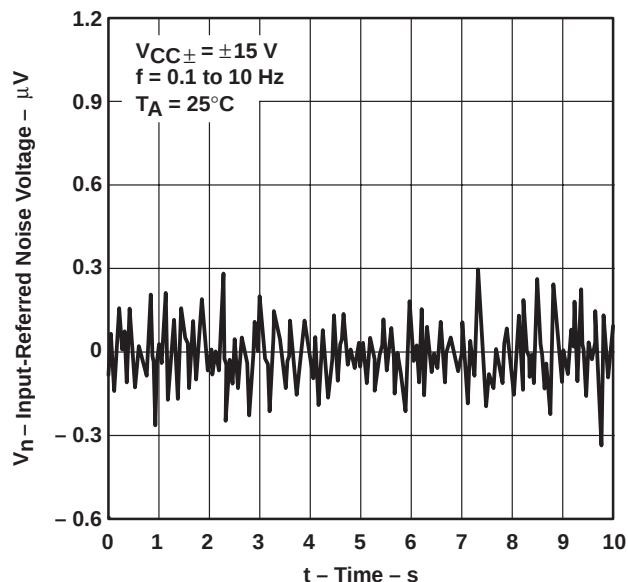


Figure 55

THIRD-OCTAVE SPECTRAL NOISE DENSITY  
VS  
FREQUENCY BANDS

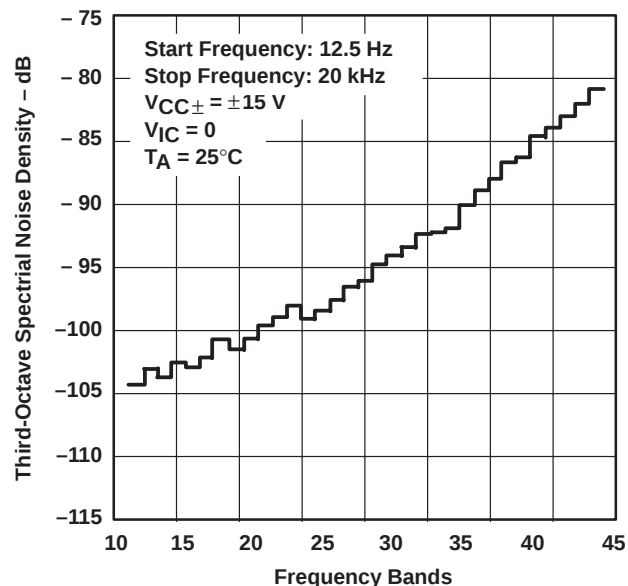


Figure 56

TOTAL HARMONIC DISTORTION PLUS NOISE  
VS  
FREQUENCY

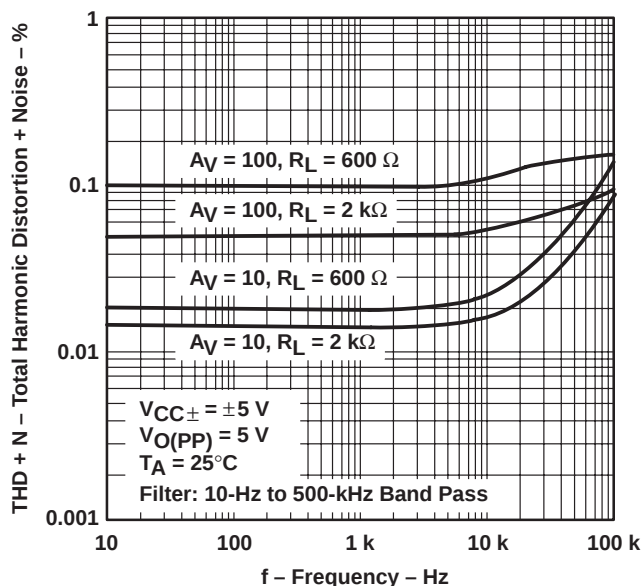


Figure 57

## TYPICAL CHARACTERISTICS

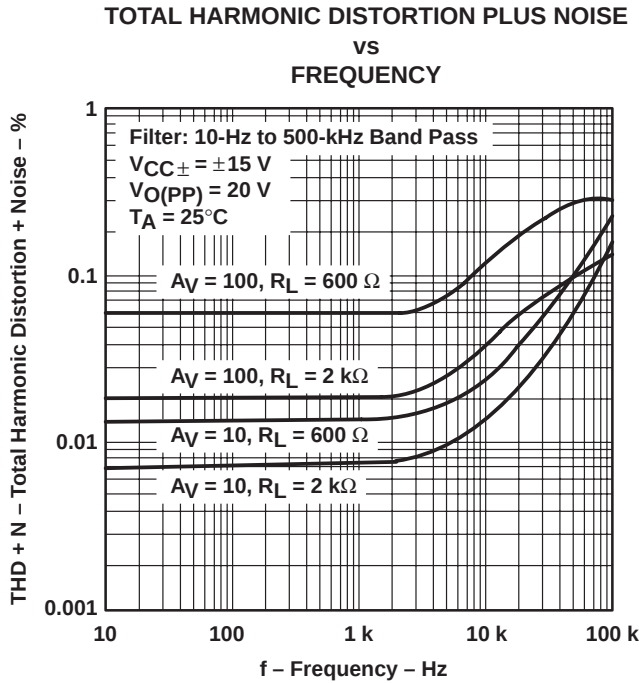


Figure 58

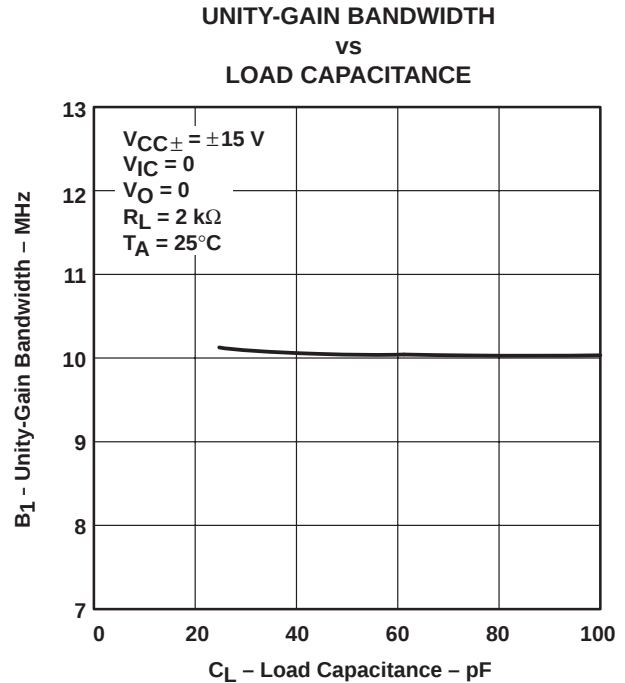


Figure 59

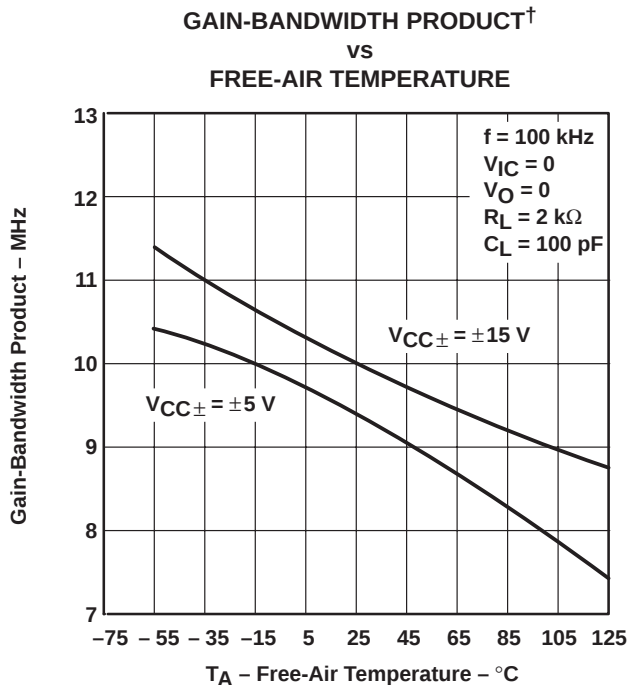


Figure 60

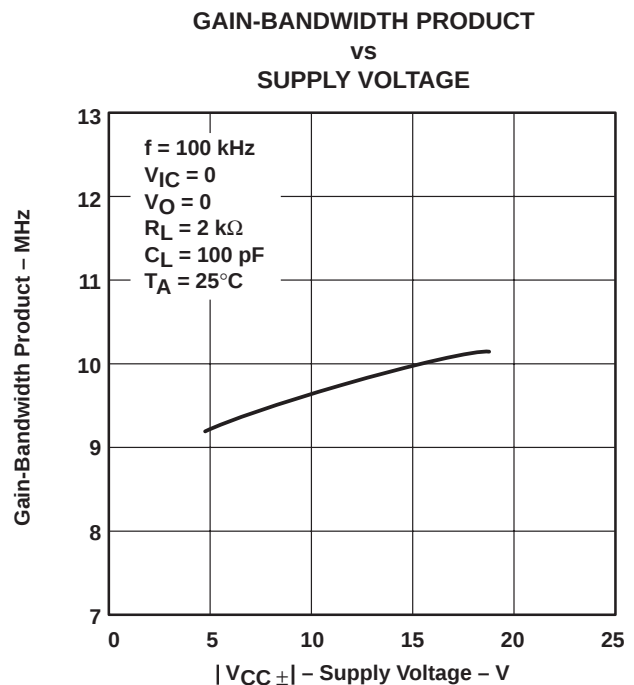


Figure 61

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

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181A – FEBRUARY 1997 – REVISED MARCH 2000

## TYPICAL CHARACTERISTICS

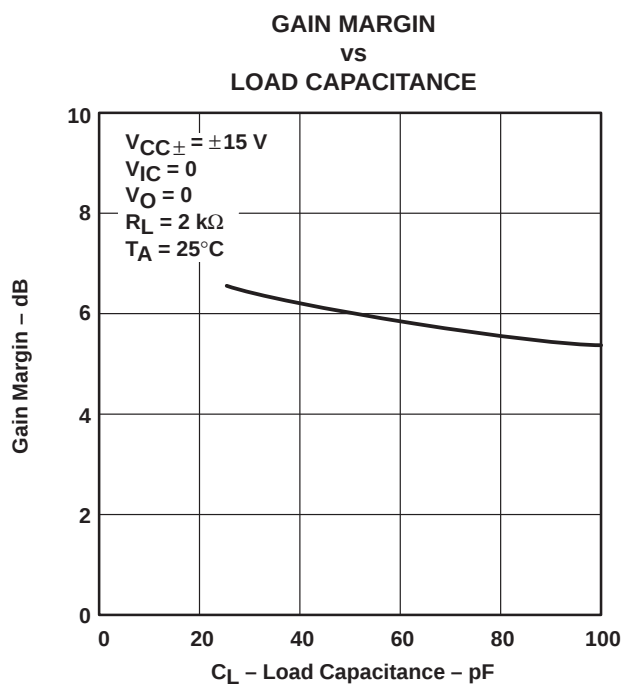


Figure 62

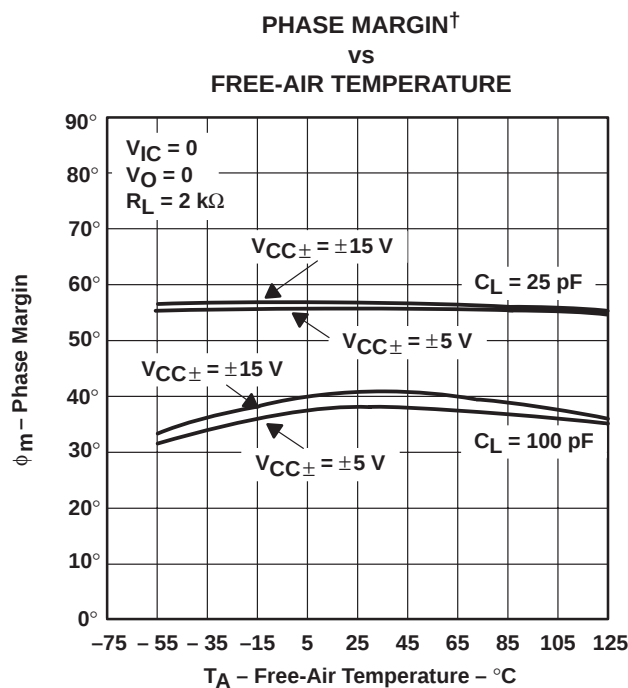


Figure 63

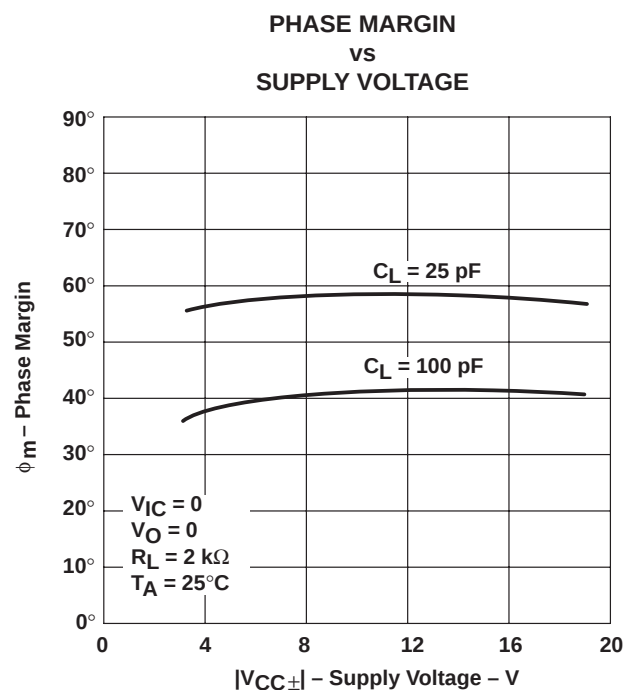


Figure 64

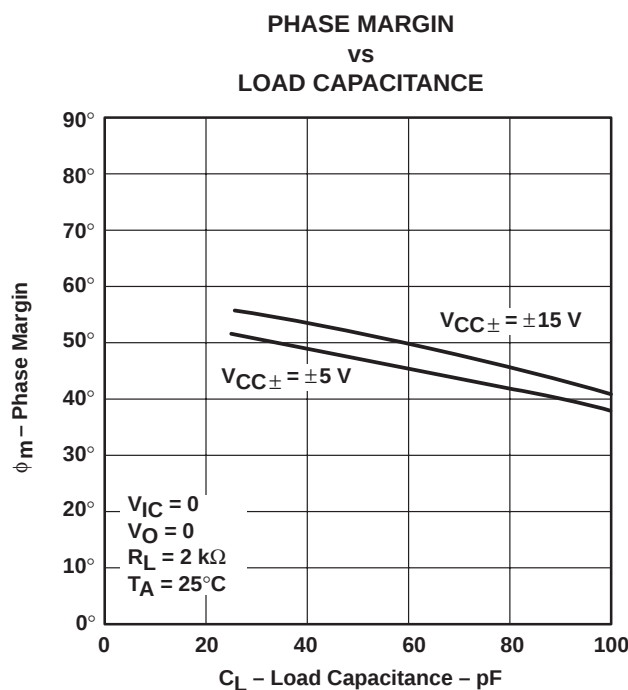


Figure 65

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

## TYPICAL CHARACTERISTICS

NONINVERTING LARGE-SIGNAL  
PULSE RESPONSE†

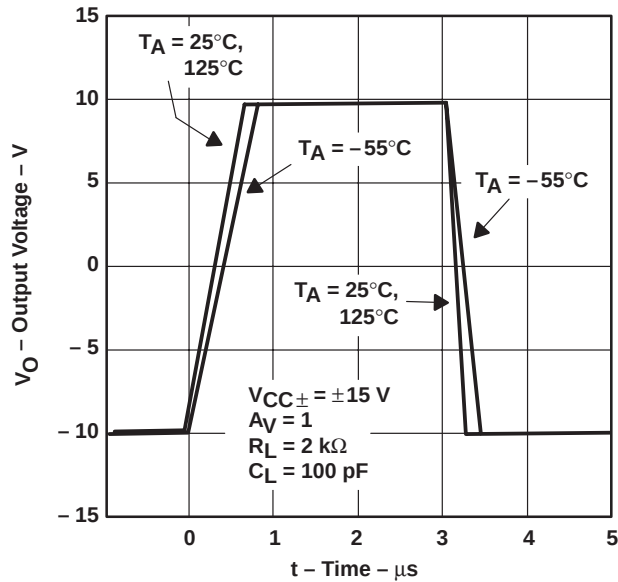


Figure 66

SMALL-SIGNAL PULSE RESPONSE

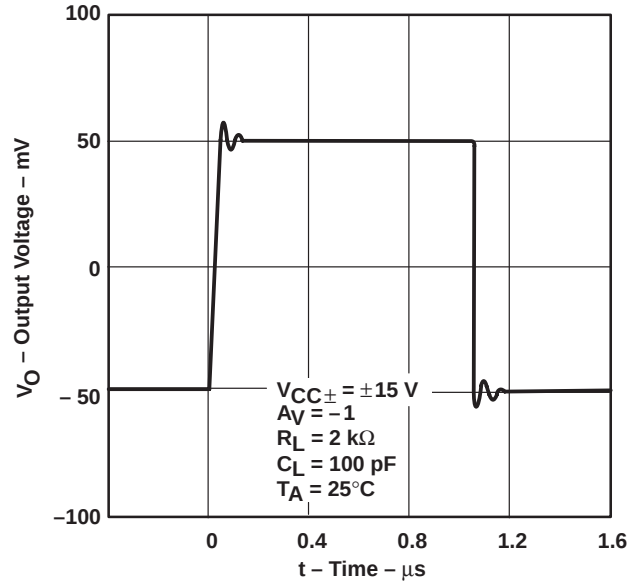


Figure 67

CLOSED-LOOP OUTPUT IMPEDANCE  
VS  
FREQUENCY

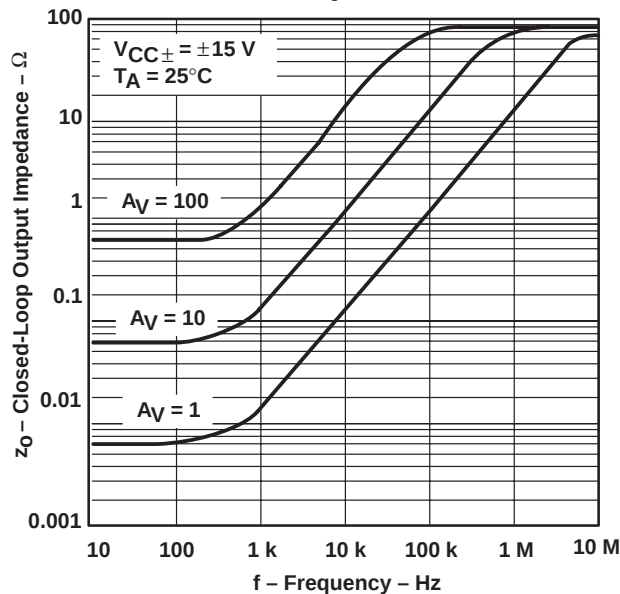


Figure 68

TLE2072 AND TLE2074  
CROSSTALK ATTENUATION  
VS  
FREQUENCY

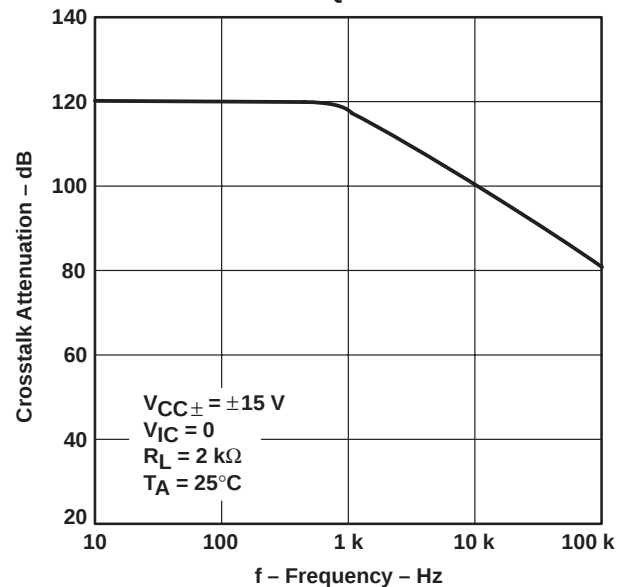


Figure 69

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

# TLE207x, TLE207xA, TLE207xB EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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## APPLICATION INFORMATION

### input characteristics

The TLE207x, TLE207xA, and TLE207xB are specified with a minimum and a maximum input voltage that if exceeded at either input could cause the device to malfunction. Because of the extremely high input impedance and resulting low bias current requirements, the TLE207x, TLE207xA, and TLE207xB are well suited for low-level signal processing; however, leakage currents on printed-circuit boards and sockets can easily exceed bias current requirements and cause degradation in system performance. It is good practice to include guard rings around inputs (see Figure 70). These guards should be driven from a low-impedance source at the same voltage level as the common-mode input.

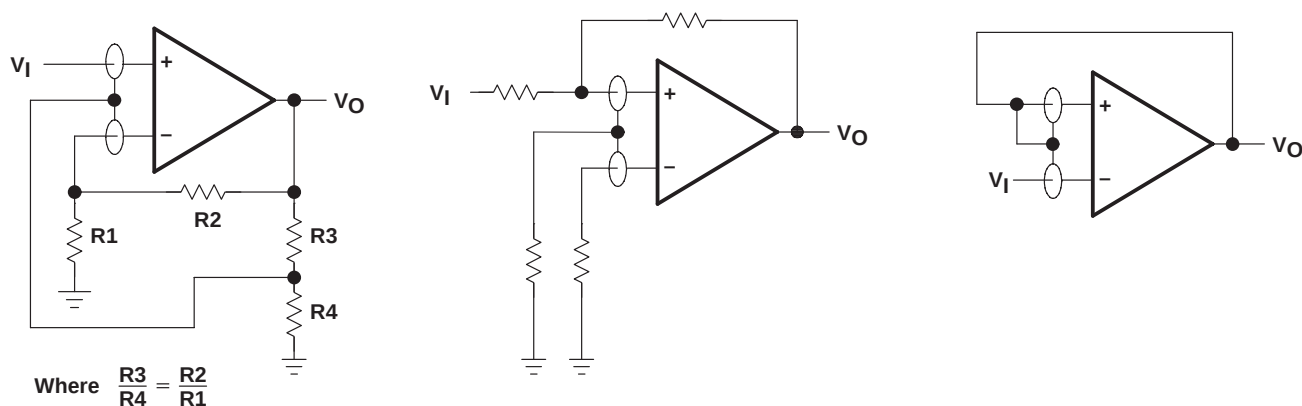


Figure 70. Use of Guard Rings

### TLE2071 input offset voltage nulling

The TLE2071 series offers external null pins that can be used to further reduce the input offset voltage. The circuit of Figure 71 can be connected as shown if the feature is desired. When external nulling is not needed, the null pins may be left unconnected.

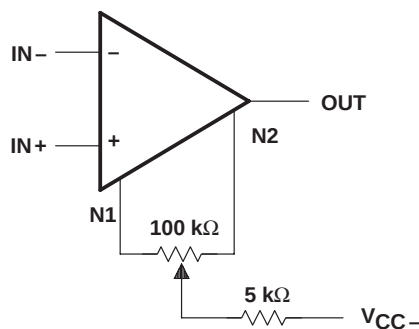


Figure 71. Input Offset Voltage Nulling

## APPLICATION INFORMATION

### macromodel information

Macromodel information provided was derived using *PSpice™ Parts™* model generation software. The Boyle macromodel (see Note 4) and subcircuit Figure 72 were generated using the TLE207x typical electrical and operating characteristics at  $T_A = 25^\circ\text{C}$ . Using this information, output simulations of the following key parameters can be generated to a tolerance of 20% (in most cases):

- Maximum positive output voltage swing
- Maximum negative output voltage swing
- Slew rate
- Quiescent power dissipation
- Input bias current
- Open-loop voltage amplification
- Unity-gain frequency
- Common-mode rejection ratio
- Phase margin
- DC output resistance
- AC output resistance
- Short-circuit output current limit

NOTE 4: G.R. Boyle, B.M. Cohn, D. O. Pederson, and J. E. Solomon, "Macromodeling of Integrated Circuit Operational Amplifiers", *IEEE Journal of Solid-State Circuits*, SC-9, 353 (1974).

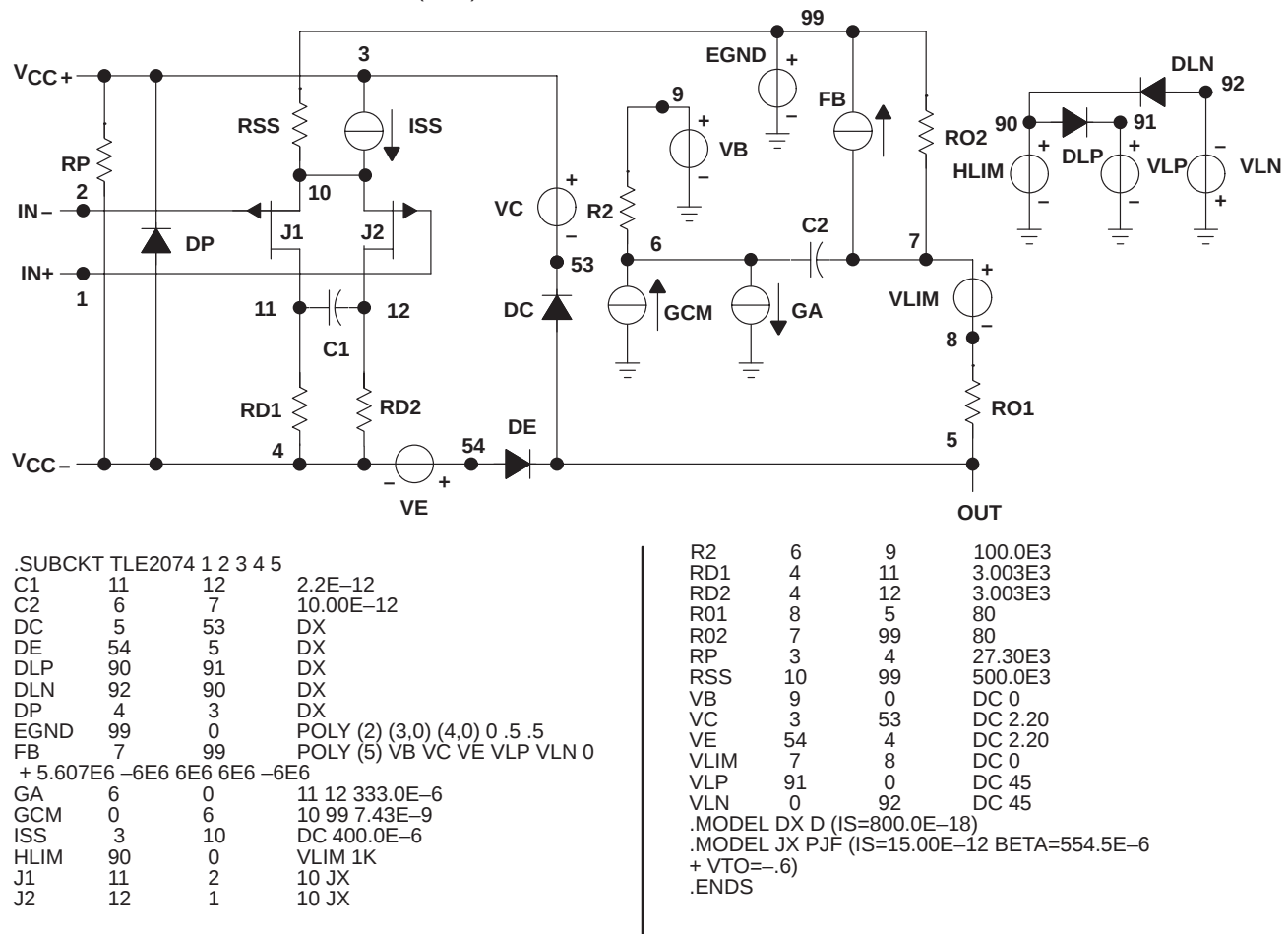


Figure 72. Boyle Macromodel and Subcircuit

*PSpice* and *Parts* are trademarks of MicroSim Corporation.

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

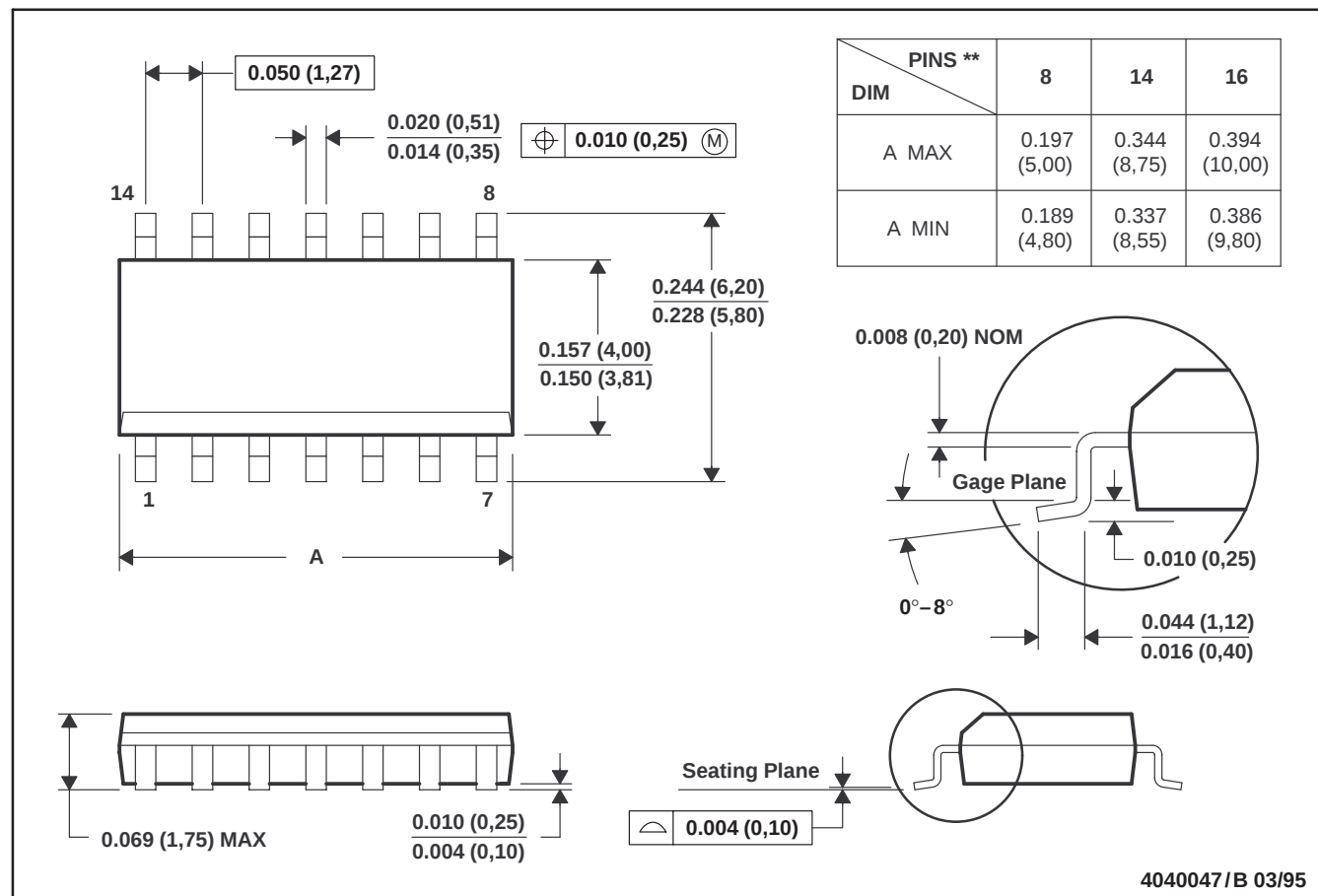
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## MECHANICAL INFORMATION

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

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



- 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. Four center pins are connected to die mount pad.
  - E. Falls within JEDEC MS-012

**TLE207x, TLE207xA, TLE207xY**  
**EXCALIBUR LOW-NOISE HIGH-SPEED**  
**JFET-INPUT OPERATIONAL AMPLIFIERS**

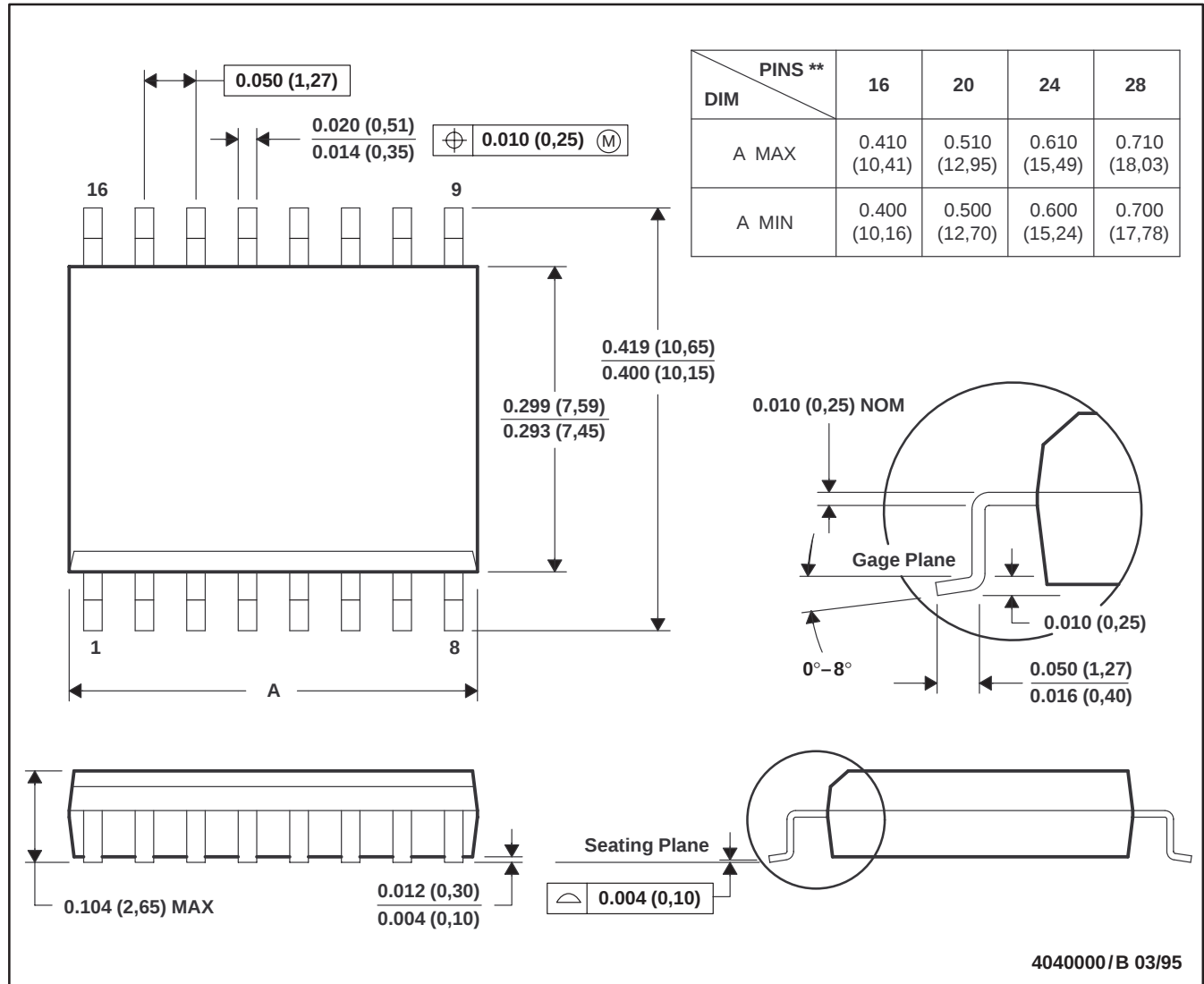
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**MECHANICAL INFORMATION**

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

**PLASTIC SMALL-OUTLINE PACKAGE**

**16 PIN SHOWN**



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-013

# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

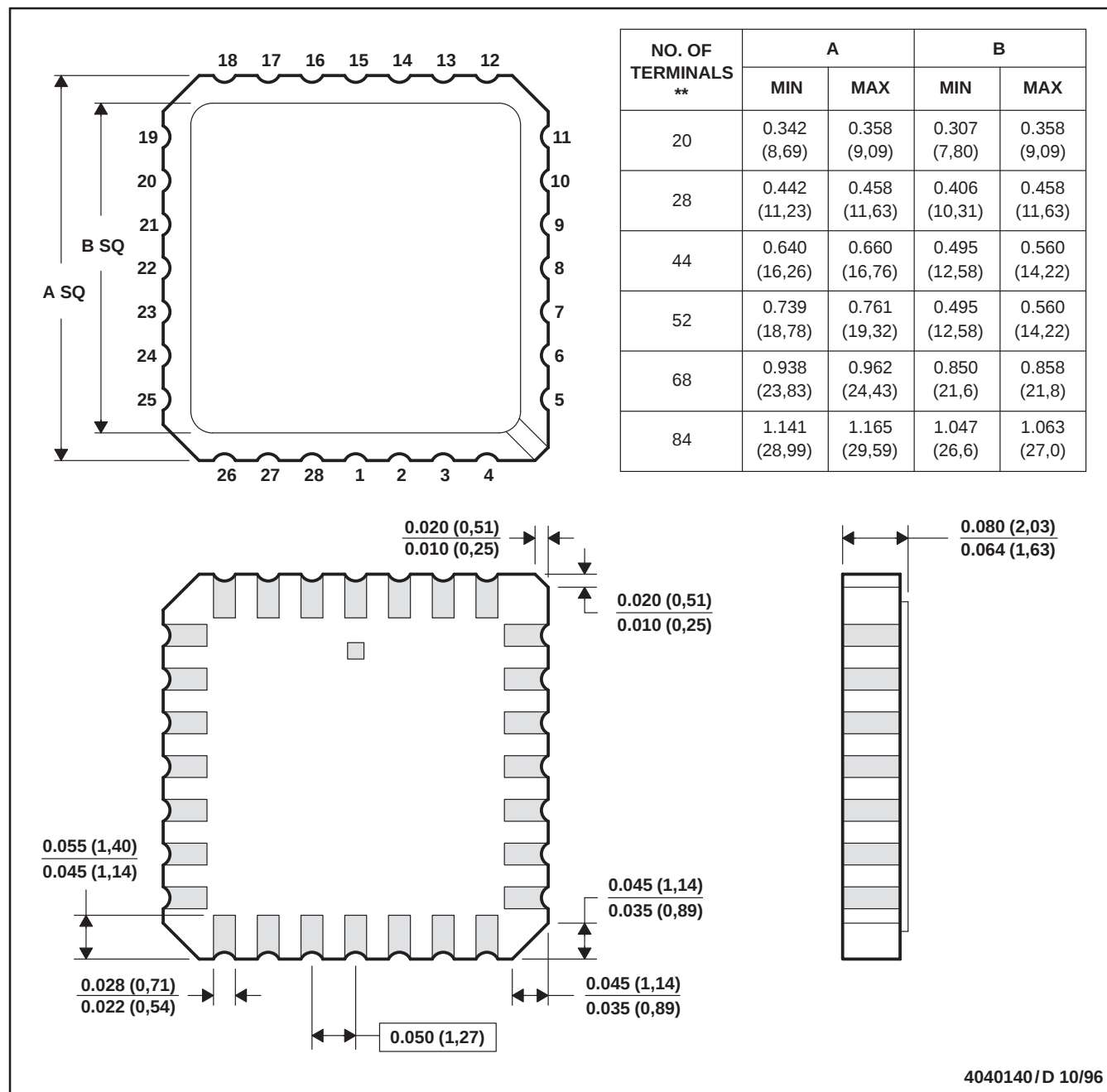
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## MECHANICAL INFORMATION

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

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



4040140/D 10/96

- 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

**TLE207x, TLE207xA, TLE207xY**  
**EXCALIBUR LOW-NOISE HIGH-SPEED**  
**JFET-INPUT OPERATIONAL AMPLIFIERS**

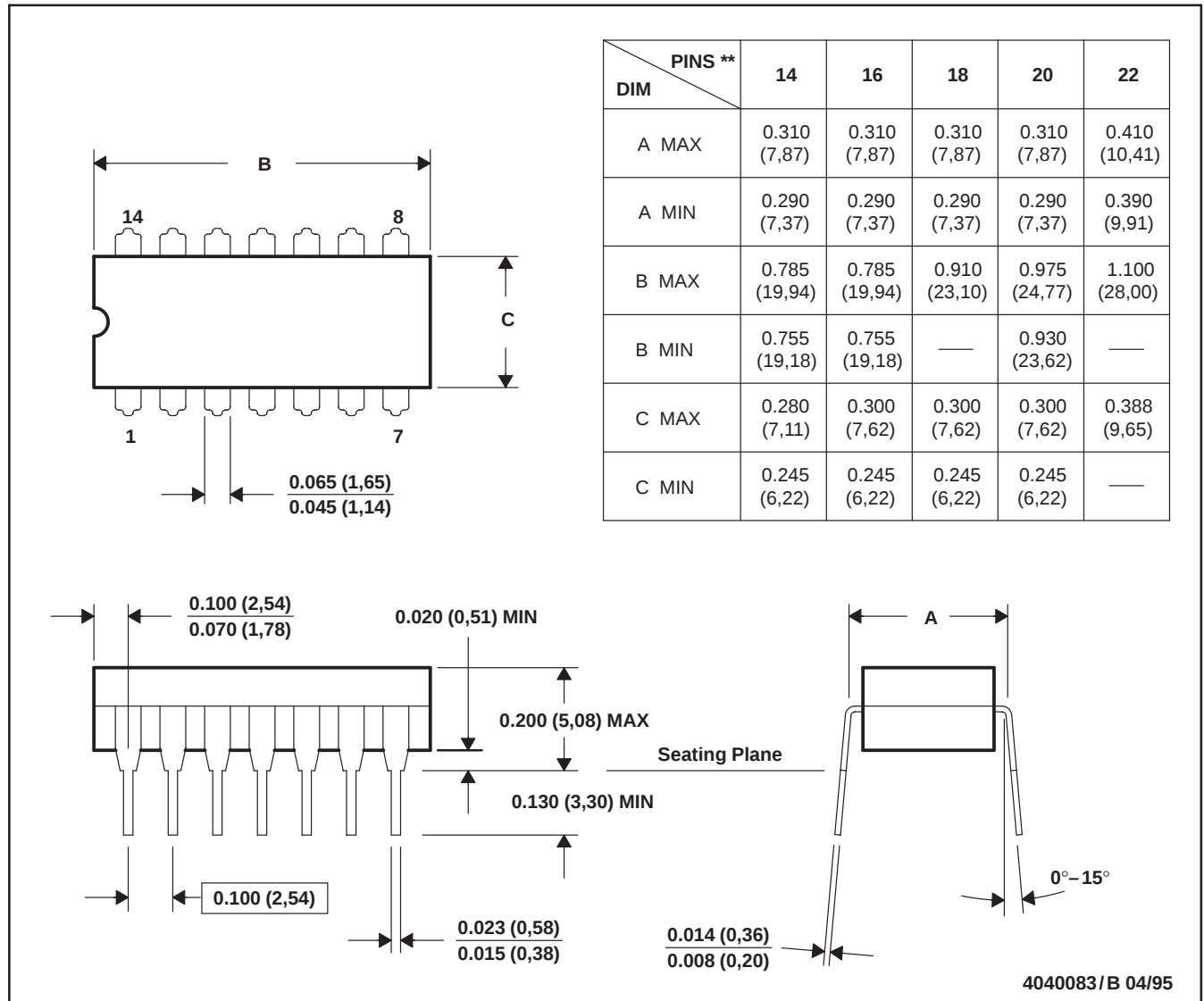
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**MECHANICAL INFORMATION**

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

**CERAMIC DUAL-IN-LINE PACKAGE**

14 PIN 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 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, GDIP1-T20, and GDIP1-T22

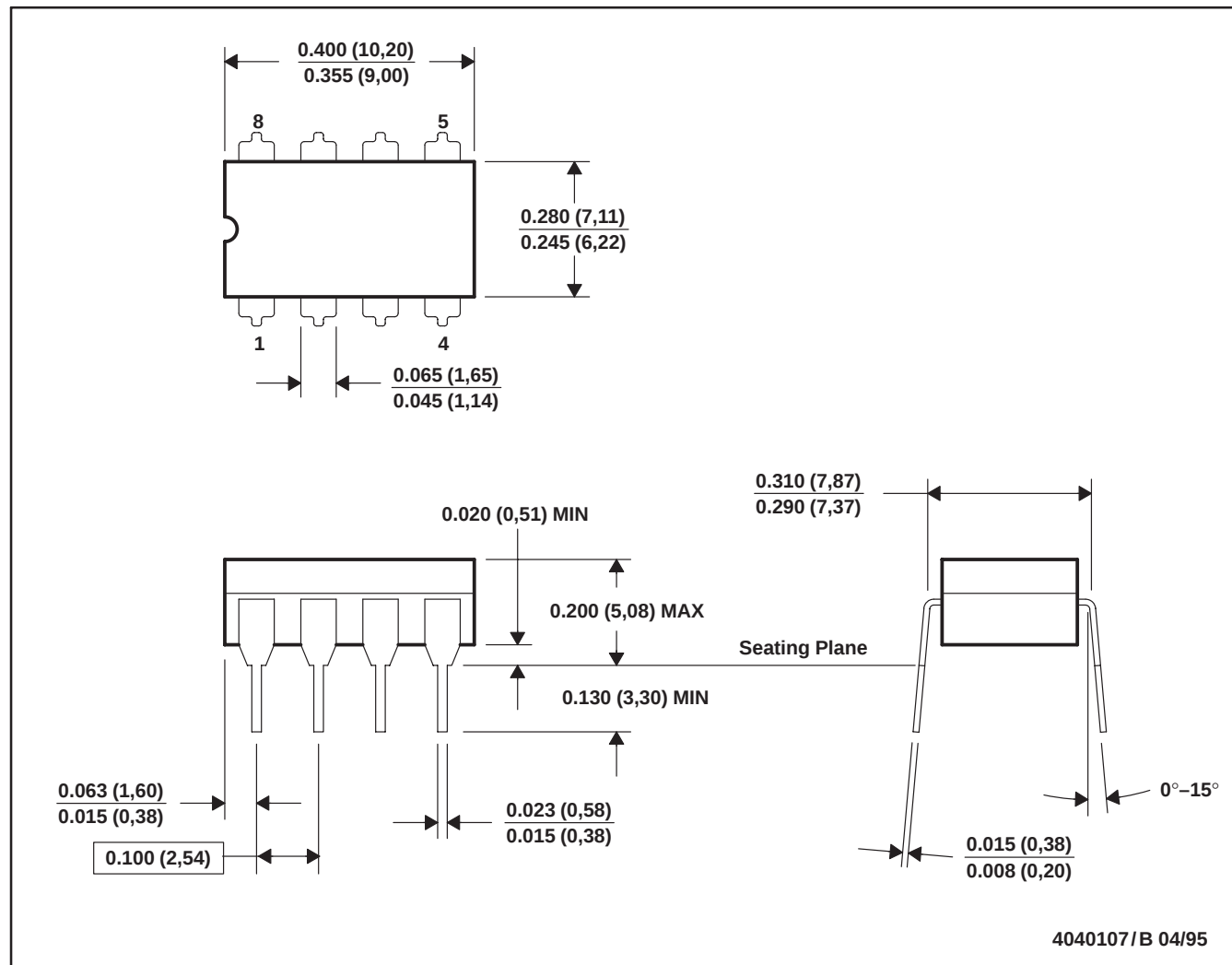
# TLE207x, TLE207xA, TLE207xY EXCALIBUR LOW-NOISE HIGH-SPEED JFET-INPUT OPERATIONAL AMPLIFIERS

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## MECHANICAL INFORMATION

JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE PACKAGE



- 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 on press ceramic glass frit seal only
  - E. Falls within MIL-STD-1835 GDIP1-T8

**TLE207x, TLE207xA, TLE207xY**  
**EXCALIBUR LOW-NOISE HIGH-SPEED**  
**JFET-INPUT OPERATIONAL AMPLIFIERS**

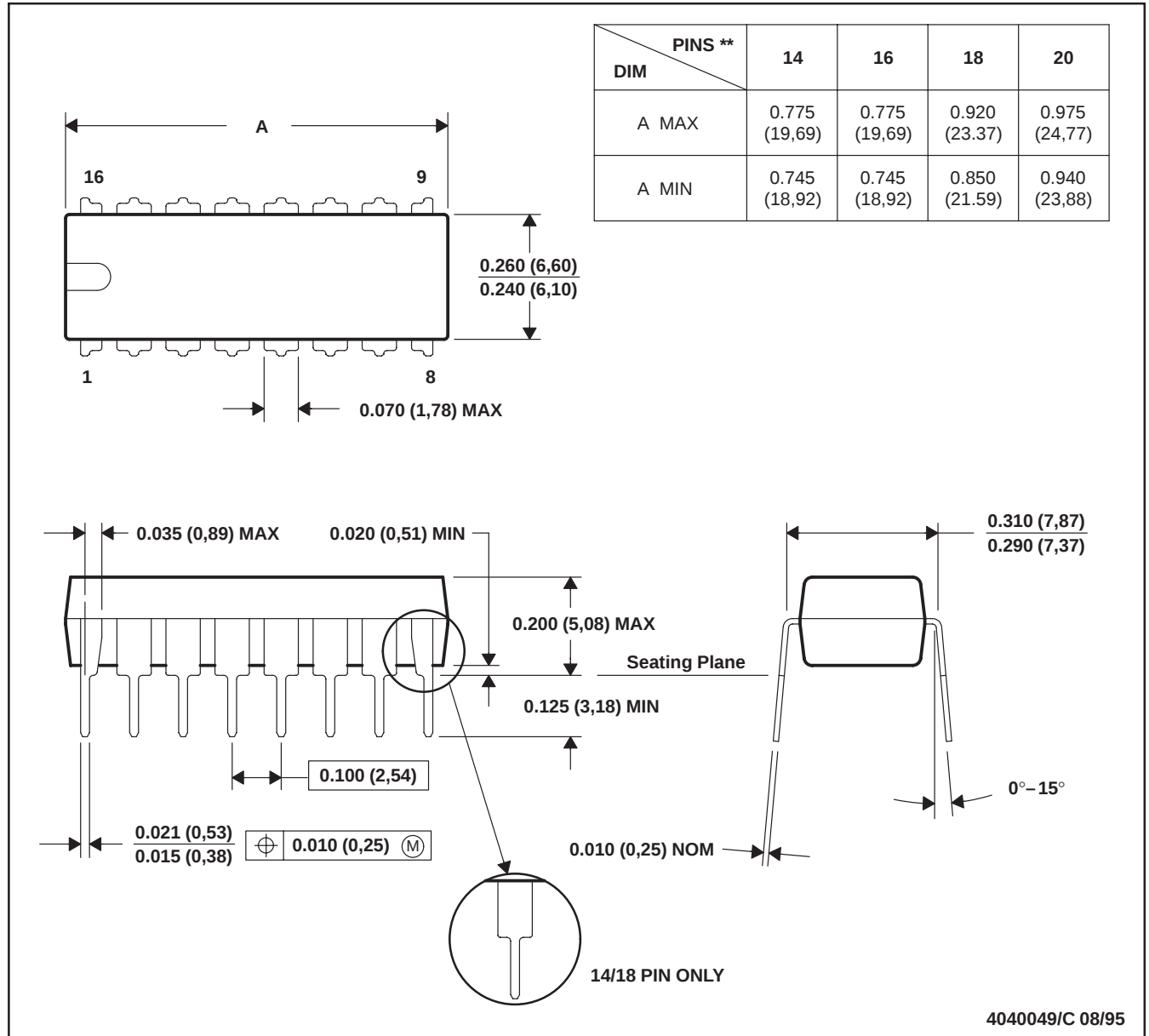
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## MECHANICAL INFORMATION

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

**PLASTIC DUAL-IN-LINE PACKAGE**

**16 PIN SHOWN**



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001 (20 pin package is shorter than MS-001.)

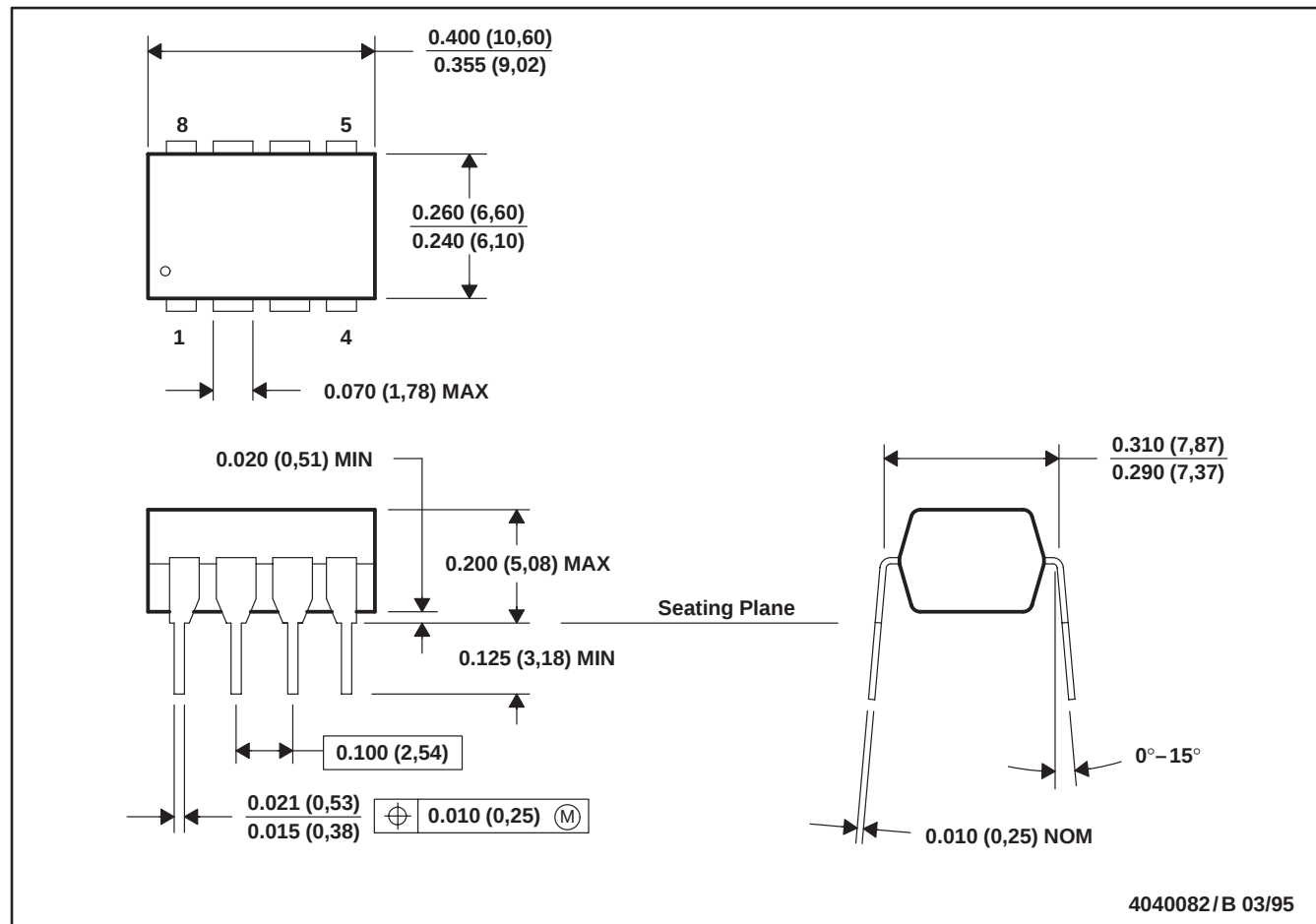
**TLE207x, TLE207xA, TLE207xY**  
**EXCALIBUR LOW-NOISE HIGH-SPEED**  
**JFET-INPUT OPERATIONAL AMPLIFIERS**

SLOS181A – FEBRUARY 1997 – REVISED MARCH 2000

**MECHANICAL INFORMATION**

**P (R-PDIP-T8)**

**PLASTIC DUAL-IN-LINE PACKAGE**



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

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