

- **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.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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

 **TEXAS
INSTRUMENTS**

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

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TLE2071 AVAILABLE OPTIONS

| T_A | V_{IOmax} AT 25°C | PACKAGED DEVICES | | | | |
|----------------|------------------------|--------------------------|---------------------------|---------------------------|-------------------------|-----------------------------|
| | | SMALL OUTLINE† (D) | CHIP CARRIER (FK) | CERAMIC DIP (JG) | PLASTIC DIP (P) | CERAMIC FLAT PACK (U) |
| 0°C to 70°C | 2 mV 4 mV | TLE2071ACD TLE2071CD | — | — | TLE2071ACP TLE2071CP | — |
| –40°C to 85°C | 2 mV 4 mV | TLE2071AID TLE2071ID | — | — | TLE2071AIP TLE2071IP | — |
| –55°C to 125°C | 2 mV 4 mV | — — | TLE2071AMFK TLE2071MFK | TLE2071AMJG TLE2071MJG | — — | TLE2071AMU TLE2071MU |

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

TLE2072 AVAILABLE OPTIONS

| T_A | V_{IOmax} AT 25°C | PACKAGED DEVICES | | | | |
|----------------|------------------------|--------------------------|---------------------------|---------------------------|-------------------------|-----------------------------|
| | | SMALL OUTLINE† (D) | CHIP CARRIER (FK) | CERAMIC DIP (JG) | PLASTIC DIP (P) | CERAMIC FLAT PACK (U) |
| 0°C to 70°C | 3.5 mV 6 mV | TLE2072ACD TLE2072CD | — | — | TLE2072ACP TLE2072CP | — |
| –40°C to 85°C | 3.5 mV 6 mV | TLE2072AID TLE2072ID | — | — | TLE2072AIP TLE2072IP | — |
| –55°C to 125°C | 3.5 mV 6 mV | — | TLE2072AMFK TLE2072MFK | TLE2072AMJG TLE2072MJG | — | TLE2072AMU TLE2072MU |

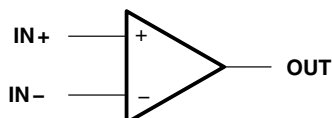
† The D packages are available taped and reeled. Add R suffix to device type (e.g., TLE2072ACDR).

TLE2074 AVAILABLE OPTIONS

| T_A | V_{IOmax} AT 25°C | PACKAGED DEVICES | | | | |
|----------------|------------------------|---------------------------|---------------------------|-------------------------|-------------------------|-----------------------------|
| | | SMALL OUTLINE† (DW) | CHIP CARRIER (FK) | CERAMIC DIP (J) | PLASTIC DIP (N) | CERAMIC FLAT PACK (W) |
| 0°C to 70°C | 3 mV 5 mV | TLE2074ACDW TLE2074CDW | — | — | TLE2074ACN TLE2074CN | — |
| –40°C to 85°C | 3 mV 5 mV | TLE2074AIDW TLE2074IDW | — | — | TLE2074AIN TLE2074IN | — |
| –55°C to 125°C | 3 mV 5 mV | — | TLE2074AMFK TLE2074MFK | TLE2074AMJ TLE2074MJ | — | TLE2074AMW TLE2074MW |

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

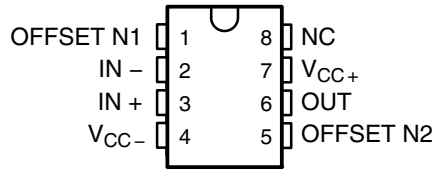
symbol



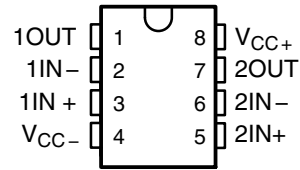
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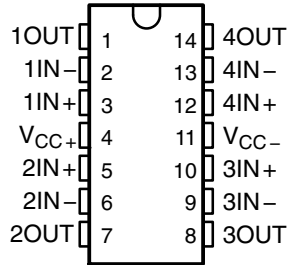
**TLE2071 AND TLE2071A
D, JG, OR P PACKAGE
(TOP VIEW)**



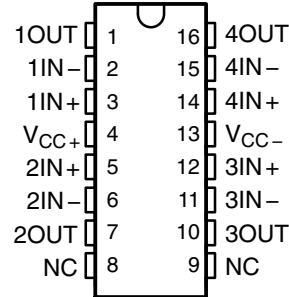
**TLE2072 AND TLE2072A
D, JG, OR P PACKAGE
(TOP VIEW)**



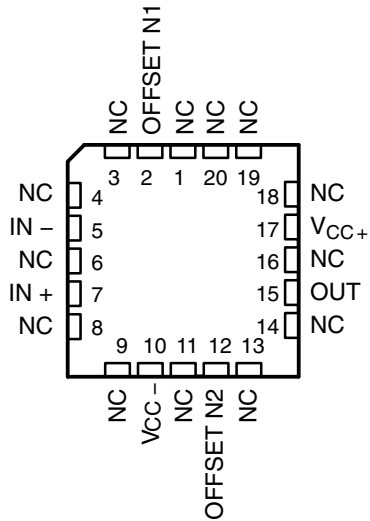
**TLE2074 AND TLE2074A
J, N, OR W PACKAGE
(TOP VIEW)**



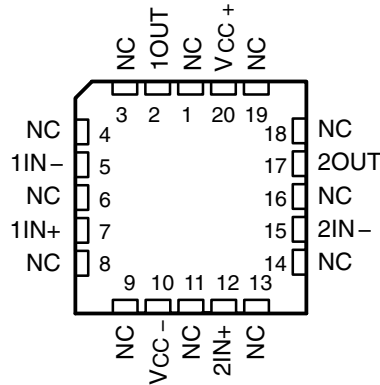
**TLE2074 AND TLE2074A
DW PACKAGE
(TOP VIEW)**



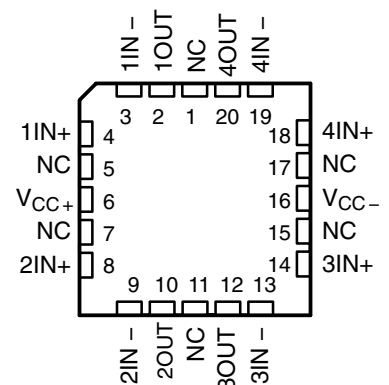
**TLE2071M AND TLE2071AM
FK PACKAGE
(TOP VIEW)**



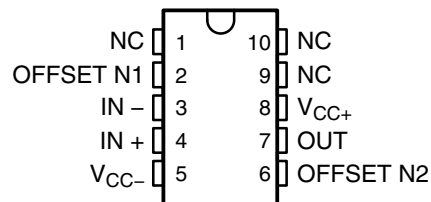
**TLE2072M AND TLE2072AM
FK PACKAGE
(TOP VIEW)**



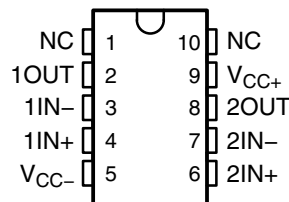
**TLE2074M AND TLE2074AM
FK PACKAGE
(TOP VIEW)**



**TLE2071 AND TLE2071A
U PACKAGE
(TOP VIEW)**

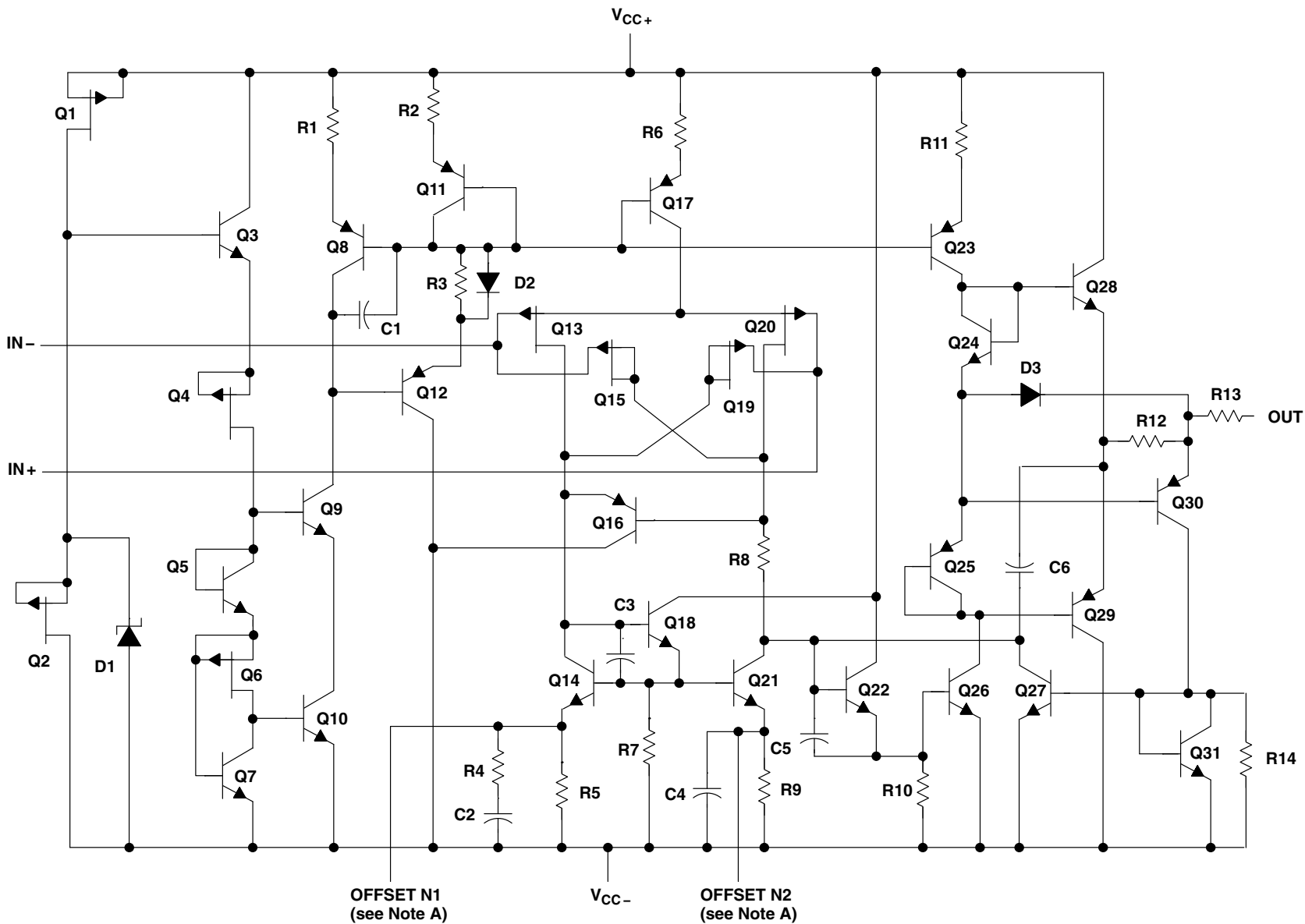


**TLE2072 AND TLE2072A
U PACKAGE
(TOP VIEW)**



NC – No internal connection

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

equivalent schematic (continued)

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

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

| | |
|--|------------------------|
| 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 |
| Package thermal impedance, θ_{JA} (see Notes 4 and 5): | |
| D package | 97.1°C/W |
| DW package | 57.3°C/W |
| N package | 79.7°C/W |
| P package | 84.6°C/W |
| Package thermal impedance, θ_{JC} (see Notes 4 and 5): | |
| FK package | 5.6°C/W |
| J package | 15.1°C/W |
| JG package | 14.5°C/W |
| U package | 14.7°C/W |
| W package | 10°C/W |
| 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, JG, U, or W package | 300°C |

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

- NOTES:
1. All voltage values, except differential voltages, are with respect to the midpoint between V_{CC+} and V_{CC-} .
 2. Differential voltages are at 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.
 4. Maximum power dissipation is a function of $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
 5. The package thermal impedance is calculated in accordance with JESD 51-7 (plastic) or MIL-STD-883 Method 1012 (ceramic).

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 |



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

| PARAMETER | | TEST CONDITIONS | | T _A † | TLE2071C | | | TLE2071AC | | | UNIT | |
|------------------|--|--|------------------------|------------------|------------------|------------|-----|------------------|-----------|-----|------|----|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | | |
| V _{IO} | Input offset voltage | V _{IC} = 0, R _S = 50 Ω | V _O = 0, | 25°C | 0.34 | | 4 | 0.3 | | 2 | mV | |
| | | | | Full range | | | 6 | | | 4 | | |
| α _{VIO} | Temperature coefficient of input offset voltage | | | | | Full range | 3.2 | | 29 | 3.2 | | 29 |
| I _{IO} | Input offset current | V _{IC} = 0, See Figure 4 | V _O = 0, | 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 Ω | | 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 μA | | 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 μA | | 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 = ± 2.3 V | R _L = 600 Ω | 25°C | 80 | 91 | | 80 | 91 | | dB | |
| | | | | Full range | 79 | | | 79 | | | | |
| | | | R _L = 2 kΩ | | 25°C | 90 | 100 | | 90 | 100 | | |
| | | | | | Full range | 89 | | | 89 | | | |
| | | | R _L = 10 kΩ | | 25°C | 95 | 106 | | 95 | 106 | | |
| | | | | | Full range | 94 | | | 94 | | | |
| r _i | Input resistance | V _{IC} = 0 | | 25°C | 10 ¹² | | | 10 ¹² | | Ω | | |
| c _i | Input capacitance | V _{IC} = 0, 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 | | | Ω | |
| CMRR | Common-mode rejection ratio | V _{IC} = V _{ICRmin} , V _O = 0, R _S = 50 Ω | | 25°C | 70 | 89 | | 70 | 89 | | dB | |
| | | | | Full range | 68 | | | 68 | | | | |
| k _{SVR} | Supply-voltage rejection ratio(ΔV _{CC±} /ΔV _{IO}) | V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω | | 25°C | 82 | 99 | | 82 | 99 | | dB | |
| | | | | Full range | 80 | | | 80 | | | | |

† 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_A^\dagger | TLE2071C | | | TLE2071AC | | | UNIT |
|---------------------------------------|---------------------|-----------------|----------|-----|-----|-----------|-----|-----|------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| I_{CC} Supply current | $V_O = 0$, No load | 25°C | 1.35 | 1.6 | 2.2 | 1.35 | 1.6 | 2.2 | mA |
| | | Full range | | | 2.2 | | | 2.2 | |
| I_{OS} Short-circuit output current | $V_O = 0$ | $V_{ID} = 1$ V | | –35 | | | –35 | | mA |
| | | $V_{ID} = -1$ V | | 45 | | | 45 | | |

† 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 _A [†] | TLE2071C | | TLE2071AC | | UNIT |
|--------------------|---|---|---|-----------------------------|----------|-----|-----------|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | |
| SR + | Positive slew rate | V _{O(PP)} = ±2.3 V, A _{VD} = −1, C _L = 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 _s | Settling time | A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.25 | | 0.25 | | μs |
| | | To 1 mV | 0.4 | | 0.4 | | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85 | 48 | 85 | nV/√Hz |
| | f = 10 kHz | | 12 | | 17 | 12 | 17 | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, f = 10 kHz | | 25°C | 2.8 | | 2.8 | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 5 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.013% | | 0.013% | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 9.4 | | 9.4 | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 4 V, R _L = 2 kΩ , | A _{VD} = −1, C _L = 25 pF | 25°C | 2.8 | | 2.8 | | MHz |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 56° | | 56° | | |

† Full range is 0°C to 70°C.



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 | |
| α_{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} | | | Ω |
| 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 | | | Ω |
| 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 | | | |

† 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 | | |

† 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 _A [†] | TLE2071C | | | TLE2071AC | | | UNIT |
|--------------------|---|---|--|-----------------------------|----------|-----|-----|-----------|-----|--------|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = 10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, 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 _s | Settling time | A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.4 | | | 0.4 | | | μs |
| | | | To 1 mV | | 1.5 | | | 1.5 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85 | | 48 | 85 | | nV/√Hz |
| | | | f = 10 kHz | | 12 | 17 | | 12 | 17 | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz | |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 20 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.008% | | | 0.008% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 8 | 10 | | 8 | 10 | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 20 V, R _L = 2 kΩ, | A _{VD} = −1, C _L = 25 pF | 25°C | 478 | 637 | | 478 | 637 | | kHz |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 57° | | | 57° | | | |

† Full range is 0°C to 70°C.



TLE2071I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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 | |
| α_{VIO} Temperature coefficient of input offset voltage | | Full range | | 3.2 | 29 | | 3.2 | 29 | $\mu V/^\circ C$ |
| I_{IO} Input offset current | $V_{IC} = 0, V_O = 0$, 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 | $I_O = -200 \mu A$ | 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} | | Ω |
| c_i Input capacitance | $V_{IC} = 0$, 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 | | | Ω |
| 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 | | | |

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

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

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

| PARAMETER | TEST CONDITIONS | T_A^\dagger | TLE2071I | | | TLE2071AI | | | UNIT |
|---------------------------------------|---------------------|-----------------|----------|-----|-----|-----------|-----|-----|------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| I_{CC} Supply current | $V_O = 0$, No load | 25°C | 1.35 | 1.6 | 2.2 | 1.35 | 1.6 | 2.2 | mA |
| | | Full range | | | 2.2 | | | 2.2 | |
| I_{OS} Short-circuit output current | $V_O = 0$ | $V_{ID} = 1$ V | | –35 | | | –35 | | mA |
| | | $V_{ID} = -1$ V | | 45 | | | 45 | | |

† Full range is -40°C to 85°C .

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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2071I | | | TLE2071AI | | | UNIT |
|--------------------|---|--|---|-----------------------------|----------|-----|-----|-----------|--------|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = ±2.3 V, A _{VD} = − 1, R _L = 2 kΩ, C _L = 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 _s | Settling time | A _{VD} = − 1, 2-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.25 | | | 0.25 | | | μs |
| | | | To 1 mV | | 0.4 | | | 0.4 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85 | 48 | 85 | nV/√Hz | | |
| | | | f = 10 kHz | | 12 | 17 | 12 | 17 | | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, f = 10 kHz | | 25°C | 2.8 | | | 2.8 | | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 5 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω | | 25°C | 0.013% | | | 0.013% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 9.4 | | | 9.4 | | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 4 V, R _L = 2 kΩ , | A _{VD} = − 1, C _L = 25 pF | 25°C | 2.8 | | | 2.8 | | | MHz |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _I = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 56° | | | 56° | | | |

† Full range is -40°C to 85°C .



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 | |
| α_{VIO} Temperature coefficient of input offset voltage | | Full range | | 3.2 | 29 | | 3.2 | 29 | $\mu V/^\circ C$ |
| I_{IO} Input offset current | $V_{IC} = 0, V_O = 0$, 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 Ω | 25°C | 90 | 109 | 90 | 109 | | |
| | | | Full range | 89 | | 89 | | | |
| | | $R_L = 10$ k Ω | 25°C | 95 | 118 | 95 | 118 | | |
| | | | Full range | 94 | | 94 | | | |
| r_i Input resistance | $V_{IC} = 0$ | 25°C | | 10^{12} | | 10^{12} | | | Ω |
| c_i Input capacitance | $V_{IC} = 0$, 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 | | | Ω |
| 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 ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm} = \pm 5$ V to ± 15 V, $V_O = 0, R_S = 50 \Omega$ | 25°C | 82 | 99 | | 82 | 99 | | dB |
| | | Full range | 80 | | | 80 | | | |

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

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

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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_A^\dagger | TLE2071I | | | TLE2071AI | | | 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 | | |

† 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 _A † | TLE2071I | | | TLE2071AI | | | UNIT |
|--------------------|---|--|---------------------|------------------|----------|-----|-----|-----------|-----|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = ±10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 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 _s | Settling time | A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.4 | | | 0.4 | | | μs |
| | | To 1 mV | 1.5 | | | 1.5 | | | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 85 | | | 48 85 | | | nV/√Hz |
| | | | f = 10 kHz | | 12 17 | | | 12 17 | | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, f = 10 kHz | | 25°C | 2.8 | | | 2.8 | | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 20 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω | | 25°C | 0.008% | | | 0.008% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2 | 25°C | 8 | 10 | | 8 | 10 | | MHz | |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 20 V, R _L = 2 kΩ, A _{VD} = −1, C _L = 25 pF | 25°C | 478 | 637 | | 478 | 637 | | kHz | |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2 | 25°C | 57° | | | 57° | | | | |

† Full range is -40°C to 85°C.



TLE2071M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (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 | 0.34 | 4 | | 0.3 | 2 | | mV |
| | | Full range | | | 9.2 | | | 7.2 | |
| α_{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 | $V_{IC} = 0, V_O = 0,$ 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 | $I_O = -200\ \mu\text{A}$ | 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 | $I_O = 200\ \mu\text{A}$ | 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} | | Ω |
| c_i Input capacitance | $V_{IC} = 0,$ 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 | | Ω |
| 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 | | | |

[†] Full range is -55°C to 125°C .

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

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

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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 | |
| I_{CC} Supply current | $V_O = 0$, No load | 25°C | 1.35 | 1.6 | 2.2 | 1.35 | 1.6 | 2.2 | mA |
| | | Full range | | | 2.2 | | | 2.2 | |
| I_{OS} Short-circuit output current | $V_O = 0$ | $V_{ID} = 1$ V | | –35 | | | –35 | | mA |
| | | $V_{ID} = -1$ V | | 45 | | | 45 | | |

† 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 _A [†] | TLE2071M | | | TLE2071AM | | | UNIT |
|--------------------|---|---|---------------------|-----------------------------|-----------------|-----------------|-----|-----------------|-----------------|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 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 _s | Settling time | A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.25 | | | 0.25 | | | μs |
| | | | To 1 mV | | 0.4 | | | 0.4 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85 [‡] | | 48 | 85 [‡] | | nV/√Hz |
| | | | f = 10 kHz | | 12 | 17 [‡] | | 12 | 17 [‡] | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, f = 10 kHz | | 25°C | 2.8 | | | 2.8 | | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 5 V, f = 1 kHz, R _S = 25 Ω | | 25°C | 0.013% | | | 0.013% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2 | | 25°C | 9.4 | | | 9.4 | | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 4 V, R _L = 2 kΩ , A _{VD} = −1, C _L = 25 pF | | 25°C | 2.8 | | | 2.8 | | | MHz |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2 | | 25°C | 56° | | | 56° | | | |

† Full range is –55°C to 125°C.

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



TLE207x, TLE207xA
EXCALIBUR LOW-NOISE HIGH-SPEED
JFET-INPUT OPERATIONAL AMPLIFIERS
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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 [†] | TLE2071M | | | TLE2071AM | | | UNIT |
|------------------|---|---|------------------------|-----------------------------|------------------|-------------|------------------|-------------|-----|-----|-------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V _{IO} | Input offset voltage | V _{IC} = 0, V _O = 0, R _S = 50 Ω | | 25°C | 0.49 | | 4 | 0.47 | | 2 | mV |
| | | | | Full range | | | 9.2 | | | 7.2 | |
| α _{VIO} | Temperature coefficient of input offset voltage | | | Full range | 3.2 | | 29* | 3.2 | | 29* | μV/°C |
| I _{IO} | Input offset current | V _{IC} = 0, V _O = 0, 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 Ω | | 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 μA | | 25°C | 13.8 | 14.1 | 13.8 | 14.1 | V | | |
| | | | | Full range | 13.6 | | 13.6 | | | | |
| | | I _O = −2 mA | | 25°C | 13.5 | 13.9 | 13.5 | 13.9 | | | |
| | | | | Full range | 13.3 | | 13.3 | | | | |
| | | I _O = −20 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 μA | | 25°C | −13.8 | −14.2 | −13.8 | −14.2 | V | | |
| | | | | Full range | −13.6 | | −13.6 | | | | |
| | | I _O = 2 mA | | 25°C | −13.5 | −14 | −13.5 | −14 | | | |
| | | | | Full range | −13.3 | | −13.3 | | | | |
| | | I _O = 20 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 = ±10 V | R _L = 600 Ω | 25°C | 80 | 96 | 80 | 96 | dB | | |
| | | | | Full range | 78 | | 78 | | | | |
| | | | R _L = 2 kΩ | 25°C | 90 | 109 | 90 | 109 | | | |
| | | | | Full range | 88 | | 88 | | | | |
| | | | R _L = 10 kΩ | 25°C | 95 | 118 | 95 | 118 | | | |
| | | | | Full range | 93 | | 93 | | | | |
| r _i | Input resistance | V _{IC} = 0 | | 25°C | 10 ¹² | | 10 ¹² | | Ω | | |
| c _i | Input capacitance | V _{IC} = 0, 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 | | Ω | | |
| CMRR | Common-mode rejection ratio | V _{IC} = V _{ICRmin} , V _O = 0, R _S = 50 Ω | | 25°C | 80 | 98 | 80 | 98 | dB | | |
| | | | | Full range | 78 | | 78 | | | | |
| k _{SVR} | Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO}) | V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 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 $125^\circ C$.



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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_A^\dagger | TLE2071M | | | TLE2071AM | | | 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 | | |

† 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 _A [†] | TLE2071M | | | TLE2071AM | | | UNIT |
|--------------------|---|---|---|---|----------|--------|-----|-----------|--------|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = 10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, 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 _s | Settling time | A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.4 | | | 0.4 | | | μs |
| | | | To 1 mV | | 1.5 | | | 1.5 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85* | | 48 | 85* | | nV/√Hz |
| | | | f = 10 kHz | | 12 | 17* | | 12 | 17* | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | | V _{IC} = 0, f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | | V _{O(PP)} = 20 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, See Figure 2 | 25°C | 0.008% | | | 0.008% | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 8* | 10 | | 8* | 10 | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 20 V, R _L = 2 kΩ, | A _{VD} = −1, C _L = 25 pF | 25°C | 478* | 637 | | 478* | 637 | | kHz |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 57° | | | 57° | | | |

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

† Full range is -55°C to 125°C.



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 to -11 | 15 to 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 | | | Ω |
| c_i | Input capacitance | $V_O = 0$, See Figure 5 | Common mode | 7.5 | | | pF |
| | | | Differential | 2.5 | | | |
| z_o | Open-loop output impedance | $f = 1\ \text{MHz}$ | | 80 | | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$, $V_O = 0$ | | 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 | | |

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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2072C | | | TLE2072AC | | | UNIT |
|------------------|--|--|------------------------|-----------------------------|------------------|-----------|------------------|-----------|-----------|-----|-------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V _{IO} | Input offset voltage | V _{IC} = 0, V _O = 0, R _S = 50 Ω | | 25°C | 0.9 | | 6 | 0.65 | | 3.5 | mV |
| | | | | Full range | | | 7.8 | | | 5.3 | |
| α _{VIO} | Temperature coefficient of input offset voltage | | | Full range | 2.3 | | 25 | 2.3 | | 25 | μV/°C |
| I _{IO} | Input offset current | V _{IC} = 0, V _O = 0, 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 Ω | | 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 μA | | 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 μA | | 25°C | -3.8 | -4.2 | | -3.8 | -4.2 | | V |
| | | | | Full range | -3.7 | | -3.7 | | | | |
| | | I _O = 2 mA | | 25°C | -3.5 | -4.1 | | -3.5 | -4.1 | | |
| | | | | Full range | -3.4 | | -3.4 | | | | |
| | | 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 = ±2.3 V | R _L = 600 Ω | 25°C | 80 | 91 | | 80 | 91 | | dB |
| | | | | Full range | 79 | | 79 | | | | |
| | | | R _L = 2 kΩ | 25°C | 90 | 100 | | 90 | 100 | | |
| | | | | Full range | 89 | | 89 | | | | |
| | | | R _L = 10 kΩ | 25°C | 95 | 106 | | 95 | 106 | | |
| | | | | Full range | 94 | | 94 | | | | |
| r _i | Input resistance | V _{IC} = 0 | | 25°C | 10 ¹² | | 10 ¹² | | | Ω | |
| c _i | Input capacitance | V _{IC} = 0, 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 | | | Ω | |
| CMRR | Common-mode rejection ratio | V _{IC} = V _{ICRmin} , V _O = 0, R _S = 50 Ω | | 25°C | 70 | 89 | | 70 | 89 | | dB |
| | | | | Full range | 68 | | 68 | | | | |
| k _{SVR} | Supply-voltage rejection ratio(ΔV _{CC±} /ΔV _{IO}) | V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω | | 25°C | 82 | 99 | | 82 | 99 | | dB |
| | | | | Full range | 80 | | 80 | | | | |

† Full range is 0°C to 70°C.



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 kΩ | 25°C | 120 | | | 120 | | | dB |
| I _{OS} | Short-circuit output current | V _O = 0 | V _{ID} = 1 V | 25°C | −35 | | | −35 | | | mA |
| | | | V _{ID} = −1 V | | 45 | | | 45 | | | |

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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2072C | | | TLE2072AC | | | UNIT |
|--------------------|---|---|--|---|----------|--------|-----|-----------|--------|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 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 _s | Settling time | A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.25 | | | 0.25 | | | μs |
| | | | To 1 mV | | 0.4 | | | 0.4 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85 | 48 | 85 | nV/√Hz | | |
| | | | f = 10 kHz | | 12 | 17 | 12 | 17 | | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | | V _{IC} = 0, f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | | V _{O(PP)} = 5 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.013% | | | 0.013% | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 9.4 | | | 9.4 | | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 4 V, R _L = 2 kΩ , | A _{VD} = −1, C _L = 25 pF | 25°C | 2.8 | | | 2.8 | | | MHz |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 56° | | | 56° | | | |

† Full range is 0°C to 70°C.

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EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

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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 | |
| α_{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} | | Ω |
| 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 | | Ω |
| 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 | | | |

† 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) (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 | 3.1 | 3.9 | 2.7 | 3.1 | 3.9 | mA |
| | | | | Full range | 3.9 | | | 3.9 | | | |
| a _x | Crosstalk attenuation | V _{IC} = 0, | R _L = 2 kΩ | 25°C | 120 | | | 120 | | | dB |
| I _{OS} | Short-circuit output current | V _O = 0 | V _{ID} = 1 V | 25°C | −30 | −45 | | −30 | −45 | | mA |
| | | | V _{ID} = −1 V | | 30 | 48 | | 30 | 48 | | |

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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2072C | | | TLE2072AC | | | UNIT | | |
|--------------------|---|---|---|---|----------|--------|-----|-----------|--------|-----|------|--------|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | | | |
| SR + | Positive slew rate | V _{O(PP)} = 10 V, A _{VD} = −1, C _L = 100 pF, R _L = 2 kΩ, 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 _s | Settling time | A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.4 | | | 0.4 | | | μs | | |
| | | | To 1 mV | | 1.5 | | | 1.5 | | | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | | | 85 | 48 | | | 85 | nV/√Hz |
| | | | f = 10 kHz | | 12 | | | 17 | 12 | | | 17 | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | | V _{IC} = 0, | f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz | |
| THD + N | Total harmonic distortion plus noise | | V _{O(PP)} = 20 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.008% | | | 0.008% | | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 8 | 10 | | 8 | 10 | | MHz | | |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 20 V, R _L = 2 kΩ, | A _{VD} = −1, C _L = 25 pF | 25°C | 478 | 637 | | 478 | 637 | | kHz | | |
| ϕ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 57° | | | 57° | | | | | |

† Full range is 0°C to 70°C.

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

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 | $V_{IC} = 0, V_O = 0, R_S = 50\ \Omega$ | 25°C | | 0.9 | 6 | | 0.65 | 3.5 | mV |
| | | Full range | | | 9.1 | | | 6.4 | |
| α_{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 | $V_{IC} = 0, V_O = 0, \text{See Figure 4}$ | 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} | | | Ω |
| 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 | | | Ω |
| 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 | | | |

† Full range is -40°C to 85°C .



TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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 | $V_{IC} = 0$, $R_L = 2$ k Ω | 25°C | | 120 | | | 120 | | dB |
| I_{OS} Short-circuit output current | $V_O = 0$ | 25°C | | $V_{ID} = 1$ V | | | -35 | | mA |
| | | | | $V_{ID} = -1$ V | | | -35 | | |
| | | | | | 45 | | | 45 | |

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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2072I | | | TLE2072AI | | | UNIT |
|--------------------|---|---|---------------------|-----------------------------|----------|-----|--------|-----------|--------|--------|------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 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 _s | Settling time | A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.25 | | | 0.25 | | | μs |
| | | | To 1 mV | | 0.4 | | | 0.4 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85 | 48 | 85 | nV/√Hz | | |
| | | | f = 10 kHz | | 12 | 17 | 12 | 17 | | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz | |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 5 V, A _{VD} = 10, f = 1 kHz, R _L = 2 kΩ, R _S = 25 Ω | 25°C | 0.013% | | | 0.013% | | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, R _L = 2 kΩ, C _L = 25 pF, See Figure 2 | 25°C | 9.4 | | | 9.4 | | | MHz | |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 4 V, A _{VD} = −1, R _L = 2 kΩ , C _L = 25 pF | 25°C | 2.8 | | | 2.8 | | | MHz | |
| ϕ _m | Phase margin at unity gain | V _I = 10 mV, R _L = 2 kΩ, C _L = 25 pF, See Figure 2 | 25°C | 56° | | | 56° | | | | |

† Full range is 40°C to 85°C.

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2072I | | | TLE2072AI | | | UNIT |
|------------------|---|--|------------------------|-----------------------------|------------------|-------------|------------------|-----------|-------------|-----|-------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V _{IO} | Input offset voltage | V _{IC} = 0, V _O = 0, R _S = 50 Ω, | | 25°C | 1.1 | | 6 | 0.7 | | 3.5 | mV |
| | | | | Full range | | | 9.1 | | | 6.4 | |
| α _{VIO} | Temperature coefficient of input offset voltage | | | Full range | 2.4 | | 25 | 2.4 | | 25 | μV/°C |
| I _{IO} | Input offset current | V _{IC} = 0, V _O = 0, 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 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 _{OM+} | Maximum positive peak output voltage swing | I _O = −200 μA | | 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 μA | | 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 = ±10 V | R _L = 600 Ω | 25°C | 80 | 96 | 80 | | 96 | dB | |
| | | | | Full range | 79 | | 79 | | | | |
| | | | R _L = 2 kΩ | 25°C | 90 | 109 | 90 | | 109 | | |
| | | | | Full range | 89 | | 89 | | | | |
| | | | R _L = 10 kΩ | 25°C | 95 | 118 | 95 | | 118 | | |
| | | | | Full range | 94 | | 94 | | | | |
| r _i | Input resistance | V _{IC} = 0 | | 25°C | 10 ¹² | | 10 ¹² | | Ω | | |
| c _i | Input capacitance | V _{IC} = 0, 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 | | Ω | | |
| CMRR | Common-mode rejection ratio | V _{IC} = V _{ICRmin} , V _O = 0, R _S = 50 Ω | | 25°C | 80 | 98 | 80 | | 98 | dB | |
| | | | | Full range | 79 | | 79 | | | | |
| k _{SVR} | Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO}) | V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω | | 25°C | 82 | 99 | 82 | | 99 | dB | |
| | | | | Full range | 80 | | 80 | | | | |

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

TLE2072I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ 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 | 3.1 | 3.9 | 2.7 | 3.1 | 3.9 | mA |
| | | Full range | | | 3.9 | | | 3.9 | |
| a_x Crosstalk attenuation | $V_{IC} = 0$, $R_L = 2$ k Ω | 25°C | | 120 | | | 120 | | dB |
| I_{OS} Short-circuit output current | $V_O = 0$ | 25°C | | $V_{ID} = 1$ V | | | $V_{ID} = 1$ V | | mA |
| | | | | $V_{ID} = -1$ V | | | $V_{ID} = -1$ V | | |
| | | | -30 | -45 | | -30 | -45 | | |
| | | | 30 | 48 | | 30 | 48 | | |

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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2072I | | | TLE2072AI | | | UNIT | | |
|--------------------|---|--|---|-----------------------------|----------|-----|-----|-----------|-----|-----|--------|----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | | | |
| SR + | Positive slew rate | V _{O(PP)} = ±10 V, A _{VD} = −1, C _L = 100 pF, R _L = 2 kΩ, 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 _s | Settling time | A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.4 | | | 0.4 | | | μs | | |
| | | | To 1 mV | | 1.5 | | | 1.5 | | | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | | | 85 | 48 | | | 85 | nV/√Hz |
| | f = 10 kHz | | 12 | | | 17 | 12 | | | 17 | | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, | f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz | | |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 20 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.008% | | | 0.008% | | | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 8 | 10 | | 8 | 10 | | MHz | | |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 20 V, R _L = 2 kΩ, | A _{VD} = −1, C _L = 25 pF | 25°C | 478 | 637 | | 478 | 637 | | kHz | | |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 57° | | | 57° | | | | | |

† Full range is -40°C to 85°C.

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

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 | $V_{IC} = 0, V_O = 0,$ $R_S = 50 \Omega,$ | 25°C | 0.9 | 6 | | 0.65 | 3.5 | | mV |
| | | Full range | | 10.5 | | | 8 | | |
| α_{VIO} Temperature coefficient of input offset voltage | | Full range | 2.3 | 25* | | 2.3 | 25* | | $\mu V/^\circ C$ |
| I_{IO} Input offset current | $V_{IC} = 0, V_O = 0,$ 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 Ω | 25°C | 90 | 100 | 90 | 100 | | |
| | | | Full range | 88 | | 88 | | | |
| | | $R_L = 10$ k Ω | 25°C | 95 | 106 | 95 | 106 | | |
| | | | Full range | 93 | | 93 | | | |
| r_i Input resistance | $V_{IC} = 0$ | 25°C | 10^{12} | | | 10^{12} | | | Ω |
| c_i Input capacitance | $V_{IC} = 0,$ 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 | | | Ω |
| 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 | | | |

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

† Full range is -55°C to 125°C.

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

| PARAMETER | | TEST CONDITIONS | | T _A † | TLE2072M | | | TLE2072AM | | | UNIT |
|------------------|---|---|------------------------|------------------|----------|-----|-----|-----------|-----|-----|------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| k _{SVR} | Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO}) | V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω | | Full range | 80 | | | 80 | | | dB |
| I _{CC} | Supply current (both channels) | V _O = 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 _x | Crosstalk attenuation | V _{IC} = 0, | R _L = 2 kΩ | 25°C | 120 | | | 120 | | | dB |
| I _{OS} | Short-circuit output current | V _O = 0 | V _{ID} = 1 V | 25°C | –35 | | | –35 | | | mA |
| | | | V _{ID} = –1 V | | 45 | | | 45 | | | |

† Full range is -55°C to 125°C .

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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2072M | | | TLE2072AM | | | UNIT |
|--------------------|---|---|---|-----------------------------|----------|-----|-----|-----------|--------|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR+ | Positive slew rate | V _{O(PP)} = ±2.3 V, A _{VD} = −1, C _L = 100 pF, R _L = 2 kΩ, 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 _s | Settling time | A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.25 | | | 0.25 | | | μs |
| | | | To 1 mV | | 0.4 | | | 0.4 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85* | 48 | 85* | nV/√Hz | | |
| | | | f = 10 kHz | | 12 | 17* | 12 | 17* | | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, | f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 5 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.013% | | | 0.013% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 9.4 | | | 9.4 | | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 4 V, R _L = 2 kΩ , | A _{VD} = −1, C _L = 25 pF | 25°C | 2.8 | | | 2.8 | | | MHz |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 56° | | | 56° | | | |

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

† Full range is -55°C to 125°C .

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

JFET-INPUT OPERATIONAL AMPLIFIERS

SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2072M | | | TLE2072AM | | | UNIT |
|------------------|---|---|------------------------|-----------------------------|------------------|-------------|-------------|------------------|-------------|-----|-------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V _{IO} | Input offset voltage | V _{IC} = 0, V _O = 0, R _S = 50 Ω | | 25°C | 1.1 | | 6 | 0.7 | | 3.5 | mV |
| | | | | Full range | | | 10.5 | | | 8 | |
| α _{VIO} | Temperature coefficient of input offset voltage | | | Full range | 2.4 | | 25* | 2.4 | | 25* | μV/°C |
| I _{IO} | Input offset current | V _{IC} = 0, V _O = 0, 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 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 _{OM+} | Maximum positive peak output voltage swing | I _O = −200 μA | | 25°C | 13.8 | 14.1 | 13.8 | | 14.1 | V | |
| | | | | Full range | 13.6 | | 13.6 | | | | |
| | | I _O = −2 mA | | 25°C | 13.5 | 13.9 | 13.5 | | 13.9 | | |
| | | | | Full range | 13.3 | | 13.3 | | | | |
| | | I _O = −20 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 μA | | 25°C | −13.8 | −14.2 | −13.8 | | −14.2 | V | |
| | | | | Full range | −13.6 | | −13.6 | | | | |
| | | I _O = 2 mA | | 25°C | −13.5 | −14 | −13.5 | | −14 | | |
| | | | | Full range | −13.3 | | −13.3 | | | | |
| | | I _O = 20 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 = ±10 V | R _L = 600 Ω | 25°C | 80 | 96 | 80 | | 96 | dB | |
| | | | | Full range | 78 | | 78 | | | | |
| | | | R _L = 2 kΩ | 25°C | 90 | 109 | 90 | | 109 | | |
| | | | | Full range | 89 | | 89 | | | | |
| | | | R _L = 10 kΩ | 25°C | 95 | 118 | 95 | | 118 | | |
| | | | | Full range | 93 | | 93 | | | | |
| r _i | Input resistance | V _{IC} = 0 | | 25°C | 10 ¹² | | | 10 ¹² | | Ω | |
| c _i | Input capacitance | V _{IC} = 0, 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 | | Ω | |
| CMRR | Common-mode rejection ratio | V _{IC} = V _{ICRmin} , V _O = 0, R _S = 50 Ω | | 25°C | 80 | 98 | 80 | | 98 | dB | |
| | | | | Full range | 78 | | 78 | | | | |
| k _{SVR} | Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO}) | V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 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°C to 125°C.



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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | 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 kΩ | 25°C | 120 | | | 120 | | | dB |
| I _{OS} | Short-circuit output current | V _O = 0 | V _{ID} = 1 V | 25°C | −30 | −45 | | −30 | −45 | | mA |
| | | | V _{ID} = −1 V | | 30 | 48 | | 30 | 48 | | |

† 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 _A † | TLE2072M | | | TLE2072AM | | | UNIT |
|--------------------|---|---|---|------------------|----------|--------|------|-----------|--------|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = 10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 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 _s | Settling time | A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.4 | | 0.4 | | | μs | |
| | | | To 1 mV | | 1.5 | | 1.5 | | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85* | | 48 | 85* | | nV/√Hz |
| | | | f = 10 kHz | | 12 | 17* | | 12 | 17* | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, f = 10 kHz | 25°C | 2.8 | | 2.8 | | | fA/√Hz | | |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 20 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, 25°C | 0.008% | | 0.008% | | | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2 | 25°C | 8* | 10 | | 8* | 10 | | MHz | |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 20 V, R _L = 2 kΩ, A _{VD} = −1, C _L = 25 pF | 25°C | 478* | 637 | | 478* | 637 | | kHz | |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, R _L = 2 kΩ, See Figure 2 | 25°C | 57° | | 57° | | | | | |

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

† Full range is -55°C to 125°C .

TLE207x, TLE207xA

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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 to -11 | 15 to 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} | | Ω |
| c_i Input capacitance | $V_{IC} = 0$, See Figure 5 | Common mode | 7.5 | | pF |
| | | Differential | 2.5 | | |
| z_o Open-loop output impedance | $f = 1\text{ MHz}$ | | 80 | | Ω |
| CMRR Common-mode rejection ratio | $V_{IC} = V_{ICRmin}$, $V_O = 0$, $R_S = 50\ \Omega$ | 80 | 98 | | dB |
| k_{SVR} Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm} = \pm 5\text{ V to } \pm 15\text{ V}$, $R_S = 50\ \Omega$, $V_O = 0$ | 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 | |

TLE2074C electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5\text{ V}$ (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 | |
| α_{VIO} | Temperature coefficient of input offset voltage | | Full range | | 10.1 | 30 | | 10.1 | 30 | $\mu\text{V}/^\circ\text{C}$ |
| 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 | $I_O = -200\ \mu\text{A}$ | 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} | | Ω |
| 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 | | Ω |
| 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 | | | |

† Full range is 0°C to 70°C.

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

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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_A^\dagger | TLE2074C | | | TLE2074AC | | | 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 Ω | 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 | | |

† 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 _A [†] | TLE2074C | | | TLE2074AC | | | UNIT |
|--------------------|---|---|--|-----------------------------|----------|-----|-----|-----------|-----|--------|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = ±2.3 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 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 _s | Settling time | A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.25 | | | 0.25 | | | μs |
| | | | To 1 mV | | 0.4 | | | 0.4 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 85 | | | 48 85 | | | nV/√Hz |
| | | | f = 10 kHz | | 12 17 | | | 12 17 | | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz | |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 5 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.013% | | | 0.013% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 9.4 | | | 9.4 | | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 4 V, R _L = 2 kΩ , | A _{VD} = −1, C _L = 25 pF | 25°C | 2.8 | | | 2.8 | | | MHz |
| ϕ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 56° | | | 56° | | | |

† 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)

| PARAMETER | | TEST CONDITIONS | T_A^\dagger | TLE2074C | | | TLE2074AC | | | UNIT |
|----------------|---|--|---------------------|-------------|-------------|-----|-------------|-------------|-----|------------------|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V_{IO} | Input offset voltage | $V_{IC} = 0,$ $R_S = 50\ \Omega$ | 25°C | -1.6 | 5 | | -0.5 | 3 | | mV |
| | | | Full range | | 7.1 | | | 5.1 | | |
| α_{VIO} | Temperature coefficient of input offset voltage | | Full range | 10.1 | 30 | | 10.1 | 30 | | $\mu V/^\circ C$ |
| I_{IO} | Input offset current | $V_{IC} = 0,$ $V_O = 0,$ 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 | | | |
| | | $I_O = -2\ mA$ | 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 | -13.7 | -14 | | -13.7 | -14 | | |
| | | | Full range | -13.6 | | | -13.6 | | | |
| | | $I_O = 20\ mA$ | 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} | | Ω |
| 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 | $f = 1\ MHz$ | 25°C | | 80 | | | 80 | | Ω |
| 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 ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm} = \pm 5\ V$ to $\pm 15\ V,$ $V_O = 0,$ $R_S = 50\ \Omega$ | 25°C | 82 | 99 | | 82 | 99 | | dB |
| | | | Full range | 81 | | | 81 | | | |

† Full range is 0°C to 70°C.

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

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

| PARAMETER | TEST CONDITIONS | T_A^\dagger | TLE2074C | | | TLE2074AC | | | UNIT |
|---|-------------------------------------|-----------------|----------|-----|-----|-----------|-----|-----|------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| I_{CC} Supply current (four amplifiers) | $V_O = 0$, 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 | $V_{IC} = 0$, $R_L = 2$ k Ω | 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 | | |

† 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 _A [†] | TLE2074C | | | TLE2074AC | | | UNIT |
|--------------------|---|---|--|-----------------------------|----------|-----|-----|-----------|-----|--------|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = 10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 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 _s | Settling time | A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.4 | | | 0.4 | | | μs |
| | | | To 1 mV | | 1.5 | | | 1.5 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85 | | 48 | 85 | | nV/√Hz |
| | | | f = 10 kHz | | 12 | 17 | | 12 | 17 | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz | |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 20 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ | 25°C | 0.008% | | | 0.008% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 8 | 10 | | 8 | 10 | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 20 V, R _L = 2 kΩ, | A _{VD} = −1, C _L = 25 pF | 25°C | 478 | 637 | | 478 | 637 | | kHz |
| φ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 57° | | | 57° | | | |

† Full range is 0°C to 70°C.



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

| PARAMETER | | TEST CONDITIONS | T_A^\dagger | TLE2074I | | | TLE2074AI | | | UNIT |
|----------------|---|---|------------------------------|------------|-----------|-----|-----------|-----------|-----|------------------------------|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V_{IO} | Input offset voltage | $V_{IC} = 0, \quad V_O = 0, \quad R_S = 50 \, \Omega$ | 25°C | -1.6 | 5 | | -0.5 | 3 | | mV |
| | | | Full range | | | 9 | | | 7 | |
| α_{VIO} | Temperature coefficient of input offset voltage | | Full range | | 10.1 | 30 | | 10.1 | 30 | $\mu\text{V}/^\circ\text{C}$ |
| I_{IO} | Input offset current | $V_{IC} = 0, \quad V_O = 0, \quad \text{See Figure 4}$ | 25°C | 15 | 100 | | 15 | 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 | 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} | | Ω |
| 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 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = V_{ICRmin}, \quad V_O = 0, \quad R_S = 50 \, \Omega$ | 25°C | 70 | 89 | | 70 | 89 | | dB |
| | | | Full range | 68 | | | 68 | | | |
| k_{SVR} | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm} = \pm 5 \, \text{V to } \pm 15 \, \text{V}, \quad V_O = 0, \quad R_S = 50 \, \Omega$ | 25°C | 82 | 99 | | 82 | 99 | | dB |
| | | | Full range | 80 | | | 80 | | | |

† Full range is -40°C to 85°C .

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

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TLE2074I electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 5$ 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 | $V_{IC} = 0$, $R_L = 2$ k Ω | 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 | | |

† Full range is –40°C to 85°C.

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

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2074I | | | TLE2074AI | | | UNIT |
|--------------------|---|---|---|-----------------------------|------------|-----|-----|------------|-----|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = ±2.3 V, A _{VD} = −1, C _L = 100 pF, R _L = 2 kΩ, 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 _s | Settling time | A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.25 | | | 0.25 | | | μs |
| | | | To 1 mV | | 0.4 | | | 0.4 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 85 | | | 48 85 | | | nV/√Hz |
| | | | f = 10 kHz | | 12 17 | | | 12 17 | | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, | f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 5 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.013% | | | 0.013% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 9.4 | | | 9.4 | | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 4 V, R _L = 2 kΩ , | A _{VD} = −1, C _L = 25 pF | 25°C | 2.8 | | | 2.8 | | | MHz |
| ϕ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 56° | | | 56° | | | |

† Full range is –40°C to 85°C.

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

| PARAMETER | | | TEST CONDITIONS | T _A † | TLE2074I | | | TLE2074AI | | | UNIT | |
|------------------|---|--------------|---|------------------------|------------------|-----|-------------|------------------|-----|-------------|-------|----|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | | |
| V _{IO} | Input offset voltage | | V _{IC} = 0, V _O = 0, R _S = 50 Ω | 25°C | -1.6 | | 5 | -0.5 | | 3 | mV | |
| | | | | Full range | | | 9 | | | 7 | | |
| α _{VIO} | Temperature coefficient of input offset voltage | | | Full range | 10.1 | | 30 | 10.1 | | 30 | μV/°C | |
| I _{IO} | Input offset current | | V _{IC} = 0, V _O = 0, See Figure 4 | 25°C | 15 | | 100 | 15 | | 100 | pA | |
| | | | | Full range | | | 5 | | | 5 | nA | |
| I _{IB} | Input bias current | | | 25°C | 25 | | 175 | 25 | | 175 | pA | |
| | | | | Full range | | | 10 | | | 10 | nA | |
| V _{ICR} | Common-mode input voltage range | | R _S = 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 _{OM+} | Maximum positive peak output voltage swing | | I _O = -200 μA | 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 μA | 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 = ±10 V | R _L = 600 Ω | 25°C | 80 | | 96 | 80 | | 96 | dB |
| | | | | | Full range | 79 | | | 79 | | | |
| | | | | R _L = 2 kΩ | 25°C | 90 | | 109 | 90 | | 109 | |
| | | | | | Full range | 89 | | | 89 | | | |
| | | | | R _L = 10 kΩ | 25°C | 95 | | 118 | 95 | | 118 | |
| | | | | | Full range | 94 | | | 94 | | | |
| r _i | Input resistance | | V _{IC} = 0 | 25°C | 10 ¹² | | | 10 ¹² | | | Ω | |
| c _i | Input capacitance | Common mode | V _{IC} = 0, See Figure 5 | 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 | | | Ω | |
| CMRR | Common-mode rejection ratio | | V _{IC} = V _{ICRmin} , V _O = 0, R _S = 50 Ω | 25°C | 80 | | 98 | 80 | | 98 | dB | |
| | | | | Full range | 79 | | | 79 | | | | |
| k _{SVR} | Supply-voltage rejection ratio (ΔV _{CC±} /ΔV _{IO}) | | V _{CC±} = ±5 V to ±15 V, V _O = 0, R _S = 50 Ω | 25°C | 82 | | 99 | 82 | | 99 | dB | |
| | | | | Full range | 80 | | | 80 | | | | |

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

TLE207x, TLE207xA

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) (continued)

| PARAMETER | | TEST CONDITIONS | | T _A [†] | TLE2074I | | | TLE2074AI | | | UNIT |
|-----------------------|-------------------------------------|----------------------|------------------------|-----------------------------|----------|-----|-----|-----------|-----|-----|------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| I _{CC} | Supply current (four amplifiers) | V _O = 0, | No load | 25°C | 5.2 | 6.5 | 7.5 | 5.2 | 6.5 | 7.5 | mA |
| | | | | Full range | 7.5 | | | 7.5 | | | |
| Crosstalk attenuation | | V _{IC} = 0, | R _L = 2 kΩ | 25°C | 120 | | | 120 | | | dB |
| I _{OS} | Short-circuit output current | V _O = 0 | V _{ID} = 1 V | 25°C | -30 | -45 | | -30 | -45 | | mA |
| | | | V _{ID} = -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 _A [†] | TLE2074I | | | TLE2074AI | | | UNIT |
|--------------------|---|---|--|-----------------------------|----------|-----|-----|-----------|-----|--------|------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = ±10 V, A _{VD} = −1, C _L = 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 _s | Settling time | A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.4 | | | 0.4 | | | μs |
| | | To 1 mV | 1.5 | | | 1.5 | | | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85 | | 48 | 85 | nV/√Hz | |
| | f = 10 kHz | | 12 | | 17 | 12 | 17 | | | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz | |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 20 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.008% | | | 0.008% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 8 | 10 | | 8 | 10 | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 20 V, R _L = 2 kΩ, | A _{VD} = −1, C _L = 25 pF | 25°C | 478 | 637 | | 478 | 637 | | kHz |
| ϕ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 57° | | | 57° | | | |

† Full range is -40°C to 85°C.



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

| PARAMETER | TEST CONDITIONS | T_A^\dagger | TLE2074M | | | TLE2074AM | | | 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 | | | 10.5 | | | 8.5 | |
| α_{VIO} Temperature coefficient of input offset voltage | | Full range | 10.1 | 30 [‡] | | 10.1 | 30 [‡] | | $\mu\text{V}/^\circ\text{C}$ |
| I_{IO} Input offset current | $V_{IC} = 0, V_O = 0, \text{See Figure 4}$ | 25°C | 15 | 100 | | 15 | 100 | | pA |
| | | Full range | | | 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 | $I_O = -200\mu\text{A}$ | 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 | $I_O = 200\mu\text{A}$ | 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} | | Ω |
| 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 | | Ω |
| 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 | | | |

[†] Full range is -55°C to 125°C.

[‡] On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

TLE207x, TLE207xA

EXCALIBUR LOW-NOISE HIGH-SPEED

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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 Ω | 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 | | |

† 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 _A [†] | TLE2074M | | | TLE2074AM | | | UNIT |
|--------------------|---|---|---|-----------------------------|-----------------|-----------------|-----|-----------------|--------|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = ±2.3 V, A _{VD} = −1, C _L = 100 pF, R _L = 2 kΩ, 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 _s | Settling time | A _{VD} = −1, 2-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.25 | | | 0.25 | | | μs |
| | | | To 1 mV | | 0.4 | | | 0.4 | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85 [‡] | 48 | 85 [‡] | nV/√Hz | | |
| | | | f = 10 kHz | | 12 | 17 [‡] | 12 | 17 [‡] | | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, | f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 5 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.013% | | | 0.013% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 9.4 | | | 9.4 | | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 4 V, R _L = 2 kΩ, | A _{VD} = −1, C _L = 25 pF | 25°C | 2.8 | | | 2.8 | | | MHz |
| f _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 56° | | | 56° | | | |

† Full range is –55°C to 125°C.

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



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

| PARAMETER | TEST CONDITIONS | T_A^\dagger | TLE2074M | | | TLE2074AM | | | 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 | | | 10.5 | | | 8.5 | |
| α_{VIO} Temperature coefficient of input offset voltage | | Full range | | 10.1 | 30 [‡] | | 10.1 | 30 [‡] | $\mu V/^\circ C$ |
| I_{IO} Input offset current | $V_{IC} = 0, V_O = 0,$ See Figure 4 | 25°C | | 15 | 100 | | 15 | 100 | pA |
| | | Full range | | | 20 | | | 20 | nA |
| I_{IB} Input bias current | | 25°C | | 25 | 175 | | 25 | 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 | 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} | | Ω |
| 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 | | Ω |
| 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 | | |

[†] Full range is -55°C to 125°C.

[‡] On products compliant to MIL-PRF-38535, Class B, this parameter is not production tested.

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JFET-INPUT OPERATIONAL AMPLIFIERS

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TLE2074M electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ 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 | 6.5 | 7.5 | 5.2 | 6.5 | 7.5 | mA |
| | | Full range | | | 7.5 | | | 7.5 | |
| Crosstalk attenuation | $V_{IC} = 0$, $R_L = 2$ k Ω | 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 | | |

† 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 _A [†] | TLE2074M | | | TLE2074AM | | | UNIT |
|--------------------|---|---|--|-----------------------------|------------------|-----------------|-----|------------------|-----------------|-----|--------|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR + | Positive slew rate | V _{O(PP)} = 10 V, A _{VD} = −1, R _L = 2 kΩ, C _L = 100 pF, 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 _s | Settling time | A _{VD} = −1, 10-V step, R _L = 1 kΩ, C _L = 100 pF | To 10 mV | 25°C | 0.4 | | | 0.4 | | | μs |
| | | To 1 mV | 1.5 | | | 1.5 | | | | | |
| V _n | Equivalent input noise voltage | R _S = 20 Ω, See Figure 3 | f = 10 Hz | 25°C | 48 | 85 [‡] | | 48 | 85 [‡] | | nV/√Hz |
| | | | f = 10 kHz | | 12 | 17 [‡] | | 12 | 17 [‡] | | |
| V _{N(PP)} | 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 _n | Equivalent input noise current | V _{IC} = 0, | f = 10 kHz | 25°C | 2.8 | | | 2.8 | | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | V _{O(PP)} = 20 V, f = 1 kHz, R _S = 25 Ω | A _{VD} = 10, R _L = 2 kΩ, | 25°C | 0.008% | | | 0.008% | | | |
| B ₁ | Unity-gain bandwidth | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 8 [‡] | 10 | | 8 [‡] | 10 | | MHz |
| B _{OM} | Maximum output-swing bandwidth | V _{O(PP)} = 20 V, R _L = 2 kΩ, | A _{VD} = −1, C _L = 25 pF | 25°C | 478 [‡] | 637 | | 478 [‡] | 637 | | kHz |
| ϕ _m | Phase margin at unity gain | V _I = 10 mV, C _L = 25 pF, | R _L = 2 kΩ, See Figure 2 | 25°C | 57° | | | 57° | | | |

† Full range is –55°C to 125°C.

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



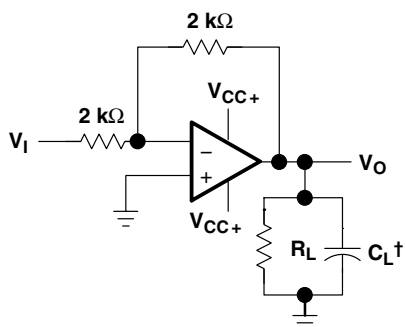
TLE2074Y electrical characteristics at $V_{CC\pm} = \pm 15$ V, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | TLE2074Y | | | UNIT |
|-----------|---|---|----------------------------|------------------|-----|----------|
| | | | MIN | TYP | MAX | |
| V_{IO} | Input offset voltage | $V_{IC} = 0$, $R_S = 50\ \Omega$ | | | 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 to –11 | 15 to 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} | | Ω |
| c_i | Input capacitance | Common mode | | 7.5 | | pF |
| | | Differential | | 2.5 | | |
| z_o | Open-loop output impedance | $f = 1\ \text{MHz}$ | | 80 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = V_{ICRmin}$, $R_S = 50\ \Omega$ | 80 | 98 | | dB |
| k_{SVR} | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm} = \pm 5\ \text{V to } \pm 15\ \text{V}$, $V_O = 0$, $R_S = 50\ \Omega$ | 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 | |

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

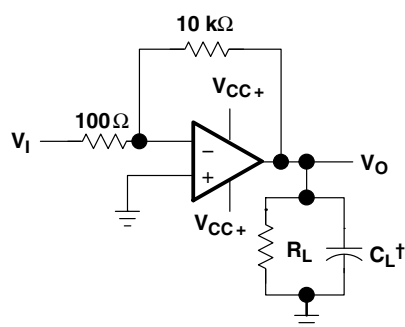
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PARAMETER MEASUREMENT INFORMATION



† 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

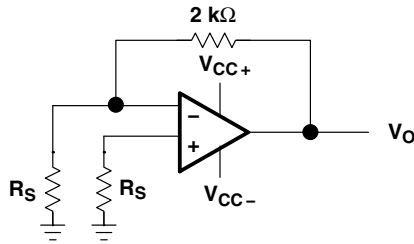


Figure 3. Noise-Voltage Test Circuit

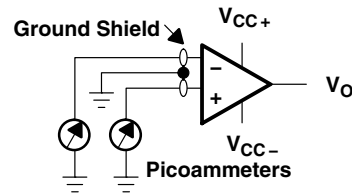


Figure 4. Input-Bias and Offset-Current Test Circuit

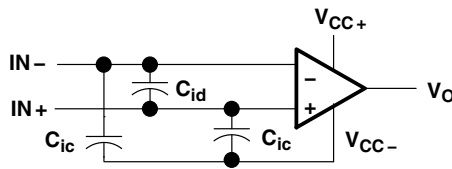


Figure 5. Internal Input Capacitance

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.

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TYPICAL CHARACTERISTICS

Table of Graphs

| | | | FIGURE |
|----------------|---|--|-------------------------------------|
| V_{IO} | Input offset voltage | Distribution | 6, 7, 8 |
| α_{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 vs Total supply voltage | 12, 13 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 vs Supply voltage | 20, 21 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 vs Free-air temperature | 25 26, 27 |
| A_{VD} | Small-signal differential voltage amplification | vs Frequency | 28, 29 |
| CMRR | Common-mode rejection ratio | vs Frequency vs Free-air temperature | 30 31 |
| k_{SVR} | Supply-voltage rejection ratio | vs Frequency vs Free-air temperature | 32 33 |
| I_{CC} | Supply current | vs Supply voltage vs Free-air temperature vs Differential input voltage | 34, 35, 36 37, 38, 39 40 – 45 |
| I_{OS} | Short-circuit output current | vs Supply voltage vs Elapsed time vs Free-air temperature | 46 47 48 |
| SR | Slew rate | vs Free-air temperature vs Load resistance vs Differential input voltage | 49, 50 51 52 |
| V_n | Equivalent Input noise voltage (spectral density) | vs Frequency | 53 |
| V_n | Input referred noise voltage | vs Noise bandwidth Over a 10-second time interval | 54 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 vs Supply voltage | 60 61 |
| | Gain margin | vs Load capacitance | 62 |
| ϕ_m | Phase margin | vs Free-air temperature vs Supply voltage vs Load capacitance | 63 64 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**

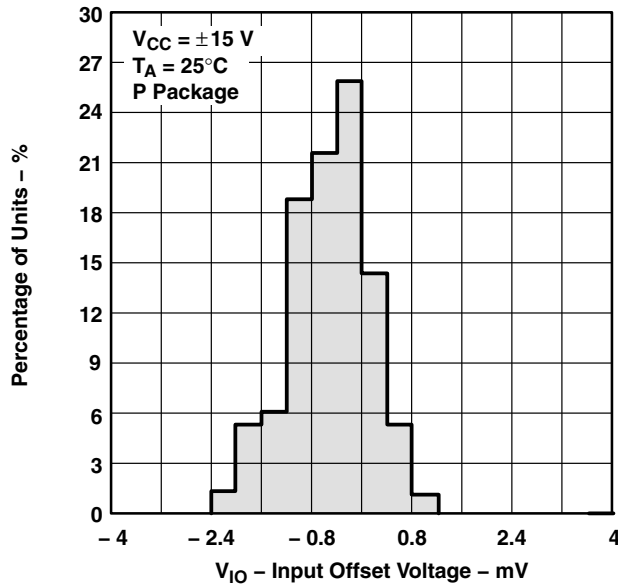


Figure 6

**DISTRIBUTION OF TLE2072
INPUT OFFSET VOLTAGE**

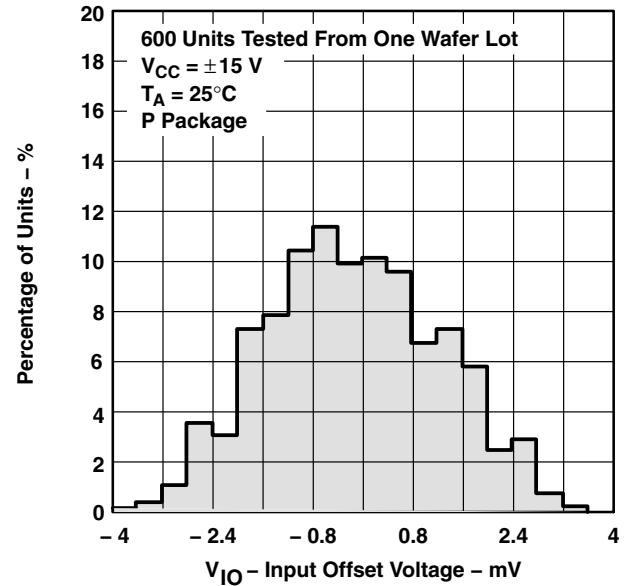


Figure 7

**DISTRIBUTION OF TLE2074
INPUT OFFSET VOLTAGE**

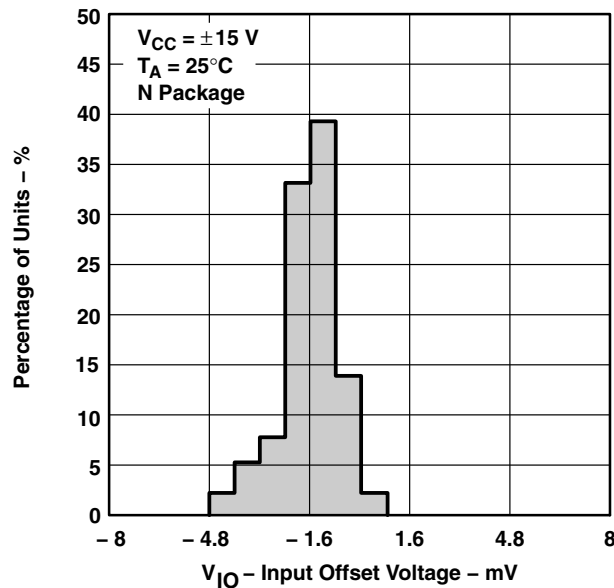


Figure 8

**DISTRIBUTION OF TLE2071 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT**

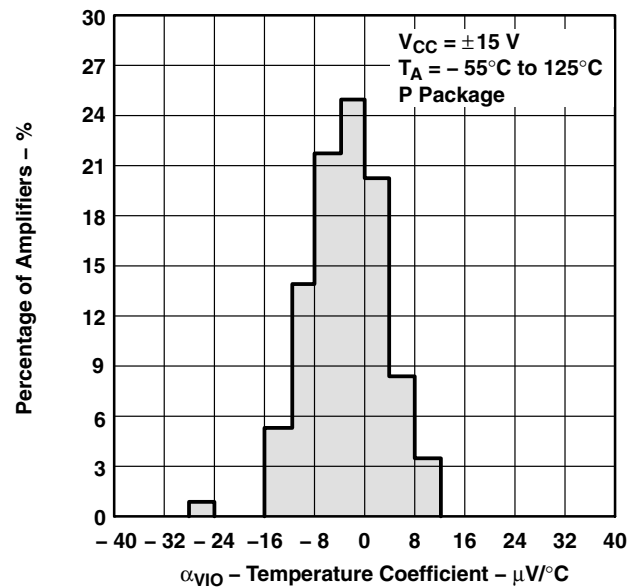


Figure 9

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

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TYPICAL CHARACTERISTICS

**DISTRIBUTION OF TLE2072 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT**

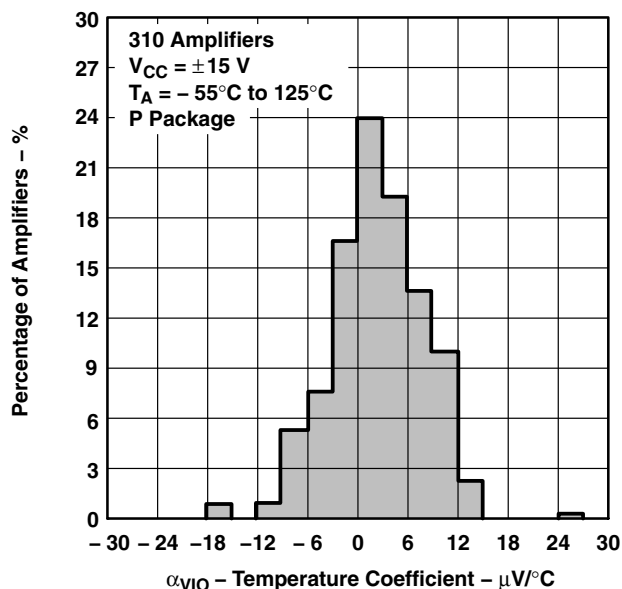


Figure 10

**DISTRIBUTION OF TLE2074 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT**

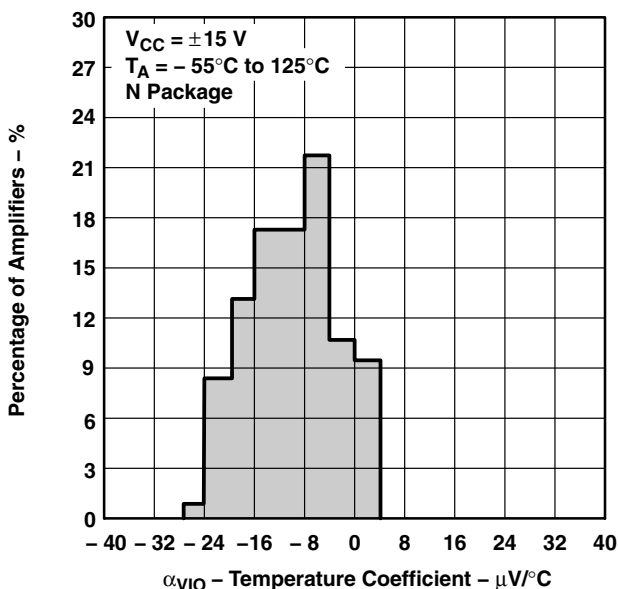


Figure 11

**INPUT BIAS CURRENT AND
INPUT OFFSET CURRENT†
vs
FREE-AIR TEMPERATURE**

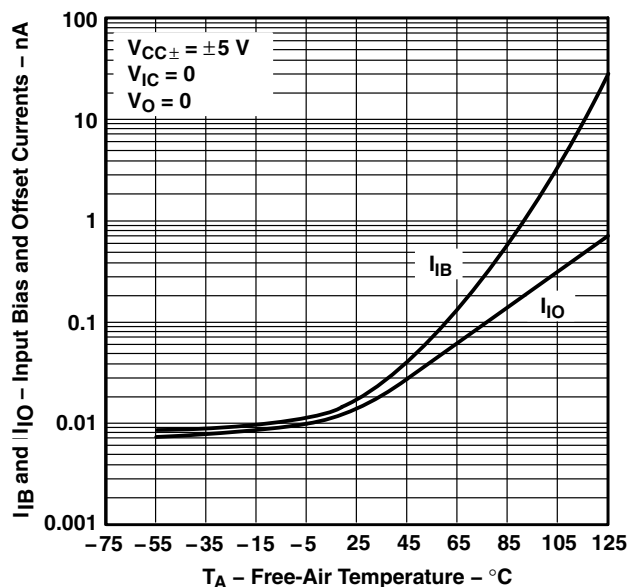


Figure 12

**INPUT BIAS CURRENT AND
INPUT OFFSET CURRENT†
vs
FREE-AIR TEMPERATURE**

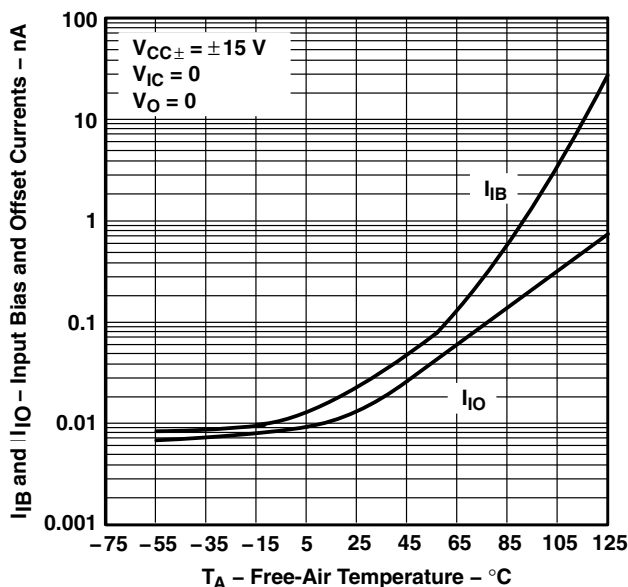
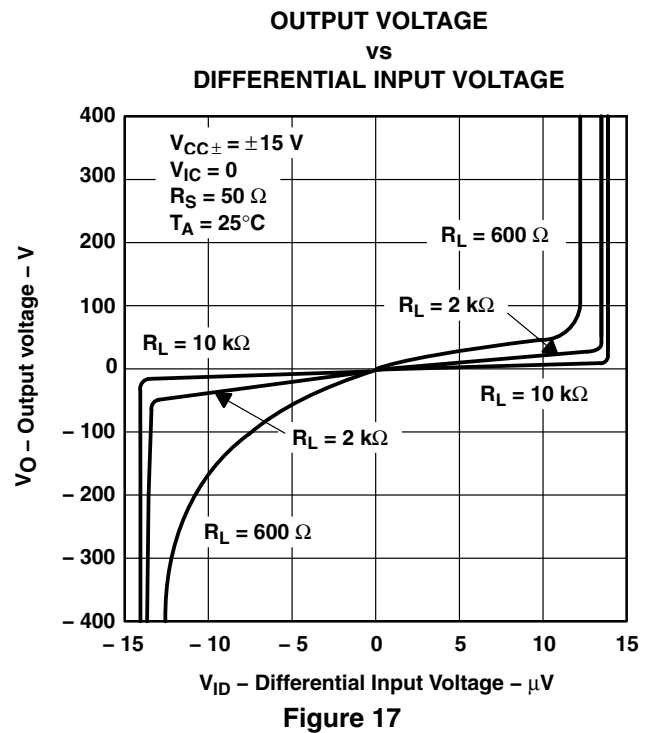
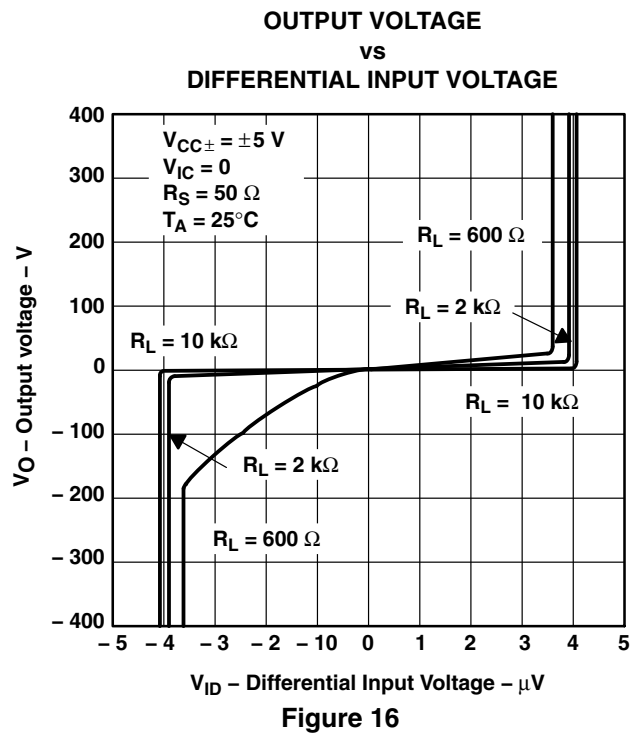
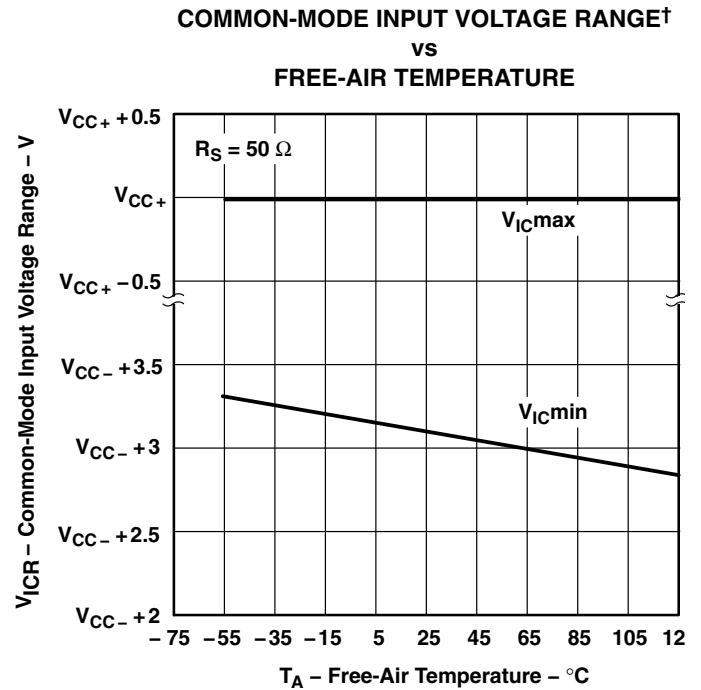
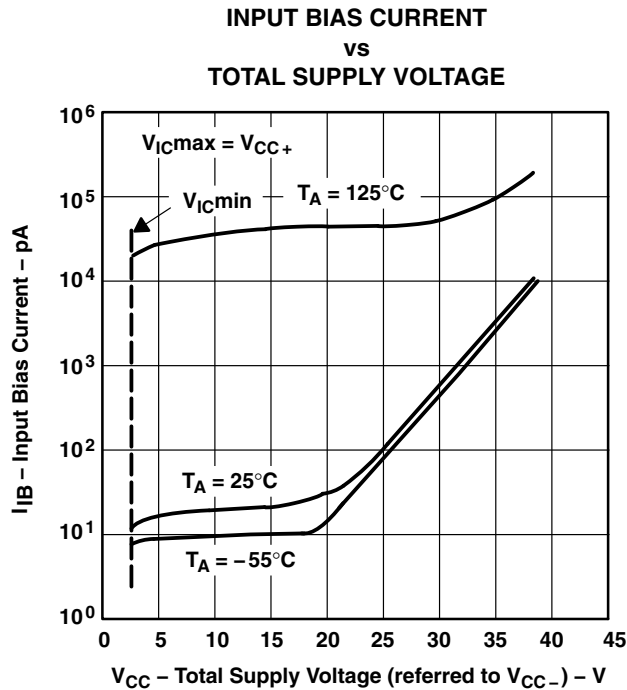


Figure 13

† 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.

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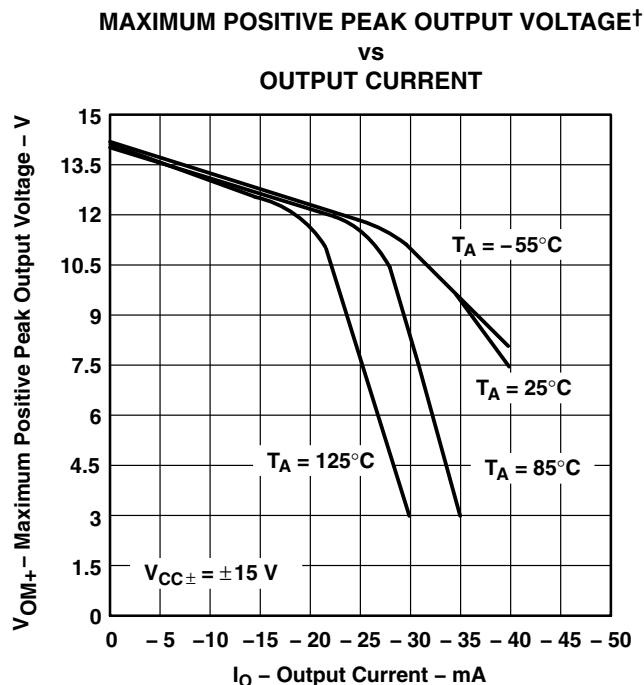


Figure 18

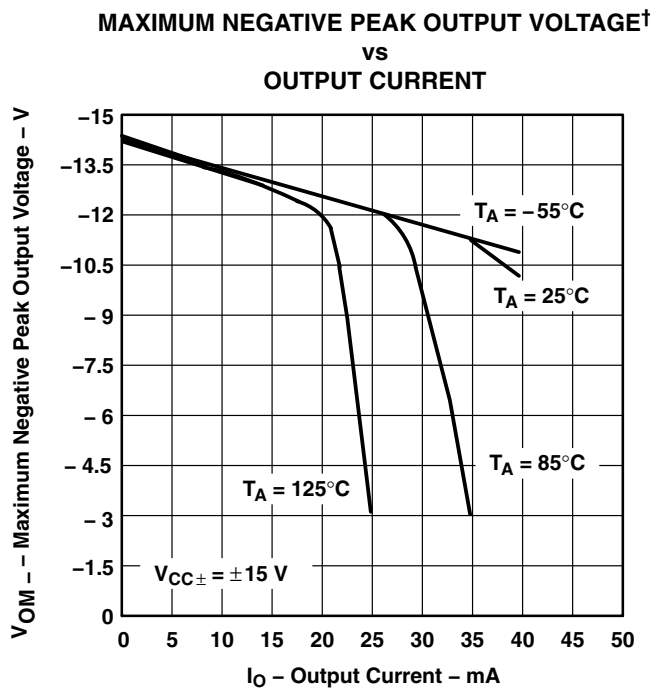


Figure 19

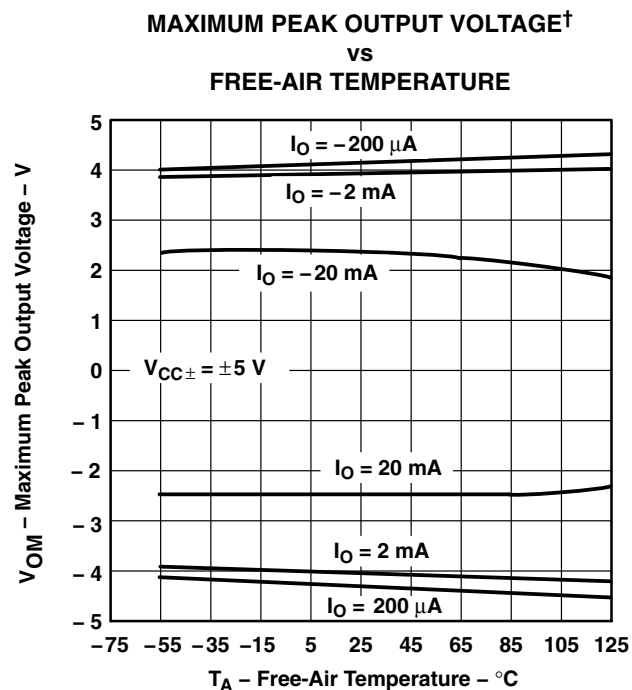


Figure 20

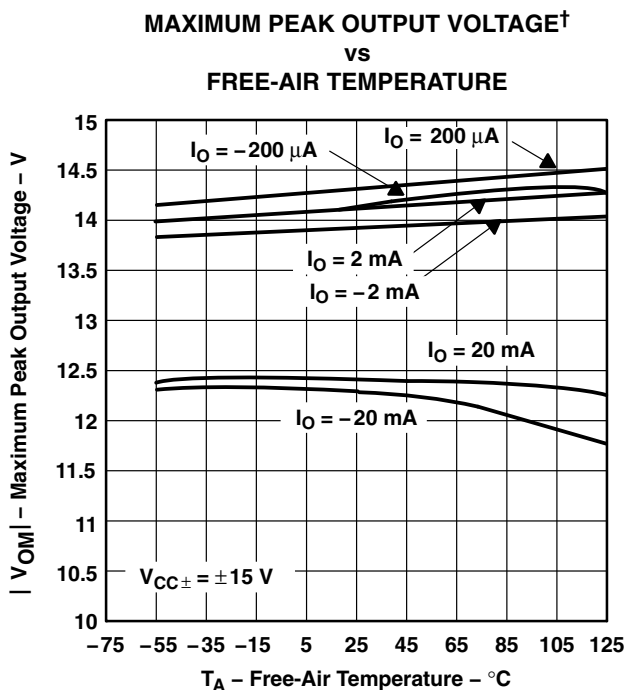
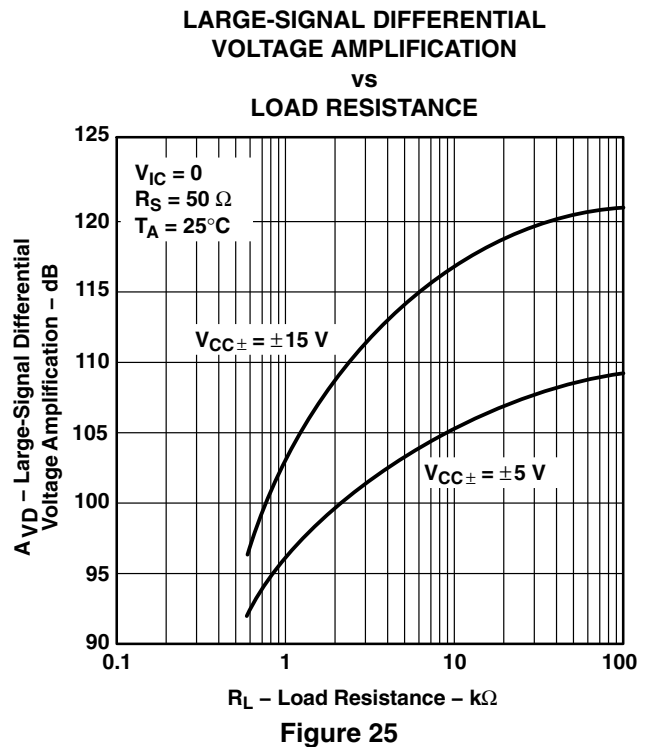
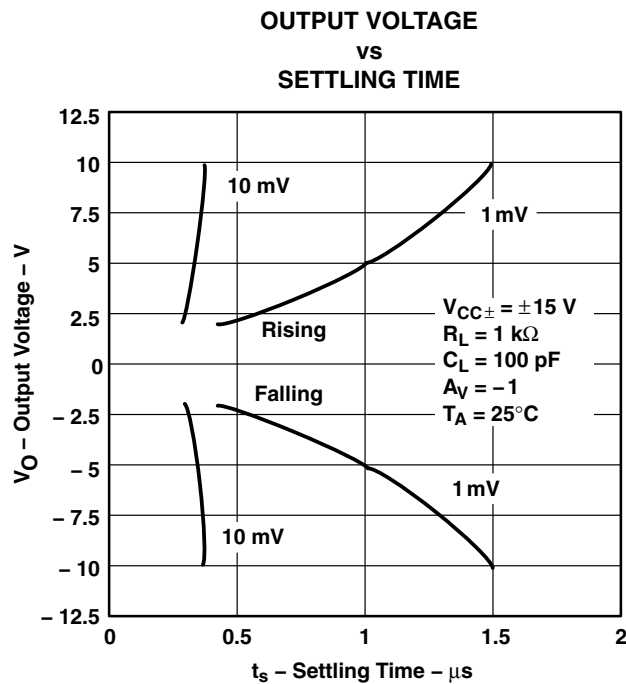
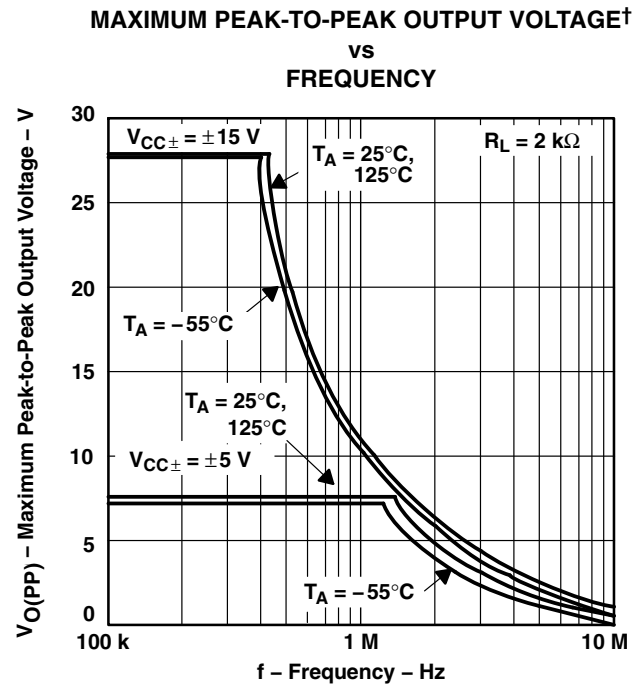
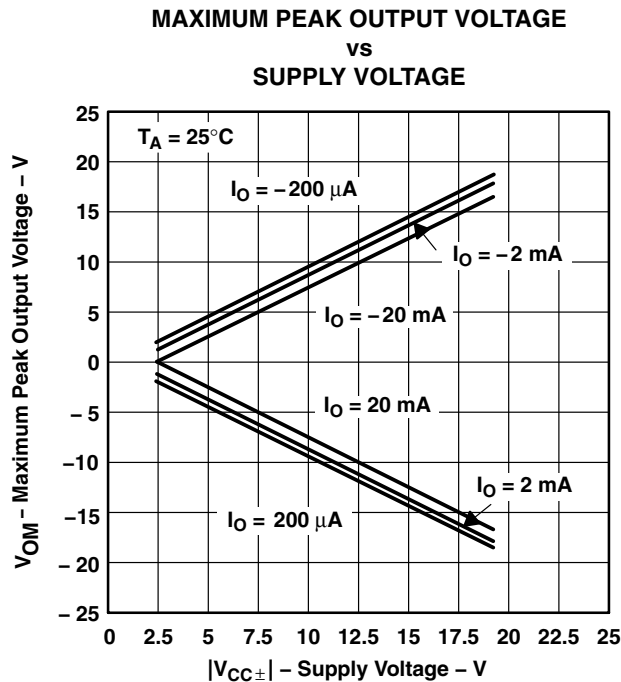


Figure 21

† 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.

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TYPICAL CHARACTERISTICS

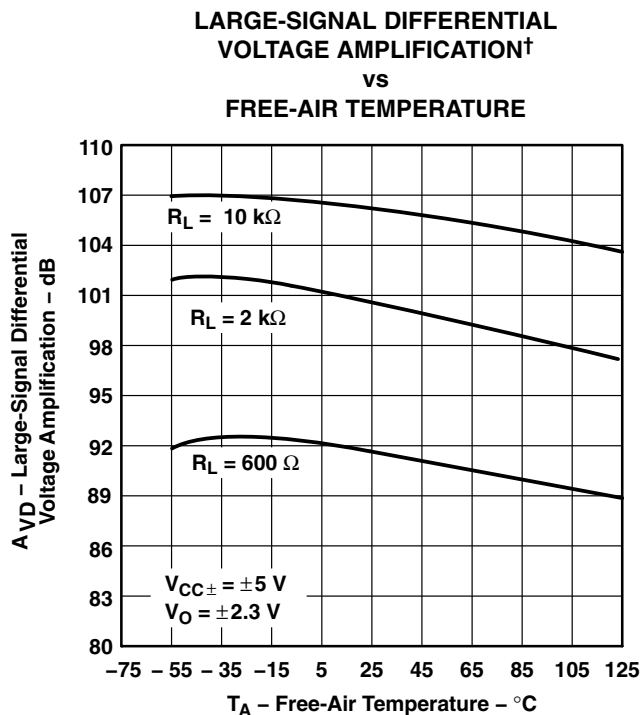


Figure 26

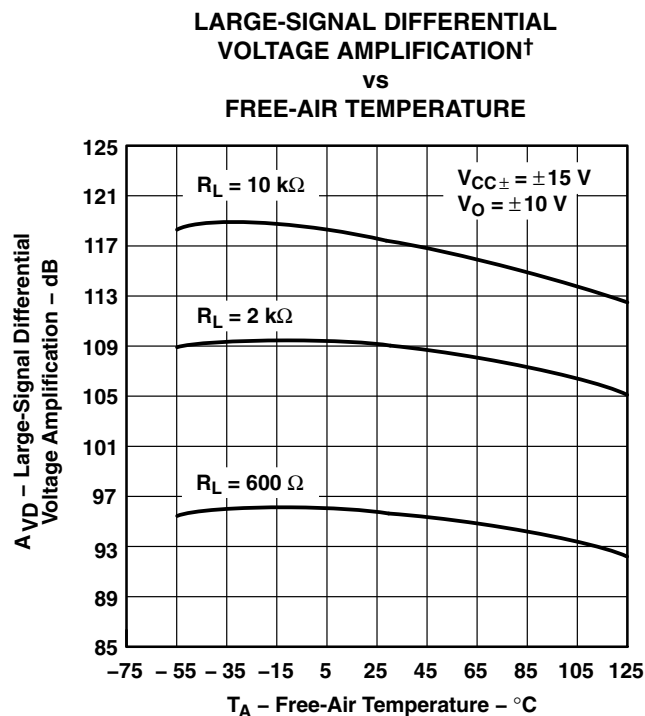


Figure 27

† 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

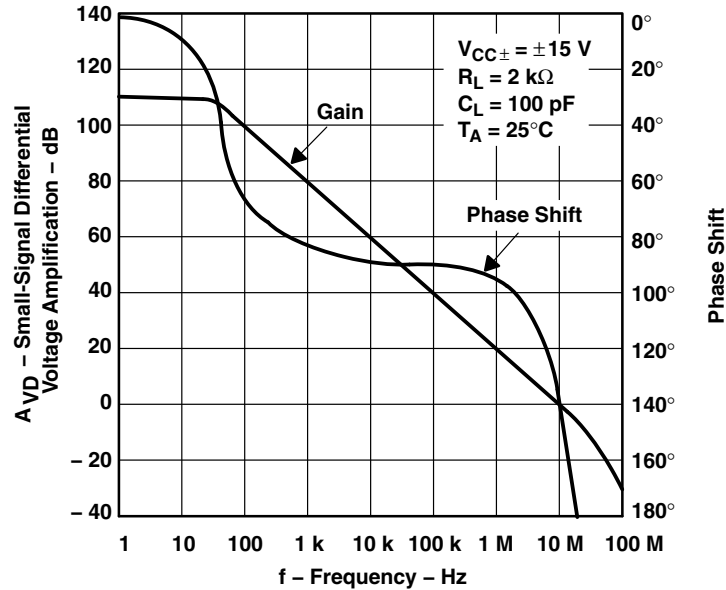


Figure 28

SMALL-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT

vs

FREQUENCY

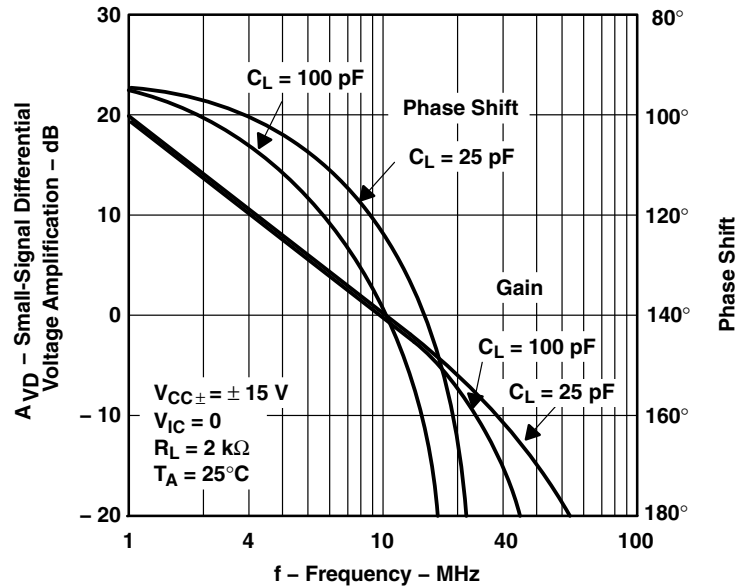


Figure 29

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

SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

TYPICAL CHARACTERISTICS

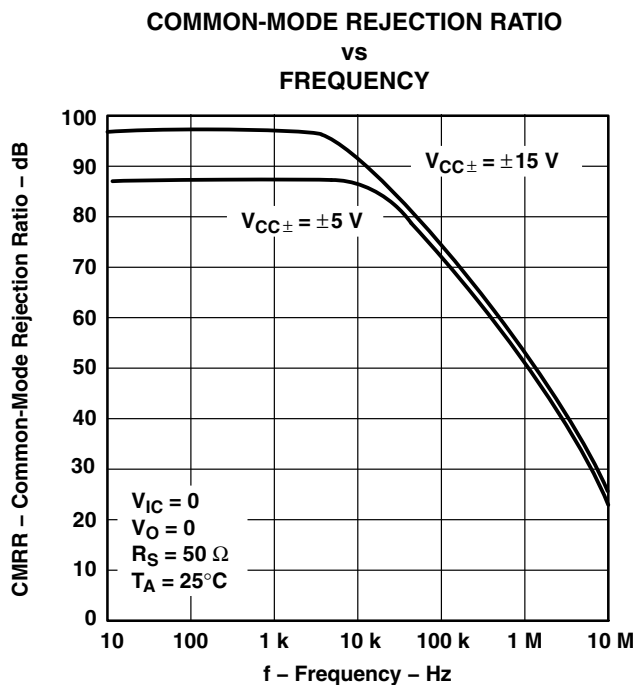


Figure 30

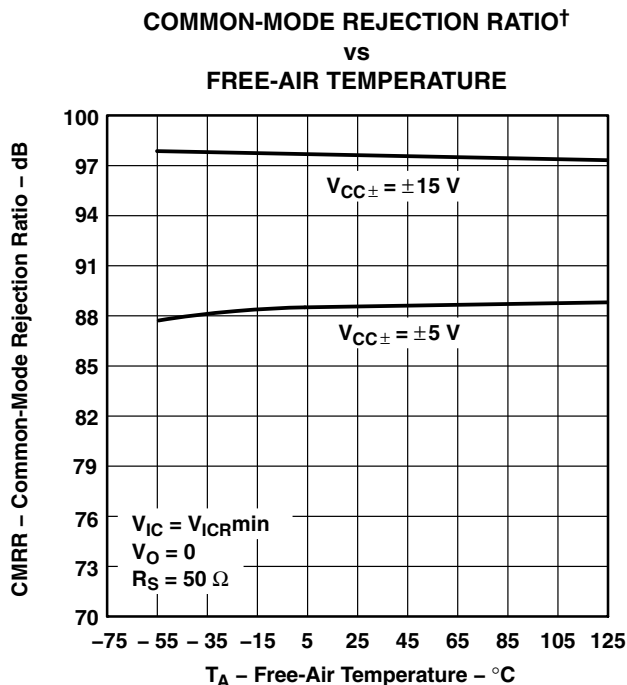


Figure 31

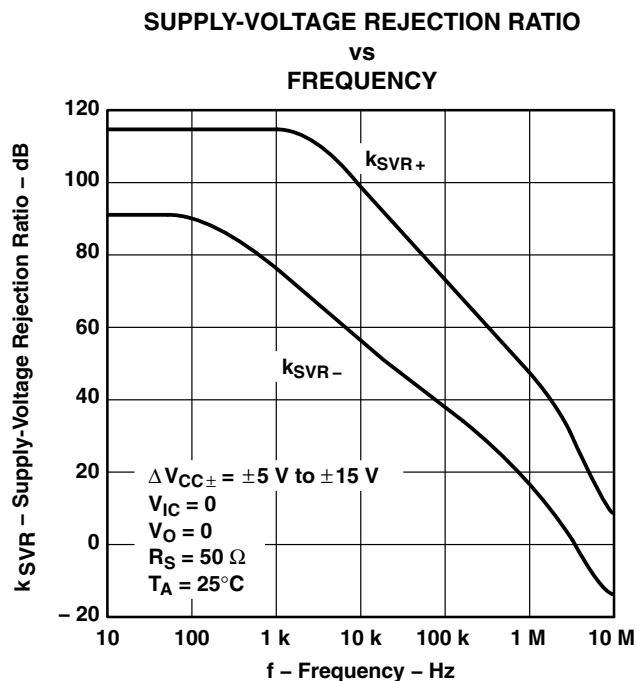


Figure 32

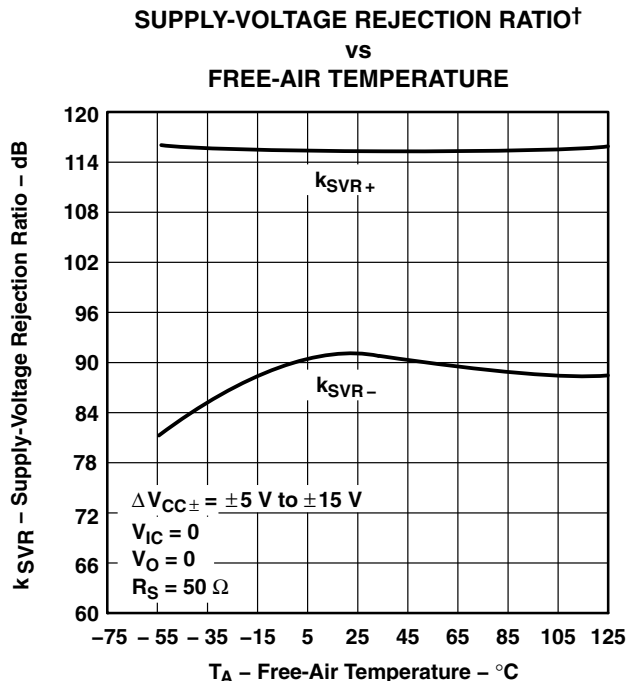
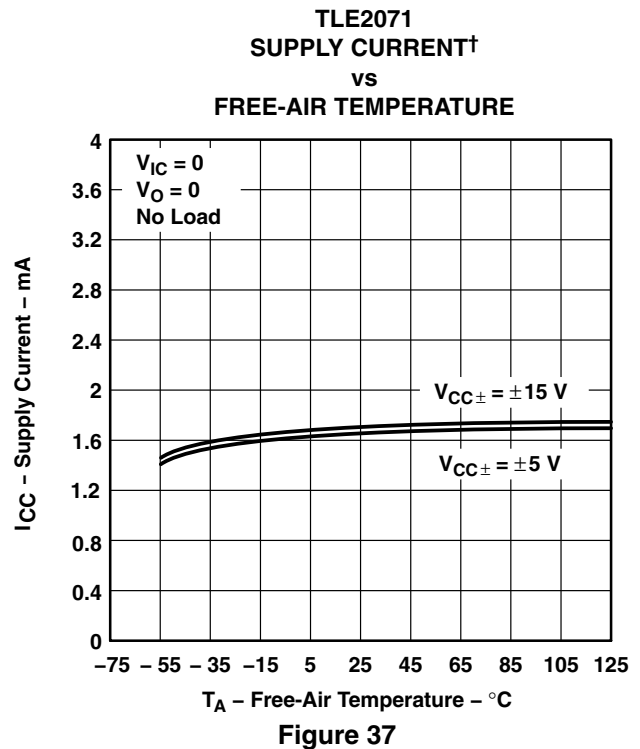
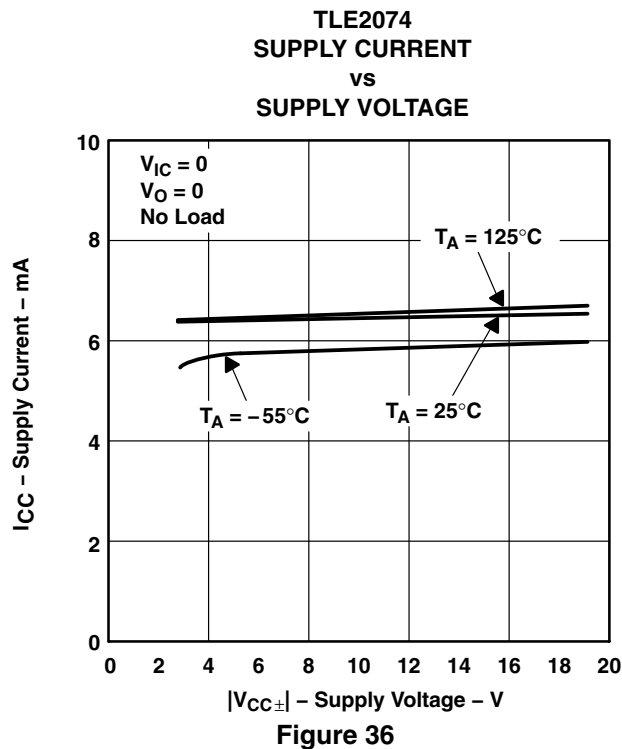
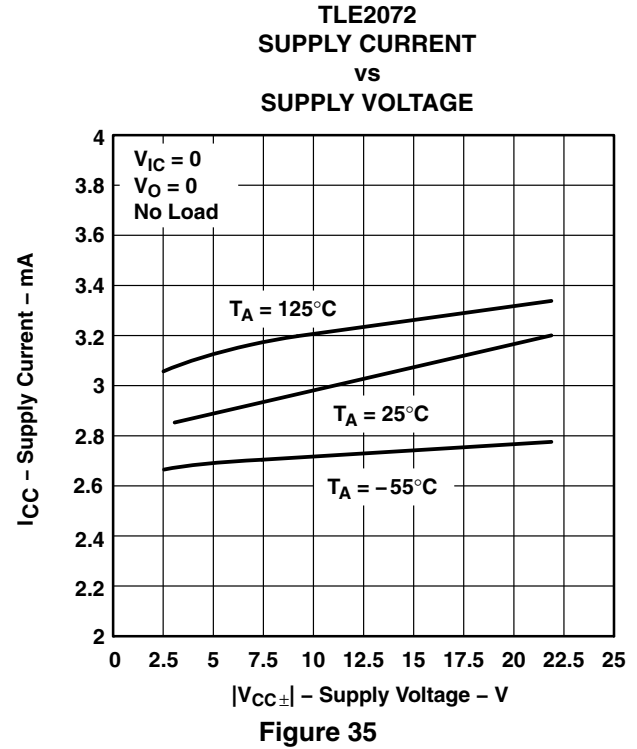
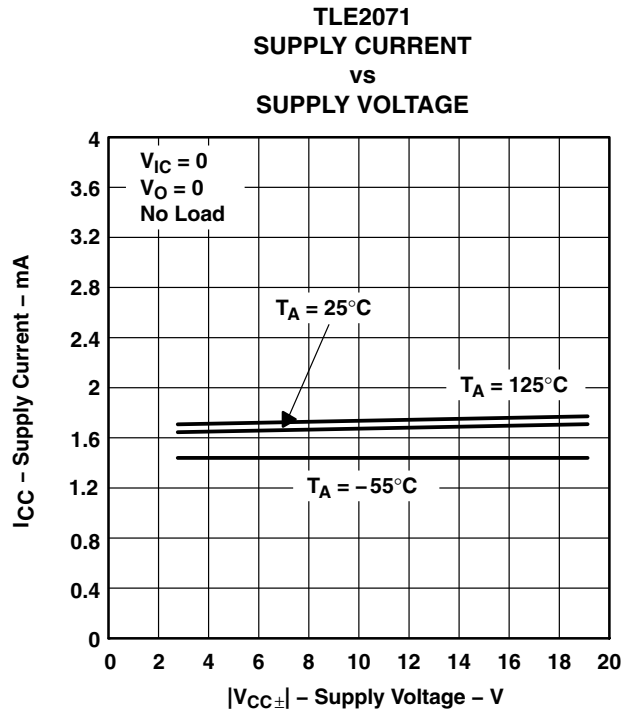


Figure 33

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

TYPICAL CHARACTERISTICS



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

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

SLOS181C – FEBRUARY 1997 – REVISED DECEMBER 2009

TYPICAL CHARACTERISTICS

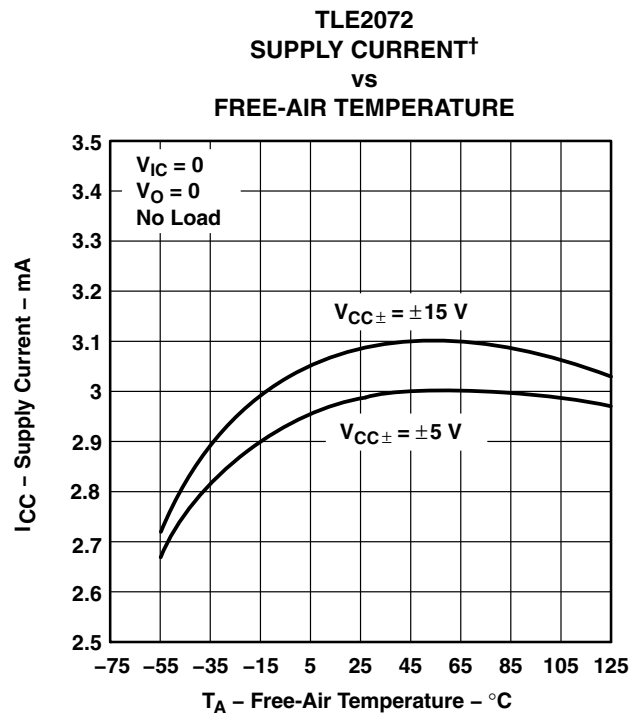


Figure 38

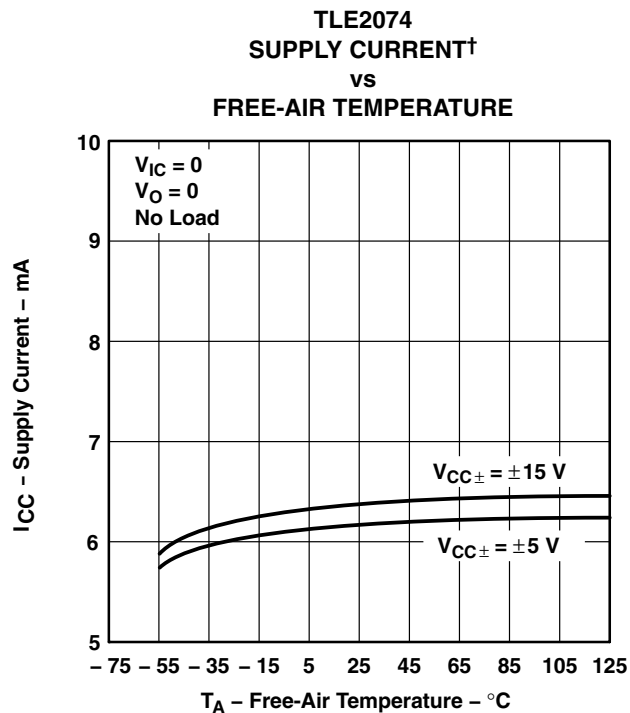


Figure 39

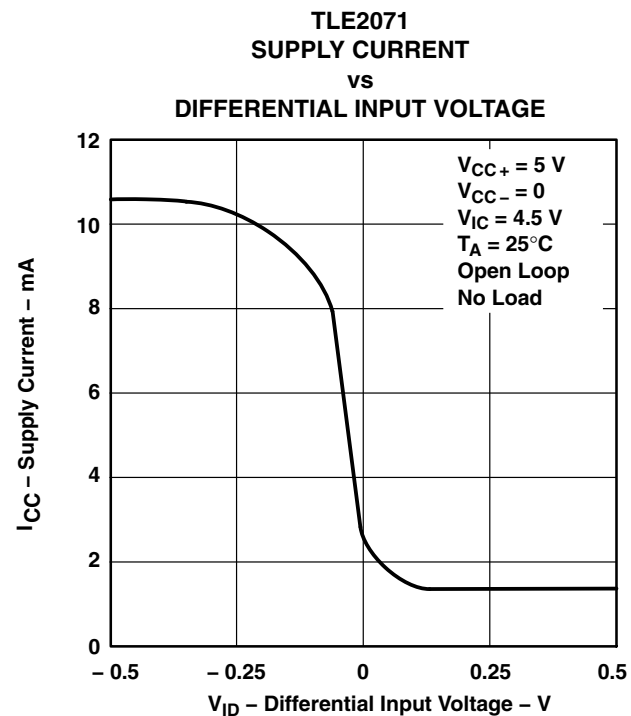


Figure 40

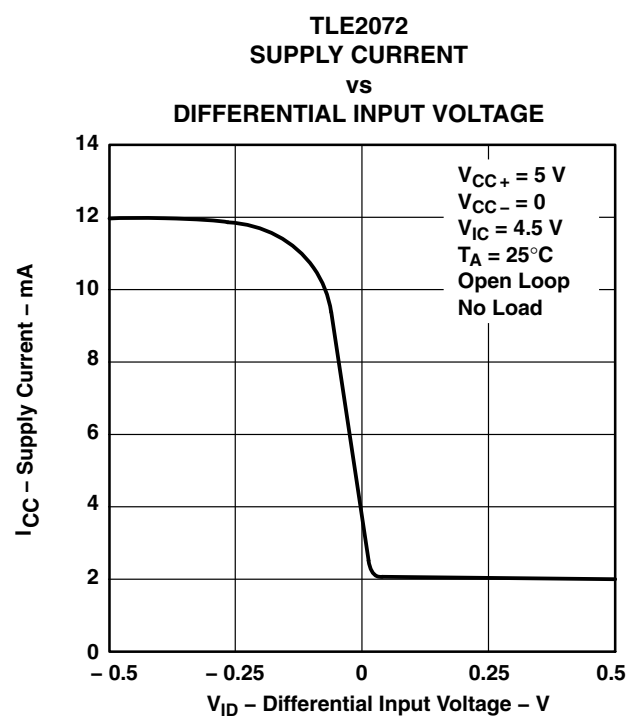
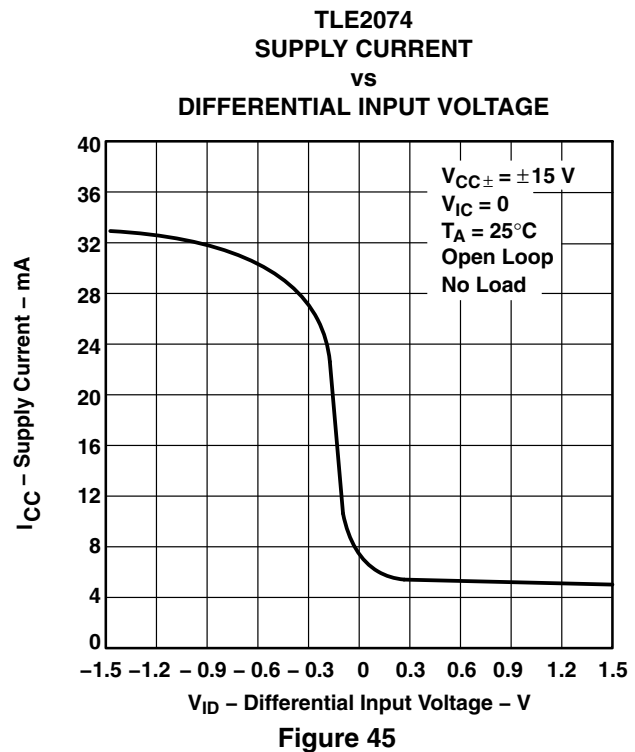
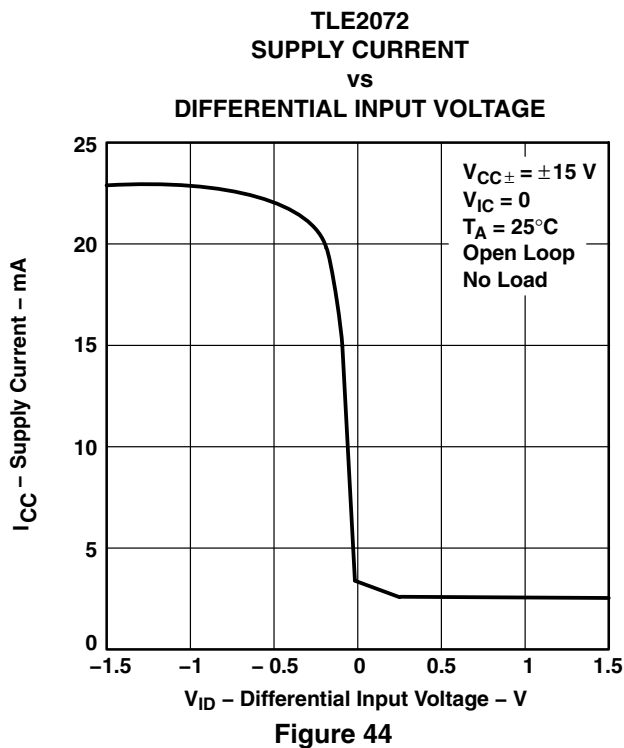
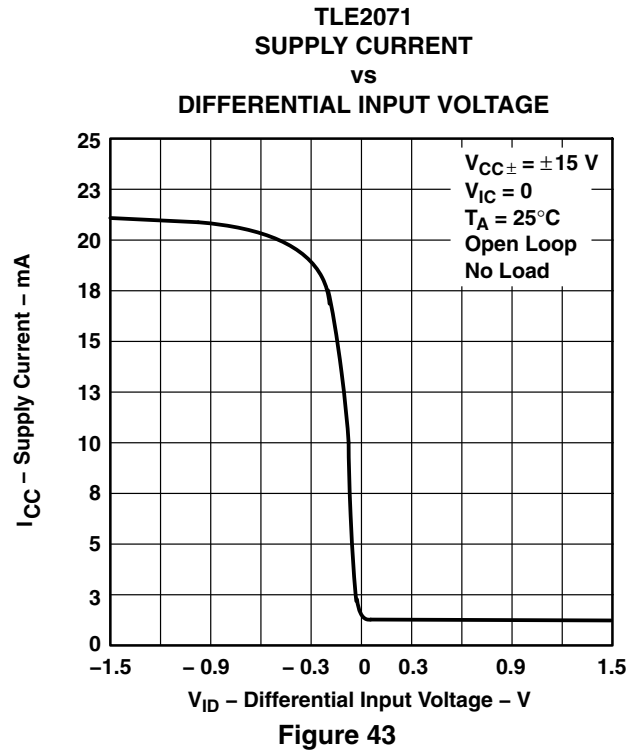
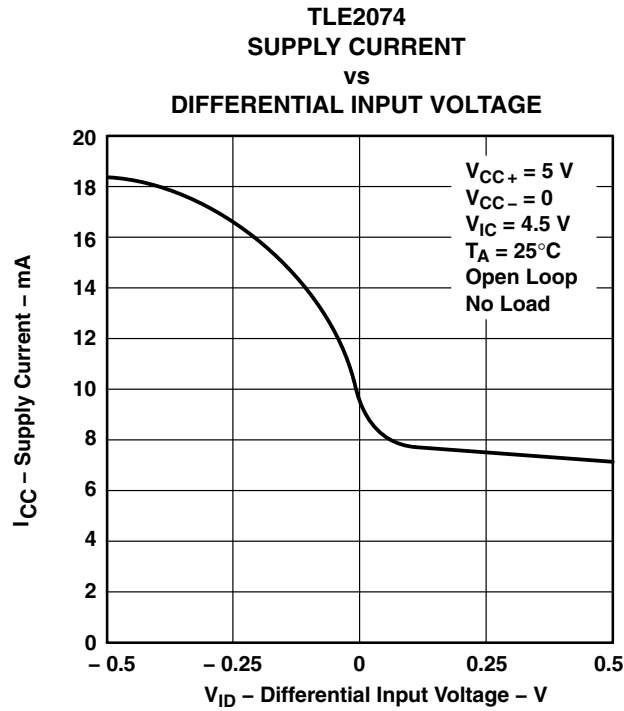


Figure 41

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

TYPICAL CHARACTERISTICS



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

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TYPICAL CHARACTERISTICS

SHORT-CIRCUIT OUTPUT CURRENT
vs
SUPPLY VOLTAGE

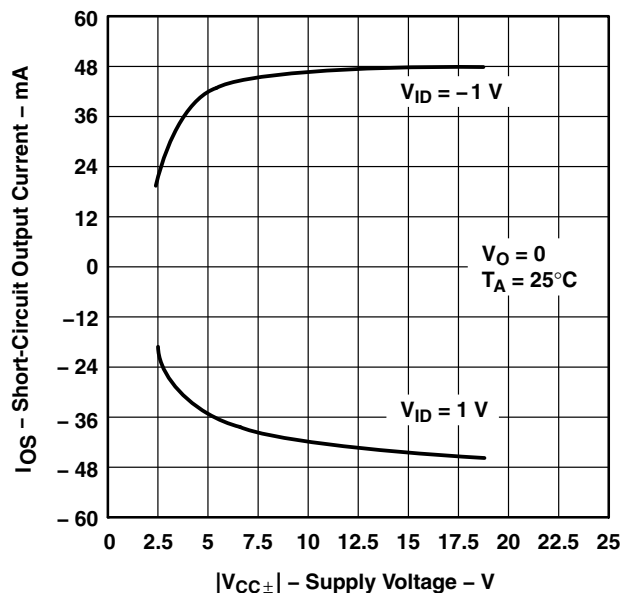


Figure 46

SHORT-CIRCUIT OUTPUT CURRENT
vs
ELAPSED TIME

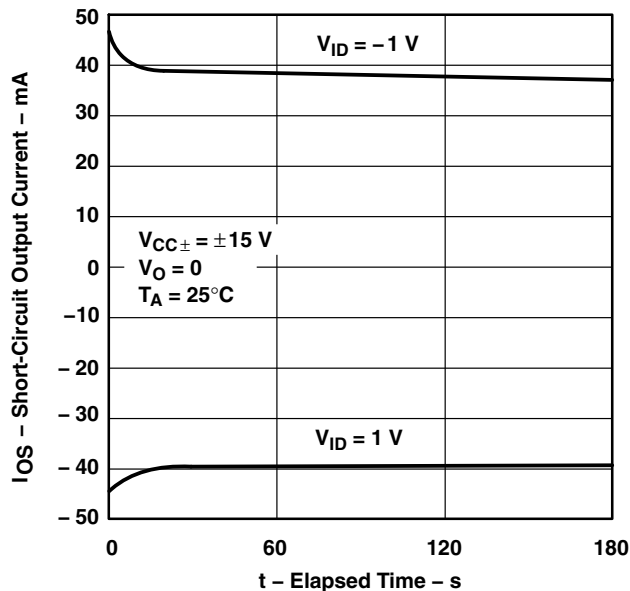


Figure 47

SHORT-CIRCUIT OUTPUT CURRENT†
vs
FREE-AIR TEMPERATURE

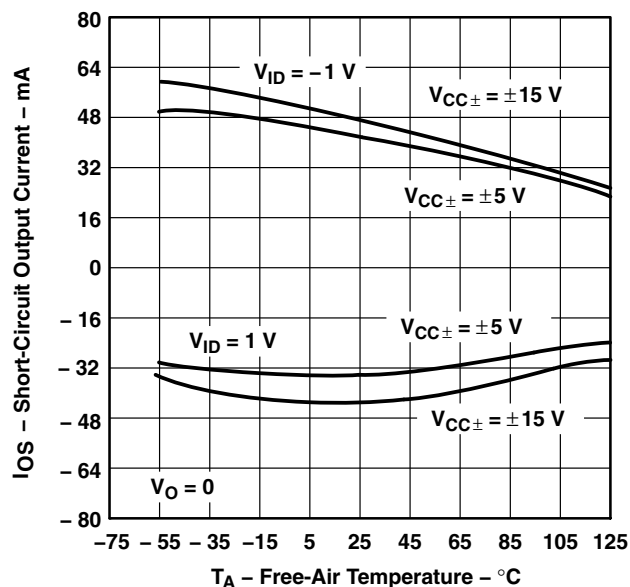


Figure 48

SLEW RATE†
vs
FREE-AIR TEMPERATURE

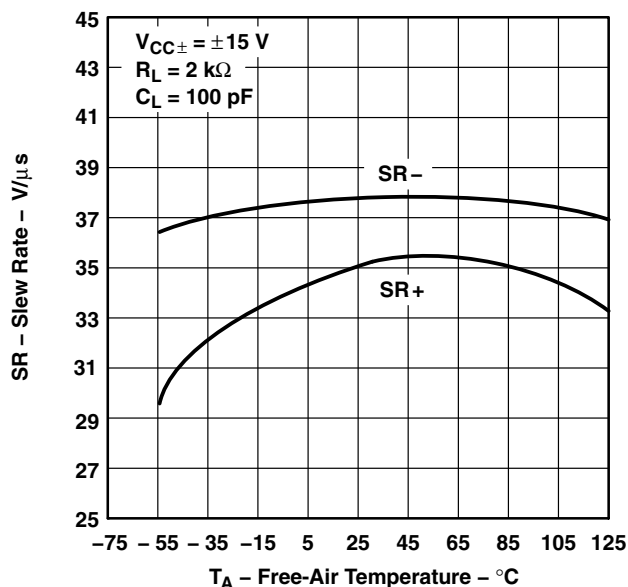


Figure 49

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

TYPICAL CHARACTERISTICS

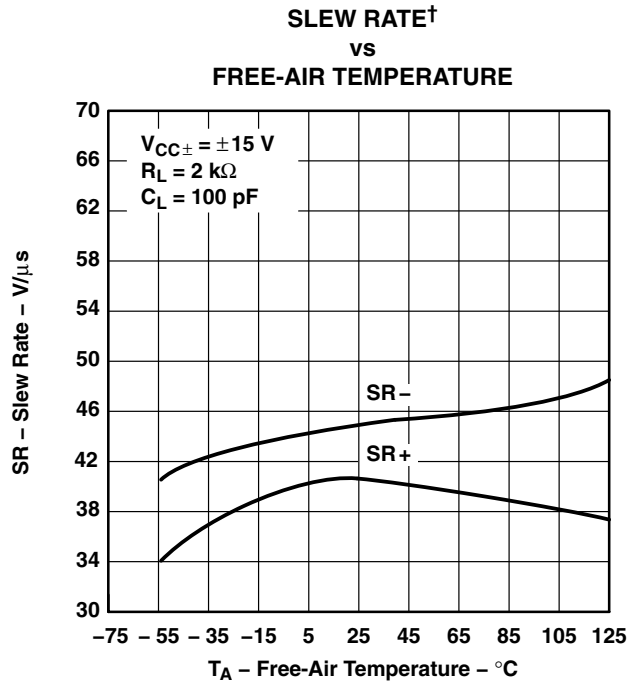


Figure 50

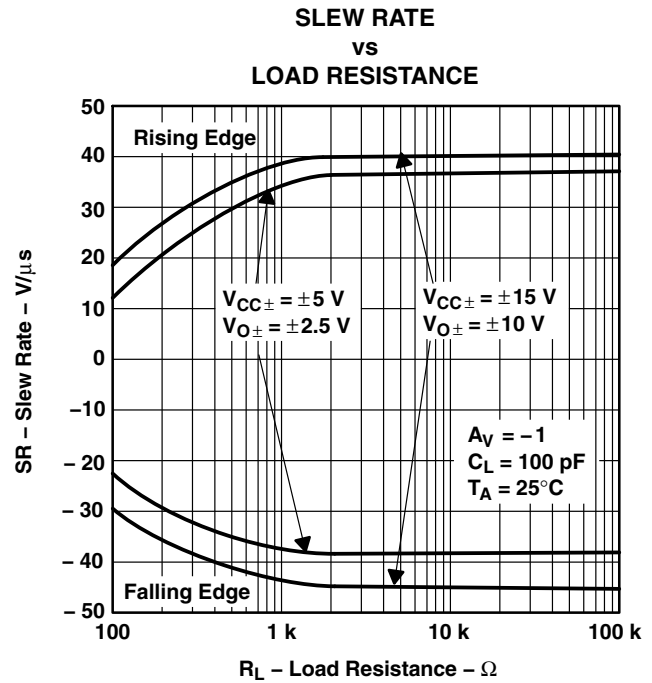


Figure 51

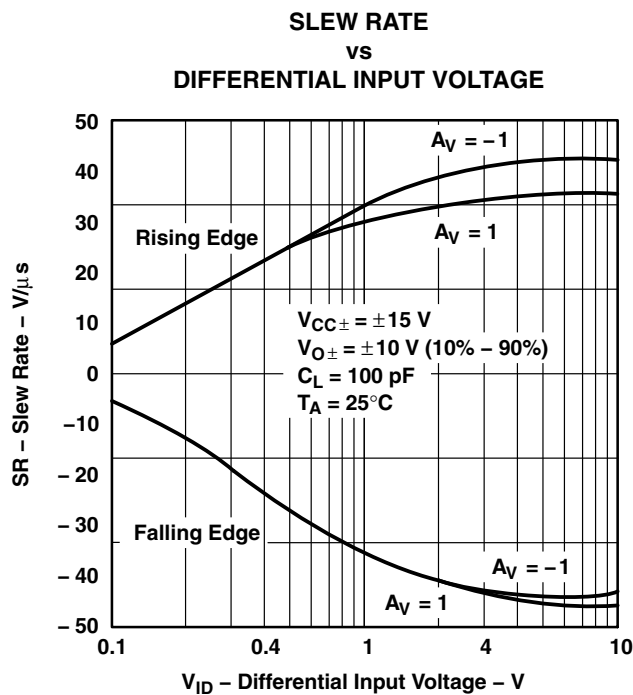


Figure 52

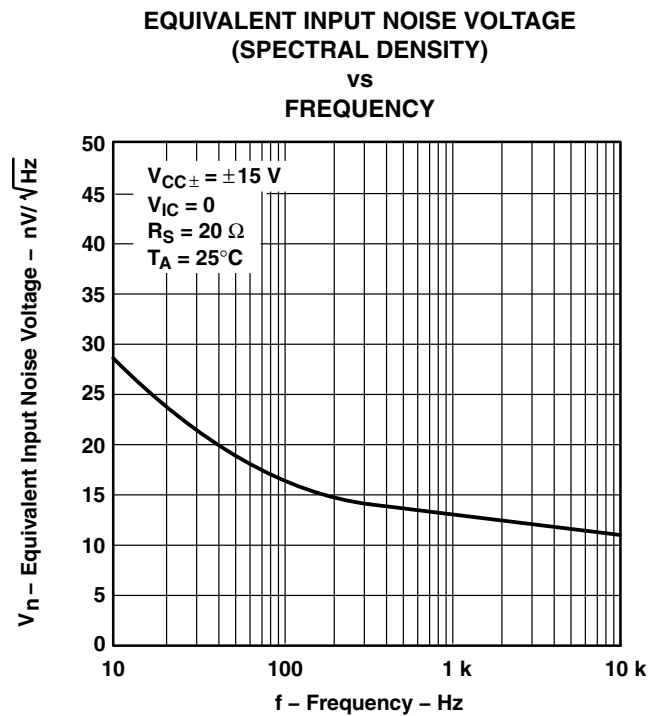


Figure 53

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

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

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TYPICAL CHARACTERISTICS

INPUT-REFERRED NOISE VOLTAGE
vs
NOISE BANDWIDTH

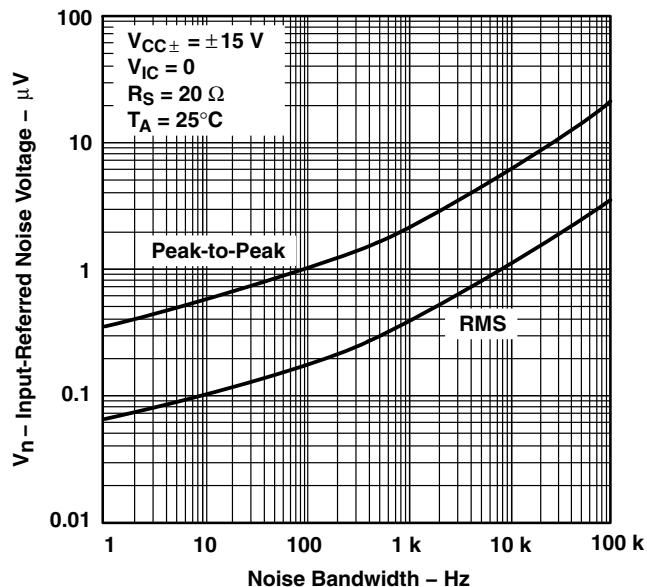


Figure 54

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

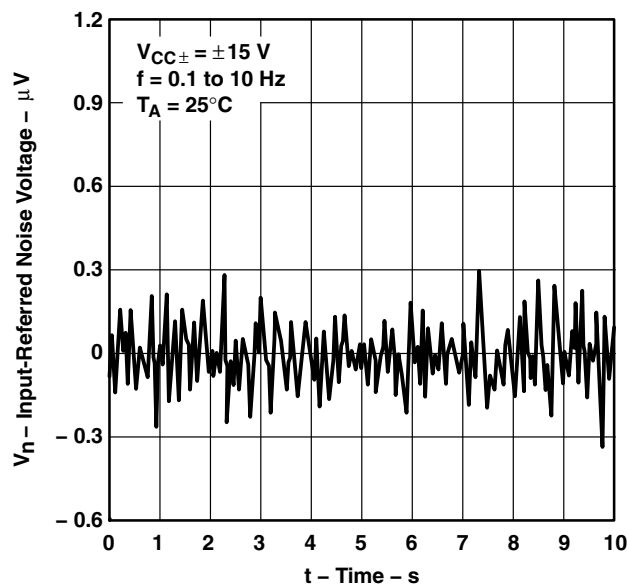


Figure 55

THIRD-OCTAVE SPECTRAL NOISE DENSITY
vs
FREQUENCY BANDS

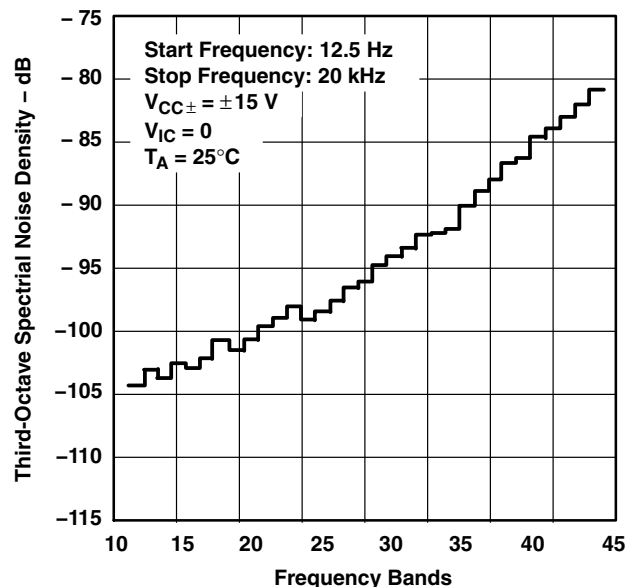


Figure 56

TOTAL HARMONIC DISTORTION PLUS NOISE
vs
FREQUENCY

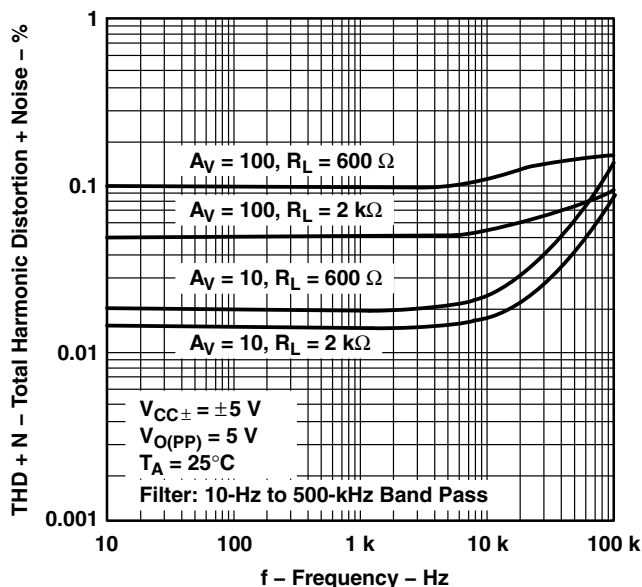


Figure 57

TYPICAL CHARACTERISTICS

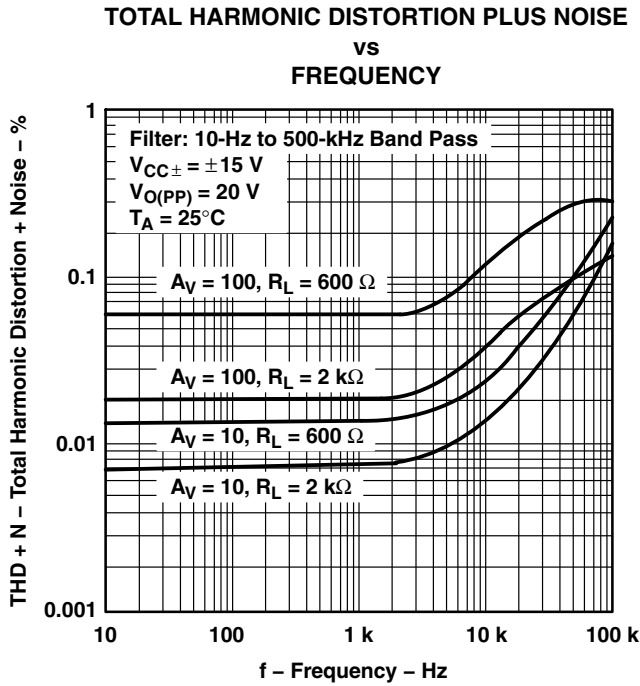


Figure 58

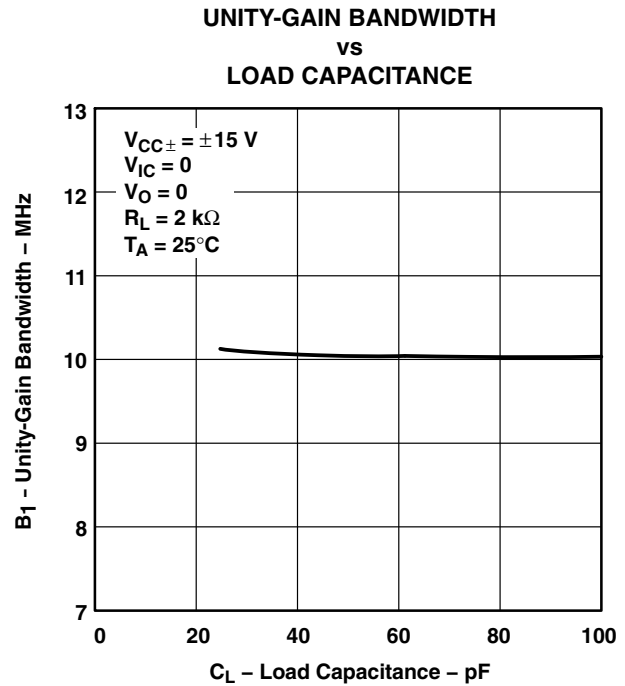


Figure 59

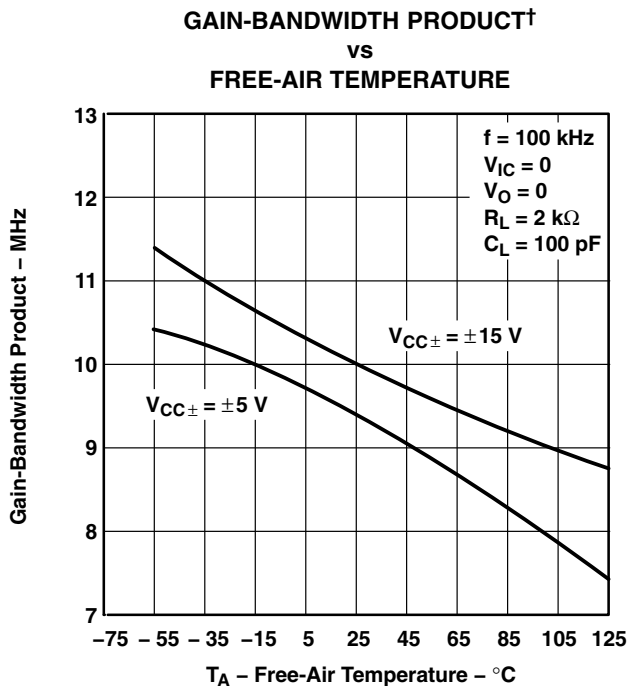


Figure 60

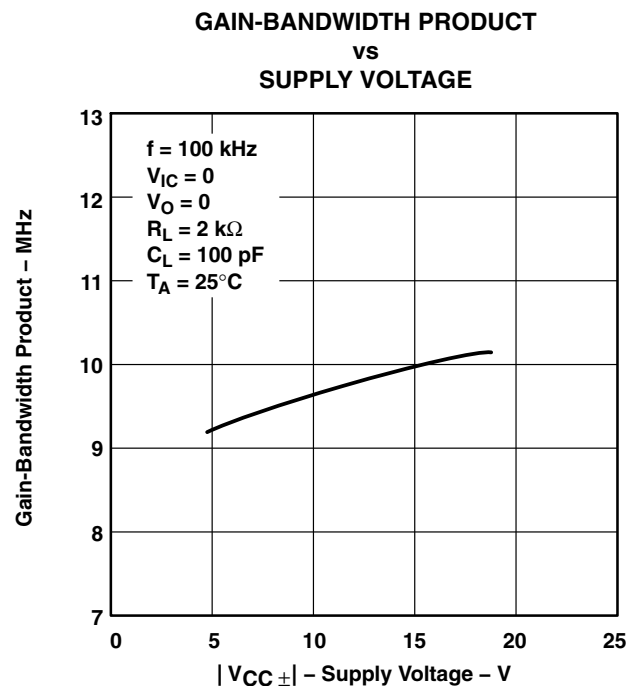


Figure 61

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

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

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TYPICAL CHARACTERISTICS

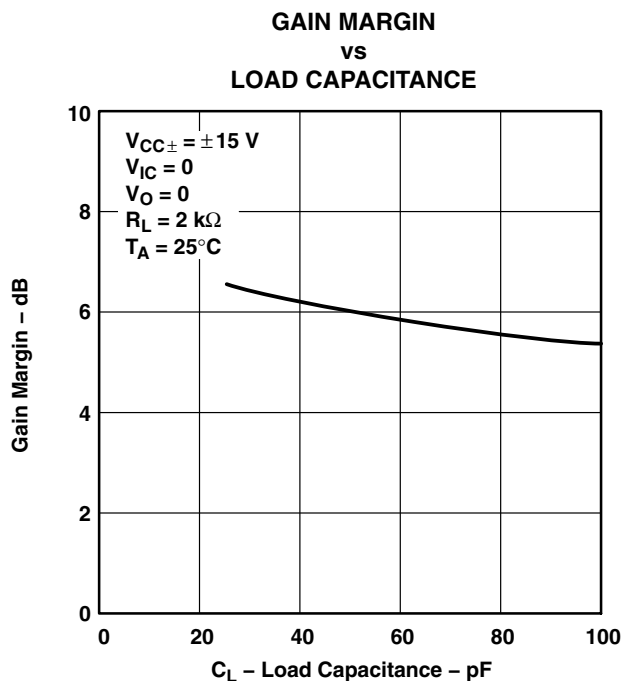


Figure 62

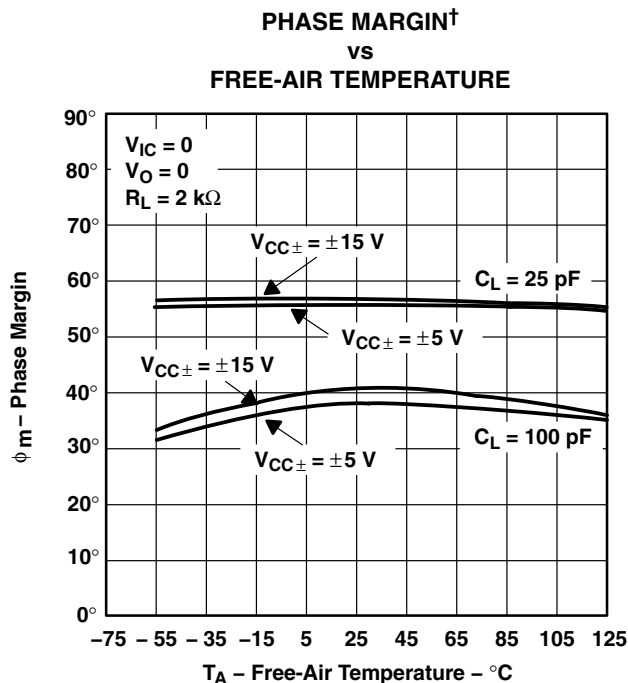


Figure 63

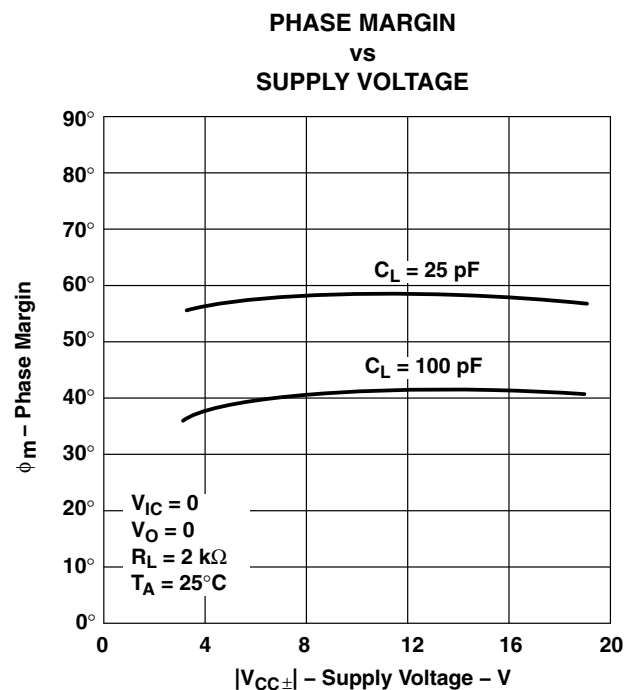


Figure 64

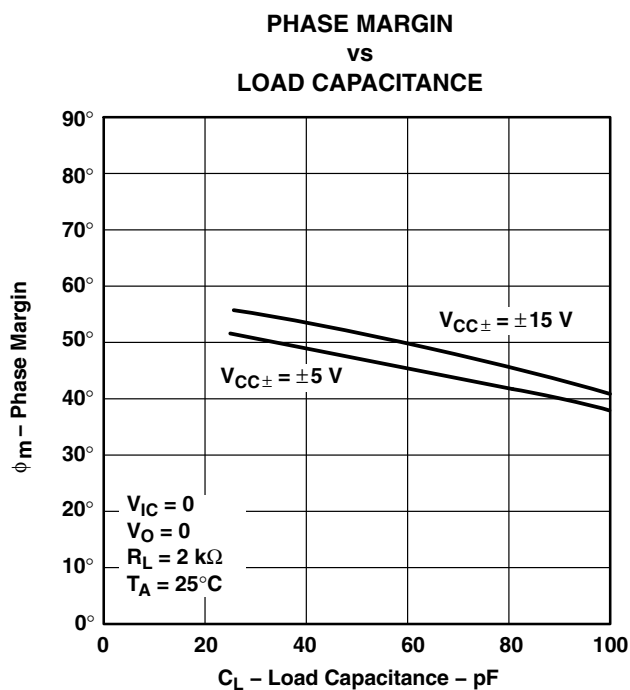


Figure 65

† 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†**

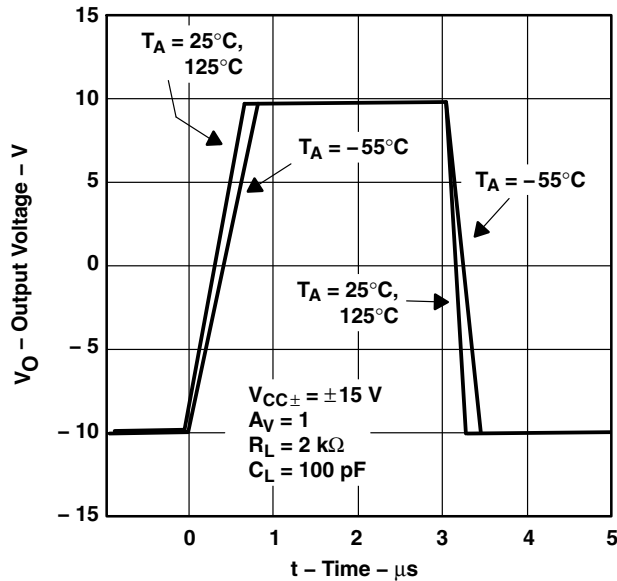


Figure 66

SMALL-SIGNAL PULSE RESPONSE

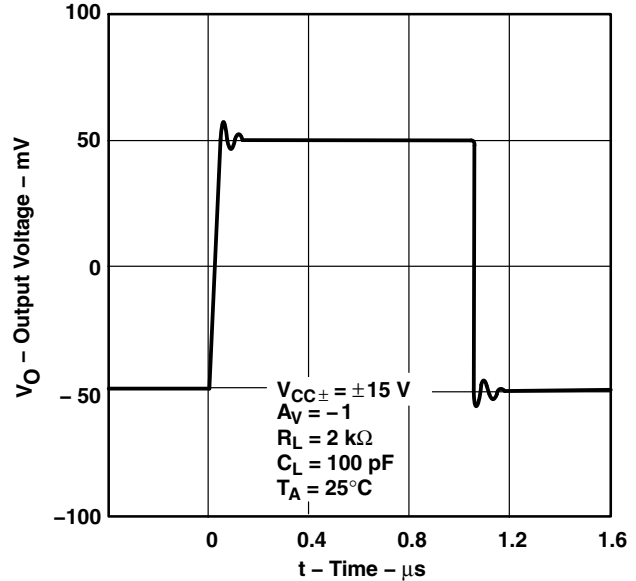


Figure 67

**CLOSED-LOOP OUTPUT IMPEDANCE
vs
FREQUENCY**

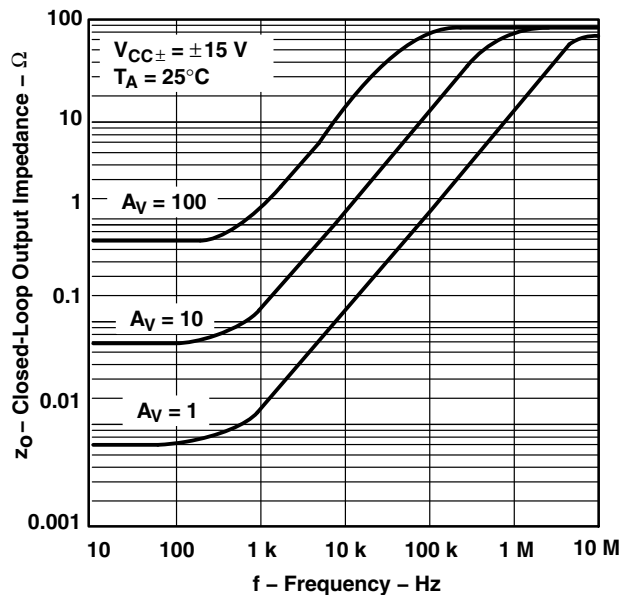


Figure 68

**TLE2072 AND TLE2074
CROSSTALK ATTENUATION
vs
FREQUENCY**

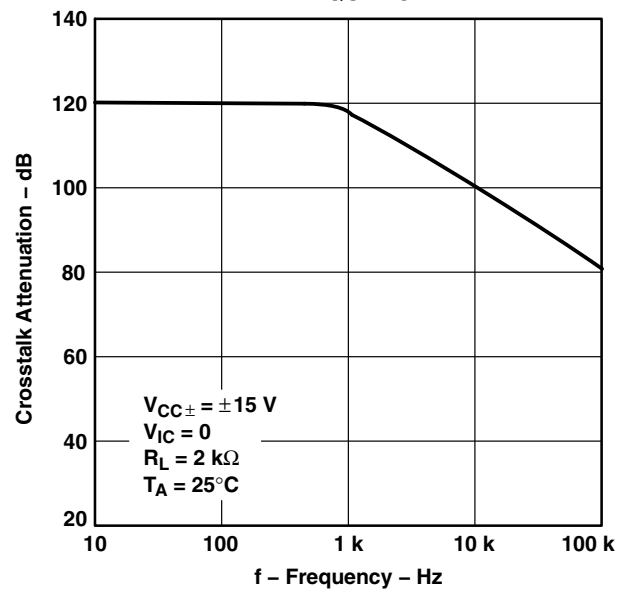


Figure 69

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

TLE207x, TLE207xA 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.

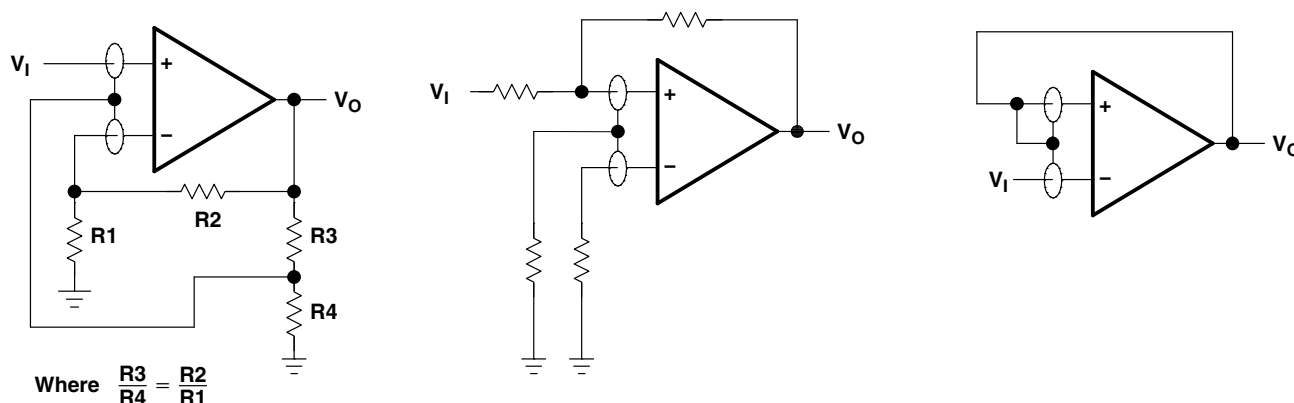


Figure 70. Use of Guard Rings

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.

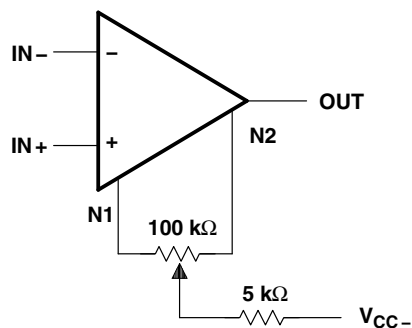


Figure 71. Input Offset Voltage Nulling

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).

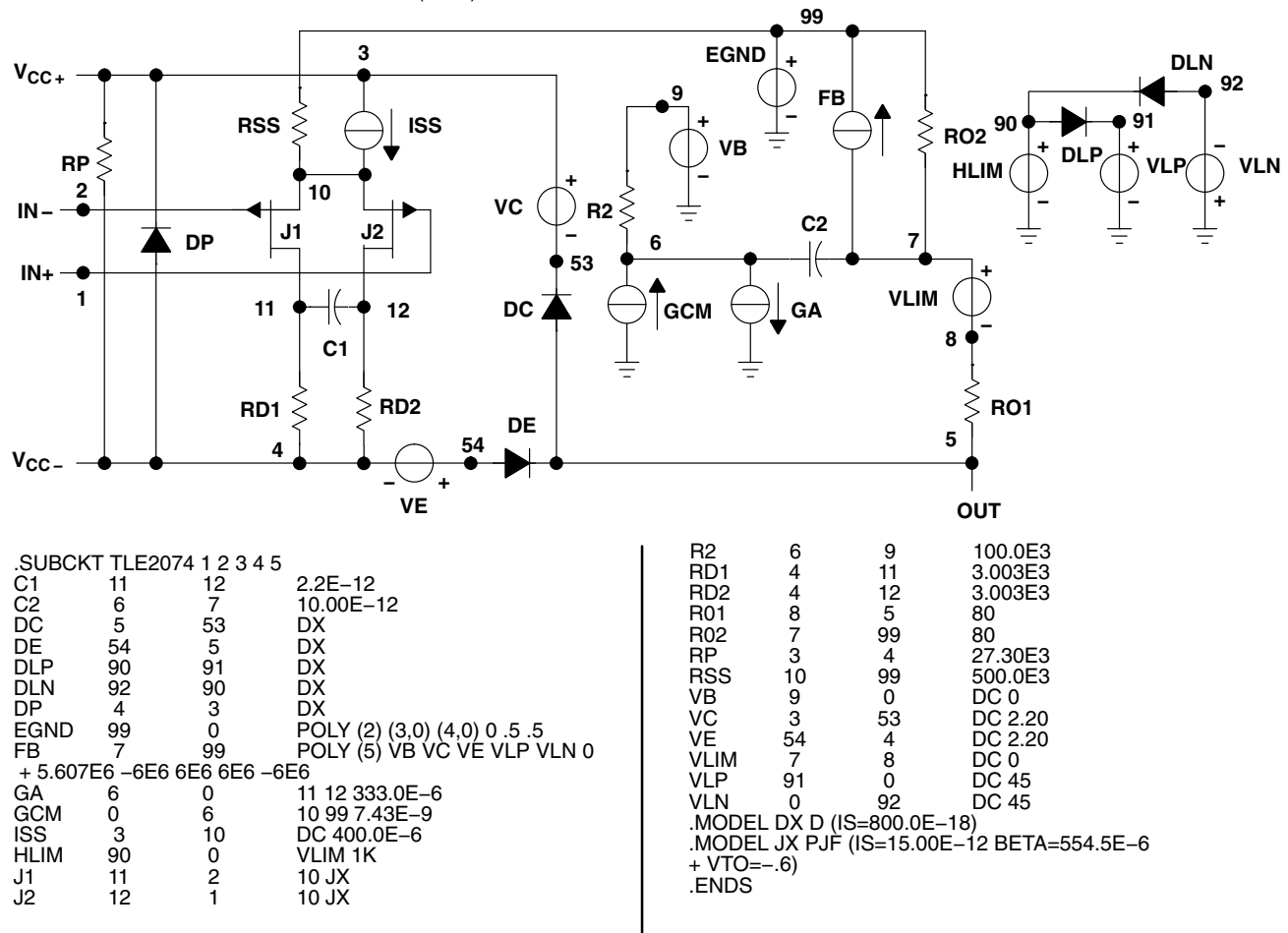


Figure 72. Boyle Macromodel and Subcircuit

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

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Revision History

| Version | Date | Changes |
|---------|----------|--|
| C | Dec-2009 | <ul style="list-style-type: none">– For TLE2071M/1AM (VCC $\pm 5V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 16– For TLE2071M/1AM (VCC $\pm 15V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 18– For TLE2072M/2AM (VCC $\pm 5V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 29– For TLE2072M/2AM (VCC $\pm 15V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 31– For TLE2074M/4AM (VCC $\pm 5V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 42– For TLE2074M/4AM (VCC $\pm 15V$) changed V_n NOM & MAX from 28/55 to 48/85 (f = 10 Hz); 11.6/17 to 12/17 (f = 10 KHz), Pg. 44 |



PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/ Ball Finish | MSL Peak Temp ⁽³⁾ | Samples (Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| 5962-9460201Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | Call TI | Call TI | |
| 5962-9460201QHA | ACTIVE | CFP | U | 10 | 1 | TBD | Call TI | Call TI | |
| 5962-9460201QPA | ACTIVE | CDIP | JG | 8 | 1 | TBD | Call TI | Call TI | |
| 5962-9460202Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | Call TI | Call TI | |
| 5962-9460202QHA | ACTIVE | CFP | U | 10 | 1 | TBD | Call TI | Call TI | |
| 5962-9460202QPA | ACTIVE | CDIP | JG | 8 | 1 | TBD | Call TI | Call TI | |
| 5962-9460203Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | Call TI | Call TI | |
| 5962-9460203QCA | ACTIVE | CDIP | J | 14 | 1 | TBD | Call TI | Call TI | |
| 5962-9460203QDA | ACTIVE | CFP | W | 14 | 1 | TBD | Call TI | Call TI | |
| 5962-9460204Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | Call TI | Call TI | |
| 5962-9460204QHA | ACTIVE | CFP | U | 10 | 1 | TBD | Call TI | Call TI | |
| 5962-9460204QPA | ACTIVE | CDIP | JG | 8 | 1 | TBD | Call TI | Call TI | |
| 5962-9460205Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | Call TI | Call TI | |
| 5962-9460205QHA | ACTIVE | CFP | U | 10 | 1 | TBD | Call TI | Call TI | |
| 5962-9460205QPA | ACTIVE | CDIP | JG | 8 | 1 | TBD | Call TI | Call TI | |
| 5962-9460206Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | Call TI | Call TI | |
| 5962-9460206QCA | ACTIVE | CDIP | J | 14 | 1 | TBD | Call TI | Call TI | |
| 5962-9460206QDA | ACTIVE | CFP | W | 14 | 1 | TBD | Call TI | Call TI | |
| TLE2071ACD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071ACDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071ACDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071ACDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071ACP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2071ACPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2071AID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/ Ball Finish | MSL Peak Temp ⁽³⁾ | Samples (Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| TLE2071AIDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071AIDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071AIDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071AIP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2071AIPe4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2071AMFKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | |
| TLE2071AMJG | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2071AMJGB | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2071AMUB | ACTIVE | CFP | U | 10 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2071CD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071CDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071CDR | OBSOLETE | SOIC | D | 8 | | TBD | Call TI | Call TI | |
| TLE2071CP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2071CPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2071ID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071IDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071IDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071IDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2071IP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2071IPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2071MFKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | |
| TLE2071MJG | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2071MJGB | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2071MUB | ACTIVE | CFP | U | 10 | 1 | TBD | A42 | N / A for Pkg Type | |

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/ Ball Finish | MSL Peak Temp ⁽³⁾ | Samples (Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| TLE2072ACD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072ACDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072ACP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2072ACPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2072AID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072AIDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072AIDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072AIDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072AIP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2072AIPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2072AMFKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | |
| TLE2072AMJG | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2072AMJGB | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2072AMUB | ACTIVE | CFP | U | 10 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2072CD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072CDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072CDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072CDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072CP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2072CPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2072ID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072IDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/ Ball Finish | MSL Peak Temp ⁽³⁾ | Samples (Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| TLE2072IDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072IDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2072IP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2072IPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2072MFKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | |
| TLE2072MJG | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2072MJGB | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2072MUB | ACTIVE | CFP | U | 10 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2074ACDW | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2074ACDWG4 | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2074ACDWR | OBSOLETE | SOIC | DW | 16 | | TBD | Call TI | Call TI | |
| TLE2074ACN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2074ACNE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2074AIDW | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2074AIDWG4 | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2074AIDWR | OBSOLETE | SOIC | DW | 16 | | TBD | Call TI | Call TI | |
| TLE2074AIN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2074AINE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2074AMFKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | |
| TLE2074AMJ | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2074AMJB | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2074AMWB | ACTIVE | CFP | W | 14 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2074CDW | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2074CDWG4 | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/ Ball Finish | MSL Peak Temp ⁽³⁾ | Samples (Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|----------------------|------------------------------|-----------------------------|
| TLE2074CDWR | ACTIVE | SOIC | DW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2074CDWRG4 | ACTIVE | SOIC | DW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2074CN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2074CNE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2074IDW | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2074IDWG4 | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2074IDWR | ACTIVE | SOIC | DW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TLE2074IN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2074INE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TLE2074MFKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type | |
| TLE2074MJ | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2074MJB | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 | N / A for Pkg Type | |
| TLE2074MWB | ACTIVE | CFP | W | 14 | 1 | TBD | A42 | N / A for Pkg Type | |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

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

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

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

OBSOLETE: TI has discontinued the production of the device.

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

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

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

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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

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

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OTHER QUALIFIED VERSIONS OF TLE2071, TLE2071A, TLE2071AM, TLE2071M, TLE2072, TLE2072A, TLE2072AM, TLE2072M, TLE2074, TLE2074A, TLE2074AM, TLE2074M :

- Catalog: [TLE2071A](#), [TLE2071](#), [TLE2072A](#), [TLE2072](#), [TLE2074A](#), [TLE2074](#)
- Automotive: [TLE2071-Q1](#), [TLE2071A-Q1](#), [TLE2071A-Q1](#), [TLE2071-Q1](#), [TLE2072-Q1](#), [TLE2072A-Q1](#), [TLE2072A-Q1](#), [TLE2072-Q1](#)
- Military: [TLE2071M](#), [TLE2071AM](#), [TLE2072M](#), [TLE2072AM](#), [TLE2074M](#), [TLE2074AM](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

TAPE AND REEL INFORMATION

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TLE2071ACDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2071AIDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2071IDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2072AIDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2072AIDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2072CDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2072IDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2072IDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2072IDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2074CDWR | SOIC | DW | 16 | 2000 | 330.0 | 16.4 | 10.75 | 10.7 | 2.7 | 12.0 | 16.0 | Q1 |
| TLE2074IDWR | SOIC | DW | 16 | 2000 | 330.0 | 16.4 | 10.75 | 10.7 | 2.7 | 12.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TLE2071ACDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TLE2071AIDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TLE2071IDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TLE2072AIDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TLE2072AIDR | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| TLE2072CDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TLE2072IDR | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| TLE2072IDR | SOIC | D | 8 | 2500 | 367.0 | 367.0 | 35.0 |
| TLE2072IDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TLE2074CDWR | SOIC | DW | 16 | 2000 | 367.0 | 367.0 | 38.0 |
| TLE2074IDWR | SOIC | DW | 16 | 2000 | 367.0 | 367.0 | 38.0 |

JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE



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

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



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

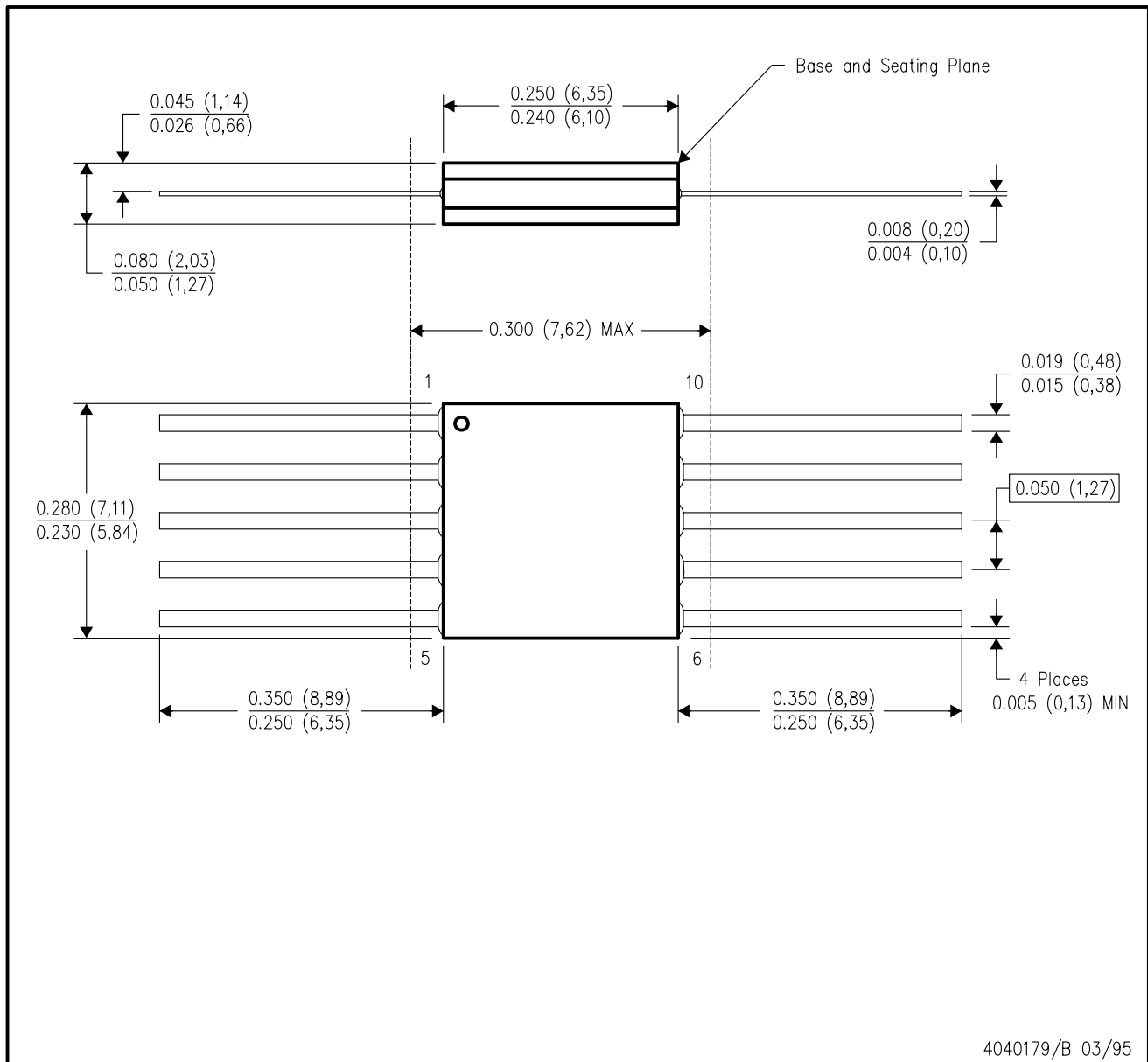


4040083/F 03/03

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

U (S-GDFP-F10)

CERAMIC DUAL FLATPACK



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

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



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

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



| NO. OF TERMINALS ** | A | | B | |
|---------------------------|------------------|------------------|------------------|------------------|
| | MIN | MAX | MIN | MAX |
| 20 | 0.342 (8,69) | 0.358 (9,09) | 0.307 (7,80) | 0.358 (9,09) |
| 28 | 0.442 (11,23) | 0.458 (11,63) | 0.406 (10,31) | 0.458 (11,63) |
| 44 | 0.640 (16,26) | 0.660 (16,76) | 0.495 (12,58) | 0.560 (14,22) |
| 52 | 0.740 (18,78) | 0.761 (19,32) | 0.495 (12,58) | 0.560 (14,22) |
| 68 | 0.938 (23,83) | 0.962 (24,43) | 0.850 (21,6) | 0.858 (21,8) |
| 84 | 1.141 (28,99) | 1.165 (29,59) | 1.047 (26,6) | 1.063 (27,0) |



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - Falls within JEDEC MS-004

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 variation BA.

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



| PINS ** | 14 | 16 | 18 | 20 |
|---------------------|------------------|------------------|------------------|------------------|
| DIM | | | | |
| A MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23,37) | 1.060 (26,92) |
| A MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21,59) | 0.940 (23,88) |
| MS-001 VARIATION | AA | BB | AC | AD |



4040049/E 12/2002

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

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE

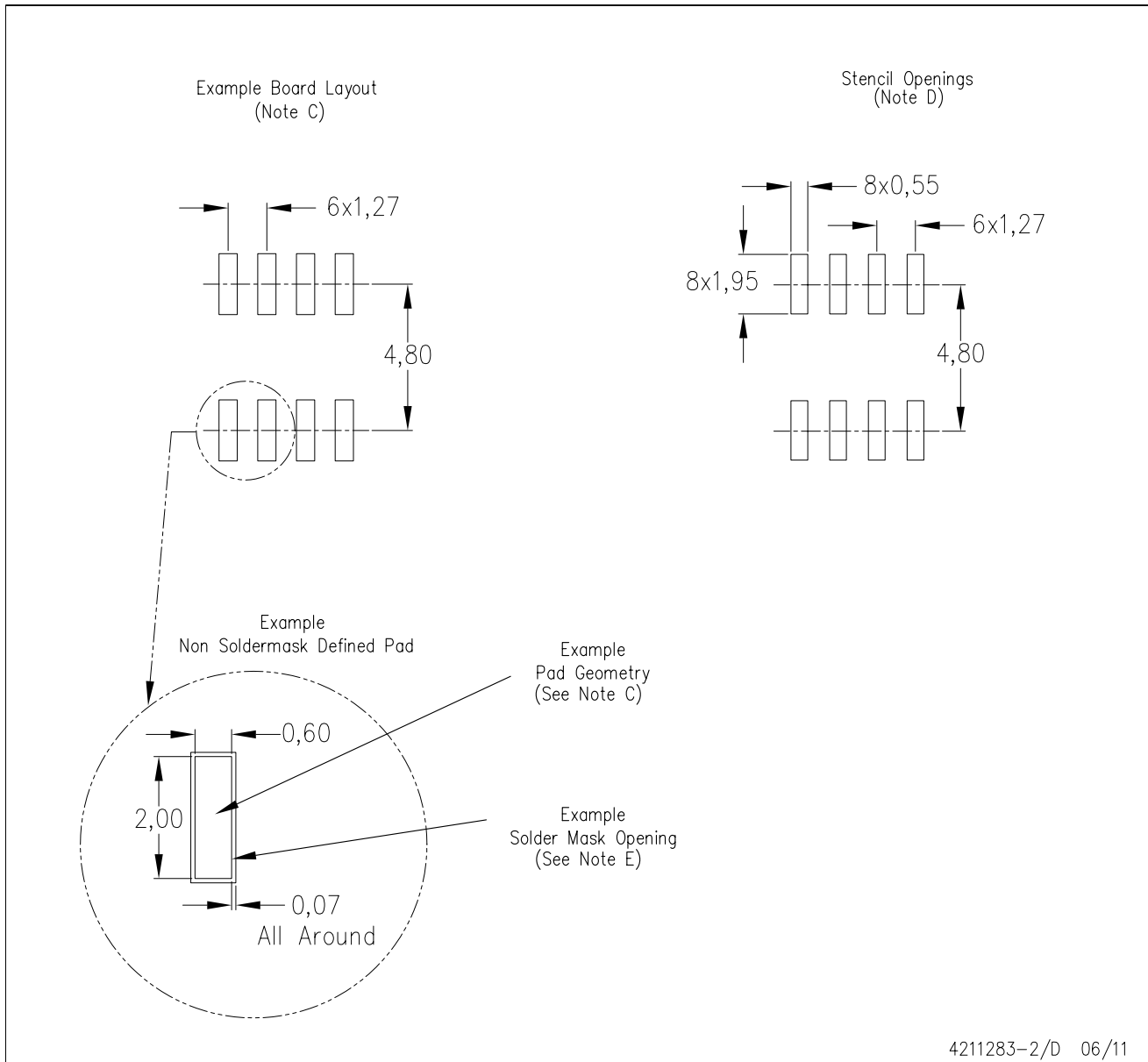


NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- $\triangle C$ Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- $\triangle D$ Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE

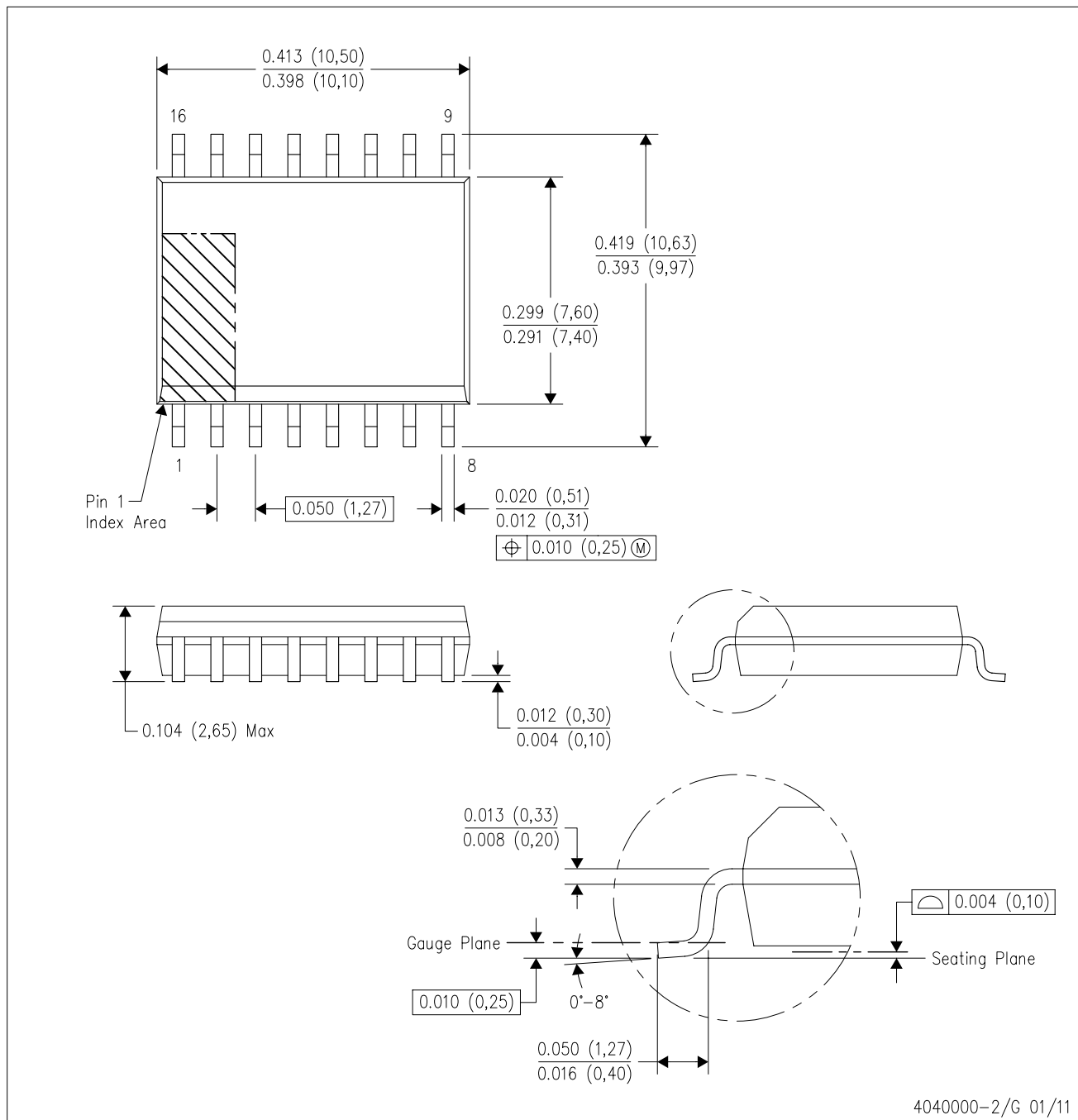


4211283-2/D 06/11

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

DW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-013 variation AA.

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