# TLE206x,TLE206xA, TLE206xB FET-Input High-Output-Drive µPower Operational Amplifiers

## 1 Features

- Wide bandwidth: 1.1MHz GBW
- Low supply current: 120µA/Ch (typical)
- High output drive, specified into 100Ω loads
- Lower noise floor than earlier generations of low-power BiFET

## 2 Applications

- Full authority digital engine control
- Flight control unit
- Analog input module

## 3 Description

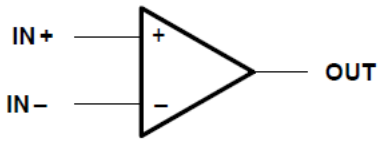
The TLE206x is a family of high voltage (36V) FET-Input operational amplifiers. These devices offer good DC precision and AC performance. This includes low noise floor and high slew rate, making TLE206x family a flexible, general-performance amplifier. TLE206x are available in standard packages PDIP and SOIC.

The TLE206xM, TLE206xAM, TLE206xBM devices use the original design with JFET-input transistors and On-chip Zener trimming of offset voltage. The TLE206xM, TLE206xAM, TLE206xBM are available in CDIP, LCCC and CFP package.

**Package Information**

| PART NUMBER | PACKAGE(1) | PACKAGE SIZE(2) |
|---|---|---|
| TLE2061, TLE2062 | P (PDIP, 8) | 9.81mm × 9.43mm |
| | D (SOIC, 8) | 4.9mm × 6mm |
| TLE2061A | P (PDIP, 8) | 9.81mm × 9.43mm |
| TLE2062A | D (SOIC, 8) | 4.9mm × 6mm |
| TLE2062AM | JG (CDIP, 8) | 9.6mm × 6.67mm |
| | D (SOIC, 8) | 4.9mm × 6mm |
| TLE2064, TLE2064A | N (PDIP, 14) | 19.3mm × 9.4mm |
| | D (SOIC, 14) | 8.65mm × 6mm |
| TLE2064M | FK (LCCC, 20) | 8.89mm × 8.89mm |
| | J (CDIP, 14) | 19.56mm × 6.67mm |
| | D (SOIC, 14) | 8.65mm × 6mm |
| TLE2061M, TLE2061AM | JG (CDIP, 8) | 9.6mm × 6.67mm |
| | FK (LCCC, 20) | 8.89mm × 8.89mm |
| TLE2064BM | J (CDIP, 14) | 19.56mm × 6.67mm |
| | FK (LCCC, 20) | 8.89mm × 8.89mm |
| TLE2061BM, TLE2062BM, TLE2062M | JG (CDIP, 8) | 9.6mm × 6.67mm |
| TLE2064AM | J (CDIP, 14) | 19.56mm × 6.67mm |
| | CFP (W, 14) | 9.21mm × 6.3mm |
| | FK (LCCC, 20) | 8.89mm × 8.89mm |
| | D (SOIC, 14) | 8.65mm × 6mm |

(1) For more information, see Section 10.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.




**Symbol**

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# 4 Available Options

**Table 4-1. TLE2061 Available Options**

| PACKAGED DEVICES | | | | | |
|---|---|---|---|---|---|
| $T_A$ | $V_{IOmax}$ at 25°C | SMALL OUTLINE (D) (1) | CHIP CARRIER (FK) | CERAMIC DIP (JG) | PLASTIC DIP (P) |
| 0°C to 70°C | 500µV | — | — | — | — |
| | 1.5mV | TLE2061ACD | — | — | TLE2061ACP |
| | 3mV | TLE2061CD | — | — | TLE2061CP |
| –40°C to 85°C | 500µV | — | — | — | — |
| | 1.5mV | TLE2061AID | — | — | TLE2061AIP |
| | 3mV | TLE2061D | — | — | TLE2061IP |
| – 55°C to 125°C | 500µV | — | — | TLE2061BMJG | — |
| | 1.5mV | | TLE2061AMFK | TLE2061AMJG | — |
| | 3mV | | TLE2061MFK | TLE2061MJG | — |

(1) The D packages are available taped and reeled. Add R suffix to device type (that is, TLE2061ACDR). Chips are tested at 25°C.

**Table 4-2. TLE2062 Available Options**

| PACKAGED DEVICES | | | | | |
|---|---|---|---|---|---|
| $T_A$ | $V_{IOmax}$ at 25°C | SMALL OUTLINE (D)(1) | CHIP CARRIER (FK) | CERAMIC DIP (JG) | PLASTIC DIP (P) |
| 0°C to 70°C | 1mV | TLE2062BCD | — | — | TLE2062BCP |
| | 2mV | TLE2062ACD | — | — | TLE2062ACP |
| | 4mV | TLE2062CD | — | — | TLE2062CP |
| – 40°C to 85°C | 1mV | TLE2062BID | — | — | TLE2062BIP |
| | 2mV | TLE2062AID | — | — | TLE2062AIP |
| | 4mV | TLE2062ID | — | — | TLE2062IP |
| – 55°C to 125°C | 1mV | | — | TLE2062BMJG | — |
| | 2mV | TLE2062AMD | TLE2062AMFK | TLE2062AMJG | — |
| | 4mV | | TLE2062MFK | TLE2062MJG | — |

(1) The D packages are available taped and reeled. Add R suffix to device type (that is, TLE2082ACDR).

**Table 4-3. TLE2064 Available Options**

| PACKAGED DEVICES | | | | | | |
|---|---|---|---|---|---|---|
| $T_A$ | $V_{IOmax}$ at 25°C | SMALL OUTLINE (D)(1) | CHIP CARRIER (FK) | CERAMIC DIP (J) | PLASTIC DIP (N) | CERAMIC FLAT PACK (W) |
| 0°C to 70°C | 2mV | — | | | TLE2064BCN | |
| | 4mV | TLE2064ACD | — | — | TLE2064ACN | — |
| | 6mV | TLE2064CD | | | TLE2064CN | |
| -40°C to 85°C | 2mV | — | | | TLE2064BIN | |
| | 4mV | TLE2064AID | — | — | TLE2064AIN | — |
| | 6mV | TLE2064ID | | | TLE2064IN | |
| -55°C to 125°C | 2mV | — | TLE2064BMFK | TLE2064BMJ | | — |
| | 4mV | TLE2064AMD | TLE2064AMFK | TLE2064AMJ | — | TLE2064AMW |
| | 6mV | TLE2064MD | TLE2064MFK | TLE2064MJ | | TLE2064MW |

(1) The D packages are available taped and reeled. Add R suffix to device type, (that is, TLE2064ACDR)

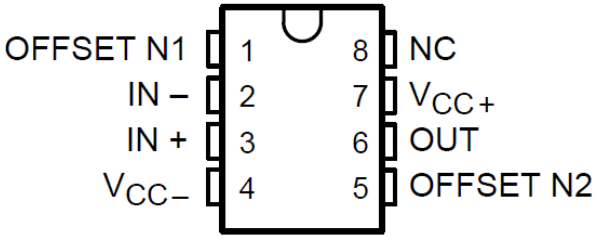



**Figure 4-1. TLE2061M, TLE2061xM, JG Package, (Top View)**

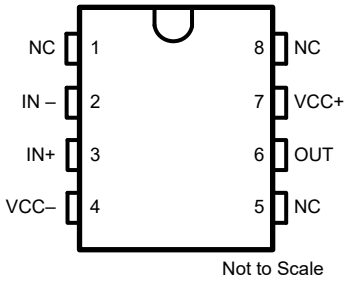



**Figure 4-2. TLE2061, TLE2061A,D, P Package (Top View)**

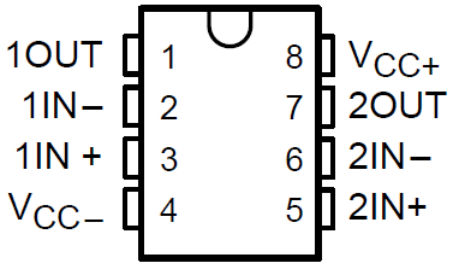



**Figure 4-3. TLE2062, TLE2062A, and TLE2062B D, JG, or P Package (Top View)**

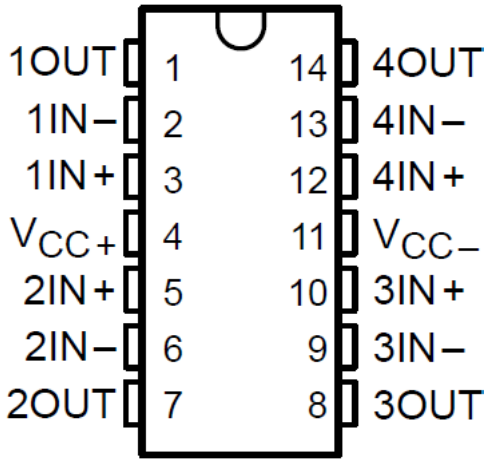



**Figure 4-4. TLE2064, TLE2064A, and TLE2064B D, J, N, or W Package (Top View)**

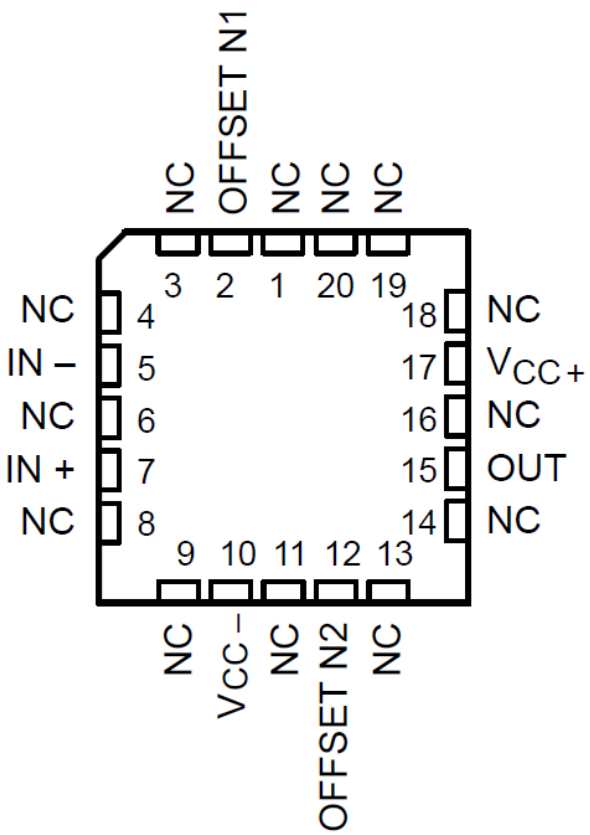



**Figure 4-5. TLE2061M, TLE2061AM, and TLE2061BM FK Package (Top View)**

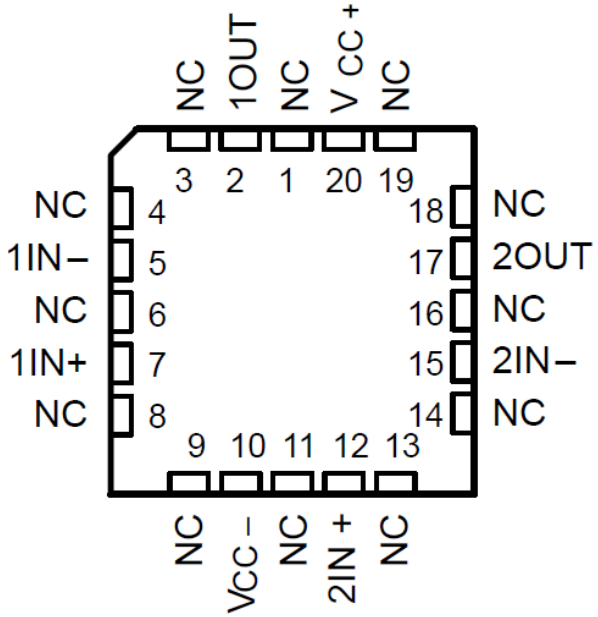



**Figure 4-6. TLE2062M, TLE2062AM, and TLE2062BM FK Package (Top View)**

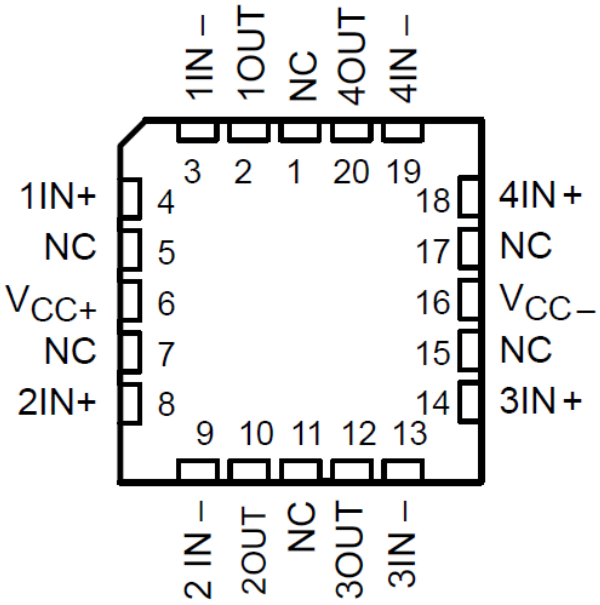



**Figure 4-7. TLE2064M, TLE2064AM, and TLE2064BM FK Package (Top View)**

# 5 Specifications

## 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC+}$ −($V_{CC–}$) | Supply voltage(2) | | 0 | 38 | V |
| $V_{ID}$ | Differential input voltage range(3) | | | $V_{CC}$ +0.2V | V |
| $V_I$ | Input voltage range (any input) | | $V_{CC–}$ | $V_{CC+}$ | |
| $I_I$ | Input current | | -1 | 1 | mA |
| | Duration of short-circuit current at (or below) 25°C(4) | | | Continous | |
| $T_A$ | Operating free-air temperature range | C suffix | 0 | 70 | °C |
| | | I suffix | –40 | 85 | |
| | | M suffix | –55 | 125 | |
| $T_{stg}$ | Storage temperature | | -65 | 150 | °C |
| | Case temperature for 60 seconds | FK package | | 260 | °C |
| | Lead temperature 1,6mm (1/16 inch) from case for 10 seconds | | | 260 | °C |
| | Lead temperature 1,6mm (1/16 inch) from case for 60 seconds | JG package | | 300 | °C |
| | | U | | | |
| | | W | | | |

(1) Stresses beyond those listed under *Absolute Maximum Ratings* can 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 can affect device reliability.
(2) All voltage values are with respect to network ground terminal GND.
(3) Differential voltages are at IN+ with respect to IN –.
(4) Short-circuit to ground, one amplifier per package. Extended short-circuit current, especially with higher supply voltage, can cause excessive heating and eventual destruction.

## 5.2 Recommended Operating Conditions

| | | | C SUFFIX | | I SUFFIX | | M SUFFIX | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| $V_{CC\pm}$ | Supply voltage | | ±3.5 | ±18 | ±3.5 | ±18 | ±3.5 | ±18 | V |
| $V_{IC}$ | Common-mode input voltage, | $V_{CC\pm}$ = ± 5V | –1.6 | 4 | –1.6 | 4 | –1.6 | 4 | V |
| | | $V_{CC\pm}$ = ±15V | –11 | 13 | –11 | 13 | –11 | 13 | |
| $T_A$ | Operating free-air temperature | | 0 | 70 | –40 | 85 | –55 | 125 | °C |

## 5.3 TLE2061C Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | $T_A$ [1] | TLE2061C TLE2061AC TLE2061BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2061C | $V_{IC}$ = 0, $R_S$ = 50Ω | 25°C | | 0.1 | 3.1 | mV |
| | | | | Full range | | | 4 | |
| | | TLE2061AC | | 25°C | | 0.1 | 2.6 | |
| | | | | Full range | | | 3.5 | |
| | | TLE2061BC | | 25°C | | 0.1 | 1.9 | |
| | | | | Full range | | | 2.4 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | 25°C | | ±5 | | pA |
| | | | | Full range | | | 0.8 | nA |
| $I_{IB}$ | Input bias current | | | 25°C | | ±10 | | pA |
| | | | | Full range | | | 2 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | 25°C | -1.6 to 4 | -2 to 6 | | V |
| | | | | Full range | -1.6 to 4 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | 25°C | 3.5 | 4.9 | | V |
| | | | | Full range | 3.3 | | | |
| | | | $R_L$ = 100kΩ | 25°C | 2.5 | 4.5 | | V |
| | | | | Full range | 2 | | | |
| $V_{OM–}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | 25°C | –3.7 | –4.9 | | V |
| | | | | Full range | –3.3 | | | |
| | | | $R_L$ = 100kΩ | 25°C | –2.5 | –4.5 | | V |
| | | | | Full range | –2 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±2.8V $R_L$ = 10Ω | 25°C | 15 | 225 | | V/mV |
| | | | | Full range | 2 | | | |
| | | | $V_O$ = 0 to 2V $R_L$ = 100Ω | 25°C | 0.75 | 225 | | |
| | | | | Full range | 0.5 | | | |
| | | | $V_O$ = 0 to -2V $R_L$ = 100Ω | 25°C | 0.5 | 225 | | |
| | | | | Full range | 0.25 | | | |
| $Z_{ID}$ | Differential | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | 25°C | | 575 | | Ω |

## 5.3 TLE2061C Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2061C TLE2061AC TLE2061BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 65 | 82 | | dB |
| | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 135 | | dB |
| | | $R_S$ = 50Ω | | Full range | 75 | | | |
| $I_{CC}$ | Supply current | $V_O$ = 0, | No load | 25°C | | 120 | 325 | µA |
| | | | | Full range | | | 350 | |

(1) Full range is 0°C to 70°C.

## 5.4 TLE2061C Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2061C TLE2061AC TLE2061BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.2 | 4 | | V/µs |
| | | | | Full range | 2.1 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 59 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 43 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 140 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is 0°C to 70°C.

## 5.5 TLE2061C Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | | $T_A$ [1] | TLE2061C TLE2061AC TLE2061BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2061C | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 0.1 | 3 | mV |
| | | | | | Full range | | | 3.9 | |
| | | TLE2061AC | | | 25°C | | 0.1 | 1.5 | |
| | | | | | Full range | | | 2.5 | |
| | | TLE2061BC | | | 25°C | | 0.1 | 0.5 | |
| | | | | | Full range | | | 1 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | | 25°C | | ±5 | | pA |
| | | | | | Full range | | | 1 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | ±10 | | pA |
| | | | | | Full range | | | 3 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -11 to 13 | -12 to 16 | | V |
| | | | | | Full range | -11 to 13 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | 13.2 | 14.9 | | V |
| | | | | | Full range | 13 | | | |
| | | | $R_L$ = 600Ω | | 25°C | 12.5 | 14.5 | | V |
| | | | | | Full range | 12 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | –13.7 | –14.9 | | V |
| | | | | | Full range | –13 | | | |
| | | | $R_L$ = 600kΩ | | 25°C | –12.5 | –14.5 | | V |
| | | | | | Full range | –12 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±10 V | $R_L$ = 10kΩ | 25°C | 30 | 225 | | V/mV |
| | | | | | Full range | 20 | | | |
| | | | $V_O$ = 0 to 8V | $R_L$ = 600Ω | 25°C | 25 | 225 | | |
| | | | | | Full range | 10 | | | |
| | | | $V_O$ = 0 to -8V | $R_L$ = 600Ω | 25°C | 3 | 225 | | |
| | | | | | Full range | 1 | | | |
| $Z_{ID}$ | Differential | | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | | 25°C | | 575 | | Ω |
| CMRR | Common-mode rejection ratio | | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 72 | 90 | | dB |
| | | | | | Full range | 70 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 93 | | dB |
| | | | $R_S$ = 50Ω | | Full range | 75 | | | |
| $I_{CC}$ | Supply current | | $V_O$ = 0, | No load | 25°C | | 125 | 350 | µA |
| | | | | | Full range | | | 375 | |

(1) Full range is 0°C to 70°C.

## 5.6 TLE2061C Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2061C TLE2061AC TLE2061BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.6 | 4 | | V/µs |
| | | | | Full range | 2.5 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 70 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 40 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1.1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 40 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is 0°C to 70°C.

## 5.7 TLE2061I Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | | $T_A$ (1) | TLE2061I TLE2061AI TLE2061BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2061I | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 0.1 | 3.1 | mV |
| | | | | | Full range | | | 4.4 | |
| | | TLE2061AI | | | 25°C | | 0.1 | 2.6 | |
| | | | | | Full range | | | 3.9 | |
| | | TLE2061BI | | | 25°C | | 0.1 | 1.9 | |
| | | | | | Full range | | | 2.7 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | | 25°C | | ±5 | | pA |
| | | | | | Full range | | | 2 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | ±10 | | pA |
| | | | | | Full range | | | 4 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -1.6 to 4 | -2 to 6 | | V |
| | | | | | Full range | -1.6 to 4 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | 3.5 | 4.9 | | V |
| | | | | | Full range | 3.1 | | | |
| | | | $R_L$ = 100kΩ | | 25°C | 2.5 | 4.5 | | V |
| | | | | | Full range | 2 | | | |

## 5.7 TLE2061I Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2061I TLE2061AI TLE2061BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | $R_L$ = 10kΩ | | 25°C | –3.7 | –4.9 | | V |
| | | | | Full range | –3.1 | | | |
| | | $R_L$ = 100kΩ | | 25°C | –2.5 | –4.5 | | V |
| | | | | Full range | –2 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O$ = ±2.8V | $R_L$ = 10Ω | 25°C | 15 | 225 | | V/mV |
| | | | | Full range | 2 | | | |
| | | $V_O$ = 0 to 2V | $R_L$ = 100Ω | 25°C | 0.75 | 225 | | |
| | | | | Full range | 0.5 | | | |
| | | $V_O$ = 0 to -2V | $R_L$ = 100Ω | 25°C | 0.5 | 225 | | |
| | | | | Full range | 0.25 | | | |
| $Z_{ID}$ | Differential | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | $I_O$ = 0 | | 25°C | | 575 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 65 | 82 | | dB |
| | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 135 | | dB |
| | | $R_S$ = 50Ω | | Full range | 65 | | | |
| $I_{CC}$ | Supply current | $V_O$ = 0, | No load | 25°C | | 120 | 325 | μA |
| | | | | Full range | | | 350 | |

(1) Full range is -40°C to 85°C.

## 5.8 TLE2061I Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2061I TLE2061AI TLE2061BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.2 | 4 | | V/μs |
| | | | | Full range | 1.7 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 59 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 43 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | μV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | μs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 140 | | kHz |

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2061I TLE2061AI TLE2061BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is -40°C to 85°C.

## 5.9 TLE2061I Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | | $T_A$ (1) | TLE2061I TLE2061AI TLE2061BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2061I | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 0.1 | 3 | mV |
| | | | | | Full range | | | 4.3 | |
| | | TLE2061AI | | | 25°C | | 0.1 | 1.5 | |
| | | | | | Full range | | | 2.9 | |
| | | TLE2061BI | | | 25°C | | 0.1 | 0.5 | |
| | | | | | Full range | | | 1.3 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | | 25°C | | ±5 | | pA |
| | | | | | Full range | | | 3 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | ±10 | | pA |
| | | | | | Full range | | | 5 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -11 to 13 | -12 to 16 | | V |
| | | | | | Full range | -11 to 13 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | 13.2 | 14.9 | | V |
| | | | | | Full range | 13 | | | |
| | | | $R_L$ = 600Ω | | 25°C | 12.5 | 14.5 | | V |
| | | | | | Full range | 12 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | –13.2 | –14.9 | | V |
| | | | | | Full range | –13 | | | |
| | | | $R_L$ = 600kΩ | | 25°C | –12.5 | –14.5 | | V |
| | | | | | Full range | –12 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±10V | $R_L$ = 10kΩ | 25°C | 30 | 225 | | V/mV |
| | | | | | Full range | 20 | | | |
| | | | $V_O$ = 0 to 8V | $R_L$ = 600Ω | 25°C | 25 | 225 | | |
| | | | | | Full range | 10 | | | |
| | | | $V_O$ = 0 to -8V | $R_L$ = 600Ω | 25°C | 3 | 225 | | |
| | | | | | Full range | 01 | | | |
| $Z_{ID}$ | Differential | | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | | 25°C | | 575 | | Ω |

## 5.9 TLE2061I Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2061I TLE2061AI TLE2061BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 72 | 90 | | dB |
| | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 93 | | dB |
| | | $R_S$ = 50Ω | | Full range | 65 | | | |
| $I_{CC}$ | Supply current | $V_O$ = 0, | No load | 25°C | | 125 | 350 | μA |
| | | | | Full range | | | 375 | |

(1) Full range is -40°C to 85°C.

## 5.10 TLE2061I Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2061I TLE2061AI TLE2061BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.6 | 4 | | V/μs |
| | | | | Full range | 2.1 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 70 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 40 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | μV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1.1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | μs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 40 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is -40°C to 85°C.

## 5.11 TLE2061M Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | $T_A$ [1] | TLE2061M TLE2061AM TLE2061BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2061M | $V_{IC}$ = 0, $R_S$ = 50Ω | 25°C | | 0.1 | 3.1 | mV |
| | | | | Full range | | | 6 | |
| | | TLE2061AM | | 25°C | | 0.1 | 2.6 | |
| | | | | Full range | | | 4.6 | |
| | | TLE2061BM | | 25°C | | 0.1 | 1.9 | |
| | | | | Full range | | | 3.1 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | Full range | | 1 | | μV/°C |
| | Input offset voltage long-term drift[2] | | | 25°C | | 0.04 | | μV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 1 | | pA |
| | | | | Full range | | | 15 | nA |
| $I_{IB}$ | Input bias current | | | 25°C | | 3 | | pA |
| | | | | Full range | | | 30 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | 25°C | -1.6 to 4 | -2 to 6 | | V |
| | | | | Full range | -1.6 to 4 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | 25°C | 3.5 | 4.9 | | V |
| | | | | Full range | 3 | | | |
| | | | $R_L$ = 600kΩ | 25°C | 2.5 | 4.5 | | |
| | | | | Full range | 2 | | | |
| | | | $R_L$ = 100kΩ | 25°C | 2.5 | 4.5 | | V |
| | | | | Full range | 2 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | 25°C | -3.5 | -4.9 | | V |
| | | | | Full range | -3 | | | |
| | | FK and JG packages | $R_L$ = 600Ω | 25°C | -2.5 | -4.5 | | |
| | | | | Full range | 2 | | | |
| | | D and P packages | $R_L$ = 100Ω | 25°C | –2.5 | –4.5 | | V |
| | | | | Full range | –2 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±2.8V $R_L$ = 10kΩ | 25°C | 15 | 225 | | V/mV |
| | | | | Full range | 2 | | | |
| | | FK and JG packages | $V_O$ = 0 to 2.5V $R_L$ = 600Ω | 25°C | 1 | 225 | | |
| | | | | Full range | 0.5 | | | |
| | | | $V_O$ = 0 to -2.5V $R_L$ = 600Ω | 25°C | 1 | 225 | | |
| | | | | Full range | 0.5 | | | |
| | | D and P packages | $V_O$ = 0 to 2V $R_L$ = 100Ω | 25°C | 0.75 | 225 | | |
| | | | | Full range | 0.5 | | | |
| | | | $V_O$ = 0 to -2V $R_L$ = 100Ω | 25°C | 0.5 | 225 | | |
| | | | | Full range | 0.25 | | | |
| $r_i$ | Input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $c_i$ | Input capacitance | | | 25°C | | 4 | | pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | 25°C | | 280 | | Ω |

## 5.11 TLE2061M Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2061M TLE2061AM TLE2061BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 65 | 82 | | dB |
| | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 135 | | dB |
| | | $R_S$ = 50Ω | | Full range | 65 | | | |
| $I_{CC}$ | Supply current | $V_O$ = 0, | No load | 25°C | | 120 | 325 | μA |
| | | | | Full range | | | 350 | |

(1) Full range is -55°C to 125°C.
(2) Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at $T_A$ = 150°C extrapolated to $T_A$ = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV

## 5.12 TLE2061M Operating Characteristics

at specified free-air temperature, $V_{CC\pm}$ =± 5V, $T_A$ = 25°C

| PARAMETER | | TEST CONDITIONS | | TLE2061M TLE2061AM TLE2061BM | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | | 4 | | V/μs |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | | 59 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | 43 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | | 1.1 | | μV |
| In | Equivalent input noise current | f = 1kHz | | | 1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | | 0.025% | | |
| B1 | Unity-gain bandwidth (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | | 1.8 | | MHz |
| | | RL = 100Ω, 0.1% | CL = 100pF | | 1.3 | | |
| ts | Settling time | 0.1% | | | 5 | | μs |
| | | 0.01% | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | | 140 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | | 58° | | |
| | | RL = 100Ω, | CL = 100pF | | 75° | | |

## 5.13 TLE2061M Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | $T_A$ (1) | TLE2061M TLE2061AM TLE2061BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2061M | $V_{IC}$ = 0, $R_S$ = 50Ω | 25°C | | 0.1 | 3 | mV |
| | | | | Full range | | | 6 | |
| | | TLE2061AM | | 25°C | | 0.1 | 1.5 | |
| | | | | Full range | | | 3.6 | |
| | | TLE2061BM | | 25°C | | 0.1 | 0.5 | |
| | | | | Full range | | | 1.7 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | Full range | | 1 | | µV/°C |
| | Input offset voltage long-term drift(2) | | | 25°C | | 0.04 | | µV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 2 | | pA |
| | | | | Full range | | | 20 | nA |
| $I_{IB}$ | Input bias current | | | 25°C | | 4 | | pA |
| | | | | Full range | | | 40 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | 25°C | -11 to 13 | -12 to 16 | | V |
| | | | | Full range | -11 to 13 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | 25°C | 13 | 14.9 | | V |
| | | | | Full range | 12.5 | | | |
| | | | $R_L$ = 600Ω | 25°C | 12.5 | 14.5 | | V |
| | | | | Full range | 12 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | 25°C | –13 | –14.9 | | V |
| | | | | Full range | –12.5 | | | |
| | | | $R_L$ = 600kΩ | 25°C | –12.5 | –14.5 | | V |
| | | | | Full range | –12 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±10V $R_L$ = 10kΩ | 25°C | 30 | 225 | | V/mV |
| | | | | Full range | 20 | | | |
| | | | $V_O$ = 0 to 8V $R_L$ = 600Ω | 25°C | 25 | 225 | | |
| | | | | Full range | 7 | | | |
| | | | $V_O$ = 0 to -8V $R_L$ = 600Ω | 25°C | 3 | 225 | | |
| | | | | Full range | 1 | | | |
| $r_i$ | Input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $c_i$ | Input capacitance | | | 25°C | | 4 | | pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | 25°C | | 280 | | Ω |
| CMRR | Common-mode rejection ratio | | $V_{IC}$ = $V_{ICRmin}$, $R_S$ = 50Ω | 25°C | 72 | 90 | | dB |
| | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | | $V_{CC\pm}$ = ± 5V to ± 15V, | 25°C | 75 | 93 | | dB |
| | | | $R_S$ = 50Ω | Full range | 65 | | | |
| $I_{CC}$ | Supply current | | $V_O$ = 0, No load | 25°C | | 125 | 350 | µA |
| | | | | Full range | | | 375 | |

(1) Full range is -55°C to 125°C.
(2) Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at $T_A$ = 150°C extrapolated to $T_A$ = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV

## 5.14 TLE2061M Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2061M TLE2061AM TLE2061BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.6 | 4 | | V/µs |
| | | | | Full range | 1.8 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 70 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 40 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1.1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| B1 | Unity-gain bandwidth (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 2 | | MHz |
| | | RL = 600Ω | CL = 100pF | | | 1.5 | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 40 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 60° | | |
| | | RL = 600Ω, | CL = 100pF | | | 70° | | |

(1) Full range is -55°C to 125°C.

## 5.15 TLE2062C Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | | $T_A$ (1) | TLE2062C TLE2062AC TLE2062BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2062C | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 0.1 | 5 | mV |
| | | | | | Full range | | | 5.9 | |
| | | TLE2062AC | | | 25°C | | 0.1 | 4 | |
| | | | | | Full range | | | 4.9 | |
| | | TLE2062BC | | | 25°C | | 0.1 | 3 | |
| | | | | | Full range | | | 3.9 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | | 25°C | | ±5 | | pA |
| | | | | | Full range | | | 0.8 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | ±10 | | pA |
| | | | | | Full range | | | 2 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -1.6 to 4 | -2 to 6 | | V |
| | | | | | Full range | -1.6 to 4 | | | V |

## 5.15 TLE2062C Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ [1] | TLE2062C TLE2062AC TLE2062BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{OM+}$ | Maximum positive peak output voltage swing | $R_L$ = 10kΩ | | 25°C | 3.5 | 4.9 | | V |
| | | | | Full range | 3.3 | | | |
| | | $R_L$ = 100kΩ | | 25°C | 2.5 | 4.5 | | V |
| | | | | Full range | 2 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | $R_L$ = 10kΩ | | 25°C | –3.7 | –4.9 | | V |
| | | | | Full range | –3.3 | | | |
| | | $R_L$ = 100kΩ | | 25°C | –2.5 | –4.5 | | V |
| | | | | Full range | –2 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O$ = ±2.8V | $R_L$ = 10Ω | 25°C | 15 | 225 | | V/mV |
| | | | | Full range | 2 | | | |
| | | $V_O$ = 0 to 2V | $R_L$ = 100Ω | 25°C | 0.75 | 225 | | |
| | | | | Full range | 0.5 | | | |
| | | $V_O$ = 0 to -2V | $R_L$ = 100Ω | 25°C | 0.5 | 225 | | |
| | | | | Full range | 0.25 | | | |
| $Z_{ID}$ | Differential | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | $I_O$ = 0 | | 25°C | | 575 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 65 | 82 | | dB |
| | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 135 | | dB |
| | | $R_S$ = 50Ω | | Full range | 75 | | | |
| $I_{CC}$ | Supply current | $V_O$ = 0, | No load | 25°C | | 120 | 620 | μA |
| | | | | Full range | | | 635 | |

(1) Full range is 0°C to 70°C.

## 5.16 TLE2062C Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | TA[1] | TLE2062C TLE20612C TLE20612C | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.2 | 4 | | V/μs |
| | | | | Full range | 2.1 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 59 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 43 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | μV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |

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

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2062C TLE20612C TLE20612C | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 140 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is 0°C to 70°C.

## 5.17 TLE2062C Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | | $T_A$ (1) | TLE2062C TLE2062AC TLE2062BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2062C | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 0.1 | 4 | mV |
| | | | | | Full range | | | 4.9 | |
| | | TLE2062AC | | | 25°C | | 0.1 | 2 | |
| | | | | | Full range | | | 2.9 | |
| | | TLE2062BC | | | 25°C | | 0.1 | 1 | |
| | | | | | Full range | | | 1.9 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | | 25°C | | ±5 | | pA |
| | | | | | Full range | | | 1 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | ±10 | | pA |
| | | | | | Full range | | | 3 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -11 to 13 | -12 to 16 | | V |
| | | | | | Full range | -11 to 13 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | 13.2 | 14.9 | | V |
| | | | | | Full range | 13 | | | |
| | | | $R_L$ = 600Ω | | 25°C | 12.5 | 14.5 | | V |
| | | | | | Full range | 12 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | –13.7 | –14.9 | | V |
| | | | | | Full range | –13 | | | |
| | | | $R_L$ = 600kΩ | | 25°C | –12.5 | –14.5 | | V |
| | | | | | Full range | –12 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±10V | $R_L$ = 10kΩ | 25°C | 30 | 225 | | V/mV |
| | | | | | Full range | 20 | | | |
| | | | $V_O$ = 0 to 8V | $R_L$ = 600Ω | 25°C | 25 | 225 | | |
| | | | | | Full range | 10 | | | |
| | | | $V_O$ = 0 to -8V | $R_L$ = 600Ω | 25°C | 3 | 225 | | |
| | | | | | Full range | 1 | | | |

## 5.17 TLE2062C Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2062C TLE2062AC TLE2062BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $Z_{ID}$ | Differential | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | $I_O$ = 0 | | 25°C | | 575 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 72 | 90 | | dB |
| | | | | Full range | 70 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 93 | | dB |
| | | $R_S$ = 50Ω | | Full range | 75 | | | |
| $I_{CC}$ | Supply current | $V_O$ = 0, | No load | 25°C | | 275 | 690 | μA |
| | | | | Full range | | | 715 | |

(1) Full range is 0°C to 70°C.

## 5.18 TLE2062C Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2062C TLE2062AC TLE2062BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.6 | 4 | | V/μs |
| | | | | Full range | 2.5 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 70 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 40 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | μV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1.1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | μs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 40 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is 0°C to 70°C.

## 5.19 TLE2062I Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | | $T_A$ [1] | TLE2062I TLE2062AI TLE2062BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2062I | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 0.1 | 5 | mV |
| | | | | | Full range | | | 6.3 | |
| | | TLE2062AI | | | 25°C | | 0.1 | 4 | |
| | | | | | Full range | | | 5.3 | |
| | | TLE2062BI | | | 25°C | | 0.1 | 3 | |
| | | | | | Full range | | | 4.3 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | | 25°C | | ±5 | | pA |
| | | | | | Full range | | | 2 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | ±10 | | pA |
| | | | | | Full range | | | 4 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -1.6 to 4 | -2 to 6 | | V |
| | | | | | Full range | -1.6 to 4 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | 3.5 | 4.9 | | V |
| | | | | | Full range | 3.1 | | | |
| | | | $R_L$ = 100kΩ | | 25°C | 2.5 | 4.5 | | V |
| | | | | | Full range | 2 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | –3.7 | –4.9 | | V |
| | | | | | Full range | –3.1 | | | |
| | | | $R_L$ = 100kΩ | | 25°C | –2.5 | –4.5 | | V |
| | | | | | Full range | –2 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±2.8V | $R_L$ = 10Ω | 25°C | 15 | 225 | | V/mV |
| | | | | | Full range | 2 | | | |
| | | | $V_O$ = 0 to 2V | $R_L$ = 100Ω | 25°C | 0.75 | 225 | | |
| | | | | | Full range | 0.5 | | | |
| | | | $V_O$ = 0 to -2 V | $R_L$ = 100Ω | 25°C | 0.5 | 225 | | |
| | | | | | Full range | 0.25 | | | |
| $Z_{ID}$ | Differential | | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | | 25°C | | 575 | | Ω |
| CMRR | Common-mode rejection ratio | | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 65 | 82 | | dB |
| | | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 135 | | dB |
| | | | $R_S$ = 50Ω | | Full range | 65 | | | |
| $I_{CC}$ | Supply current | | $V_O$ = 0, | No load | 25°C | | 120 | 620 | µA |
| | | | | | Full range | | | 640 | |

(1) Full range is -40°C to 85°C.

## 5.20 TLE2062I Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2062I TLE2062AI TLE2062BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.2 | 4 | | V/µs |
| | | | | Full range | 1.7 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 59 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 43 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 140 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is -40°C to 85°C.

## 5.21 TLE2062I Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | | $T_A$ (1) | TLE2062I TLE2062AI TLE2062BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2062I | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 0.1 | 4 | mV |
| | | | | | Full range | | | 5.3 | |
| | | TLE2062AI | | | 25°C | | 0.1 | 2 | |
| | | | | | Full range | | | 3.3 | |
| | | TLE2062BI | | | 25°C | | 0.1 | 1 | |
| | | | | | Full range | | | 2.3 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | | 25°C | | ±5 | | pA |
| | | | | | Full range | | | 3 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | ±10 | | pA |
| | | | | | Full range | | | 5 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -11 to 13 | -12 to 16 | | V |
| | | | | | Full range | -11 to 13 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | 13.2 | 14.9 | | V |
| | | | | | Full range | 13 | | | |
| | | | $R_L$ = 600Ω | | 25°C | 12.5 | 14.5 | | V |
| | | | | | Full range | 12 | | | |

## 5.21 TLE2062I Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2062I TLE2062AI TLE2062BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | $R_L$ = 10kΩ | | 25°C | –13.2 | –14.9 | | V |
| | | | | Full range | –13 | | | |
| | | $R_L$ = 600kΩ | | 25°C | –12.5 | –14.5 | | V |
| | | | | Full range | –12 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O$ = ±10V | $R_L$ = 10kΩ | 25°C | 30 | 225 | | V/mV |
| | | | | Full range | 20 | | | |
| | | $V_O$ = 0 to 8V | $R_L$ = 600Ω | 25°C | 25 | 225 | | |
| | | | | Full range | 10 | | | |
| | | $V_O$ = 0 to -8V | $R_L$ = 600Ω | 25°C | 3 | 225 | | |
| | | | | Full range | 1 | | | |
| $Z_{ID}$ | Differential | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | $I_O$ = 0 | | 25°C | | 280 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 72 | 90 | | dB |
| | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 93 | | dB |
| | | $R_S$ = 50Ω | | Full range | 65 | | | |
| $I_{CC}$ | Supply current | $V_O$ = 0, | No load | 25°C | | 275 | 690 | μA |
| | | | | Full range | | | 720 | |

(1) Full range is -40°C to 85°C.

## 5.22 TLE2062I Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2062I TLE2062AI TLE2062BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.6 | 4 | | V/μs |
| | | | | Full range | 2.1 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 70 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 40 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | μV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1.1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | μs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 40 | | kHz |

at specified free-air temperature, $V_{CC±}$ =± 15V

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2062I TLE2062AI TLE2062BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is -40°C to 85°C.

## 5.23 TLE2062M Electrical Characteristics

at specified free-air temperature, $V_{CC±}$ = ± 5V (unless otherwise noted)

| PARAMETER | | | TEST CONDITIONS | | $T_A$ (1) | TLE2062M TLE2062AM TLE2062BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2062M | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 1 | 5 | mV |
| | | | | | Full range | | | 7 | |
| | | TLE2062AM | | | 25°C | | 0.9 | 4 | |
| | | | | | Full range | | | 6 | |
| | | TLE2062BM | | | 25°C | | 0.7 | 3 | |
| | | | | | Full range | | | 5 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 6 | | µV/°C |
| | Input offset voltage long-term drift(2) | | | | 25°C | | 0.04 | | µV/mo |
| $I_{IO}$ | Input offset current | | | | 25°C | | 1 | | pA |
| | | | | | Full range | | | 15 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | 3 | | pA |
| | | | | | Full range | | | 30 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -1.6 to 4 | -2 to 6 | | V |
| | | | | | Full range | -1.6 to 4 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | 3.5 | 3.7 | | V |
| | | | | | Full range | 3 | | | |
| | | | $R_L$ = 600kΩ | | 25°C | 2.5 | 3.6 | | |
| | | | | | Full range | 2 | | | |
| | | | $R_L$ = 100kΩ | | 25°C | 2.5 | 3.1 | | V |
| | | | | | Full range | 2 | | | |
| $V_{OM–}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | –3.5 | –3.9 | | V |
| | | | | | Full range | –3 | | | |
| | | FK and JG packages | $R_L$ = 600Ω | | 25°C | –2.5 | –3.5 | | |
| | | | | | Full range | –2 | | | |
| | | D and P packages | $R_L$ = 100Ω | | 25°C | –2.5 | –2.7 | | V |
| | | | | | Full range | –2 | | | |

## 5.23 TLE2062M Electrical Characteristics (continued)

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

| PARAMETER | | | TEST CONDITIONS | | $T_A$ (1) | TLE2062M TLE2062AM TLE2062BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±2.8V | $R_L$ = 10kΩ | 25°C | 15 | 80 | | V/mV |
| | | | | | Full range | 2 | | | |
| | | FK and JG packages | $V_O$ = 0 to 2.5V | $R_L$ = 600Ω | 25°C | 1 | 65 | | |
| | | | | | Full range | 0.5 | | | |
| | | | $V_O$ = 0 to -2.5V | $R_L$ = 600Ω | 25°C | 1 | 16 | | |
| | | | | | Full range | 0.5 | | | |
| | | D and P packages | $V_O$ = 0 to 2V | $R_L$ = 100Ω | 25°C | 0.75 | 45 | | |
| | | | | | Full range | 0.5 | | | |
| | | | $V_O$ = 0 to -2V | $R_L$ = 100Ω | 25°C | 0.5 | 3 | | |
| | | | | | Full range | 0.25 | | | |
| $r_i$ | Input resistance | | | | 25°C | | $10^{12}$ | | Ω |
| $c_i$ | Input capacitance | | | | 25°C | | 4 | | pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | | 25°C | | 560 | | Ω |
| CMRR | Common-mode rejection ratio | | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 65 | 82 | | dB |
| | | | | | Full range | 60 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 93 | | dB |
| | | | $R_S$ = 50Ω | | Full range | 65 | | | |
| $I_{CC}$ | Supply current | | $V_O$ = 0, | No load | 25°C | | 560 | 620 | μA |
| | | | | | Full range | | | 650 | |

(1) Full range is -55°C to 125°C.
(2) Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at $T_A$ = 150°C extrapolated to $T_A$ = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV

## 5.24 TLE2062M Operating Characteristics

at specified free-air temperature, $T_A$ = 25°C, $V_{CC}\pm$ = ±5 V

| PARAMETER | | TEST CONDITIONS | | TLE2062M TLE2062AM TLE2062BM | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | | 4 | | V/μs |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | | 59 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | 43 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | | 1.1 | | μV |
| In | Equivalent input noise current | f = 1kHz | | | 1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | | 0.025% | | |
| B1 | Unity-gain bandwidth (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | | 1.8 | | MHz |
| | | RL = 100Ω, 0.1% | CL = 100pF | | 1.3 | | |
| ts | Settling time | 0.1% | | | 5 | | μs |
| | | 0.01% | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | | 140 | | kHz |

at specified free-air temperature, $T_A$ = 25°C, $V_{CC}$± = ±5 V

| PARAMETER | | TEST CONDITIONS | | TLE2062M TLE2062AM TLE2062BM | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | | 58° | | |
| | | RL = 100Ω, | CL = 100pF | | 75° | | |

## 5.25 TLE2062M Electrical Characteristics

at specified free-air temperature, $V_{CC±}$ = ± 15V (unless otherwise noted)

| PARAMETER | | | TEST CONDITIONS | | $T_A$ (1) | TLE2062M TLE2062AM TLE2062BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2062M | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 0.1 | 4 | mV |
| | | | | | Full range | | | 6 | |
| | | TLE2062AM | | | 25°C | | 0.1 | 2 | |
| | | | | | Full range | | | 4 | |
| | | TLE2062BM | | | 25°C | | 0.1 | 1 | |
| | | | | | Full range | | | 3 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 1 | | µV/°C |
| | Input offset voltage long-term drift (2) | | | | 25°C | | 0.04 | | µV/mo |
| $I_{IO}$ | Input offset current | | | | 25°C | | 2 | | pA |
| | | | | | Full range | | | 20 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | 4 | | pA |
| | | | | | Full range | | | 40 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -11 to 13 | -12 to 16 | | V |
| | | | | | Full range | -11 to 13 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | 13 | 14.9 | | V |
| | | | | | Full range | 12.5 | | | |
| | | | $R_L$ = 600Ω | | 25°C | 12.5 | 14.5 | | V |
| | | | | | Full range | 11 | | | |
| $V_{OM–}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | –13 | –14.9 | | V |
| | | | | | Full range | –12.5 | | | |
| | | | $R_L$ = 600kΩ | | 25°C | –12.5 | –14.5 | | V |
| | | | | | Full range | –11 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±10 V | $R_L$ = 10kΩ | 25°C | 30 | 225 | | V/mV |
| | | | | | Full range | 20 | | | |
| | | | $V_O$ = 0 to 8V | $R_L$ = 600Ω | 25°C | 25 | 225 | | |
| | | | | | Full range | 7 | | | |
| | | | $V_O$ = 0 to -8 V | $R_L$ = 600Ω | 25°C | 3 | 225 | | |
| | | | | | Full range | 1 | | | |
| $r_i$ | Input resistance | | | | 25°C | | $10^{12}$ | | Ω |
| $c_i$ | Input capacitance | | | | 25°C | | 4 | | pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | | 25°C | | 280 | | Ω |
| CMRR | Common-mode rejection ratio | | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 72 | 90 | | dB |
| | | | | | Full range | 65 | | | |

## 5.25 TLE2062M Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | $T_A$ (1) | TLE2062M TLE2062AM TLE2062BM | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm}$ = ± 5V to ± 15V, | 25°C | 75 | 93 | | dB |
| | | $R_S$ = 50Ω | Full range | 65 | | | |
| $I_{CC}$ | Supply current | $V_O$ = 0, No load | 25°C | | 275 | 690 | µA |
| | | | Full range | | | 730 | |

(1) Full range is -55°C to 125°C.
(2) Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at $T_A$ = 150°C extrapolated to $T_A$ = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV

## 5.26 TLE2062M Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2062M TLE2062AM TLE2062BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.6 | 4 | | V/µs |
| | | | | Full range | 1.8 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 70 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 40 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1.1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| B1 | Unity-gain bandwidth (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 2 | | MHz |
| | | RL = 600Ω | CL = 100pF | | | 1.5 | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 40 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 60° | | |
| | | RL = 600Ω, | CL = 100pF | | | 70° | | |

(1) Full range is -55°C to 125°C.

## 5.27 TLE2064C Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | | $T_A$ [1] | TLE2064C TLE2064AC TLE2064BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2064C | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 0.1 | 7 | mV |
| | | | | | Full range | | | 7.9 | |
| | | TLE2064AC | | | 25°C | | 0.1 | 6 | |
| | | | | | Full range | | | 6.9 | |
| | | TLE2064BC | | | 25°C | | 0.1 | 3.5 | |
| | | | | | Full range | | | 4.4 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | | 25°C | | ±5 | | pA |
| | | | | | Full range | | | 0.8 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | ±10 | | pA |
| | | | | | Full range | | | 2 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -1.6 to 4 | -2 to 6 | | V |
| | | | | | Full range | -1.6 to 4 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | 3.5 | 4.9 | | V |
| | | | | | Full range | 3.3 | | | |
| | | | $R_L$ = 100kΩ | | 25°C | 2.5 | 4.5 | | V |
| | | | | | Full range | 2 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | –3.7 | –4.9 | | V |
| | | | | | Full range | –3.3 | | | |
| | | | $R_L$ = 100kΩ | | 25°C | –2.5 | –4.5 | | V |
| | | | | | Full range | –2 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±2.8 V | $R_L$ = 10Ω | 25°C | 15 | 225 | | V/mV |
| | | | | | Full range | 2 | | | |
| | | | $V_O$ = 0 to 2V | $R_L$ = 100Ω | 25°C | 0.75 | 225 | | |
| | | | | | Full range | 0.5 | | | |
| | | | $V_O$ = 0 to -2V | $R_L$ = 100Ω | 25°C | 0.5 | 225 | | |
| | | | | | Full range | 0.15 | | | |
| $Z_{ID}$ | Differential | | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | | 25°C | | 575 | | Ω |
| CMRR | Common-mode rejection ratio | | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 65 | 82 | | dB |
| | | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 135 | | dB |
| | | | $R_S$ = 50Ω | | Full range | 75 | | | |
| $I_{CC}$ | Supply current (four amplifiers) | | $V_O$ = 0, | No load | 25°C | | 0.6 | 1.3 | mA |
| | | | | | Full range | | | 1.3 | |

## 5.27 TLE2064C Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2064C TLE2064AC TLE2064BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{O1}/V_{O2}$ | Crosstalk attenuation | $A_{VD}$ = 1000, | f = 1kHz | 25°C | | 120 | | dB |

(1) Full range is 0°C to 70°C.

## 5.28 TLE2064C Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2064C TLE2064AC TLE2064BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.2 | 4 | | V/µs |
| | | | | Full range | 2.1 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 59 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 43 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 140 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is 0°C to 70°C.

## 5.29 TLE2064C Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | $T_A$ [1] | TLE2064C TLE2064AC TLE2064BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2064C | $V_{IC}$ = 0, $R_S$ = 50Ω | 25°C | | 0.1 | 6 | mV |
| | | | | Full range | | | 6.9 | |
| | | TLE2064AC | | 25°C | | 0.1 | 4 | |
| | | | | Full range | | | 4.9 | |
| | | TLE2064BC | | 25°C | | 0.1 | 2 | |
| | | | | Full range | | | 4 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | 25°C | | ±5 | | pA |
| | | | | Full range | | | 1 | nA |
| $I_{IB}$ | Input bias current | | | 25°C | | ±10 | | pA |
| | | | | Full range | | | 3 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | 25°C | -11 to 13 | -12 to 16 | | V |
| | | | | Full range | -11 to 13 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | 25°C | 13.2 | 14.9 | | V |
| | | | | Full range | 13 | | | |
| | | | $R_L$ = 600Ω | 25°C | 12.5 | 14.5 | | V |
| | | | | Full range | 12 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | 25°C | –13.2 | –14.9 | | V |
| | | | | Full range | –13 | | | |
| | | | $R_L$ = 600kΩ | 25°C | –12.5 | –14.5 | | V |
| | | | | Full range | –12 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±10V $R_L$ = 10kΩ | 25°C | 30 | 225 | | V/mV |
| | | | | Full range | 20 | | | |
| | | | $V_O$ = 0 to 8V $R_L$ = 600Ω | 25°C | 25 | 225 | | |
| | | | | Full range | 10 | | | |
| | | | $V_O$ = 0 to -8V $R_L$ = 600Ω | 25°C | 3 | 225 | | |
| | | | | Full range | 1 | | | |
| $Z_{ID}$ | Differential | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | 25°C | | 575 | | Ω |
| CMRR | Common-mode rejection ratio | | $V_{IC}$ = $V_{ICRmin}$, $R_S$ = 50Ω | 25°C | 72 | 90 | | dB |
| | | | | Full range | 70 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | | $V_{CC\pm}$ = ± 5V to ± 15V, | 25°C | 75 | 93 | | dB |
| | | | $R_S$ = 50Ω | Full range | 75 | | | |
| $I_{CC}$ | Supply current (four amplifiers) | | $V_O$ = 0, No load | 25°C | | 0.6 | 1.4 | µA |
| | | | | Full range | | | 1.5 | |

## 5.29 TLE2064C Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2064C TLE2064AC TLE2064BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{O1}$/ $V_{O2}$ | Crosstalk attenuation | $A_{VD}$ = 1000, | f = 1kHz | 25°C | | 120 | | dB |

(1) Full range is 0°C to 70°C.

## 5.30 TLE2064C Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2064C TLE2064AC TLE2064BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.6 | 4 | | V/µs |
| | | | | Full range | 2.5 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 70 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 40 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 40 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is 0°C to 70°C.

## 5.31 TLE2064I Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | | $T_A$ [1] | TLE2064I TLE2064AI TLE2064BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2064I | $V_{IC}$ = 0, | $R_S$ = 50Ω | 25°C | | 0.1 | 7 | mV |
| | | | | | Full range | | | 8.3 | |
| | | TLE2064AI | | | 25°C | | 0.1 | 6 | |
| | | | | | Full range | | | 7.3 | |
| | | TLE2064BI | | | 25°C | | 0.1 | 3.5 | |
| | | | | | Full range | | | 4.8 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | | 25°C | | ±5 | | pA |
| | | | | | Full range | | | 2 | nA |
| $I_{IB}$ | Input bias current | | | | 25°C | | ±10 | | pA |
| | | | | | Full range | | | 4 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | | 25°C | -1.6 to 4 | -2 to 6 | | V |
| | | | | | Full range | -1.6 to 4 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | 3.5 | 4.9 | | V |
| | | | | | Full range | 3.1 | | | |
| | | | $R_L$ = 100kΩ | | 25°C | 2.5 | 4.5 | | V |
| | | | | | Full range | 2 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | | 25°C | –3.7 | –4.9 | | V |
| | | | | | Full range | –3.1 | | | |
| | | | $R_L$ = 100kΩ | | 25°C | –2.5 | –4.5 | | V |
| | | | | | Full range | –2 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±2.8 V | $R_L$ = 10Ω | 25°C | 15 | 225 | | V/mV |
| | | | | | Full range | 2 | | | |
| | | | $V_O$ = 0 to 2V | $R_L$ = 100Ω | 25°C | 0.75 | 225 | | |
| | | | | | Full range | 0.5 | | | |
| | | | $V_O$ = 0 to -2V | $R_L$ = 100Ω | 25°C | 0.5 | 225 | | |
| | | | | | Full range | 0.15 | | | |
| $Z_{ID}$ | Differential | | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | | 25°C | | 575 | | Ω |
| CMRR | Common-mode rejection ratio | | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 65 | 82 | | dB |
| | | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 135 | | dB |
| | | | $R_S$ = 50Ω | | Full range | 65 | | | |
| $I_{CC}$ | Supply current (four amplifiers) | | $V_O$ = 0, | No load | 25°C | | 0.6 | 1.3 | mA |
| | | | | | Full range | | | 1.3 | |

## 5.31 TLE2064I Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2064I TLE2064AI TLE2064BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{O1}$/ $V_{O2}$ | Crosstalk attenuation | $A_{VD}$ = 1000, | f = 1kHz | 25°C | | 120 | | dB |

(1) Full range is -40°C to 85°C.

## 5.32 TLE2064I Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2064I TLE2064AI TLE2064BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.2 | 4 | | V/µs |
| | | | | Full range | 1.7 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 59 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 43 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 140 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is -40°C to 85°C.

## 5.33 TLE2064I Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | $T_A$ [1] | TLE2064I TLE2064AI TLE2064BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2064I | $V_{IC}$ = 0, $R_S$ = 50Ω | 25°C | | 0.1 | 6 | mV |
| | | | | Full range | | | 7.3 | |
| | | TLE2064AI | | 25°C | | 0.1 | 4 | |
| | | | | Full range | | | 5.3 | |
| | | TLE2064BI | | 25°C | | 0.1 | 2 | |
| | | | | Full range | | | 3.3 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | Full range | | 1 | | µV/°C |
| $I_{IO}$ | Input offset current | | | 25°C | | ±5 | | pA |
| | | | | Full range | | | 3 | nA |
| $I_{IB}$ | Input bias current | | | 25°C | | ±10 | | pA |
| | | | | Full range | | | 5 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | 25°C | -11 to 13 | -12 to 16 | | V |
| | | | | Full range | -11 to 13 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | 25°C | 13.2 | 14.9 | | V |
| | | | | Full range | 13 | | | |
| | | | $R_L$ = 600Ω | 25°C | 12.5 | 14.5 | | V |
| | | | | Full range | 12 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | 25°C | –13.2 | –14.9 | | V |
| | | | | Full range | –13 | | | |
| | | | $R_L$ = 600kΩ | 25°C | –12.5 | –14.5 | | V |
| | | | | Full range | –12 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±10V, $R_L$ = 10kΩ | 25°C | 30 | 225 | | V/mV |
| | | | | Full range | 20 | | | |
| | | | $V_O$ = 0 to 8V, $R_L$ = 600Ω | 25°C | 25 | 225 | | |
| | | | | Full range | 10 | | | |
| | | | $V_O$ = 0 to -8V, $R_L$ = 600Ω | 25°C | 3 | 225 | | |
| | | | | Full range | 1 | | | |
| $Z_{ID}$ | Differential | | | | | 540 \|\| 3 | | GΩ \|\| pF |
| $Z_{ICM}$ | Common-mode | | | | | 6 \|\| 1 | | TΩ \|\| pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | 25°C | | 575 | | Ω |
| CMRR | Common-mode rejection ratio | | $V_{IC}$ = $V_{ICRmin}$, $R_S$ = 50Ω | 25°C | 72 | 90 | | dB |
| | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | | $V_{CC\pm}$ = ± 5V to ± 15V, | 25°C | 75 | 93 | | dB |
| | | | $R_S$ = 50Ω | Full range | 65 | | | |
| $I_{CC}$ | Supply current (four amplifiers) | | $V_O$ = 0, No load | 25°C | | 0.6 | 1.4 | mA |
| | | | | Full range | | | 1.5 | |

## 5.33 TLE2064I Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2064I TLE2064AI TLE2064BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{O1}$/ $V_{O2}$ | Crosstalk attenuation | $A_{VD}$ = 1000, | f = 1kHz | 25°C | | 120 | | dB |

(1) Full range is -40°C to 85°C.

## 5.34 TLE2064I Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2064I TLE2064AI TLE2064BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.6 | 4 | | V/µs |
| | | | | Full range | 2.1 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 70 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 40 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1.1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 40 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 46° | | |

(1) Full range is -40°C to 85°C.

## 5.35 TLE2064M Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | $T_A$ [1] | TLE2064M TLE2064AM TLE2064BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2064M | $V_{IC}$ = 0, $R_S$ = 50Ω | 25°C | | 1.2 | 7 | mV |
| | | | | Full range | | | 9 | |
| | | TLE2064AM | | 25°C | | 1.2 | 6 | |
| | | | | Full range | | | 8 | |
| | | TLE2064BM | | 25°C | | 0.8 | 3.5 | |
| | | | | Full range | | | 5.5 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | Full range | | 6 | | µV/°C |
| | Input offset voltage long-term drift[2] | | | 25°C | | 0.04 | | µ V/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 1 | | pA |
| | | | | Full range | | | 15 | nA |
| $I_{IB}$ | Input bias current | | | 25°C | | 3 | | pA |
| | | | | Full range | | | 30 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | 25°C | -1.6 to 4 | -2 to 6 | | V |
| | | | | Full range | -1.6 to 4 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | 25°C | 3.5 | 3.7 | | V |
| | | | | Full range | 3 | | | |
| | | | $R_L$ = 600kΩ | 25°C | 2.5 | 3.6 | | |
| | | | | Full range | 2 | | | |
| | | | $R_L$ = 100kΩ | 25°C | 2.5 | 3.1 | | V |
| | | | | Full range | 2 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | 25°C | -3.5 | -3.9 | | V |
| | | | | Full range | -3 | | | |
| | | FK and JG packages | $R_L$ = 600Ω | 25°C | -2.5 | -3.5 | | |
| | | | | Full range | -2 | | | |
| | | D and P packages | $R_L$ = 100Ω | 25°C | –2.5 | –2.7 | | V |
| | | | | Full range | –2 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±2.8V $R_L$ = 10kΩ | 25°C | 15 | 80 | | V/mV |
| | | | | Full range | 2 | | | |
| | | FK and JG packages | $V_O$ = 0 to 2.5V $R_L$ = 600Ω | 25°C | 1 | 65 | | |
| | | | | Full range | 0.5 | | | |
| | | | $V_O$ = 0 to -2.5 V $R_L$ = 600Ω | 25°C | 1 | 16 | | |
| | | | | Full range | 0.5 | | | |
| | | D and P packages | $V_O$ = 0 to 2V $R_L$ = 100Ω | 25°C | 0.75 | 45 | | |
| | | | | Full range | 0.25 | | | |
| | | | $V_O$ = 0 to -2V $R_L$ = 100Ω | 25°C | 0.4 | 3 | | |
| | | | | Full range | 0.15 | | | |
| $r_i$ | Input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $c_i$ | Input capacitance | | | 25°C | | 4 | | pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | 25°C | | 560 | | Ω |

## 5.35 TLE2064M Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2064M TLE2064AM TLE2064BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = $V_{ICRmin}$, | $R_S$ = 50Ω | 25°C | 65 | 82 | | dB |
| | | | | Full range | 60 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | $V_{CC\pm}$ = ± 5V to ± 15V, | | 25°C | 75 | 93 | | dB |
| | | $R_S$ = 50Ω | | Full range | 65 | | | |
| $I_{CC}$ | Supply current (four amplifiers) | $V_O$ = 0, | No load | 25°C | | 1.12 | 1.3 | mA |
| | | | | Full range | | | 1.3 | |
| $\Delta I_{CC}$ | Supply-current change over operating temperature range (four amplifiers) | | | Full range | | 144 | | µA |
| $V_{O1}/V_{O2}$ | Crosstalk attenuation | $A_{VD}$ = 1000, f = 1kHz | | 25°C | | 120 | | dB |

(1) Full range is -55°C to 125°C.
(2) Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at $T_A$ = 150°C extrapolated to $T_A$ = 25°C using the Arrhenius equation and assuming an activation energy of 0.96eV

## 5.36 TLE2064M Operating Characteristics

, $V_{CC\pm}$ = ±5V, $T_A$ = 25°C

| PARAMETER | | TEST CONDITIONS | | TA | TLE2064M TLE2064AM TLE2064BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | | 4 | | V/µs |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | Full range | | 59 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | 25°C | | 43 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| B1 | Unity-gain bandwidth (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 1.8 | | MHz |
| | | RL = 100Ω, 0.1% | CL = 100pF | 25°C | | 1.3 | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | 25°C | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 140 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | Full range | | 58° | | |
| | | RL = 100Ω, | CL = 100pF | 25°C | | 75° | | |

## 5.37 TLE2064M Electrical Characteristics

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

| PARAMETER | | | TEST CONDITIONS | $T_A$ [1] | TLE2064M TLE2064AM TLE2064BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | TLE2064M | $V_{IC}$ = 0, $R_S$ = 50Ω | 25°C | | 0.1 | 6 | mV |
| | | | | Full range | | | 8 | |
| | | TLE2064AM | | 25°C | | 0.1 | 4 | |
| | | | | Full range | | | 6 | |
| | | TLE2064BM | | 25°C | | 0.1 | 2 | |
| | | | | Full range | | | 4 | |
| $a_{VIO}$ | Temperature coefficient of input offset voltage | | | Full range | | 1 | | µV/°C |
| | Input offset voltage long-term drift [2] | | | 25°C | | 0.04 | | µ V/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 2 | | pA |
| | | | | Full range | | | 20 | nA |
| $I_{IB}$ | Input bias current | | | 25°C | | 4 | | pA |
| | | | | Full range | | | 40 | nA |
| $V_{ICR}$ | Common-mode input voltage range | | | 25°C | -11 to 13 | -12 to 16 | | V |
| | | | | Full range | -11 to 13 | | | V |
| $V_{OM+}$ | Maximum positive peak output voltage swing | | $R_L$ = 10kΩ | 25°C | 13 | 14.9 | | V |
| | | | | Full range | 12.5 | | | |
| | | | $R_L$ = 600Ω | 25°C | 12.5 | 14.5 | | V |
| | | | | Full range | 12 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage swing | | $R_L$ = 10kΩ | 25°C | –13 | –14.9 | | V |
| | | | | Full range | –12.5 | | | |
| | | | $R_L$ = 600kΩ | 25°C | –13 | –14.5 | | V |
| | | | | Full range | –12.5 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | | $V_O$ = ±10V $R_L$ = 10kΩ | 25°C | 30 | 225 | | V/mV |
| | | | | Full range | 20 | | | |
| | | | $V_O$ = 0 to 8V $R_L$ = 600Ω | 25°C | 25 | 225 | | |
| | | | | Full range | 7 | | | |
| | | | $V_O$ = 0 to -8V $R_L$ = 600Ω | 25°C | 3 | 225 | | |
| | | | | Full range | 1 | | | |
| $r_i$ | Input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $c_i$ | Input capacitance | | | 25°C | | 4 | | pF |
| $z_o$ | Open-loop output impedance | | $I_O$ = 0 | 25°C | | 280 | | Ω |
| CMRR | Common-mode rejection ratio | | $V_{IC}$ = $V_{ICRmin}$, $R_S$ = 50Ω | 25°C | 72 | 90 | | dB |
| | | | | Full range | 65 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{CC\pm}/\Delta V_{IO}$) | | $V_{CC\pm}$ = ± 5V to ± 15V, | 25°C | 75 | 93 | | dB |
| | | | $R_S$ = 50Ω | Full range | 65 | | | |
| $I_{CC}$ | Supply current (four amplifiers) | | $V_O$ = 0, No load | 25°C | | 0.6 | 1.4 | mA |
| | | | | Full range | | | 1.5 | |

## 5.37 TLE2064M Electrical Characteristics (continued)

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

| PARAMETER | | TEST CONDITIONS | | $T_A$ (1) | TLE2064M TLE2064AM TLE2064BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{O1}$/ $V_{O2}$ | Crosstalk attenuation | $A_{VD}$ = 1000, | f = 1kHz | 25°C | | 120 | | dB |

(1) Full range is -55°C to 125°C.
(2) Typical values are based on the input offset voltage shift observed through 168 hours of operating life test at $T_A$ = 150°C extrapolated to $T_A$ = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV

## 5.38 TLE2064M Operating Characteristics

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

| PARAMETER | | TEST CONDITIONS | | TA(1) | TLE2064M TLE2064AM TLE2064BM | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain (See Figure 6-1) | RL = 10kΩ, | CL = 100pF | 25°C | 2.6 | 4 | | V/µs |
| | | | | Full range | 1.8 | | | |
| $V_n$ | Equivalent input noise voltage (See Figure 6-2) | f = 10Hz, | RS = 20Ω | 25°C | | 70 | | nV/√Hz |
| | | f = 1kHz, | RS = 20Ω | | | 40 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1Hz to 10Hz | | 25°C | | 1.1 | | µV |
| In | Equivalent input noise current | f = 1kHz | | 25°C | | 1.1 | | fA/√Hz |
| THD | Total harmonic distortion | AVD = 2, VO(PP) = 2V, | f = 10kHz, RL = 10kΩ | 25°C | | 0.025% | | |
| B1 | Unity-gain bandwidth (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 2 | | MHz |
| | | RL = 600Ω | CL = 100pF | | | 1.5 | | |
| ts | Settling time | 0.1% | | 25°C | | 5 | | µs |
| | | 0.01% | | | | 10 | | |
| BOM | Maximum output-swing bandwidth | AVD = 1, | RL = 10kΩ | 25°C | | 40 | | kHz |
| φm | Phase margin at unity gain (See Figure 6-3) | RL = 10kΩ, | CL = 100pF | 25°C | | 60° | | |
| | | RL = 600Ω, | CL = 100pF | | | 70° | | |

(1) Full range is -55°C to 125°C.

## 5.39 Typical Characteristics

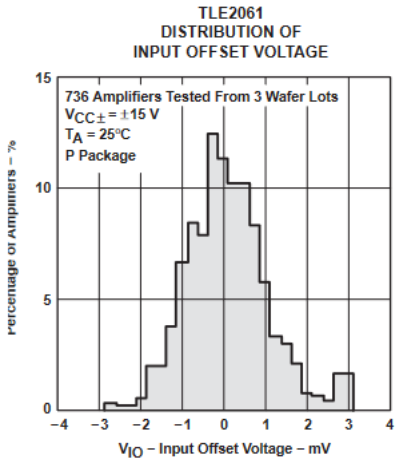



**Figure 5-1. TLE2061 Distribution of Input Offset Voltage**

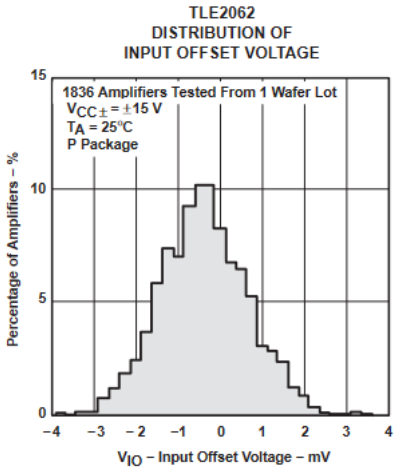



**Figure 5-2. TLE2062 Distribution of Input Offset Voltage**

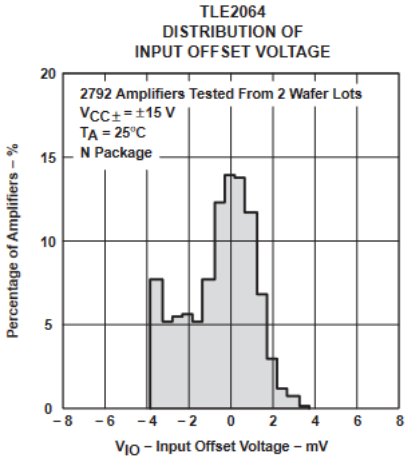



**Figure 5-3. TLE2064 Distribution of Input Offset Voltage**

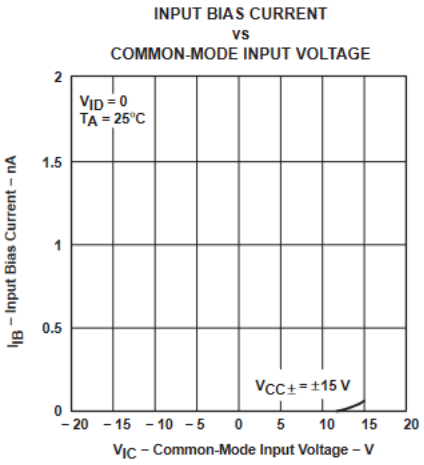



**Figure 5-4. Input Bias Current vs Common Mode Input Voltage**

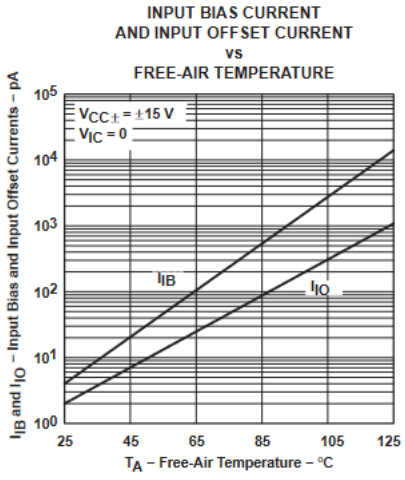



**Figure 5-5. Input Bias Current and Input Offset Current vs Free-Air Temperature**

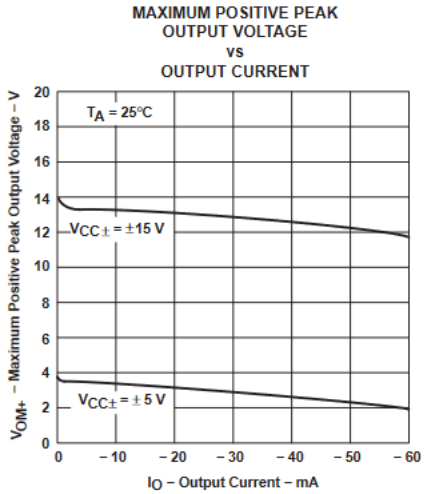



**Figure 5-6. Maximum Positive Peak Output Voltage vs Output Current**

## 5.39 Typical Characteristics (continued)

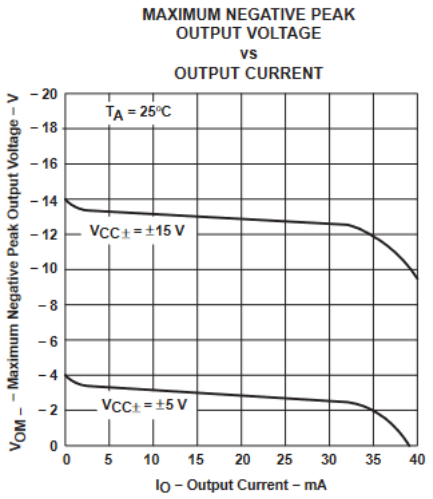



**Figure 5-7. Maximum Negative Peak Output Voltage vs Output Current**

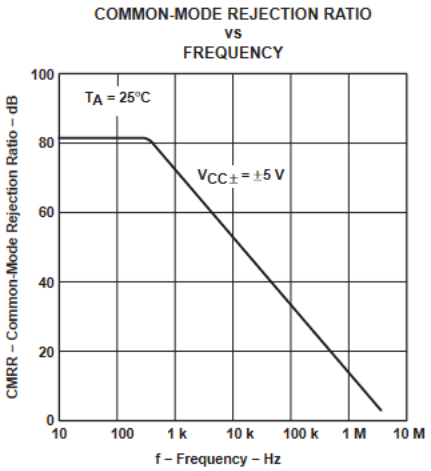



**Figure 5-8. Common Mode Rejection Ratio vs Frequency**

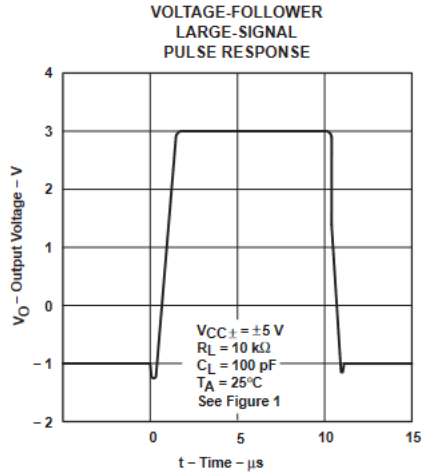



**Figure 5-9. Voltage Follower Large Signal Pulse Response**

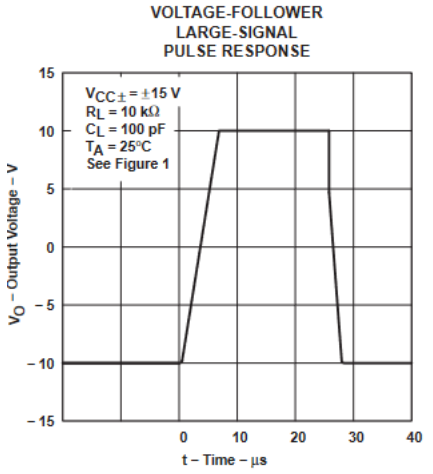



**Figure 5-10. Voltage Follower Large Signal Pulse Response**

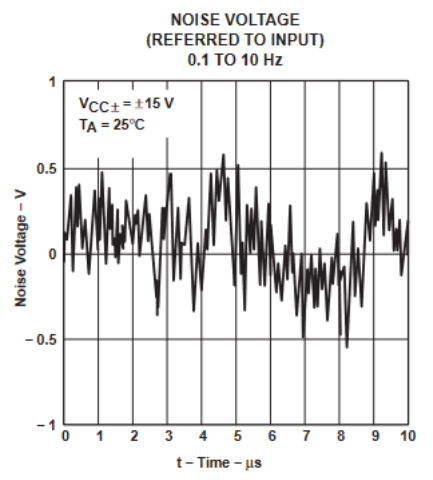



**Figure 5-11. Noise Voltage**

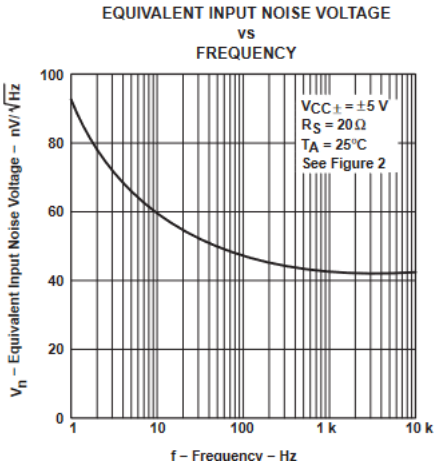



**Figure 5-12. Equivalent Input Noise Voltage vs Frequency**

## 5.39 Typical Characteristics (continued)

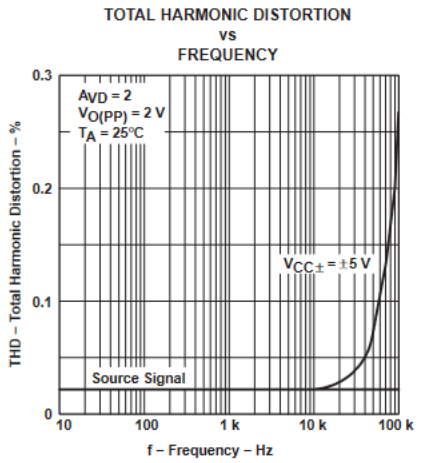



**Figure 5-13. Total Harmonic Distortion vs Frequency**

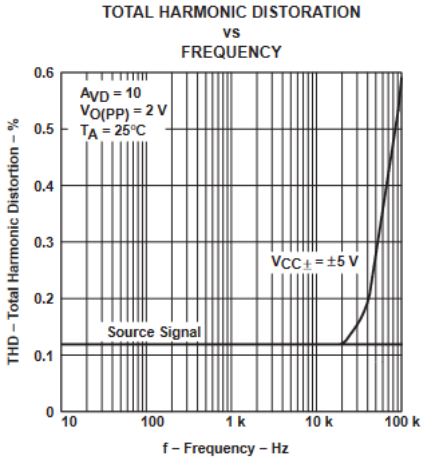



**Figure 5-14. Total Harmonic Distortion vs Frequency**

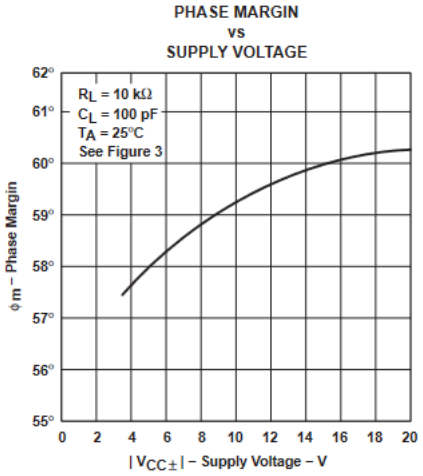
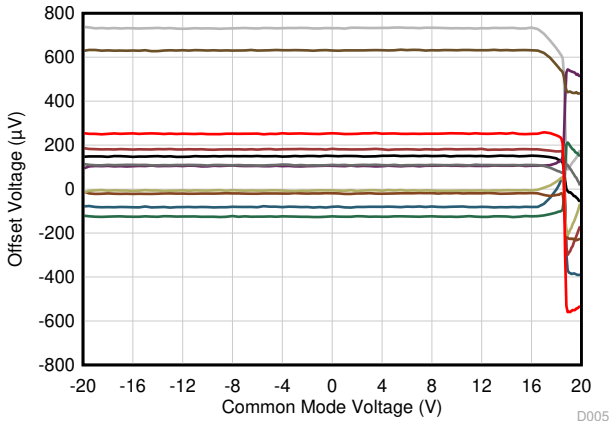


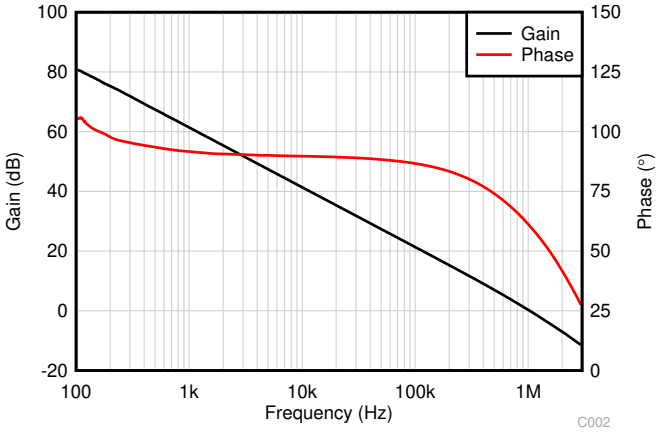

**Figure 5-15. Phase Margin vs Supply Voltage**




$T_A$ = 25°C

Each color represents one sample device.

**Figure 5-16. Offset Voltage vs Common-Mode Voltage**




$C_L$ = 20pF

**Figure 5-17. Open-Loop Gain and Phase vs Frequency**

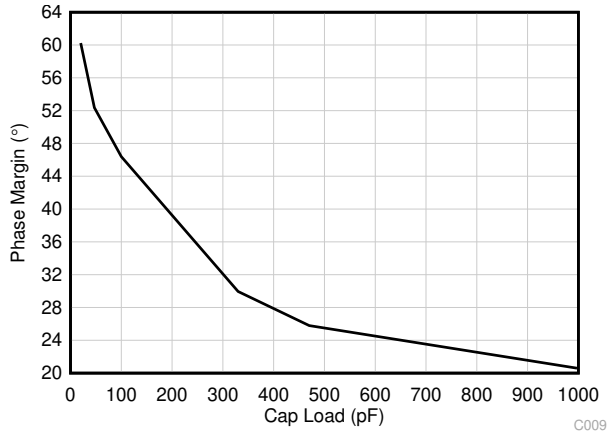



**Figure 5-18. Phase Margin vs Capacitive Load**

# 6 Parameter Measurement Information

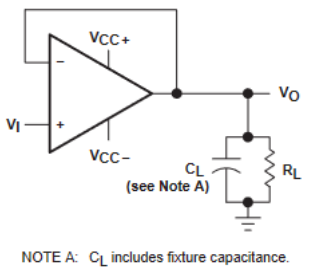



**Figure 6-1. Slew-Rate Test Circuit**

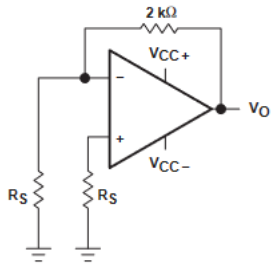



**Figure 6-2. Noise-Voltage Test Circuit**

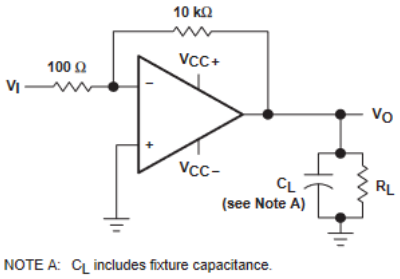



**Figure 6-3. Unity-Gain Bandwidth and Phase-Margin Test Circuit**

## 6.1 Typical Values

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

## 6.2 Input Bias and Offset Current

At the picoampere bias current level typical of the TLE206x, TLE2064xA, and TLE206xB, 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 into the socket and a second test that measures both the socket leakage and the device input bias current is performed. The two measurements are then subtracted algebraically to determine the bias current of the device.

# 7 Application and Implementation

**Note**

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

## 7.1 Application Information

### *7.1.1 Input Characteristics*

The TLE206x, TLE206xA, and TLE206xB are specified with a minimum and a maximum input voltage that, if exceeded at either input, can cause the device to malfunction. Due to the extremely high input impedance and resulting low bias current requirements, the TLE206x, TLE206xA, and TLE206xB are designed 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. To include guard rings around inputs (see Figure 7-1) is a good practice. Drive these guards from a low-impedance source at the same voltage level as the common-mode input

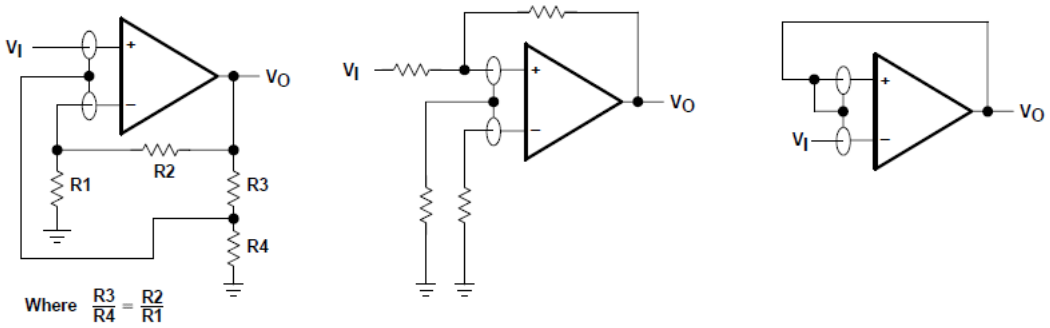



**Figure 7-1. Use of Guard Rings**

### *7.1.2 TLE2061 Input Offset Voltage Nulling*

Some versions of TLE2061 series offers external null pins that can be used to further reduce the input offset voltage. The circuit can be connected if the feature is desired (see Figure 7-2). When external nulling is not needed, the null pins can be left unconnected.

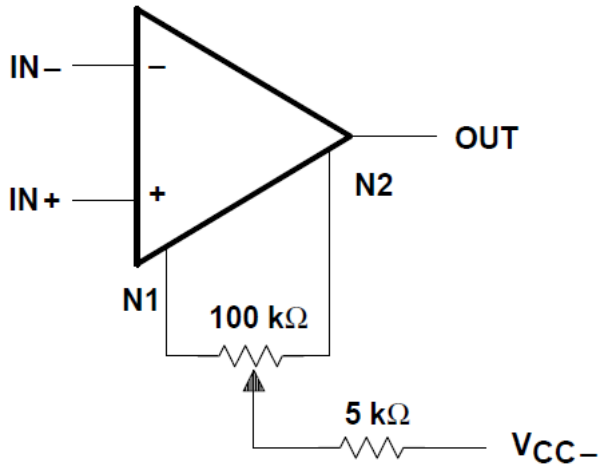



**Figure 7-2. Input Offset Voltage Nulling**

# 8 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

## 8.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

## 8.2 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

## 8.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

## 8.4 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## 8.5 Glossary

| | |
|---|---|
| TI Glossary | This glossary lists and explains terms, acronyms, and definitions. |

## 9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision C (July 2025) to Revision D (March 2026) | Page |
|---|---|
| • Updated Wide bandwidth from 2MHz to 1.1MHz GBW | 1 |
| • Updated Low supply current from 290µA/Ch to 120µA/Ch | 1 |
| • Updated Description as per latest die information | 1 |
| • Removed Ceramic Flat Pack (U) column | 3 |
| • Removed TSSOP (PW) column | 3 |
| • Updated Supply voltages $V_{CC+}$ and $V_{CC–}$ to single$V_{CC+}$ −($V_{CC–}$) with minimum value 0V and maximum value 38V | 6 |
| • Removed Differential input voltage range minimum value of −38V | 6 |
| • Updated Differential input voltage range maximum value from 38V to $V_{CC}$ +0.2V | 6 |
| • Removed Output current specification | 6 |
| • Removed Total current into and Total current out of specification | 6 |
| • Updated Duration of short-circuit current at (or below) 25°C to Continous | 6 |
| • Removed all references to D, P and PW package in Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | 6 |
| • Removed Input offset voltage long-term drift parameter in all *Electrical Characteristics* tables | 7 |
| • Updated Input capacitance parameter in all *Electrical Characteristics* tables excluding M suffix tables | 7 |
| • Updated Input offset current at 25°C from 1pA to ±5pA in all 5V *Electrical Characteristics* tables excluding M suffix tables | 7 |
| • Updated Input bias current at 25°C from 3pA to ±10pA in all 5V *Electrical Characteristics* tables excluding M suffix tables | 7 |
| • Updated Open-loop output impedance from 280Ω to 575Ω in all 5V *Electrical Characteristics* tables excluding M suffix tables | 7 |
| • Removed Equivalent input noise voltage maximum values in all *Operating Characteristics* tables | 8 |
| • Removed Unity-gain bandwidth parameter all *Operating Characteristics* tables excluding M suffix table | 8 |
| • Updated Phase margin at unity gain for $R_L$=10kΩ to 46° in all *Operating Characteristics* tables excluding M suffix table | 8 |
| • Removed Phase margin at unity gain for $R_L$=100Ω *Operating Characteristics* tables excluding M suffix table | 8 |
| • Updated Input offset current at 25°C from 2pA to ±5pA in all 15V *Electrical Characteristics* tables excluding M suffix tables | 9 |
| • Updated Input bias current at 25°C from 4pA to ±10pA in all 15V *Electrical Characteristics* tables excluding M suffix tables | 9 |
| • Removed all Y suffix tables | 9 |
| • Removed figure 5-6, 5-9, 5-10, 5-11, 5-12, 5-13, 5-14, 5-15, 5-16,5-17,5-18,5-19,5-20,5-22,5-23,5-24,5-25,5-26,5-27,5-28,5-35,5-36,5-38,5-39,5-40 | 40 |
| • Added Offset Voltage vs Common-Mode Voltage plot | 40 |
| • Added Open-Loop Gain and Phase vs Frequency plot | 40 |
| • Added Phase Margin vs Capacitive Load plot | 40 |

| Changes from Revision B (May 2004) to Revision C (July 2025) | Page |
|---|---|
| • Added *Applications* section | 1 |
| • Updated typical offset to 0.1mV all test conditions and supply voltages | 7 |
| • Updated typical offset drift to 1µV/°C across all test conditions and supply voltages | 7 |
| • Updated typical open-loop gain to 225V/mV across all test conditions and supply voltages | 7 |
| • Updated typical quiescent current across all test conditions and supply voltages | 7 |
| • Updated typical output swing across all test conditions and supply voltages | 7 |
| • Updated typical slew rate to 4V/µs across all test conditions and supply voltages | 7 |

## 10 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| 5962-9080701M2A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080701M2A TLE2061MFKB |
| 5962-9080701MPA | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080701MPA TLE2061M |
| 5962-9080702Q2A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080702Q2A TLE2061 AMFKB |
| 5962-9080702QPA | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080702QPA TLE2061AM |
| 5962-9080703QPA | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080703QPA TLE2061BM |
| 5962-9080801MPA | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080801MPA TLE2062M |
| 5962-9080803QPA | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080803QPA TLE2062BM |
| 5962-9080901M2A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080901M2A TLE2064 MFKB |
| 5962-9080901MCA | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080901MCA TLE2064MJB |
| 5962-9080902M2A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080902M2A TLE2064A MFKB |
| 5962-9080902MDA | Active | Production | CFP (W) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080902MDA TLE2064AMWB |
| 5962-9080903Q2A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080903Q2A TLE2064 BMFKB |

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| 5962-9080903QCA | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080903QCA TLE2064BMJB |
| TLE2061ACD | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | 0 to 70 | 2061AC |
| TLE2061ACP | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | TLE2061AC |
| TLE2061ACP.A | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | TLE2061AC |
| TLE2061ACPE4 | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | - | Call TI | Call TI | 0 to 70 | |
| TLE2061AID | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | -40 to 85 | 2061AI |
| TLE2061AIP | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -40 to 85 | TLE2061AI |
| TLE2061AIP.A | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -40 to 85 | TLE2061AI |
| TLE2061AMFKB | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080702Q2A TLE2061AMFKB |
| TLE2061AMFKB.A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080702Q2A TLE2061AMFKB |
| TLE2061AMJGB | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080702QPA TLE2061AM |
| TLE2061AMJGB.A | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080702QPA TLE2061AM |
| TLE2061BMJGB | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080703QPA TLE2061BM |
| TLE2061BMJGB.A | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080703QPA TLE2061BM |
| TLE2061CD | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | 0 to 70 | 2061C |
| TLE2061CDR | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 2061C |
| TLE2061CDR.A | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 2061C |
| TLE2061CDRG4 | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | - | Call TI | Call TI | 0 to 70 | |
| TLE2061CP | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | TLE2061CP |
| TLE2061CP.A | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | TLE2061CP |
| TLE2061ID | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | -40 to 85 | 2061I |
| TLE2061IDR | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2061I |

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| TLE2061IDR.A | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2061I |
| TLE2061IP | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -40 to 85 | TLE2061IP |
| TLE2061IP.A | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -40 to 85 | TLE2061IP |
| TLE2061MD | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | -55 to 125 | |
| TLE2061MDG4 | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | -55 to 125 | |
| TLE2061MFKB | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080701M2A TLE2061MFKB |
| TLE2061MFKB.A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080701M2A TLE2061MFKB |
| TLE2061MJGB | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080701MPA TLE2061M |
| TLE2061MJGB.A | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080701MPA TLE2061M |
| TLE2062ACD | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | 0 to 70 | 2062AC |
| TLE2062ACDR | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 2062AC |
| TLE2062ACDR.A | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 2062AC |
| TLE2062ACDRG4 | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2062AC |
| TLE2062ACDRG4.A | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2062AC |
| TLE2062AID | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | -40 to 85 | 2062AI |
| TLE2062AIDR | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2062AI |
| TLE2062AIDR.A | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2062AI |
| TLE2062AMD | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | -55 to 125 | |
| TLE2062AMDR | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | 2062AM |
| TLE2062AMDR.A | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | 2062AM |
| TLE2062AMJG | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2062 AMJG |
| TLE2062AMJG.A | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2062 AMJG |
| TLE2062BMJG | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2062 BMJG |

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| TLE2062BMJG.A | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2062 BMJG |
| TLE2062BMJGB | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080803QPA TLE2062BM |
| TLE2062BMJGB.A | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080803QPA TLE2062BM |
| TLE2062CD | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | 0 to 70 | 2062C |
| TLE2062CDR | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 2062C |
| TLE2062CDR.A | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 2062C |
| TLE2062CDRG4 | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | - | Call TI | Call TI | 0 to 70 | |
| TLE2062CP | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | TLE2062CP |
| TLE2062CP.A | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | TLE2062CP |
| TLE2062ID | Obsolete | Production | SOIC (D) \| 8 | - | - | Call TI | Call TI | -40 to 85 | 2062I |
| TLE2062IDR | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2062I |
| TLE2062IDR.A | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2062I |
| TLE2062IDRG4 | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2062I |
| TLE2062IDRG4.A | Active | Production | SOIC (D) \| 8 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2062I |
| TLE2062IP | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -40 to 85 | TLE2062IP |
| TLE2062IP.A | Active | Production | PDIP (P) \| 8 | 50 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -40 to 85 | TLE2062IP |
| TLE2062MFKB | Obsolete | Production | LCCC (FK) \| 20 | - | - | Call TI | Call TI | - | 5962-9080801M2A TLE2062MFKB |
| TLE2062MJG | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2062MJG |
| TLE2062MJG.A | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2062MJG |
| TLE2062MJGB | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080801MPA TLE2062M |
| TLE2062MJGB.A | Active | Production | CDIP (JG) \| 8 | 50 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 9080801MPA TLE2062M |
| TLE2064ACD | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | 0 to 70 | 2064AC |
| TLE2064ACDR | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2064AC |
| TLE2064ACDR.A | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2064AC |
| TLE2064ACN | Active | Production | PDIP (N) \| 14 | 25 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -40 to 85 | TLE2064ACN |

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| TLE2064ACN.A | Active | Production | PDIP (N) \| 14 | 25 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -40 to 85 | TLE2064ACN |
| TLE2064AID | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | -40 to 85 | 2064AI |
| TLE2064AIDR | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2064AI |
| TLE2064AIDR.A | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2064AI |
| TLE2064AIDRG4 | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2064AI |
| TLE2064AIDRG4.A | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 2064AI |
| TLE2064AMD | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | -55 to 125 | |
| TLE2064AMDG4 | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | - | |
| TLE2064AMDR | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | 2064AM |
| TLE2064AMDR.A | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | 2064AM |
| TLE2064AMDRG4 | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | - | |
| TLE2064AMFKB | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080902M2A TLE2064A MFKB |
| TLE2064AMFKB.A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080902M2A TLE2064A MFKB |
| TLE2064AMJ | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2064AMJ |
| TLE2064AMJ.A | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2064AMJ |
| TLE2064AMWB | Active | Production | CFP (W) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080902MDA TLE2064AMWB |
| TLE2064AMWB.A | Active | Production | CFP (W) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080902MDA TLE2064AMWB |
| TLE2064BMFKB | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080903Q2A TLE2064 BMFKB |
| TLE2064BMFKB.A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080903Q2A TLE2064 BMFKB |

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| TLE2064BMJ | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2064BMJ |
| TLE2064BMJ.A | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2064BMJ |
| TLE2064BMJB | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080903QC A TLE2064BMJB |
| TLE2064BMJB.A | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080903QC A TLE2064BMJB |
| TLE2064CD | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | 0 to 70 | TLE2064C |
| TLE2064CDR | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | TLE2064C |
| TLE2064CDR.A | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | TLE2064C |
| TLE2064CDRG4 | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | - | Call TI | Call TI | 0 to 70 | |
| TLE2064CN | Active | Production | PDIP (N) \| 14 | 25 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | TLE2064CN |
| TLE2064CN.A | Active | Production | PDIP (N) \| 14 | 25 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | 0 to 70 | TLE2064CN |
| TLE2064CNE4 | Active | Production | PDIP (N) \| 14 | 25 \| TUBE | - | Call TI | Call TI | 0 to 70 | |
| TLE2064ID | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | -40 to 85 | TLE2064I |
| TLE2064IDR | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TLE2064I |
| TLE2064IDR.A | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TLE2064I |
| TLE2064IN | Active | Production | PDIP (N) \| 14 | 25 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -40 to 85 | TLE2064IN |
| TLE2064IN.A | Active | Production | PDIP (N) \| 14 | 25 \| TUBE | Yes | NIPDAU | N/A for Pkg Type | -40 to 85 | TLE2064IN |
| TLE2064INE4 | Active | Production | PDIP (N) \| 14 | 25 \| TUBE | - | Call TI | Call TI | -40 to 85 | |
| TLE2064MD | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | -55 to 125 | |
| TLE2064MDG4 | Obsolete | Production | SOIC (D) \| 14 | - | - | Call TI | Call TI | - | |
| TLE2064MDR | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | TLE2064M |
| TLE2064MDR.A | Active | Production | SOIC (D) \| 14 | 2500 \| LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | TLE2064M |
| TLE2064MFKB | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080901M2A TLE2064 MFKB |
| TLE2064MFKB.A | Active | Production | LCCC (FK) \| 20 | 55 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080901M2A TLE2064 MFKB |

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| TLE2064MJ | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2064MJ |
| TLE2064MJ.A | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | TLE2064MJ |
| TLE2064MJB | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080901MC A TLE2064MJB |
| TLE2064MJB.A | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-9080901MC A TLE2064MJB |

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

**OTHER QUALIFIED VERSIONS OF TLE2061, TLE2061A, TLE2061AM, TLE2061M, TLE2062, TLE2062A, TLE2062AM, TLE2062M, TLE2064, TLE2064A, TLE2064AM, TLE2064M :**

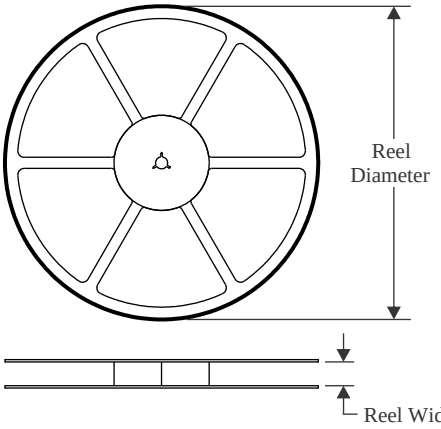
- Catalog : TLE2061A, TLE2061, TLE2062A, TLE2062, TLE2064A, TLE2064
- Military : TLE2061M, TLE2061AM, TLE2062M, TLE2062AM, TLE2064M, TLE2064AM

NOTE: Qualified Version Definitions:

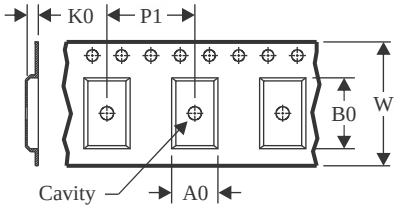
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

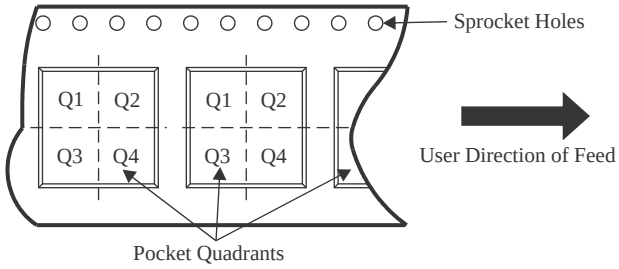



**TAPE DIMENSIONS**




| | |
|---|---|
| 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 |

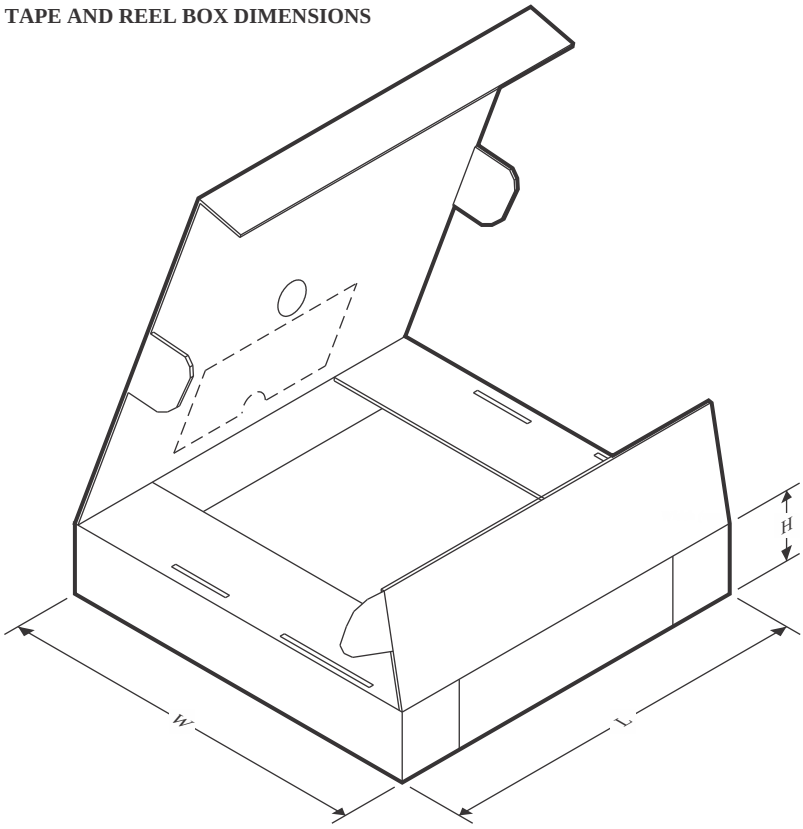
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TLE2061CDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2061IDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2062ACDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2062ACDRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2062AIDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2062AMDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2062CDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2062IDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2062IDRG4 | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLE2064ACDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLE2064AIDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLE2064AIDRG4 | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLE2064AMDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLE2064CDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLE2064IDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLE2064MDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |

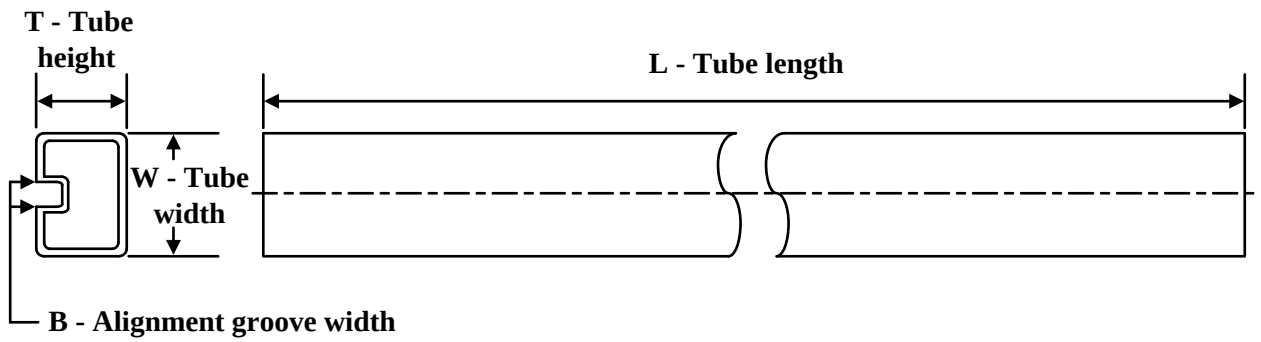
TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TLE2061CDR | SOIC | D | 8 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2061IDR | SOIC | D | 8 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2062ACDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TLE2062ACDRG4 | SOIC | D | 8 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2062AIDR | SOIC | D | 8 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2062AMDR | SOIC | D | 8 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2062CDR | SOIC | D | 8 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2062IDR | SOIC | D | 8 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2062IDRG4 | SOIC | D | 8 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2064ACDR | SOIC | D | 14 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2064AIDR | SOIC | D | 14 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2064AIDRG4 | SOIC | D | 14 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2064AMDR | SOIC | D | 14 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2064CDR | SOIC | D | 14 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2064IDR | SOIC | D | 14 | 2500 | 353.0 | 353.0 | 32.0 |
| TLE2064MDR | SOIC | D | 14 | 2500 | 353.0 | 353.0 | 32.0 |

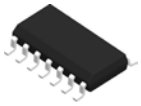
## TUBE




*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (µm) | B (mm) |
|---|---|---|---|---|---|---|---|---|
| 5962-9080701M2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| 5962-9080702Q2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| 5962-9080901M2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| 5962-9080902M2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| 5962-9080902MDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| 5962-9080903Q2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TLE2061ACP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2061ACP.A | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2061AIP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2061AIP.A | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2061AMFKB | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TLE2061AMFKB.A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TLE2061CP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2061CP.A | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2061IP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2061IP.A | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2061MFKB | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TLE2061MFKB.A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TLE2062CP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2062CP.A | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2062IP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2062IP.A | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TLE2064ACN | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TLE2064ACN.A | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TLE2064AMFKB | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TLE2064AMFKB.A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TLE2064AMWB | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| TLE2064AMWB.A | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| TLE2064BMFKB | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (µm) | B (mm) |
|---|---|---|---|---|---|---|---|---|
| TLE2064BMFKB.A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TLE2064CN | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TLE2064CN.A | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TLE2064IN | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TLE2064IN.A | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TLE2064MFKB | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TLE2064MFKB.A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |

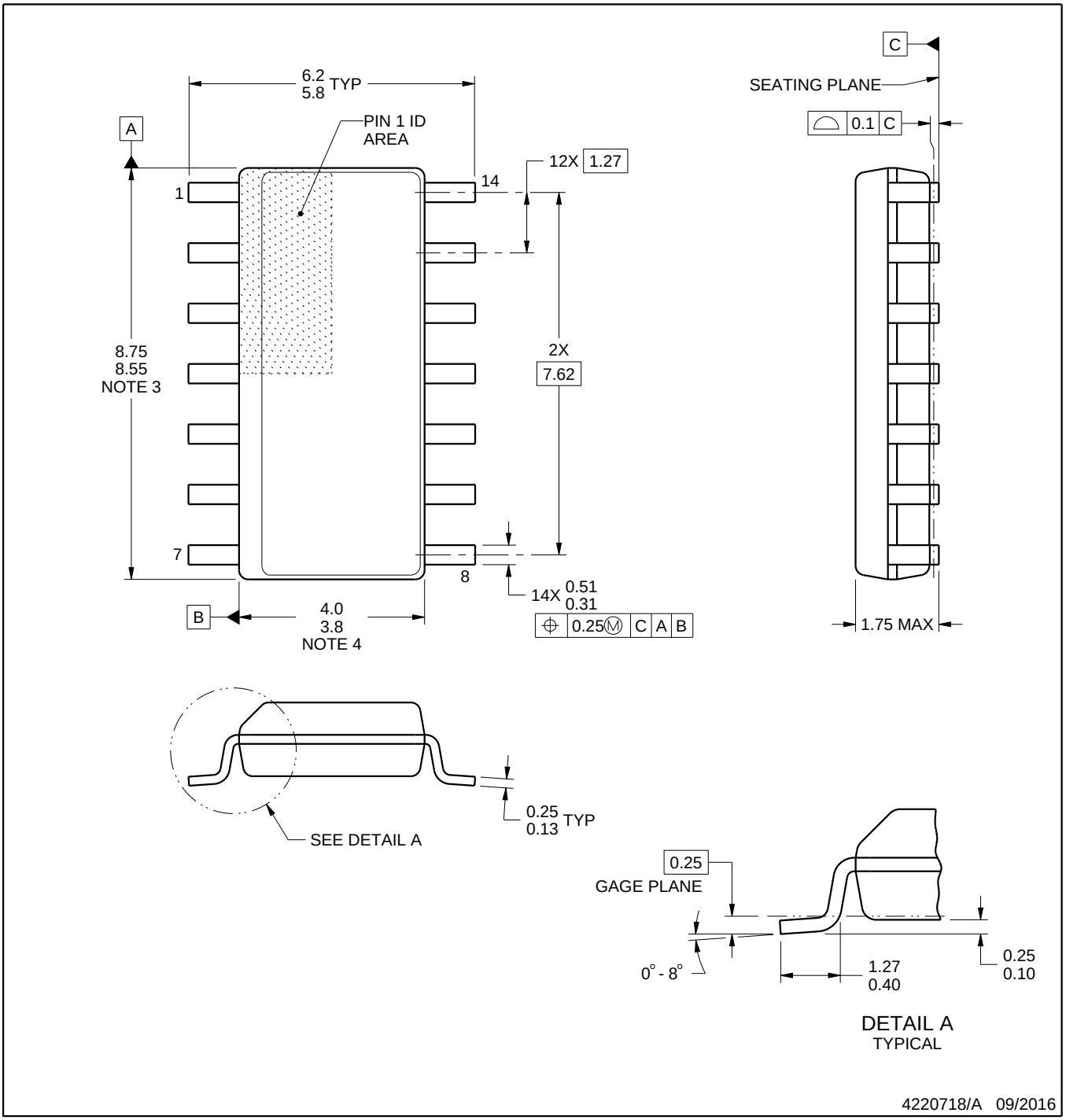


# PACKAGE OUTLINE

## D0014A

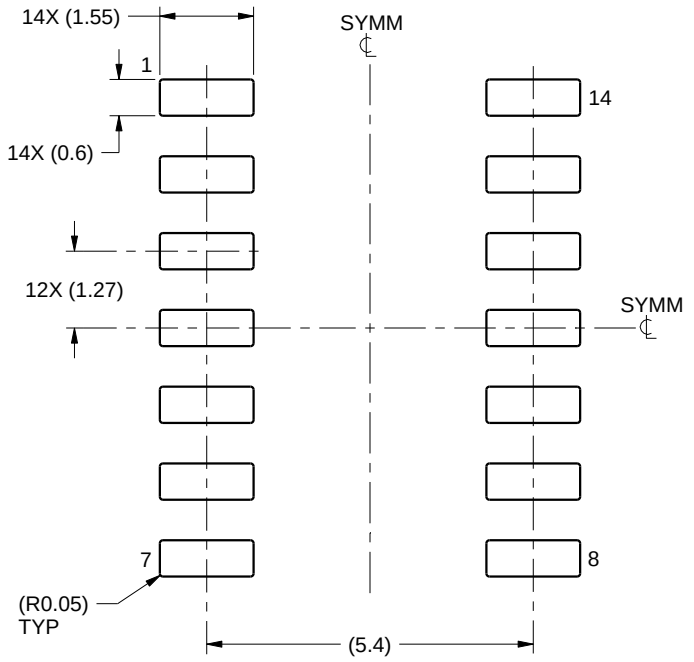
## SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT

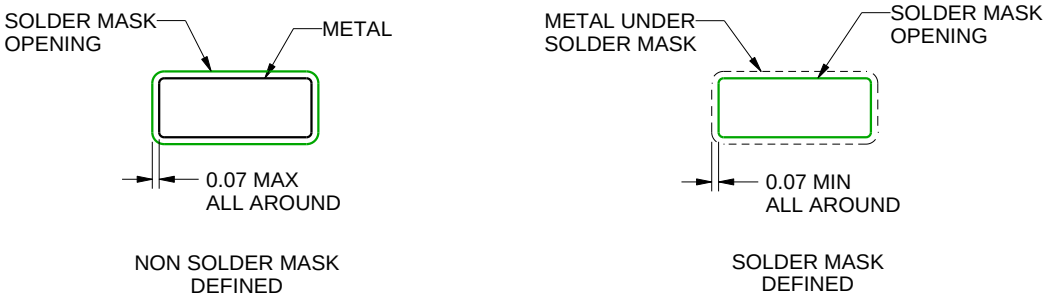



NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.




LAND PATTERN EXAMPLE
SCALE:8X




SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

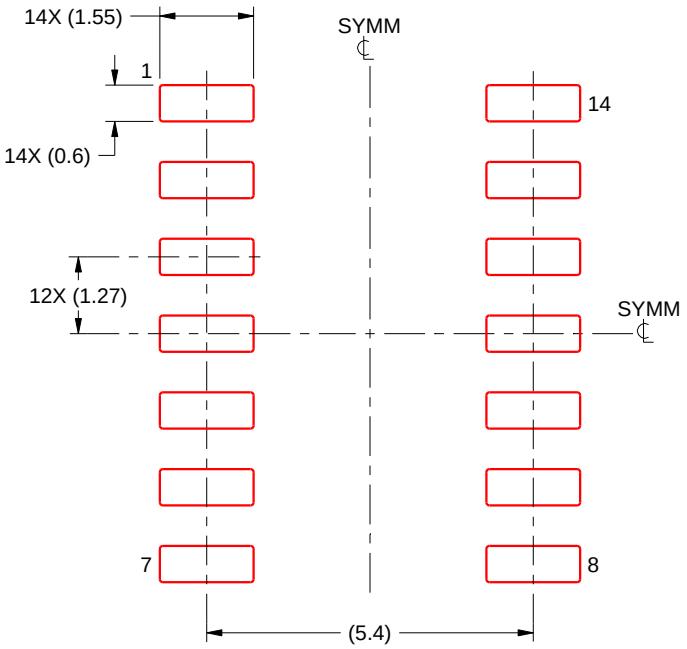
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

## D0014A

## SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



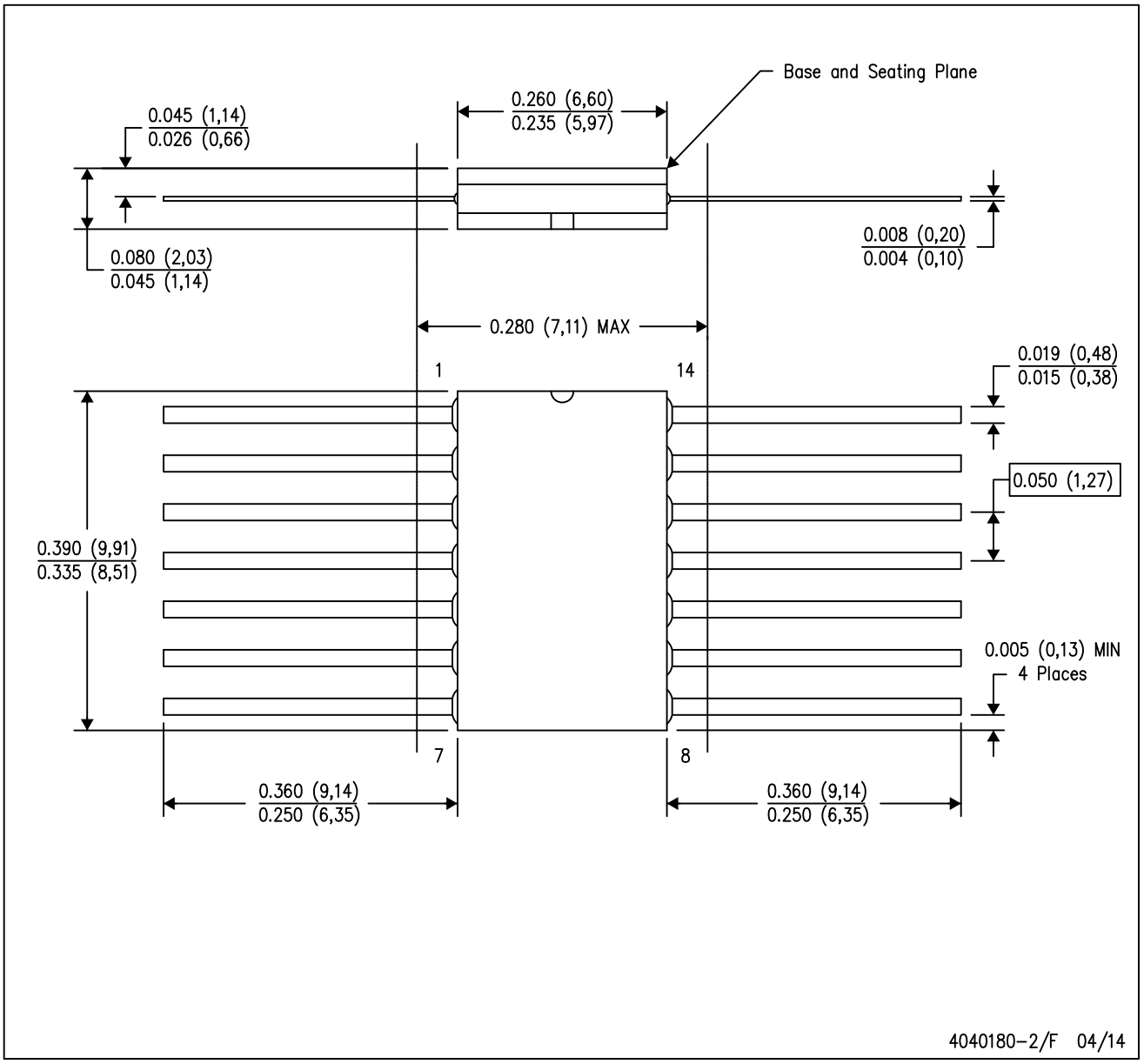

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:8X

4220718/A 09/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

W (R–GDFP–F14) 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–F14

# GENERIC PACKAGE VIEW

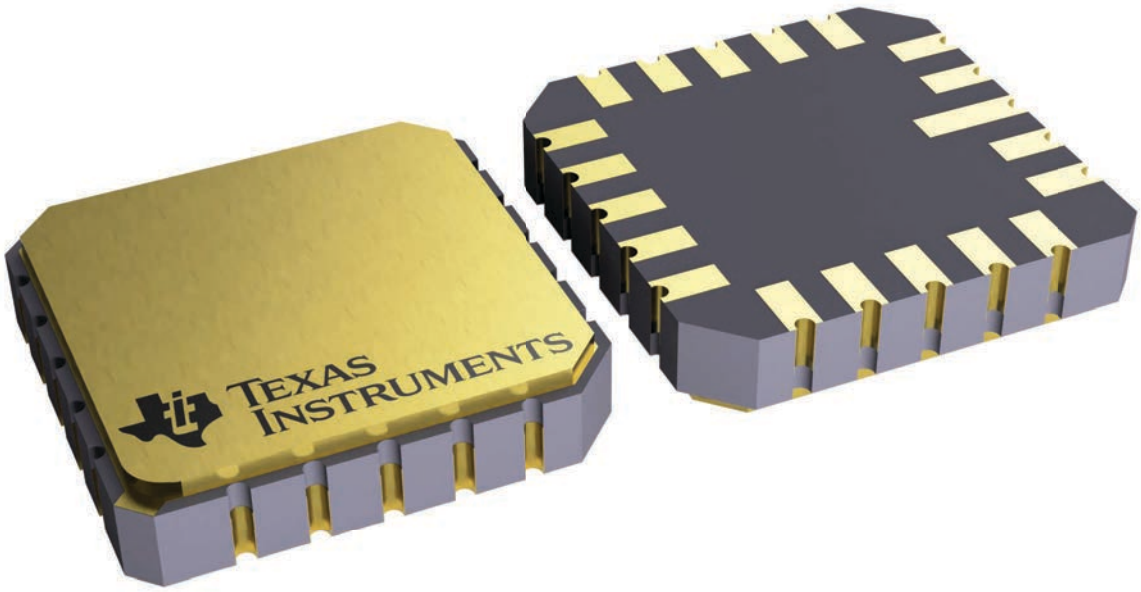
## FK 20

## LCCC - 2.03 mm max height

**8.89 x 8.89, 1.27 mm pitch**

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

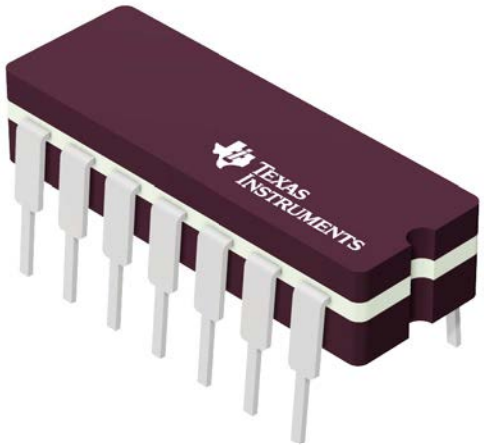



4229370VA\

# GENERIC PACKAGE VIEW

## J 14 CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE




Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

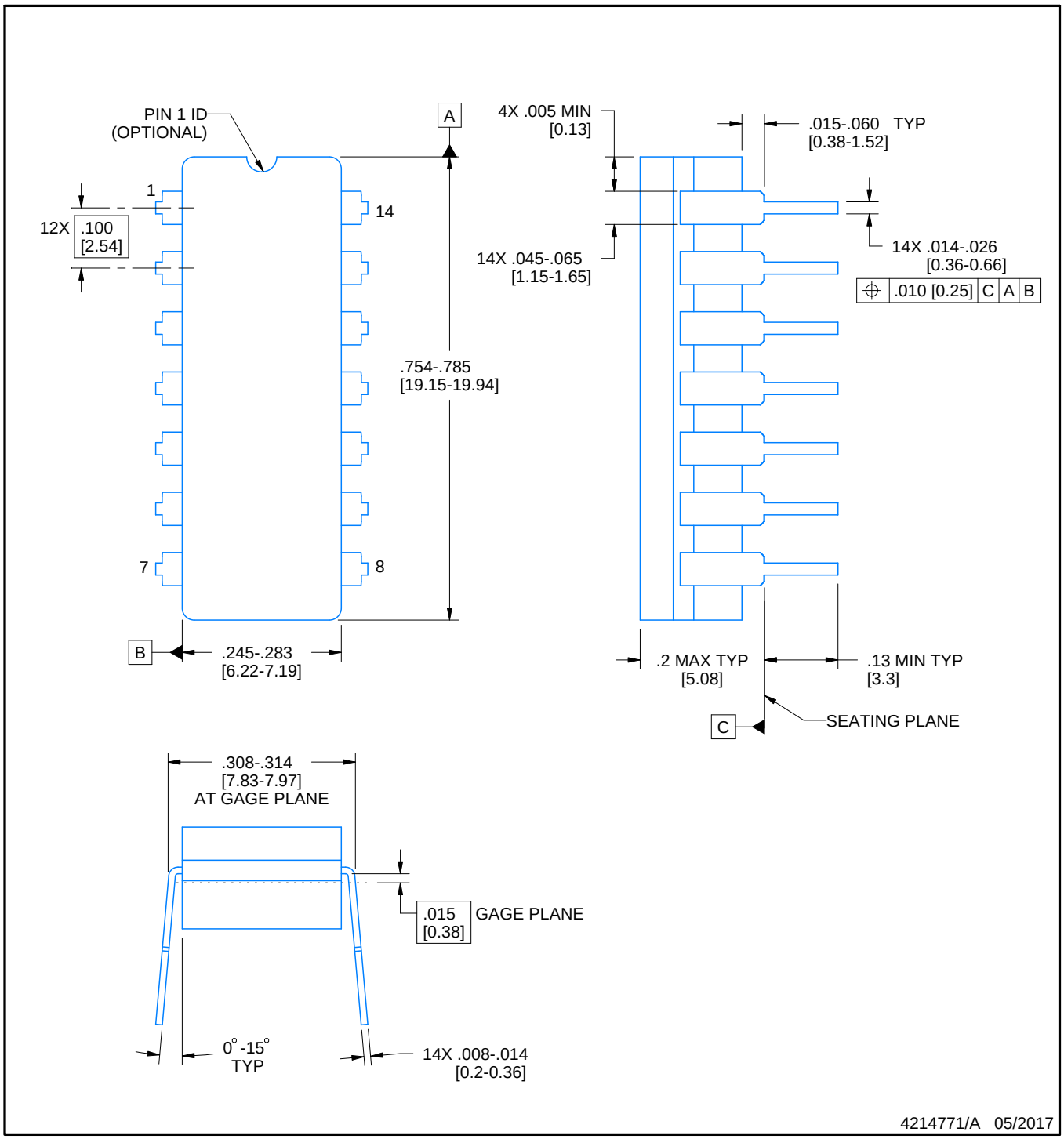
4040083-5/G

# PACKAGE OUTLINE

## J0014A

## CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE




NOTES:

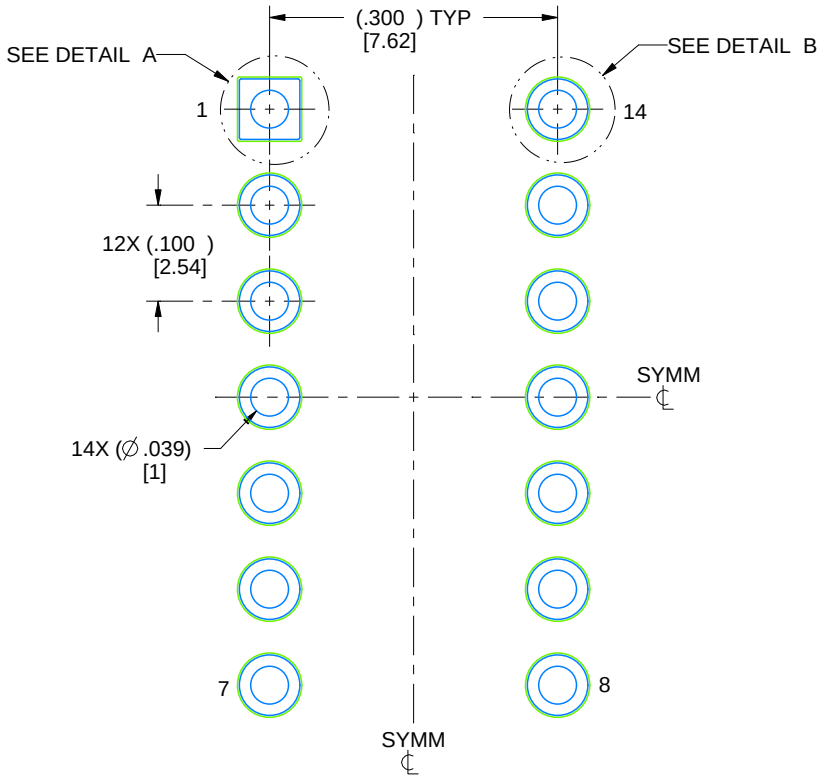
1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermitically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.

# EXAMPLE BOARD LAYOUT

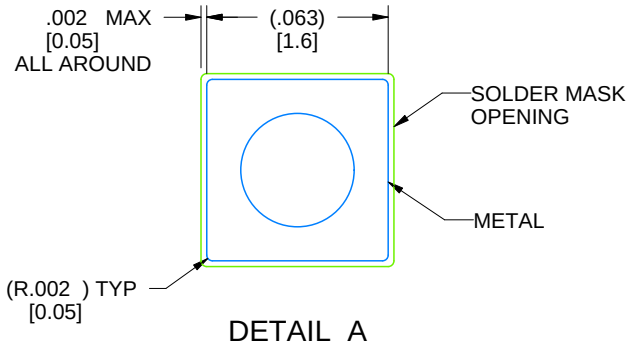
## J0014A

## CDIP - 5.08 mm max height

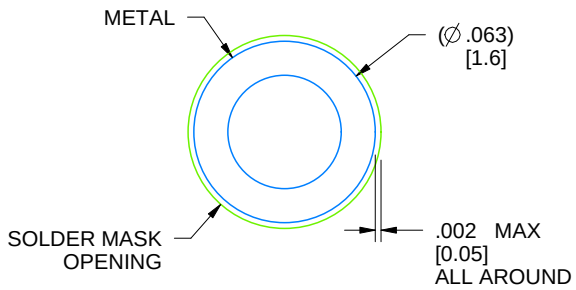
CERAMIC DUAL IN LINE PACKAGE




LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE: 5X

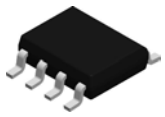



DETAIL A
SCALE: 15X




DETAIL B
13X, SCALE: 15X

4214771/A 05/2017

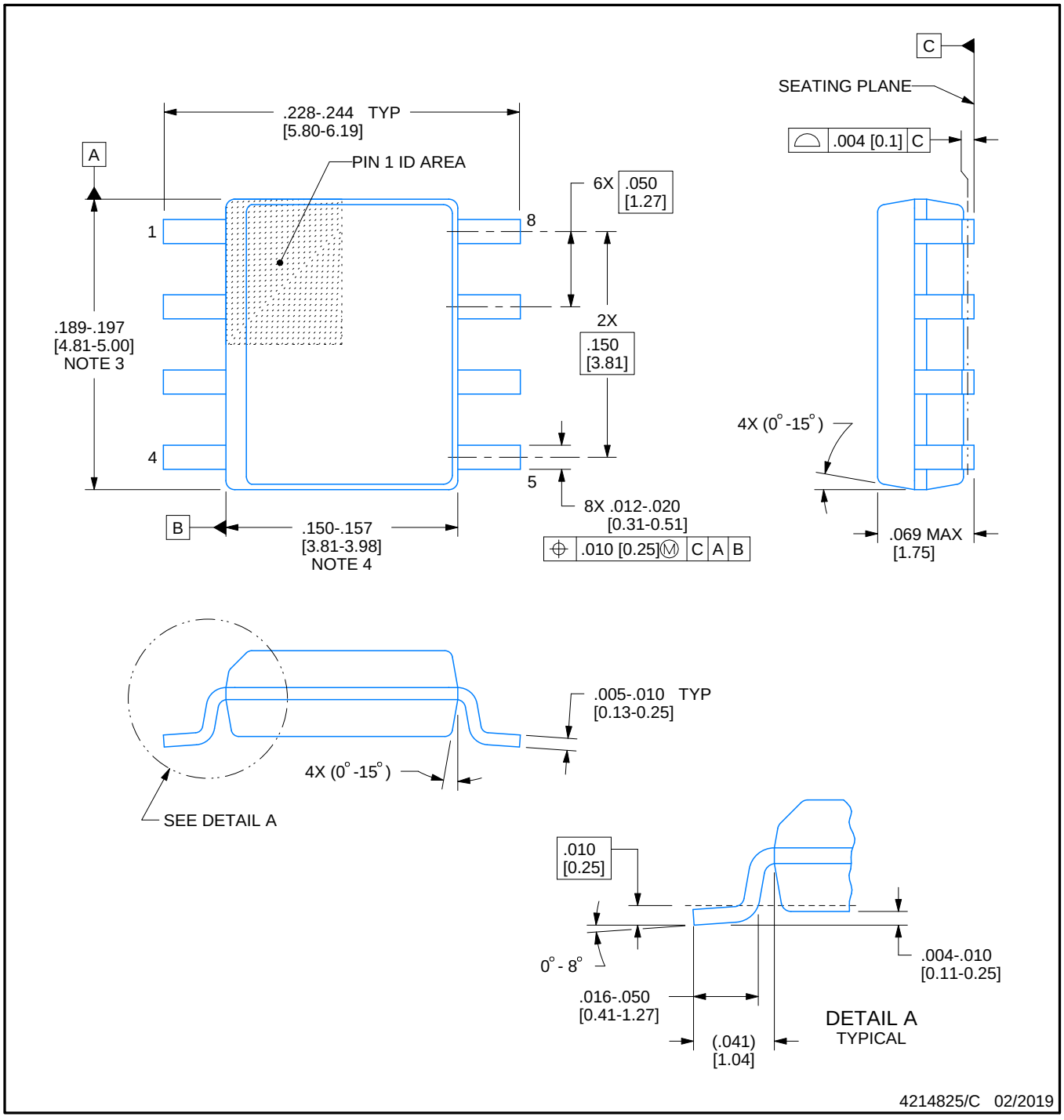


# PACKAGE OUTLINE

## D0008A

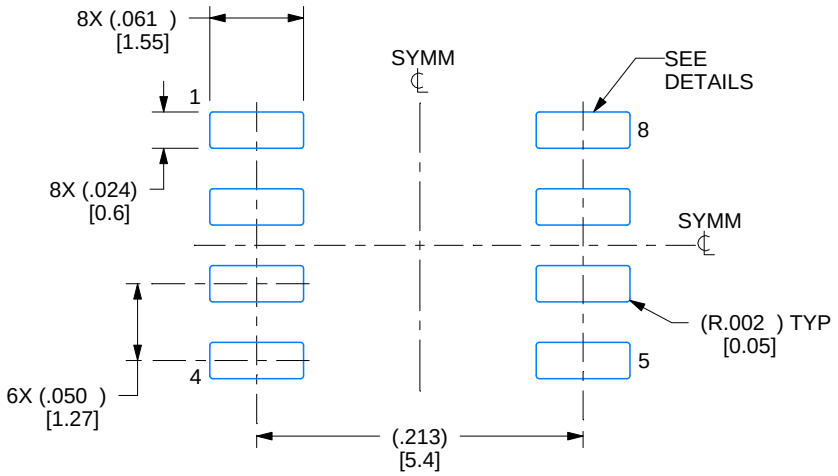
## SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT

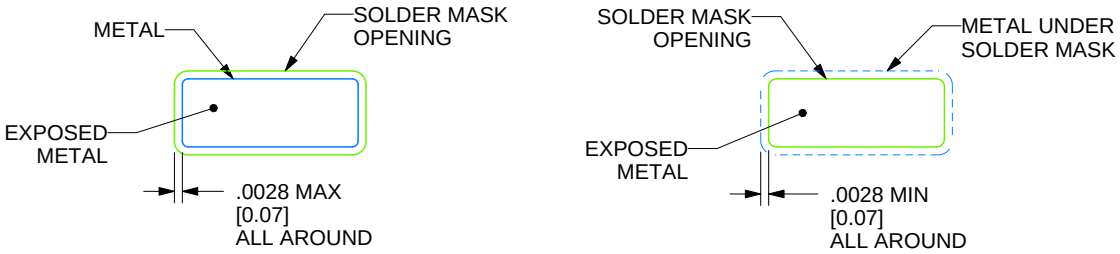



NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.




LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X




SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

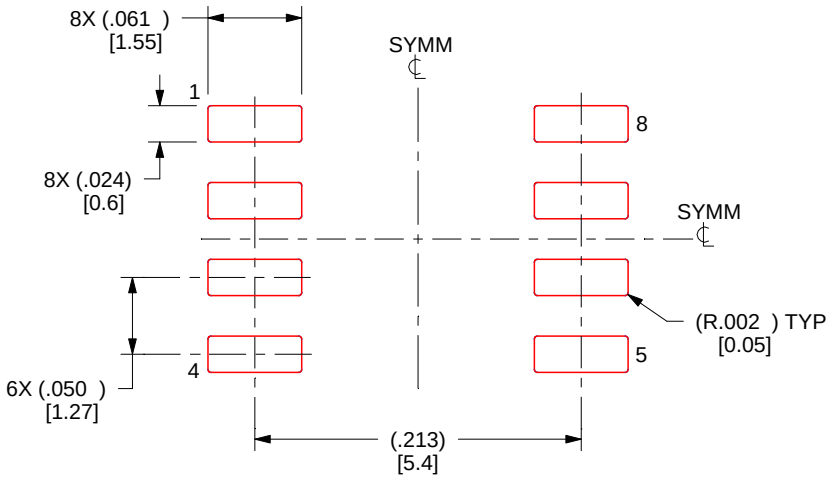
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

## D0008A

## SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



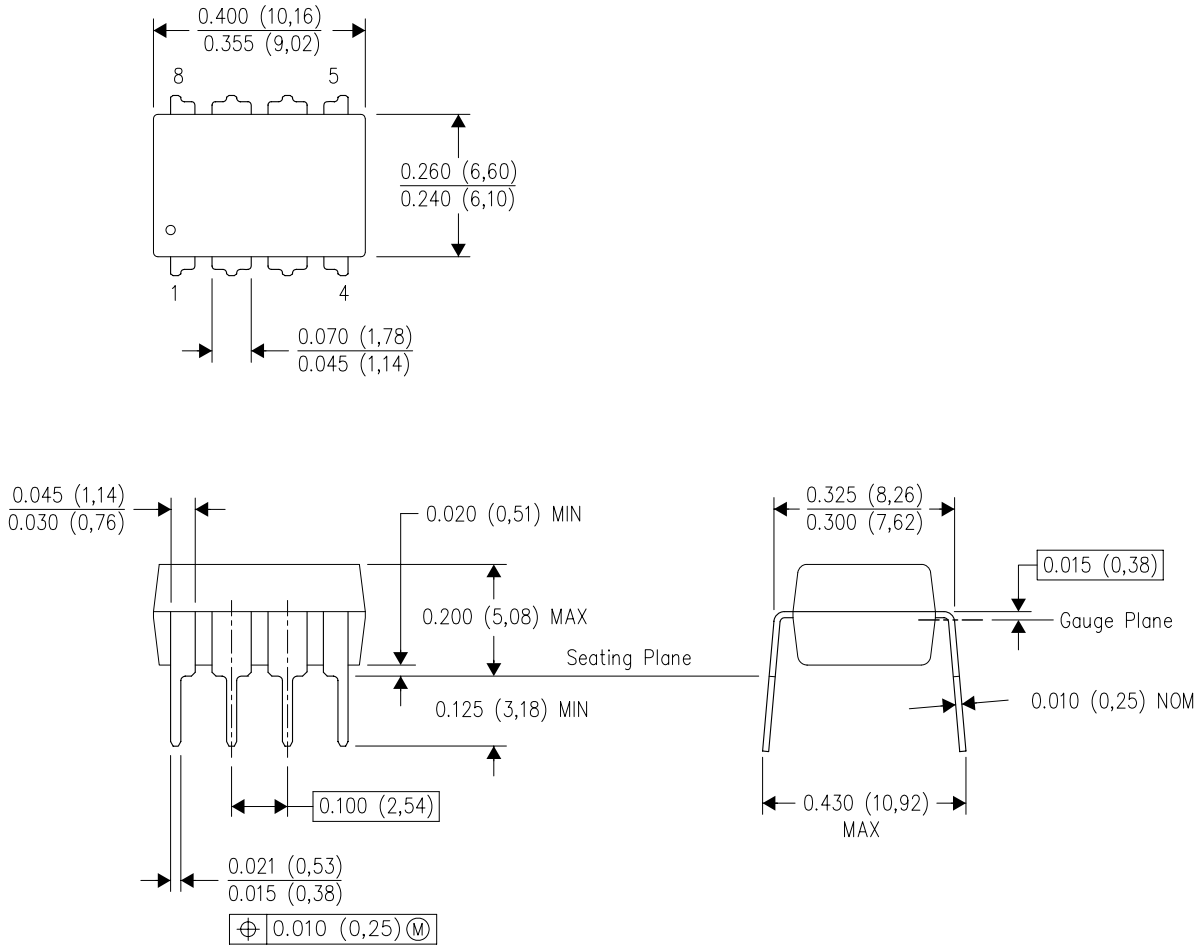

SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

4214825/C 02/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

P (R–PDIP–T8) PLASTIC DUAL–IN–LINE PACKAGE

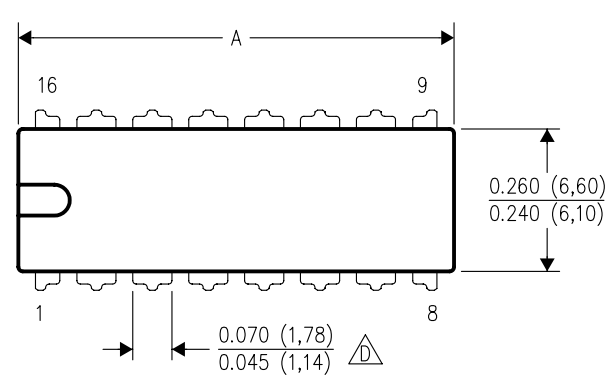



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001 variation BA.

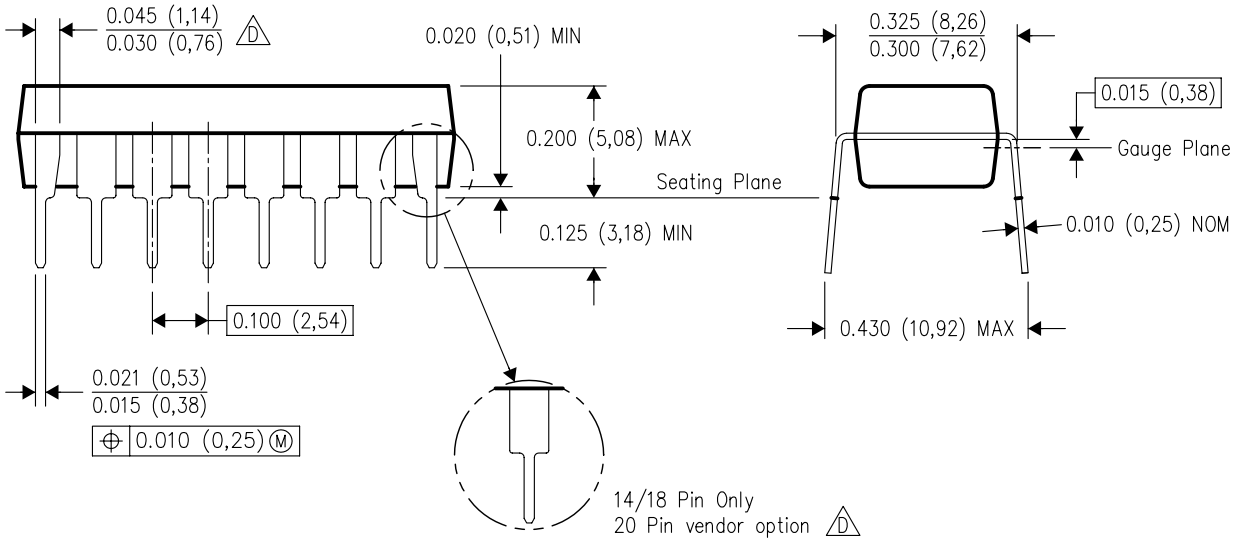
## N (R–PDIP–T**)

## PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN




| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---|---|---|---|---|
| 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 (C) | AA | BB | AC | AD |




4040049/E 12/2002

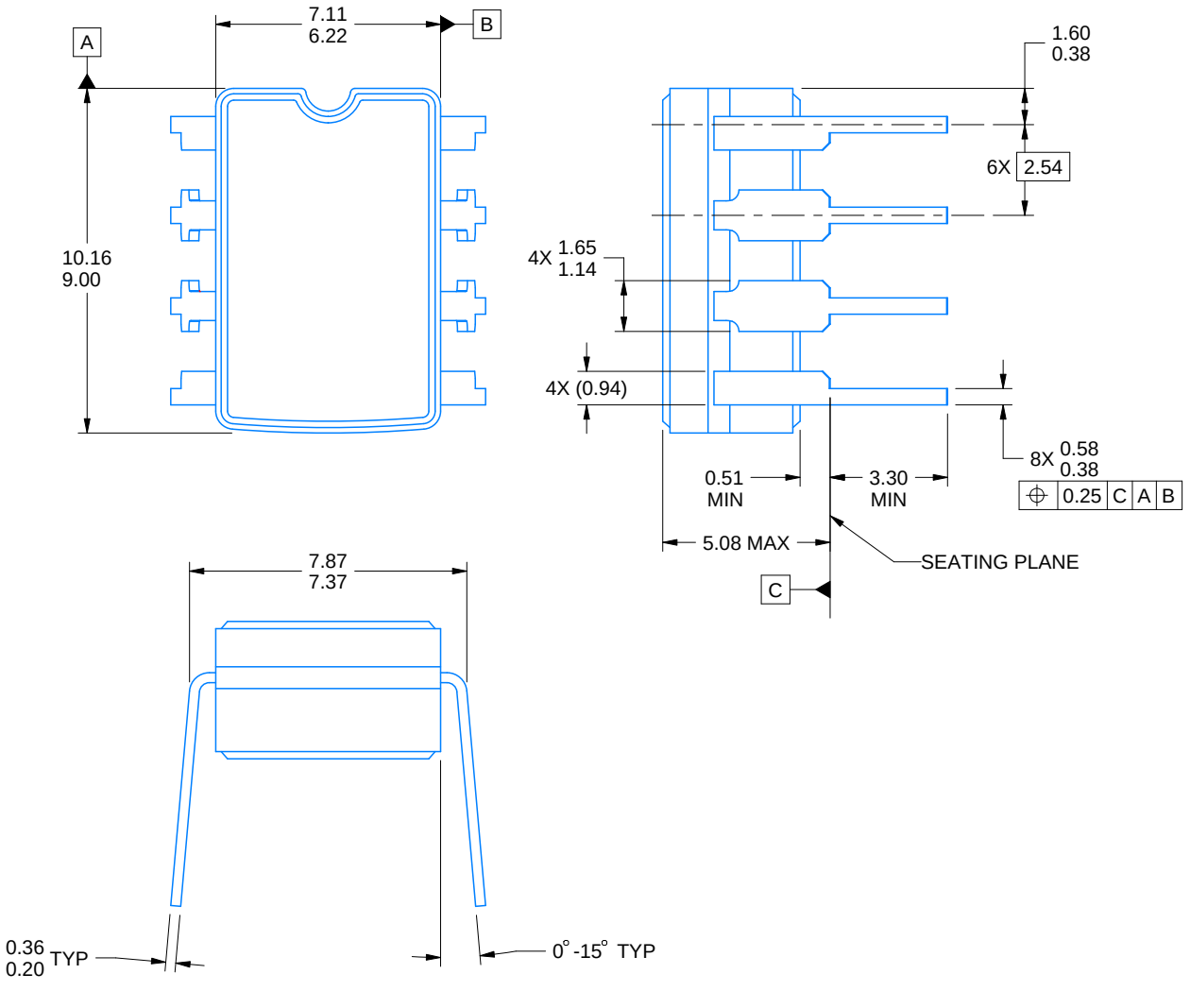
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

# PACKAGE OUTLINE

## JG0008A

## CDIP - 5.08 mm max height

CERAMIC DUAL IN-LINE PACKAGE




4230036/A 09/2023

NOTES:

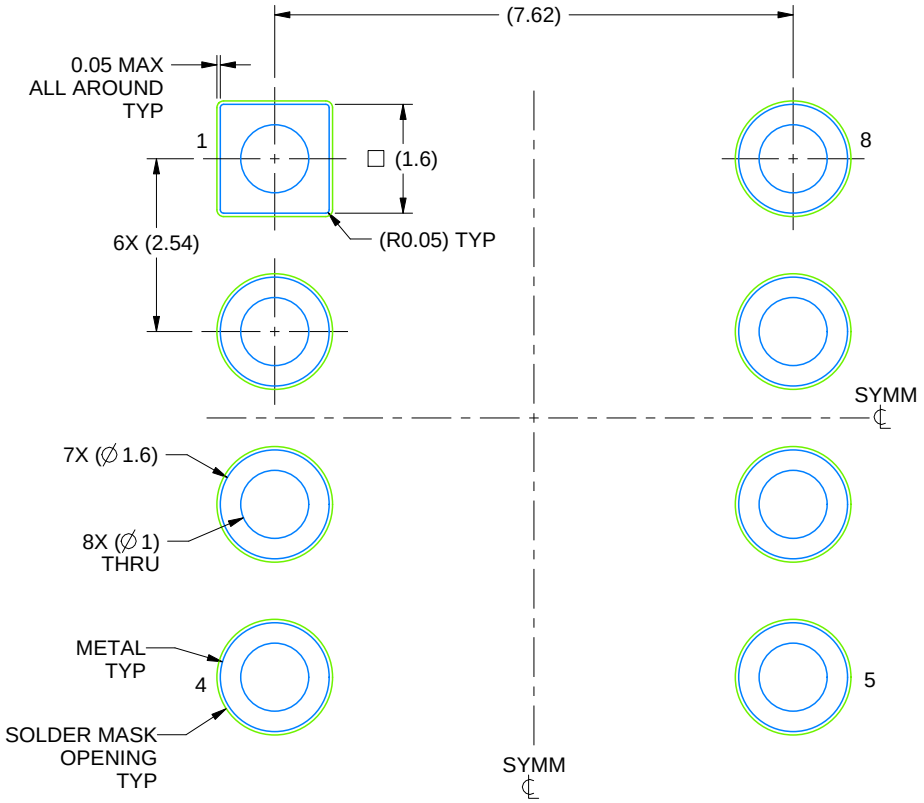
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package can be hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification.
5. Falls within MIL STD 1835 GDIP1-T8

# EXAMPLE BOARD LAYOUT

## JG0008A

## CDIP - 5.08 mm max height

CERAMIC DUAL IN-LINE PACKAGE




LAND PATTERN EXAMPLE
NON SOLDER MASK DEFINED
SCALE: 9X

4230036/A 09/2023

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