- **Output Swing includes Both Supply Rails**
- **Low Noise . . . 12 nV/$\sqrt{\text{Hz}}$ Typ at f = 1 kHz**
- **Low Input Bias Current . . . 1 pA Typ**
- **Fully Specified for Both Single-Supply and Split-Supply Operation**
- **Low Power . . . 500 $\mu$A Max**
- **Common-Mode Input Voltage Range Includes Negative Rail**

- **Low Input Offset Voltage 950 $\mu$V Max at $T_A$ = 25°C (TLC2262A)**
- **Macromodel Included**
- **Performance Upgrade for the TS27M2/M4 and TLC27M2/M4**
- **Available in Q-Temp Automotive HighRel Automotive Applications Configuration Control/Print Support Qualification to Automotive Standards**

### description

The TLC2262 and TLC2264 are dual and quadruple operational amplifiers from Texas Instruments. Both devices exhibit rail-to-rail output performance for increased dynamic range in single- or split-supply applications. The TLC226x family offers a compromise between the micropower TLC225x and the ac performance of the TLC227x. It has low supply current for battery-powered applications, while still having adequate ac performance for applications that demand it. The noise performance has been dramatically improved over previous generations of CMOS amplifiers. Figure 1 depicts the low level of noise voltage for this CMOS amplifier, which has only 200 $\mu$A (typ) of supply current per amplifier.

The TLC226x, exhibiting high input impedance and low noise, are excellent for small-signal conditioning for high-impedance sources, such as piezoelectric transducers. Because of the micro-power dissipation levels, these devices work well in hand-held monitoring and remote-sensing applications. In addition, the rail-to-rail output feature with single or split supplies makes this family a great choice when interfacing with analog-to-digital converters (ADCs). For precision applications, the TLC226xA family is available and has a maximum input offset voltage of 950 $\mu$V. This family is fully characterized at 5 V and $\pm$5 V.

The TLC2262/4 also makes great upgrades to the TLC27M2/L4 or TS27M2/L4 in standard designs. They offer increased output dynamic range, lower noise voltage and lower input offset voltage. This enhanced feature set allows them to be used in a wider range of applications. For applications that require higher output drive and wider input voltage range, see the TLV2432 and TLV2442. If your design requires single amplifiers, please see the TLV2211/21/31 family. These devices are single rail-to-rail operational amplifiers in the SOT-23 package. Their small size and low power consumption, make them ideal for high density, battery-powered equipment.

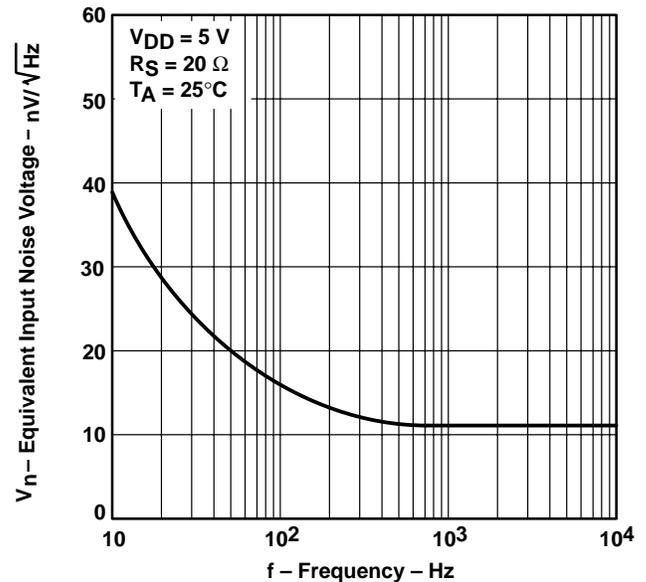**EQUIVALENT INPUT NOISE VOLTAGE**
**vs**
**FREQUENCY**



**Figure 1**

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

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**TEXAS INSTRUMENTS**

**TLC2262 AVAILABLE OPTIONS**

| T$_A$ | V$_{IO}$max AT 25°C | PACKAGED DEVICES | | | | | |
|---|---|---|---|---|---|---|---|
| | | SMALL OUTLINE (D) | CHIP CARRIER (FK) | CERAMIC DIP (JG) | PLASTIC DIP (P) | TSSOP (PW) | CERAMIC FLATPACK (U) |
| 0°C to 70°C | 2.5 mV | TLC2262CD | — | — | TLC2262CP | TLC2262CPW | — |
| −40°C to 125°C | 950 µV 2.5 mV | TLC2262AID TLC2262ID | — — | — — | TLC2262AIP TLC2262IP | TLC2262AIPW — | — — |
| −40°C to 125°C | 950 µV 2.5 mV | TLC2262AQD TLC2262QD | — — | — — | — — | — — | — — |
| −55°C to 125°C | 950 µV 2.5 mV | — — | TLC2262AMFK TLC2262MFK | TLC2262AMJG TLC2262MJG | — — | — — | TLC2262AMU TLC2262MU |

The D packages are available taped and reeled. Add R suffix to device type (e.g., TLC2262CDR). The PW package is available only left-end taped and reeled. Chips are tested at 25°C.

**TLC2264 AVAILABLE OPTIONS**

| T$_A$ | V$_{IO}$max AT 25°C | PACKAGED DEVICES | | | | | |
|---|---|---|---|---|---|---|---|
| | | SMALL OUTLINE (D) | CHIP CARRIER (FK) | CERAMIC DIP (J) | PLASTIC DIP (N) | TSSOP (PW) | CERAMIC FLATPACK (W) |
| 0°C to 70°C | 2.5 mV | TLC2264CD | — | — | TLC2264CN | TLC2264CPW | — |
| −40°C to 125°C | 950 µV 2.5 mV | TLC2264AID TLC2264ID | — — | — — | TLC2264AIN TLC2264IN | TLC2264AIPW — | — — |
| −40°C to 125°C | 950 µV 2.5 mV | TLC2264AQD TLC2264QD | — — | — — | — — | — — | — — |
| −55°C to 125°C | 950 µV 2.5 mV | — — | TLC2264AMFK TLC2264MFK | TLC2264AMJ TLC2264MJ | — — | — — | TLC2264AMW TLC2264MW |

The D packages are available taped and reeled. Add R suffix to device type (e.g., TLC2264CDR). The PW package is available only left-end taped and reeled. Chips are tested at 25°C.

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INSTRUMENTS

**TLC2262C, TLC2262AC**
**TLC2262I, TLC2262AI**
**TLC2262Q, TLC2262AQ**
**D, P, OR PW PACKAGE**
**(TOP VIEW)**
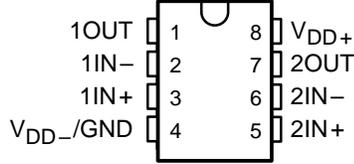


**TLC2262M, TLC2262AM . . . FK PACKAGE**
**(TOP VIEW)**
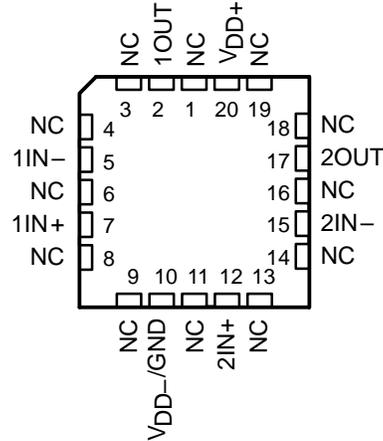


NC – No internal connection

**TLC2262M, TLC2262AM . . . JG PACKAGE**
**(TOP VIEW)**
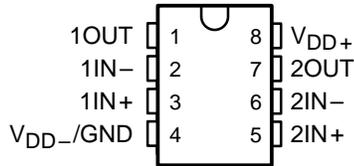


**TLC2262M, TLC2262AM . . . U PACKAGE**
**(TOP VIEW)**
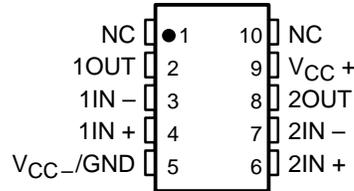


NC – No internal connection

**TLC2264C, TLC2264AC**
**TLC2264I, TLC2264AI**
**TLC2264Q, TLC2264AQ**
**D, N, OR PW PACKAGE**
**(TOP VIEW)**
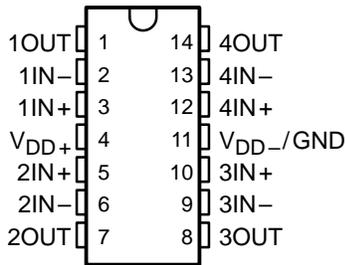


**TLC2264M, TLC2264AM . . . J OR W PACKAGE**
**(TOP VIEW)**
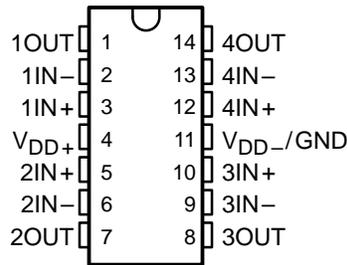


**TLC2264M, TLC2264AM . . . FK PACKAGE**
**(TOP VIEW)**
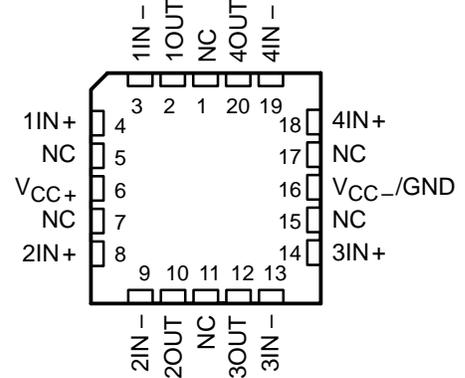


NC – No internal connection

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## equivalent schematic (each amplifier)
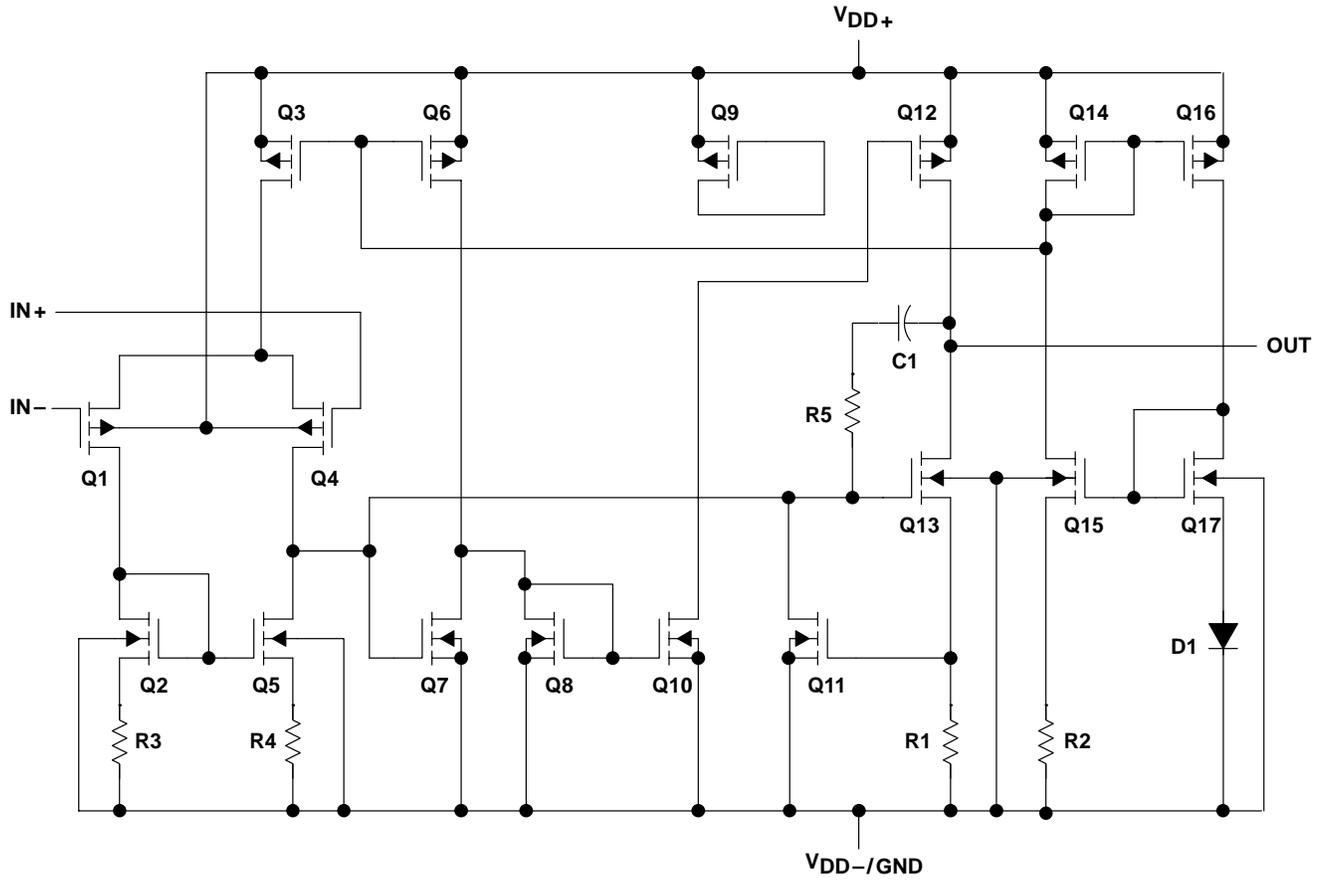


| ACTUAL DEVICE COMPONENT COUNT† | | |
|---|---|---|
| **COMPONENT** | **TLC2262** | **TLC2264** |
| Transistors | 38 | 76 |
| Resistors | 28 | 56 |
| Diodes | 9 | 18 |
| Capacitors | 3 | 6 |

† Includes both amplifiers and all ESD, bias, and trim circuitry

**TEXAS**
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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, $V_{DD+}$ (see Note 1) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 8 V
Supply voltage, $V_{DD-}$ (see Note 1) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . −8 V
Differential input voltage, $V_{ID}$ (see Note 2) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ±16 V
Input voltage, $V_I$ (any input, see Note 1) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . $V_{DD-} - 0.3$ V to $V_{DD+}$
Input current, $I_I$ (each input) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ±5 mA
Output current, $I_O$ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ±50 mA
Total current into $V_{DD+}$ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ±50 mA
Total current out of $V_{DD-}$ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ±50 mA
Duration of short-circuit current at (or below) 25°C (see Note 3) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . unlimited
Continuous total dissipation . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . See Dissipation Rating Table
Operating free-air temperature range, $T_A$: C suffix . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 0°C to 70°C
I suffix . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . −40°C to 125°C
Q suffix . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . −40°C to 125°C
M suffix . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . −55°C to 125°C
Storage temperature range, $T_{stg}$ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . −65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D, N, P, and PW packages . . . . . . . 260°C
J, JG, U, and W packages . . . . . . . 300°C

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

NOTES: 1. All voltage values, except differential voltages, are with respect to the midpoint between $V_{DD+}$ and $V_{DD-}$.
2. Differential voltages are at IN+ with respect to IN−. Excessive current flows if input is brought below $V_{DD-} - 0.3$ V.
3. The output may be shorted to either supply. Temperature and/or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.

### DISSIPATION RATING TABLE

| PACKAGE | $T_A \leq 25°C$ POWER RATING | DERATING FACTOR ABOVE $T_A = 25°C$ | $T_A = 70°C$ POWER RATING | $T_A = 85°C$ POWER RATING | $T_A = 125°C$ POWER RATING |
|---------|---------|---------|---------|---------|---------|
| D–8 | 725 mW | 5.8 mW/°C | 464 mW | 377 mW | 145 mW |
| D–14 | 950 mW | 7.6 mW/°C | 608 mW | 494 mW | 190 mW |
| FK | 1375 mW | 11.0 mW/°C | 880 mW | 715 mW | 275 mW |
| J | 1375 mW | 11.0 mW/°C | 880 mW | 715 mW | 275 mW |
| JG | 1050 mW | 8.4 mW/°C | 672 mW | 546 mW | 210 mW |
| N | 1150 mW | 9.2 mW/°C | 736 mW | 598 mW | 230 mW |
| P | 1000 mW | 8.0 mW/°C | 640 mW | 520 mW | 200 mW |
| PW–8 | 525 mW | 4.2 mW/°C | 336 mW | 273 mW | 105 mW |
| PW–14 | 700 mW | 5.6 mW/°C | 448 mW | 364 mW | 140 mW |
| U | 700 mW | 5.5 mW/°C | 452 mW | 370 mW | 150 mW |
| W | 700 mW | 5.5 mW/°C | 452 mW | 370 mW | 150 mW |

## recommended operating conditions

| | C SUFFIX | | I SUFFIX | | Q SUFFIX | | M SUFFIX | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| Supply voltage, $V_{DD\pm}$ | ±2.2 | ±8 | ±2.2 | ±8 | ±2.2 | ±8 | ±2.2 | ±8 | V |
| Input voltage range, $V_I$ | $V_{DD-}$ | $V_{DD+} -1.5$ | $V_{DD-}$ | $V_{DD+} -1.5$ | $V_{DD-}$ | $V_{DD+} -1.5$ | $V_{DD-}$ | $V_{DD+} -1.5$ | V |
| Common-mode input voltage, $V_{IC}$ | $V_{DD-}$ | $V_{DD+} -1.5$ | $V_{DD-}$ | $V_{DD+} -1.5$ | $V_{DD-}$ | $V_{DD+} -1.5$ | $V_{DD-}$ | $V_{DD+} -1.5$ | V |
| Operating free-air temperature, $T_A$ | 0 | 70 | −40 | 125 | −40 | 125 | −55 | 125 | °C |

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## TLC2262C electrical characteristics at specified free-air temperature, $V_{DD}$ = 5 V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262C MIN | TLC2262C TYP | TLC2262C MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{IO}$ | Input offset voltage | | | 25°C | | 300 | 2500 | µV |
| | | | | Full range | | | 3000 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | 25°C to 70°C | | 2 | | µV/°C |
| | Input offset voltage long-term drift (see Note 4) | $V_{IC}$ = 0, $V_O$ = 0, | $V_{DD}\pm = \pm 2.5$ V, $R_S$ = 50 Ω | 25°C | | 0.003 | | µV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 0.5 | | pA |
| | | | | Full range | | | 100 | |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | pA |
| | | | | Full range | | | 100 | |
| $V_{ICR}$ | Common-mode input voltage range | $R_S$ = 50 Ω, | $|V_{IO}| \le 5$ mV | 25°C | 0 to 4 | −0.3 to 4.2 | | V |
| | | | | Full range | 0 to 3.5 | | | |
| $V_{OH}$ | High-level output voltage | $I_{OH}$ = −20 µA | | 25°C | | 4.99 | | V |
| | | $I_{OH}$ = −100 µA | | 25°C | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | |
| | | $I_{OH}$ = −400 µA | | 25°C | 4.70 | 4.85 | | |
| | | | | Full range | 4.60 | | | |
| $V_{OL}$ | Low-level output voltage | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 50 µA | 25°C | | 0.01 | | V |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 500 µA | 25°C | | 0.09 | 0.15 | |
| | | | | Full range | | | 0.15 | |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 1 mA | 25°C | | 0.2 | 0.3 | |
| | | | | Full range | | | 0.3 | |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 4 mA | 25°C | | 0.7 | 1 | |
| | | | | Full range | | | 1.2 | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_{IC}$ = 2.5 V, $V_O$ = 1 V to 4 V | $R_L$ = 50 kΩ‡ | 25°C | 80 | 170 | | V/mV |
| | | | | Full range | 55 | | | |
| | | | $R_L$ = 1 MΩ‡ | 25°C | | 550 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | f = 10 kHz, | P package | 25°C | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | f = 100 kHz, | $A_V$ = 10 | 25°C | | 240 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = 0 to 2.7 V, $V_O$ = 2.5 V, $R_S$ = 50 Ω | | 25°C | 70 | 83 | | dB |
| | | | | Full range | 70 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$) | $V_{DD}$ = 4.4 V to 16 V, $V_{IC}$ = $V_{DD}$/2, No load | | 25°C | 80 | 95 | | dB |
| | | | | Full range | 80 | | | |
| $I_{DD}$ | Supply current | $V_O$ = 2.5 V, | No load | 25°C | | 400 | 500 | µA |
| | | | | Full range | | | 500 | |

† Full range is 0°C to 70°C.
‡ Referenced to 2.5 V
NOTE 4: Typical values are based on the input offset voltage shift observed through 500 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.

## TLC2262C operating characteristics at specified free-air temperature, $V_{DD}$ = 5 V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262C | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | **MIN** | **TYP** | **MAX** | |
| SR | Slew rate at unity gain | $V_O$ = 1.5 V to 3.5 V,  $R_L$ = 50 kΩ‡, $C_L$ = 100 pF‡ | | 25°C | 0.35 | 0.55 | | V/µs |
| | | | | Full range | 0.3 | | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 40 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.7 | | µV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | fA√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O$ = 0.5 V to 2.5 V, f = 20 kHz, $R_L$ = 50 kΩ‡ | $A_V$ = 1 | 25°C | | 0.017% | | |
| | | | $A_V$ = 10 | | | 0.03% | | |
| | Gain-bandwidth product | f = 10 kHz, $C_L$ = 100 pF‡ | $R_L$ = 50 kΩ‡, | 25°C | | 0.71 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)}$ = 2 V, $R_L$ = 50 kΩ‡, | $A_V$ = 1, $C_L$ = 100 pF‡ | 25°C | | 185 | | kHz |
| $t_s$ | Settling time | $A_V$ = −1, Step = 0.5 V to 2.5 V, $R_L$ = 50 kΩ‡, $C_L$ = 100 pF‡ | To 0.1% | 25°C | | 6.4 | | µs |
| | | | To 0.01% | | | 14.1 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L$ = 50 kΩ‡, | $C_L$ = 100 pF‡ | 25°C | | 56° | | |
| | Gain margin | | | 25°C | | 11 | | dB |

† Full range is 0°C to 70°C.
‡ Referenced to 2.5 V

## TLC2262C electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm5$ V (unless otherwise specified)

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262C MIN | TLC2262C TYP | TLC2262C MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{IO}$ | Input offset voltage | $V_{IC} = 0$, $V_O = 0$, $R_S = 50\ \Omega$ | | 25°C | | 300 | 2500 | µV |
| | | | | Full range | | | 3000 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | 25°C to 70°C | | 2 | | µV/°C |
| | Input offset voltage long-term drift (see Note 4) | | | 25°C | | 0.003 | | µV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 0.5 | | pA |
| | | | | Full range | | | 100 | |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | pA |
| | | | | Full range | | | 100 | |
| $V_{ICR}$ | Common-mode input voltage range | $|V_{IO}| \leq 5$ mV, $R_S = 50\ \Omega$ | | 25°C | −5 to 4 | −5.3 to 4.2 | | V |
| | | | | Full range | −5 to 3.5 | | | |
| $V_{OM+}$ | Maximum positive peak output voltage | $I_O = -20$ µA | | 25°C | | 4.99 | | V |
| | | $I_O = -100$ µA | | 25°C | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | |
| | | $I_O = -400$ µA | | 25°C | 4.7 | 4.85 | | |
| | | | | Full range | 4.6 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage | $V_{IC} = 0$, | $I_O = 50$ µA | 25°C | | −4.99 | | V |
| | | $V_{IC} = 0$, | $I_O = 500$ µA | 25°C | −4.85 | −4.91 | | |
| | | | | Full range | −4.85 | | | |
| | | $V_{IC} = 0$, | $I_O = 1$ mA | 25°C | −4.7 | −4.8 | | |
| | | | | Full range | −4.7 | | | |
| | | $V_{IC} = 0$, | $I_O = 4$ mA | 25°C | −4 | −4.3 | | |
| | | | | Full range | −3.8 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O = \pm4$ V | $R_L = 50$ kΩ | 25°C | 80 | 200 | | V/mV |
| | | | | Full range | 55 | | | |
| | | | $R_L = 1$ MΩ | 25°C | | 1000 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | $f = 10$ kHz, P package | | 25°C | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | $f = 100$ kHz, $A_V = 10$ | | 25°C | | 220 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = -5$ V to 2.7 V, $V_O = 0$ V, $R_S = 50\ \Omega$ | | 25°C | 75 | 88 | | dB |
| | | | | Full range | 75 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$) | $V_{DD\pm} = 2.2$ V to ±8 V, $V_{IC} = 0$, No load | | 25°C | 80 | 95 | | dB |
| | | | | Full range | 80 | | | |
| $I_{DD}$ | Supply current | $V_O = 0$ V, No load | | 25°C | | 425 | 500 | µA |
| | | | | Full range | | | 500 | |

† Full range is 0°C to 70°C.
NOTE 4:  Typical values are based on the input offset voltage shift observed through 500 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.

**TEXAS INSTRUMENTS**

## TLC2262C operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm5$ V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262C | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain | $V_O = \pm1.9$ V, $C_L = 100$ pF | $R_L = 50$ kΩ | 25°C | 0.35 | 0.55 | | V/µs |
| | | | | Full range | | 0.3 | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 43 | | nV/√$\overline{Hz}$ |
| | | f = 1 kHz | | 25°C | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.8 | | µV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | fA√$\overline{Hz}$ |
| THD + N | Total harmonic distortion pulse duration | $V_O = \pm2.3$ V, f = 20 kHz, $R_L = 50$ kΩ | $A_V = 1$ | 25°C | | 0.014% | | |
| | | | $A_V = 10$ | | | 0.024% | | |
| | Gain-bandwidth product | f = 10 kHz, $C_L = 100$ pF | $R_L = 50$ kΩ | 25°C | | 0.73 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)} = 4.6$ V, $R_L = 50$ kΩ, | $A_V = 1$, $C_L = 100$ pF | 25°C | | 85 | | kHz |
| $t_s$ | Settling time | $A_V = -1$, Step = $-2.3$ V to 2.3 V, $R_L = 50$ kΩ, $C_L = 100$ pF | To 0.1% | 25°C | | 7.1 | | µs |
| | | | To 0.01% | | | 16.5 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L = 50$ kΩ, | $C_L = 100$ pF | 25°C | | 57° | | |
| | Gain margin | | | 25°C | | 11 | | dB |

† Full range is 0°C to 70°C.

## TLC2264C electrical characteristics at specified free-air temperature, $V_{DD}$ = 5 V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264C MIN | TLC2264C TYP | TLC2264C MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{IO}$ | Input offset voltage | | | 25°C | | 300 | 2500 | µV |
| | | | | Full range | | | 3000 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | 25°C to 70°C | | 2 | | µV/°C |
| | Input offset voltage long-term drift (see Note 4) | $V_{IC}$ = 0, $V_O$ = 0, | $V_{DD\pm}$ = ±2.5 V, $R_S$ = 50 Ω | 25°C | | 0.003 | | µV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 0.5 | | pA |
| | | | | Full range | | | 100 | |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | pA |
| | | | | Full range | | | 100 | |
| $V_{ICR}$ | Common-mode input voltage range | $R_S$ = 50 Ω, | $|V_{IO}| \leq 5$ mV | 25°C | 0 to 4 | −0.3 to 4.2 | | V |
| | | | | Full range | 0 to 3.5 | | | |
| $V_{OH}$ | High-level output voltage | $I_{OH}$ = −20 µA | | 25°C | | 4.99 | | V |
| | | $I_{OH}$ = −100 µA | | 25°C | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | |
| | | $I_{OH}$ = −400 µA | | 25°C | 4.70 | 4.85 | | |
| | | | | Full range | 4.60 | | | |
| $V_{OL}$ | Low-level output voltage | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 50 µA | 25°C | | 0.01 | | V |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 500 µA | 25°C | | 0.09 | 0.15 | |
| | | | | Full range | | | 0.15 | |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 1 mA | 25°C | | 0.2 | 0.3 | |
| | | | | Full range | | | 0.3 | |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 4 mA | 25°C | | 0.7 | 1 | |
| | | | | Full range | | | 1.2 | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_{IC}$ = 2.5 V, $V_O$ = 1 V to 4 V | $R_L$ = 50 kΩ‡ | 25°C | 80 | 170 | | V/mV |
| | | | | Full range | 55 | | | |
| | | | $R_L$ = 1 MΩ‡ | 25°C | | 550 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | f = 10 kHz, | N package | 25°C | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | f = 100 kHz, | $A_V$ = 10 | 25°C | | 240 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = 0 to 2.7 V, $R_S$ = 50 Ω | $V_O$ = 2.5 V, | 25°C | 70 | 83 | | dB |
| | | | | Full range | 70 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$) | $V_{DD}$ = 4.4 V to 16 V, $V_{IC}$ = $V_{DD}$/2, | No load | 25°C | 80 | 95 | | dB |
| | | | | Full range | 80 | | | |
| $I_{DD}$ | Supply current (four amplifiers) | $V_O$ = 2.5 V, | No load | 25°C | | 0.8 | 1 | mA |
| | | | | Full range | | | 1 | |

† Full range is 0°C to 70°C.
‡ Referenced to 2.5 V
NOTE 4.  Typical values are based on the input offset voltage shift observed through 500 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.

**TEXAS INSTRUMENTS**

## TLC2264C operating characteristics at specified free-air temperature, $V_{DD}$ = 5 V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264C | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain | $V_O$ = 1.4 V to 2.6 V, $R_L$ = 50 kΩ‡, $C_L$ = 100 pF‡ | | 25°C | 0.35 | 0.55 | | V/µs |
| | | | | Full range | | 0.3 | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 40 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.7 | | µV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O$ = 0.5 V to 2.5 V, f = 20 kHz, $R_L$ = 50 kΩ‡ | $A_V$ = 1 | 25°C | | 0.017% | | |
| | | | $A_V$ = 10 | | | 0.03% | | |
| | Gain-bandwidth product | f = 10 kHz, $C_L$ = 100 pF‡ | $R_L$ = 50 kΩ‡, | 25°C | | 0.71 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)}$ = 2 V, $R_L$ = 50 kΩ‡, | $A_V$ = 1, $C_L$ = 100 pF‡ | 25°C | | 185 | | kHz |
| $t_s$ | Settling time | $A_V$ = –1, Step = 0.5 V to 2.5 V, $R_L$ = 50 kΩ‡, $C_L$ = 100 pF‡ | To 0.1% | 25°C | | 6.4 | | µs |
| | | | To 0.01% | | | 14.1 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L$ = 50 kΩ‡, | $C_L$ = 100 pF‡ | 25°C | | 56° | | |
| | Gain margin | | | 25°C | | 11 | | dB |

† Full range is 0°C to 70°C.
‡ Referenced to 2.5 V

## TLC2264C electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm5$ V (unless otherwise specified)

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264C MIN | TLC2264C TYP | TLC2264C MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{IO}$ | Input offset voltage | $V_{IC} = 0$, $R_S = 50\ \Omega$ | $V_O = 0$, | 25°C | | 300 | 2500 | µV |
| | | | | Full range | | | 3000 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | 25°C to 70°C | | 2 | | µV/°C |
| | Input offset voltage long-term drift (see Note 4) | | | 25°C | | 0.003 | | µV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 0.5 | | pA |
| | | | | Full range | | | 100 | |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | pA |
| | | | | Full range | | | 100 | |
| $V_{ICR}$ | Common-mode input voltage range | $|V_{IO}| \leq 5$ mV, | $R_S = 50\ \Omega$ | 25°C | −5 to 4 | −5.3 to 4.2 | | V |
| | | | | Full range | −5 to 3.5 | | | |
| $V_{OM+}$ | Maximum positive peak output voltage | $I_O = -20$ µA | | 25°C | | 4.99 | | V |
| | | $I_O = -100$ µA | | 25°C | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | |
| | | $I_O = -400$ µA | | 25°C | 4.7 | 4.85 | | |
| | | | | Full range | 4.6 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage | $V_{IC} = 0$, | $I_O = 50$ µA | 25°C | | −4.99 | | V |
| | | $V_{IC} = 0$, | $I_O = 500$ µA | 25°C | −4.85 | −4.91 | | |
| | | | | Full range | −4.85 | | | |
| | | $V_{IC} = 0$, | $I_O = 1$ mA | 25°C | −4.7 | −4.8 | | |
| | | | | Full range | −4.7 | | | |
| | | $V_{IC} = 0$, | $I_O = 4$ mA | 25°C | −4 | −4.3 | | |
| | | | | Full range | −3.8 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O = \pm4$ V | $R_L = 50$ kΩ | 25°C | 80 | 200 | | V/mV |
| | | | | Full range | 55 | | | |
| | | | $R_L = 1$ MΩ | 25°C | | 1000 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | $f = 10$ kHz, | N package | 25°C | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | $f = 100$ kHz, | $A_V = 10$ | 25°C | | 220 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = -5$ V to 2.7 V, $V_O = 0$, | $R_S = 50\ \Omega$ | 25°C | 75 | 88 | | dB |
| | | | | Full range | 75 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$) | $V_{DD\pm} = \pm2.2$ V to $\pm8$ V, $V_{IC} = 0$, | No load | 25°C | 80 | 95 | | dB |
| | | | | Full range | 80 | | | |
| $I_{DD}$ | Supply current (four amplifiers) | $V_O = 0$, | No load | 25°C | | 0.85 | 1 | mA |
| | | | | Full range | | | 1 | |

† Full range is 0°C to 70°C.
NOTE 4:  Typical values are based on the input offset voltage shift observed through 500 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.

**TEXAS INSTRUMENTS**

## TLC2264C operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm5$ V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264C | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| SR | Slew rate at unity gain | $V_O = \pm1.9$ V, $C_L = 100$ pF | $R_L = 50$ kΩ, | 25°C | 0.35 | 0.55 | | V/µs |
| | | | | Full range | 0.3 | | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 43 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.8 | | µV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O = \pm2.3$ V, f = 20 kHz, $R_L = 50$ kΩ | $A_V = 1$ | 25°C | | 0.014% | | |
| | | | $A_V = 10$ | | | 0.024% | | |
| | Gain-bandwidth product | f = 10 kHz, $C_L = 100$ pF | $R_L = 50$ kΩ, | 25°C | | 0.73 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)} = 4.6$ V, $R_L = 50$ kΩ, | $A_V = 1$, $C_L = 100$ pF | 25°C | | 70 | | kHz |
| $t_s$ | Settling time | $A_V = -1$, Step = $-2.3$ V to 2.3 V, $R_L = 50$ kΩ, $C_L = 100$ pF | To 0.1% | 25°C | | 7.1 | | µs |
| | | | To 0.01% | | | 16.5 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L = 50$ kΩ, | $C_L = 100$ pF | 25°C | | 57° | | |
| | Gain margin | | | 25°C | | 11 | | dB |

† Full range is 0°C to 70°C.

**TLC2262I electrical characteristics at specified free-air temperature, $V_{DD}$ = 5 V (unless otherwise noted)**

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262I | | | TLC2262AI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | $V_{DD\pm}$ = ± 2.5 V, $V_{IC}$ = 0, $V_O$ = 0, $R_S$ = 50 Ω | | 25°C | | 300 | 2500 | | 300 | 950 | μV |
| | | | | Full range | | | 3000 | | | 1500 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | 25°C to 85°C | | 2 | | | 2 | | μV/°C |
| | Input offset voltage long-term drift (see Note 4) | | | 25°C | | 0.003 | | | 0.003 | | μV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 0.5 | | | 0.5 | | pA |
| | | | | 85°C | | | 150 | | | 150 | |
| | | | | Full range | | | 800 | | | 800 | pA |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | | 1 | | pA |
| | | | | 85°C | | | 150 | | | 150 | pA |
| | | | | Full range | | | 800 | | | 800 | pA |
| $V_{ICR}$ | Common-mode input voltage range | $R_S$ = 50 Ω, | $|V_{IO}| \leq 5$ mV | 25°C | 0 to 4 | −0.3 to 4.2 | | 0 to 4 | −0.3 to 4.2 | | V |
| | | | | Full range | 0 to 3.5 | | | 0 to 3.5 | | | |
| $V_{OH}$ | High-level output voltage | $I_{OH}$ = −20 μA | | 25°C | | 4.99 | | | 4.99 | | V |
| | | $I_{OH}$ = −100 μA | | 25°C | 4.85 | 4.94 | | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | 4.82 | | | |
| | | $I_{OH}$ = −400 μA | | 25°C | 4.7 | 4.85 | | 4.7 | 4.85 | | |
| | | | | Full range | 4.5 | | | 4.5 | | | |
| $V_{OL}$ | Low-level output voltage | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 50 μA | 25°C | | 0.01 | | | 0.01 | | V |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 500 μA | 25°C | | 0.09 | 0.15 | | 0.09 | 0.15 | |
| | | | | Full range | | | 0.15 | | | 0.15 | |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 4 mA | 25°C | | 0.8 | 1 | | 0.7 | 1 | |
| | | | | Full range | | | 1.2 | | | 1.2 | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_{IC}$ = 2.5 V, $V_O$ = 1 V to 4 V | $R_L$ = 50 kΩ‡ | 25°C | 80 | 100 | | 80 | 170 | | V/mV |
| | | | | Full range | 50 | | | 50 | | | |
| | | | $R_L$ = 1 MΩ‡ | 25°C | | 550 | | | 550 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | f = 10 kHz, | P package | 25°C | | 8 | | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | f = 100 kHz, | $A_V$ = 10 | 25°C | | 240 | | | 240 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = 0 to 2.7 V, $V_O$ = 2.5 V, $R_S$ = 50 Ω | | 25°C | 70 | 83 | | 70 | 83 | | dB |
| | | | | Full range | 70 | | | 70 | | | |

† Full range is – 40°C to 125°C.
‡ Referenced to 2.5 V
NOTE 4:  Typical values are based on the input offset voltage shift observed through 500 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.

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## TLC2262I operating characteristics at specified free-air temperature, $V_{DD}$ = 5 V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262I MIN | TLC2262I TYP | TLC2262I MAX | TLC2262AI MIN | TLC2262AI TYP | TLC2262AI MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$) | $V_{DD}$ = 4.4 V to 16 V, $V_{IC}$ = $V_{DD}$/2, | No load | 25°C | 80 | 95 | | 80 | 95 | | dB |
| | | | | Full range | 80 | | | 80 | | | |
| $I_{DD}$ | Supply current | $V_O$ = 2.5 V, | No load | 25°C | | 400 | 500 | | 400 | 500 | µA |
| | | | | Full range | | | 500 | | | 500 | |
| SR | Slew rate at unity gain | $V_O$ = 1.5 V to 3.5 V, $C_L$ = 100 pF‡ | $R_L$ = 50 kΩ‡, | 25°C | 0.35 | 0.55 | | 0.35 | 0.55 | | V/µs |
| | | | | Full range | 0.25 | | | 0.25 | | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 40 | | | 40 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.7 | | | 0.7 | | µV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | | 0.6 | | fA√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O$ = 0.5 V to 2.5 V, f = 20 kHz, $R_L$ = 50 kΩ‡ | $A_V$ = 1 | 25°C | | 0.017% | | | 0.017% | | |
| | | | $A_V$ = 10 | | | 0.03% | | | 0.03% | | |
| | Gain-bandwidth product | f = 50 kHz, $C_L$ = 100 pF‡ | $R_L$ = 50 kΩ‡, | 25°C | | 0.82 | | | 0.82 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)}$ = 2 V, $R_L$ = 50 kΩ‡, | $A_V$ = 1, $C_L$ = 100 pF‡ | 25°C | | 185 | | | 185 | | kHz |
| $t_s$ | Settling time | $A_V$ = −1, Step = 0.5 V to 2.5 V, $R_L$ = 50 kΩ‡, $C_L$ = 100 pF‡ | To 0.1% | 25°C | | 6.4 | | | 6.4 | | µs |
| | | | To 0.01% | | | 14.1 | | | 14.1 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L$ = 50 kΩ‡, | $C_L$ = 100 pF‡ | 25°C | | 56° | | | 56° | | |
| | Gain margin | | | 25°C | | 11 | | | 11 | | dB |

† Full range is – 40°C to 125°C.
‡ Referenced to 2.5 V

## TLC2262I electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262I MIN | TLC2262I TYP | TLC2262I MAX | TLC2262AI MIN | TLC2262AI TYP | TLC2262AI MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $V_{IO}$ | Input offset voltage | | | 25°C | | 300 | 2500 | | 300 | 950 | μV |
| | | | | Full range | | | 3000 | | | 1500 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | 25°C to 85°C | | 2 | | | 2 | | μV/°C |
| | Input offset voltage long-term drift (see Note 4) | | | 25°C | | 0.003 | | | 0.003 | | μV/mo |
| $I_{IO}$ | Input offset current | $V_{IC} = 0$, $V_O = 0$ $R_S = 50\ \Omega$ | | 25°C | | 0.5 | | | 0.5 | | pA |
| | | | | 85°C | | | 150 | | | 150 | pA |
| | | | | Full range | | | 800 | | | 800 | pA |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | | 1 | | pA |
| | | | | 85°C | | | 150 | | | 150 | pA |
| | | | | Full range | | | 800 | | | 800 | pA |
| $V_{ICR}$ | Common-mode input voltage range | $R_S = 50\ \Omega$, $|V_{IO}| \le 5$ mV | | 25°C | −5 to 4 | −5.3 to 4.2 | | −5 to 4 | −5.3 to 4.2 | | V |
| | | | | Full range | −5 to 3.5 | | | −5 to 3.5 | | | |
| $V_{OM+}$ | Maximum positive peak output voltage | $I_O = -20\ \mu A$ | | 25°C | | 4.99 | | | 4.99 | | V |
| | | $I_O = -100\ \mu A$ | | 25°C | 4.85 | 4.94 | | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | 4.82 | | | |
| | | $I_O = -400\ \mu A$ | | 25°C | 4.7 | 4.85 | | 4.7 | 4.85 | | |
| | | | | Full range | 4.5 | | | 4.5 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage | $V_{IC} = 0$, $I_O = 50\ \mu A$ | | 25°C | | −4.99 | | | −4.99 | | V |
| | | $V_{IC} = 0$, $I_O = 500\ \mu A$ | | 25°C | −4.85 | −4.91 | | −4.85 | −4.91 | | |
| | | | | Full range | −4.85 | | | −4.85 | | | |
| | | $V_{IC} = 0$, $I_O = 4$ mA | | 25°C | −4 | −4.3 | | −4 | −4.3 | | |
| | | | | Full range | −3.8 | | | −3.8 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O = \pm 4$ V | $R_L = 50\ k\Omega$ | 25°C | 80 | 200 | | 80 | 200 | | V/mV |
| | | | | Full range | 50 | | | 50 | | | |
| | | | $R_L = 1\ M\Omega$ | 25°C | | 1000 | | | 1000 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | $f = 10$ kHz, P package | | 25°C | | 8 | | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | $f = 100$ kHz, $A_V = 10$ | | 25°C | | 220 | | | 220 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = -5$ V to 2.7 V, $V_O = 0$, $R_S = 50\ \Omega$ | | 25°C | 75 | 88 | | 75 | 88 | | dB |
| | | | | Full range | 75 | | | 75 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD\pm} / \Delta V_{IO}$) | $V_{DD} = 4.4$ V to 16 V, $V_{IC} = V_{DD}/2$, No load | | 25°C | 80 | 95 | | 80 | 95 | | dB |
| | | | | Full range | 80 | | | 80 | | | |

† Full range is − 40°C to 125°C.

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 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.

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## TLC2262I operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262I | | | TLC2262AI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $I_{DD}$ | Supply Current | $V_O = 2.5$ V, | No load | 25°C | | 425 | 500 | | 425 | 500 | |
| | | | | Full range | | | 500 | | | 500 | |
| SR | Slew rate at unity gain | $V_O = \pm 1.9$ V, $C_L = 100$ pF | $R_L = 50$ kΩ, | 25°C | 0.35 | 0.55 | | 0.35 | 0.55 | | V/μs |
| | | | | Full range | 0.25 | | | 0.25 | | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 43 | | | 43 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.8 | | | 0.8 | | μV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | | 0.6 | | fA√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O = \pm 2.3$ V, $R_L = 50$ kΩ, f = 20 kHz | $A_V = 1$ | 25°C | | 0.014% | | | 0.014% | | |
| | | | $A_V = 10$ | | | 0.024% | | | 0.024% | | |
| | Gain-bandwidth product | f =10 kHz, $C_L = 100$ pF | $R_L = 50$ kΩ, | 25°C | | 0.73 | | | 0.73 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)} = 4.6$ V, $R_L = 50$ kΩ, | $A_V = 1$, $C_L = 100$ pF | 25°C | | 85 | | | 85 | | kHz |
| $t_S$ | Settling time | $A_V = -1$, Step = −2.3 V to 2.3 V, $R_L = 50$ kΩ, $C_L = 100$ pF | To 0.1% | 25°C | | 7.1 | | | 7.1 | | μs |
| | | | To 0.01% | | | 16.5 | | | 16.5 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L = 50$ kΩ, | $C_L = 100$ pF | 25°C | | 57° | | | 57° | | |
| | Gain margin | | | 25°C | | 11 | | | 11 | | dB |

† Full range is −40°C to 125°C.

### TLC2264I electrical characteristics at specified free-air temperature, $V_{DD}$ = 5 V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264I | | | TLC2264AI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | | | 25°C | | 300 | 2500 | | 300 | 950 | μV |
| | | | | Full range | | | 3000 | | | 1500 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | 25°C to 125°C | | 2 | | | 2 | | μV/°C |
| | Input offset voltage long-term drift (see Note 4) | $V_{DD\pm}$ =±2.5 V, $V_O$ = 0, | $V_{IC}$ = 0, $R_S$ = 50 Ω | 25°C | | 0.003 | | | 0.003 | | μV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 0.5 | | | 0.5 | | pA |
| | | | | 85°C | | | 150 | | | 150 | |
| | | | | Full range | | | 800 | | | 800 | |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | | 1 | | pA |
| | | | | 85°C | | | 150 | | | 150 | |
| | | | | Full range | | | 800 | | | 800 | |
| $V_{ICR}$ | Common-mode input voltage range | $R_S$ = 50 Ω, | $|V_{IO}| \leq 5$ mV | 25°C | 0 to 4 | −0.3 to 4.2 | | 0 to 4 | −0.3 to 4.2 | | V |
| | | | | Full range | 0 to 3.5 | | | 0 to 3.5 | | | |
| $V_{OH}$ | High-level output voltage | $I_{OH}$ = −20 μA | | 25°C | | 4.99 | | | 4.99 | | V |
| | | $I_{OH}$ = −100 μA | | 25°C | 4.85 | 4.94 | | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | 4.82 | | | |
| | | $I_{OH}$ = −400 μA | | 25°C | 4.7 | 4.85 | | 4.7 | 4.85 | | |
| | | | | Full range | 4.5 | | | 4.5 | | | |
| $V_{OL}$ | Low-level output voltage | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 50 μA | 25°C | | 0.01 | | | 0.01 | | V |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 500 μA | 25°C | | 0.09 | 0.15 | | 0.09 | 0.15 | |
| | | | | Full range | | | 0.15 | | | 0.15 | |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 4 mA | 25°C | | 0.8 | 1 | | 0.7 | 1 | |
| | | | | Full range | | | 1.2 | | | 1.2 | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_{IC}$ = 2.5 V, $V_O$ = 1 V to 4 V | $R_L$ = 50 kΩ‡ | 25°C | 80 | 100 | | 80 | 170 | | V/mV |
| | | | | Full range | 50 | | | 50 | | | |
| | | | $R_L$ = 1 MΩ‡ | 25°C | | 550 | | | 550 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | f = 10 kHz, | N package | 25°C | | 8 | | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | f = 100 kHz, | $A_V$ = 10 | 25°C | | 240 | | | 240 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = 0 to 2.7 V, $R_S$ = 50 Ω | $V_O$ = 2.5 V, | 25°C | 70 | 83 | | 70 | 83 | | dB |
| | | | | Full range | 70 | | | 70 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$) | $V_{DD}$ = 4.4 V to 16 V, $V_{IC}$ = $V_{DD}/2$, | No load | 25°C | 80 | 95 | | 80 | 95 | | dB |
| | | | | Full range | 80 | | | 80 | | | |

† Full range is – 40°C to 125°C.
‡ Referenced to 2.5 V
NOTE 4:   Typical values are based on the input offset voltage shift observed through 500 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.

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## TLC2264I operating characteristics at specified free-air temperature, $V_{DD}$ = 5 V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264I | | | TLC2264AI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $I_{DD}$ | Supply current (four amplifiers) | $V_O$ = 2.5 V, | No load | 25°C | | 0.8 | 1 | | 0.8 | 1 | V/µs |
| | | | | Full range | | | 1 | | | 1 | |
| SR | Slew rate at unity gain | $V_O$ = 1.4 V to 2.6 V, $C_L$ = 100 pF‡ | $R_L$ = 50 kΩ‡, | 25°C | 0.35 | 0.55 | | 0.35 | 0.55 | | V/µs |
| | | | | Full range | 0.25 | | | 0.25 | | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 40 | | | 40 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.7 | | | 0.7 | | µV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | | 0.6 | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O$ = 0.5 V to 2.5 V, f = 20 kHz, $R_L$ = 50 kΩ‡ | $A_V$ = 1 | 25°C | | 0.017% | | | 0.017% | | |
| | | | $A_V$ = 10 | | | 0.03% | | | 0.03% | | |
| | Gain-bandwidth product | f = 50 kHz, $C_L$ = 100 pF‡ | $R_L$ = 50 kΩ‡, | 25°C | | 0.71 | | | 0.71 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)}$ = 2 V, $R_L$ = 50 kΩ‡, | $A_V$ = 1, $C_L$ = 100 pF‡ | 25°C | | 185 | | | 185 | | kHz |
| $t_S$ | Settling time | $A_V$ = −1, Step = 0.5 V to 2.5 V, $R_L$ = 50 kΩ‡, $C_L$ = 100 pF‡ | To 0.1% | 25°C | | 6.4 | | | 6.4 | | µs |
| | | | To 0.01% | | | 14.1 | | | 14.1 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L$ = 50 kΩ‡, | $C_L$ = 100 pF‡ | 25°C | | 56° | | | 56° | | |
| | Gain margin | | | 25°C | | 11 | | | 11 | | dB |

† Full range is – 40°C to 125°C.
‡ Referenced to 2.5 V

## TLC2264I electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264I | | | TLC2264AI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | $V_{IC} = 0$,     $V_O = 0$, $R_S = 50\ \Omega$ | | 25°C | | 300 | 2500 | | 300 | 950 | μV |
| | | | | Full range | | | 3000 | | | 1500 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | 25°C to 125°C | | 2 | | | 2 | | μV/°C |
| | Input offset voltage long-term drift (see Note 4) | | | 25°C | | 0.003 | | | 0.003 | | μV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 0.5 | | | 0.5 | | pA |
| | | | | 85°C | | | 150 | | | 150 | |
| | | | | Full range | | | 800 | | | 800 | |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | | 1 | | pA |
| | | | | 85°C | | | 150 | | | 150 | pA |
| | | | | Full range | | | 800 | | | 800 | pA |
| $V_{ICR}$ | Common-mode input voltage range | $R_S = 50\ \Omega$,     $\lvert V_{IO}\rvert \leq 5$ mV | | 25°C | −5 to 4 | −5.3 to 4.2 | | −5 to 4 | −5.3 to 4.2 | | V |
| | | | | Full range | −5 to 3.5 | | | −5 to 3.5 | | | |
| $V_{OM+}$ | Maximum positive peak output voltage | $I_O = -20$ μA | | 25°C | | 4.99 | | | 4.99 | | V |
| | | $I_O = -100$ μA | | 25°C | 4.85 | 4.94 | | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | 4.82 | | | |
| | | $I_O = -400$ μA | | 25°C | 4.7 | 4.85 | | 4.7 | 4.85 | | |
| | | | | Full range | 4.5 | | | 4.5 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage | $V_{IC} = 0$,     $I_O = 50$ μA | | 25°C | | −4.99 | | | −4.99 | | V |
| | | $V_{IC} = 0$,     $I_O = 500$ μA | | 25°C | −4.85 | −4.91 | | −4.85 | −4.91 | | |
| | | | | Full range | −4.85 | | | −4.85 | | | |
| | | $V_{IC} = 0$,     $I_O = 4$ mA | | 25°C | −4 | −4.3 | | −4 | −4.3 | | |
| | | | | Full range | −3.8 | | | −3.8 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O = \pm 4$ V | $R_L = 50$ kΩ | 25°C | 80 | 200 | | 80 | 200 | | V/mV |
| | | | | Full range | 50 | | | 50 | | | |
| | | | $R_L = 1$ MΩ | 25°C | | 1000 | | | 1000 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | $f = 10$ kHz,     N package | | 25°C | | 8 | | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | $f = 100$ kHz,     $A_V = 10$ | | 25°C | | 220 | | | 220 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC} = -5$ V to 2.7 V, $V_O = 0$,     $R_S = 50\ \Omega$ | | 25°C | 75 | 88 | | 75 | 88 | | dB |
| | | | | Full range | 75 | | | 75 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$) | $V_{DD\pm} = \pm 2.2$ V to ±8 V, $V_{IC} = V_{DD}/2$,   No load | | 25°C | 80 | 95 | | 80 | 95 | | dB |
| | | | | Full range | 80 | | | 80 | | | |

† Full range is − 40°C to 125°C.

NOTE 4:   Typical values are based on the input offset voltage shift observed through 500 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.

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## TLC2264I operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm5$ V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264I | | | TLC2264AI | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $I_{DD}$ | Supply current (four amplifiers) | $V_O = 0$, | No load | 25°C | | 0.85 | 1 | | 0.85 | 1 | |
| | | | | Full range | | | 1 | | | 1 | |
| SR | Slew rate at unity gain | $V_O = \pm1.9$ V, $C_L = 100$ pF | $R_L = 50$ kΩ, | 25°C | 0.35 | 0.55 | | 0.35 | 0.55 | | V/μs |
| | | | | Full range | 0.25 | | | 0.25 | | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 43 | | | 43 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.8 | | | 0.8 | | μV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | | 0.6 | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O = \pm2.3$ V, $R_L = 50$ kΩ, f = 20 kHz | $A_V = 1$ | 25°C | | 0.014% | | | 0.014% | | |
| | | | $A_V = 10$ | | | 0.024% | | | 0.024% | | |
| | Gain-bandwidth product | f =10 kHz, $C_L = 100$ pF | $R_L = 50$ kΩ, | 25°C | | 0.73 | | | 0.73 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)} = 4.6$ V, $R_L = 50$ kΩ, | $A_V = 1$, $C_L = 100$ pF | 25°C | | 70 | | | 70 | | kHz |
| $t_s$ | Settling time | $A_V = -1$, Step = −2.3 V to 2.3 V, $R_L = 50$ kΩ, $C_L = 100$ pF | To 0.1% | 25°C | | 7.1 | | | 7.1 | | μs |
| | | | To 0.01% | | | 16.5 | | | 16.5 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L = 50$ kΩ, | $C_L = 100$ pF | 25°C | | 57° | | | 57° | | |
| | Gain margin | | | 25°C | | 11 | | | 11 | | dB |

† Full range is −40°C to 125°C.

## TLC2262Q/M electrical characteristics at specified free-air temperature, $V_{DD}$ = 5 V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262Q, TLC2262M MIN | TYP | MAX | TLC2262AQ, TLC2262AM MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $V_{IO}$ | Input offset voltage | | | 25°C | | 300 | 2500 | | 300 | 950 | μV |
| | | | | Full range | | | 3000 | | | 1500 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | Full range | | 5 | | | 5 | | μV/°C |
| | Input offset voltage long-term drift (see Note 4) | $V_{DD\pm}$ = ±2.5 V,  $V_{IC}$ = 0, $V_O$ = 0,    $R_S$ = 50 Ω | | 25°C | | 0.003 | | | 0.003 | | μV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 0.5 | | | 0.5 | | pA |
| | | | | 125°C | | | 800 | | | 800 | |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | | 1 | | pA |
| | | | | 125°C | | | 800 | | | 800 | |
| $V_{ICR}$ | Common-mode input voltage range | $R_S$ = 50 Ω, | $|V_{IO}|$ ≤ 5 mV | 25°C | 0 to 4 | −0.3 to 4.2 | | 0 to 4 | −0.3 to 4.2 | | V |
| | | | | Full range | 0 to 3.5 | | | 0 to 3.5 | | | |
| $V_{OH}$ | High-level output voltage | $I_{OH}$ = −20 μA | | 25°C | | 4.99 | | | 4.99 | | V |
| | | $I_{OH}$ = −100 μA | | 25°C | 4.85 | 4.94 | | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | 4.82 | | | |
| | | $I_{OH}$ = −400 μA | | 25°C | 4.7 | 4.85 | | 4.7 | 4.85 | | |
| | | | | Full range | 4.5 | | | 4.5 | | | |
| $V_{OL}$ | Low-level output voltage | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 50 μA | 25°C | | 0.01 | | | 0.01 | | V |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 500 μA | 25°C | | 0.09 | 0.15 | | 0.09 | 0.15 | |
| | | | | Full range | | | 0.15 | | | 0.15 | |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 4 mA | 25°C | | 0.8 | 1 | | 0.7 | 1 | |
| | | | | Full range | | | 1.2 | | | 1.2 | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_{IC}$ = 2.5 V, $V_O$ = 1 V to 4 V | $R_L$ = 50 kΩ‡ | 25°C | 80 | 100 | | 80 | 170 | | V/mV |
| | | | | Full range | 50 | | | 50 | | | |
| | | | $R_L$ = 1 MΩ‡ | 25°C | | 550 | | | 550 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | f = 10 kHz, | P package | 25°C | | 8 | | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | f = 100 kHz, | $A_V$ = 10 | 25°C | | 240 | | | 240 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = 0 to 2.7 V, $R_S$ = 50 Ω | $V_O$ = 2.5 V, | 25°C | 70 | 83 | | 70 | 83 | | dB |
| | | | | Full range | 70 | | | 70 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$) | $V_{DD}$ = 4.4 V to 16 V, $V_{IC}$ = $V_{DD}$/2, | No load | 25°C | 80 | 95 | | 80 | 95 | | dB |
| | | | | Full range | 80 | | | 80 | | | |
| $I_{DD}$ | Supply current | $V_O$ = 2.5 V, | No load | 25°C | | 400 | 500 | | 400 | 500 | μA |
| | | | | Full range | | | 500 | | | 500 | |

† Full range is −40°C to 125°C for Q suffix, −55°C to 125°C for M suffix.
‡ Referenced to 2.5 V
NOTE 4:  Typical values are based on the input offset voltage shift observed through 500 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.

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## TLC2262Q/M operating characteristics at specified free-air temperature, $V_{DD}$ = 5 V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262Q, TLC2262M | | | TLC2262AQ, TLC2262AM | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR | Slew rate at unity gain | $V_O$ = 0.5 V to 3.5 V, $C_L$ = 100 pF‡ | $R_L$ = 50 kΩ‡, | 25°C | 0.35 | 0.55 | | 0.35 | 0.55 | | V/µs |
| | | | | Full range | 0.25 | | | 0.25 | | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 40 | | | 40 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.7 | | | 0.7 | | µV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | | 0.6 | | fA√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O$ = 0.5 V to 2.5 V, f = 20 kHz, $R_L$ = 50 kΩ‡ | $A_V$ = 1 | 25°C | | 0.017% | | | 0.017% | | |
| | | | $A_V$ = 10 | | | 0.03% | | | 0.03% | | |
| | Gain-bandwidth product | f = 50 kHz, $C_L$ = 100 pF‡ | $R_L$ = 50 kΩ‡, | 25°C | | 0.82 | | | 0.82 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)}$ = 2 V, $R_L$ = 50 kΩ‡, | $A_V$ = 1, $C_L$ = 100 pF‡ | 25°C | | 185 | | | 185 | | kHz |
| $t_s$ | Settling time | $A_V$ = –1, Step = 0.5 V to 2.5 V, $R_L$ = 50 kΩ‡, $C_L$ = 100 pF‡ | To 0.1% | 25°C | | 6.4 | | | 6.4 | | µs |
| | | | To 0.01% | | | 14.1 | | | 14.1 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L$ = 50 kΩ‡, | $C_L$ = 100 pF‡ | 25°C | | 56° | | | 56° | | |
| | Gain margin | | | 25°C | | 11 | | | 11 | | dB |

† Full range is –40°C to 125°C for Q suffix, – 55°C to 125°C for M suffix.
‡ Referenced to 2.5 V

## TLC2262Q/M electrical characteristics at specified free-air temperature, $V_{DD\pm}$ = ±5 V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $T_A$† | TLC2262Q, TLC2262M MIN | TYP | MAX | TLC2262AQ, TLC2262AM MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| $V_{IO}$ | Input offset voltage | $V_{IC}$ = 0, $V_O$ = 0, $R_S$ = 50 Ω | 25°C | | 300 | 2500 | | 300 | 950 | μV |
| | | | Full range | | | 3000 | | | 1500 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | Full range | | 5 | | | 5 | | μV/°C |
| | Input offset voltage long-term drift (see Note 4) | | 25°C | | 0.003 | | | 0.003 | | μV/mo |
| $I_{IO}$ | Input offset current | | 25°C | | 0.5 | | | 0.5 | | pA |
| | | | 125°C | | | 800 | | | 800 | |
| $I_{IB}$ | Input bias current | | 25°C | | 1 | | | 1 | | pA |
| | | | 125°C | | | 800 | | | 800 | |
| $V_{ICR}$ | Common-mode input voltage range | $R_S$ = 50 Ω, $|V_{IO}|$ ≤ 5 mV | 25°C | −5 to 4 | −5.3 to 4 | | −5 to 4 | −5.3 to 4.2 | | V |
| | | | Full range | −5 to 3.5 | | | −5 to 3.5 | | | |
| $V_{OM+}$ | Maximum positive peak output voltage | $I_O$ = −20 μA | 25°C | | 4.99 | | | 4.99 | | V |
| | | $I_O$ = −100 μA | 25°C | 4.85 | 4.94 | | 4.85 | 4.94 | | |
| | | | Full range | 4.82 | | | 4.82 | | | |
| | | $I_O$ = −400 μA | 25°C | 4.7 | 4.85 | | 4.7 | 4.85 | | |
| | | | Full range | 4.5 | | | 4.5 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage | $V_{IC}$ = 0, $I_O$ = 50 μA | 25°C | | −4.99 | | | −4.99 | | V |
| | | $V_{IC}$ = 0, $I_O$ = 500 μA | 25°C | −4.85 | −4.91 | | −4.85 | −4.91 | | |
| | | | Full range | −4.85 | | | −4.85 | | | |
| | | $V_{IC}$ = 0, $I_O$ = 4 mA | 25°C | −4 | −4.3 | | −4 | −4.3 | | |
| | | | Full range | −3.8 | | | −3.8 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O$ = ±4 V, $R_L$ = 50 kΩ | 25°C | 80 | 200 | | 80 | 200 | | V/mV |
| | | | Full range | 50 | | | 50 | | | |
| | | $R_L$ = 1 MΩ | 25°C | | 1000 | | | 1000 | | |
| $r_{i(d)}$ | Differential input resistance | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | f = 10 kHz, P package | 25°C | | 8 | | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | f = 100 kHz, $A_V$ = 10 | 25°C | | 220 | | | 220 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = −5 V to 2.7 V, $V_O$ = 0, $R_S$ = 50 Ω | 25°C | 75 | 88 | | 75 | 88 | | dB |
| | | | Full range | 75 | | | 75 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$) | $V_{DD}$ = 4.4 V to 16 V, $V_{IC}$ = $V_{DD}$/2, No load | 25°C | 80 | 95 | | 80 | 95 | | dB |
| | | | Full range | 80 | | | 80 | | | |
| $I_{DD}$ | Supply current | $V_O$ = 0, No load | 25°C | | 425 | 500 | | 425 | 500 | μA |
| | | | Full range | | | 500 | | | 500 | |

† Full range is −40°C to 125°C for Q suffix, −55°C to 125°C for M suffix.
NOTE 4: Typical values are based on the input offset voltage shift observed through 500 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.

## TEXAS INSTRUMENTS

## TLC2262Q/M operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm5$ V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2262Q, TLC2262M | | | TLC2262AQ, TLC2262AM | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR | Slew rate at unity gain | $V_O = \pm2$ V, $C_L = 100$ pF | $R_L = 50$ kΩ, | 25°C | 0.35 | 0.55 | | 0.35 | 0.55 | | V/µs |
| | | | | Full range | 0.25 | | | 0.25 | | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 43 | | | 43 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.8 | | | 0.8 | | µV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | | 0.6 | | fA√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O = \pm2.3$ V, $R_L = 50$ kΩ, f = 20 kHz | $A_V = 1$ | 25°C | | 0.014% | | | 0.014% | | |
| | | | $A_V = 10$ | | | 0.024% | | | 0.024% | | |
| | Gain-bandwidth product | f =10 kHz, $C_L = 100$ pF | $R_L = 50$ kΩ, | 25°C | | 0.73 | | | 0.73 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)} = 4.6$ V, $R_L = 50$ kΩ, | $A_V = 1$, $C_L = 100$ pF | 25°C | | 85 | | | 85 | | kHz |
| $t_s$ | Settling time | $A_V = -1$, Step $= -2.3$ V to 2.3 V, $R_L = 50$ kΩ, $C_L = 100$ pF | To 0.1% | 25°C | | 7.1 | | | 7.1 | | µs |
| | | | To 0.01% | | | 16.5 | | | 16.5 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L = 50$ kΩ, | $C_L = 100$ pF | 25°C | | 57° | | | 57° | | |
| | Gain margin | | | 25°C | | 11 | | | 11 | | dB |

† Full range is −40°C to 125°C for Q suffix, − 55°C to 125°C for M suffix.

**TLC2264Q/M electrical characteristics at specified free-air temperature, $V_{DD}$ = 5 V (unless otherwise noted)**

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264Q, TLC2264M MIN | TYP | MAX | TLC2264AQ, TLC2264AM MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $V_{IO}$ | Input offset voltage | | | 25°C | | 300 | 2500 | | 300 | 950 | µV |
| | | | | Full range | | | 3000 | | | 1500 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | Full range | | 2 | | | 2 | | µV/°C |
| | Input offset voltage long-term drift (see Note 4) | $V_{DD\pm}$ = ±2.5 V, $V_O$ = 0, | $V_{IC}$ = 0, $R_S$ = 50 Ω | 25°C | | 0.003 | | | 0.003 | | µV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 0.5 | | | 0.5 | | pA |
| | | | | 125°C | | | 800 | | | 800 | |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | | 1 | | pA |
| | | | | 125°C | | | 800 | | | 800 | |
| $V_{ICR}$ | Common-mode input voltage range | $R_S$ = 50 Ω, | $|V_{IO}| \leq$ 5 mV | 25°C | 0 to 4 | −0.3 to 4.2 | | 0 to 4 | −0.3 to 4.2 | | V |
| | | | | Full range | 0 to 3.5 | | | 0 to 3.5 | | | |
| $V_{OH}$ | High-level output voltage | $I_{OH}$ = −20 µA | | 25°C | | 4.99 | | | 4.99 | | V |
| | | $I_{OH}$ = −100 µA | | 25°C | 4.85 | 4.94 | | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | 4.82 | | | |
| | | $I_{OH}$ = −400 µA | | 25°C | 4.7 | 4.85 | | 4.7 | 4.85 | | |
| | | | | Full range | 4.5 | | | 4.5 | | | |
| $V_{OL}$ | Low-level output voltage | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 50 µA | 25°C | | 0.01 | | | 0.01 | | V |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 500 µA | 25°C | | 0.09 | 0.15 | | 0.09 | 0.15 | |
| | | | | Full range | | | 0.15 | | | 0.15 | |
| | | $V_{IC}$ = 2.5 V, | $I_{OL}$ = 4 mA | 25°C | | 0.8 | 1 | | 0.7 | 1 | |
| | | | | Full range | | | 1.2 | | | 1.2 | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_{IC}$ = 2.5 V, $V_O$ = 1 V to 4 V | $R_L$ = 50 kΩ‡ | 25°C | 80 | 100 | | 80 | 170 | | V/mV |
| | | | | Full range | 50 | | | 50 | | | |
| | | | $R_L$ = 1 MΩ‡ | 25°C | | 550 | | | 550 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | Ω |
| $c_{i(c)}$ | Common-mode input capacitance | f = 10 kHz, | N package | 25°C | | 8 | | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | f = 100 kHz, | $A_V$ = 10 | 25°C | | 240 | | | 240 | | Ω |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = 0 to 2.7 V, $R_S$ = 50 Ω | $V_O$ = 2.5 V, | 25°C | 70 | 83 | | 70 | 83 | | dB |
| | | | | Full range | 70 | | | 70 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$) | $V_{DD}$ = 4.4 V to 16 V, | | 25°C | 80 | 95 | | 80 | 95 | | dB |
| $I_{DD}$ | Supply current (four amplifiers) | $V_O$ = 2.5 V, | No load | 25°C | | 0.8 | 1 | | 0.8 | 1 | mA |
| | | | | Full range | | | 1 | | | 1 | |

† Full range is −40°C to 125°C for Q suffix, − 55°C to 125°C for M suffix.
‡ Referenced to 2.5 V
NOTE 4: Typical values are based on the input offset voltage shift observed through 500 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.

## TEXAS INSTRUMENTS

## TLC2264Q/M operating characteristics at specified free-air temperature, $V_{DD}$ = 5 V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264Q, TLC2264M | | | TLC2264AQ, TLC2264AM | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR | Slew rate at unity gain | $V_O$ = 0.5 V to 3.5 V, $C_L$ = 100 pF‡ | $R_L$ = 50 kΩ‡, | 25°C | 0.35 | 0.55 | | 0.35 | 0.55 | | V/μs |
| | | | | Full range | 0.25 | | | 0.25 | | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 40 | | | 40 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.7 | | | 0.7 | | μV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | | 0.6 | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O$ = 0.5 V to 2.5 V, f = 20 kHz, $R_L$ = 50 kΩ‡ | $A_V$ = 1 | 25°C | | 0.017% | | | 0.017% | | |
| | | | $A_V$ = 10 | | | 0.03% | | | 0.03% | | |
| | Gain-bandwidth product | f = 50 kHz, $C_L$ = 100 pF‡ | $R_L$ = 50 kΩ‡, | 25°C | | 0.71 | | | 0.71 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)}$ = 2 V, $R_L$ = 50 kΩ‡, | $A_V$ = 1, $C_L$ = 100 pF‡ | 25°C | | 185 | | | 185 | | kHz |
| $t_s$ | Settling time | $A_V$ = –1, Step = 0.5 V to 2.5 V, $R_L$ = 50 kΩ‡, $C_L$ = 100 pF‡ | To 0.1% | 25°C | | 6.4 | | | 6.4 | | μs |
| | | | To 0.01% | | | 14.1 | | | 14.1 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L$ = 50 kΩ‡, | $C_L$ = 100 pF‡ | 25°C | | 56° | | | 56° | | |
| | Gain margin | | | 25°C | | 11 | | | 11 | | dB |

† Full range is –40°C to 125°C for Q suffix, –55°C to 125°C for M suffix.
‡ Referenced to 2.5 V

## TLC2264Q/M electrical characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264Q, TLC2264M | | | TLC2264AQ, TLC2264AM | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | $V_{IC} = 0$, $R_S = 50\ \Omega$ | $V_O = 0$, | 25°C | | 300 | 2500 | | 300 | 950 | μV |
| | | | | Full range | | | 3000 | | | 1500 | |
| $\alpha_{VIO}$ | Temperature coefficient of input offset voltage | | | Full range | | 2 | | | 2 | | μV/°C |
| | Input offset voltage long-term drift (see Note 4) | | | 25°C | | 0.003 | | | 0.003 | | μV/mo |
| $I_{IO}$ | Input offset current | | | 25°C | | 0.5 | | | 0.5 | | pA |
| | | | | 125°C | | | 800 | | | 800 | |
| $I_{IB}$ | Input bias current | | | 25°C | | 1 | | | 1 | | pA |
| | | | | 125°C | | | 800 | | | 800 | |
| $V_{ICR}$ | Common-mode input voltage range | $R_S = 50\ \Omega$, $|V_{IO}| \leq 5$ mV | | 25°C | −5 to 4 | −5.3 to 4.2 | | −5 to 4 | −5.3 to 4.2 | | V |
| | | | | Full range | −5 to 3.5 | | | −5 to 3.5 | | | |
| $V_{OM+}$ | Maximum positive peak output voltage | $I_O = -20\ \mu A$ | | 25°C | | 4.99 | | | 4.99 | | V |
| | | $I_O = -100\ \mu A$ | | 25°C | 4.85 | 4.94 | | 4.85 | 4.94 | | |
| | | | | Full range | 4.82 | | | 4.82 | | | |
| | | $I_O = -400\ \mu A$ | | 25°C | 4.7 | 4.85 | | 4.7 | 4.85 | | |
| | | | | Full range | 4.5 | | | 4.5 | | | |
| $V_{OM-}$ | Maximum negative peak output voltage | $V_{IC} = 0$, | $I_O = 50\ \mu A$ | 25°C | | −4.99 | | | −4.99 | | V |
| | | $V_{IC} = 0$, | $I_O = 500\ \mu A$ | 25°C | −4.85 | −4.91 | | −4.85 | −4.91 | | |
| | | | | Full range | −4.85 | | | −4.85 | | | |
| | | $V_{IC} = 0$, | $I_O = 4$ mA | 25°C | −4 | −4.3 | | −4 | −4.3 | | |
| | | | | Full range | −3.8 | | | −3.8 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $V_O = \pm 4$ V | $R_L = 50\ k\Omega$ | 25°C | 80 | 200 | | 80 | 200 | | V/mV |
| | | | | Full range | 50 | | | 50 | | | |
| | | | $R_L = 1\ M\Omega$ | 25°C | | 1000 | | | 1000 | | |
| $r_{i(d)}$ | Differential input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | $\Omega$ |
| $r_{i(c)}$ | Common-mode input resistance | | | 25°C | | $10^{12}$ | | | $10^{12}$ | | $\Omega$ |
| $c_{i(c)}$ | Common-mode input capacitance | $f = 10$ kHz, | N package | 25°C | | 8 | | | 8 | | pF |
| $z_o$ | Closed-loop output impedance | $f = 100$ kHz, | $A_V = 10$ | 25°C | | 220 | | | 220 | | $\Omega$ |
| CMRR | Common-mode rejection ratio | $V_{IC} = -5$ V to 2.7 V, $V_O = 0$, | $R_S = 50\ \Omega$ | 25°C | 75 | 88 | | 75 | 88 | | dB |
| | | | | Full range | 75 | | | 75 | | | |
| $k_{SVR}$ | Supply-voltage rejection ratio ($\Delta V_{DD\pm}/\Delta V_{IO}$) | $V_{DD\pm} = \pm 2.2$ V to $\pm 8$ V, $V_{IC} = V_{DD}/2$, | No load | 25°C | 80 | 95 | | 80 | 95 | | dB |
| | | | | Full range | 80 | | | 80 | | | |
| $I_{DD}$ | Supply current (four amplifiers) | $V_O = 0$, | No load | 25°C | | 0.85 | 1 | | 0.85 | 1 | mA |
| | | | | Full range | | | 1 | | | 1 | |

† Full range is −40°C to 125°C for Q suffix, −55°C to 125°C for M suffix.

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 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.

**TEXAS INSTRUMENTS**

## TLC2264Q/M operating characteristics at specified free-air temperature, $V_{DD\pm} = \pm 5$ V

| PARAMETER | | TEST CONDITIONS | | $T_A$† | TLC2264Q, TLC2264M | | | TLC2264AQ, TLC2264AM | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| SR | Slew rate at unity gain | $V_O = \pm 2$ V, $C_L = 100$ pF | $R_L = 50$ kΩ, | 25°C | 0.35 | 0.55 | | 0.35 | 0.55 | | V/μs |
| | | | | Full range | 0.25 | | | 0.25 | | | |
| $V_n$ | Equivalent input noise voltage | f = 10 Hz | | 25°C | | 43 | | | 43 | | nV/√Hz |
| | | f = 1 kHz | | 25°C | | 12 | | | 12 | | |
| $V_{N(PP)}$ | Peak-to-peak equivalent input noise voltage | f = 0.1 Hz to 1 Hz | | 25°C | | 0.8 | | | 0.8 | | μV |
| | | f = 0.1 Hz to 10 Hz | | 25°C | | 1.3 | | | 1.3 | | |
| $I_n$ | Equivalent input noise current | | | 25°C | | 0.6 | | | 0.6 | | fA/√Hz |
| THD + N | Total harmonic distortion plus noise | $V_O = \pm 2.3$ V, $R_L = 50$ kΩ, f = 20 kHz | $A_V = 1$ | 25°C | | 0.014% | | | 0.014% | | |
| | | | $A_V = 10$ | | | 0.024% | | | 0.024% | | |
| | Gain-bandwidth product | f =10 kHz, $C_L = 100$ pF | $R_L = 50$ kΩ, | 25°C | | 0.73 | | | 0.73 | | MHz |
| $B_{OM}$ | Maximum output-swing bandwidth | $V_{O(PP)} = 4.6$ V, $R_L = 50$ kΩ, | $A_V = 1$, $C_L = 100$ pF | 25°C | | 70 | | | 70 | | kHz |
| $t_S$ | Settling time | $A_V = -1$, Step = $-2.3$ V to 2.3 V, $R_L = 50$ kΩ, $C_L = 100$ pF | To 0.1% | 25°C | | 7.1 | | | 7.1 | | μs |
| | | | To 0.01% | | | 16.5 | | | 16.5 | | |
| $\phi_m$ | Phase margin at unity gain | $R_L = 50$ kΩ, | $C_L = 100$ pF | 25°C | | 57° | | | 57° | | |
| | Gain margin | | | 25°C | | 11 | | | 11 | | dB |

† Full range is −40°C to 125°C for Q suffix, − 55°C to 125°C for M suffix.

# TYPICAL CHARACTERISTICS

## Table of Graphs

| | | | FIGURE |
|---|---|---|---|
| $V_{IO}$ | Input offset voltage | Distribution<br>vs Common-mode input voltage | 2 – 5<br>6, 7 |
| $\alpha_{VIO}$ | Input offset voltage temperature coefficient | Distribution | 8 – 11 |
| $I_{IB}/I_{IO}$ | Input bias and input offset currents | vs Free-air temperature | 12 |
| $V_I$ | Input voltage range | vs Supply voltage<br>vs Free-air temperature | 13<br>14 |
| $V_{OH}$ | High-level output voltage | vs High-level output current | 15 |
| $V_{OL}$ | Low-level output voltage | vs Low-level output current | 16, 17 |
| $V_{OM+}$ | Maximum positive output voltage | vs Output current | 18 |
| $V_{OM-}$ | Maximum negative output voltage | vs Output current | 19 |
| $V_{O(PP)}$ | Maximum peak-to-peak output voltage | vs Frequency | 20 |
| $I_{OS}$ | Short-circuit output current | vs Supply voltage<br>vs Free-air temperature | 21<br>22 |
| $V_O$ | Output voltage | vs Differential input voltage | 23, 24 |
| | Differential gain | vs Load resistance | 25 |
| $A_{VD}$ | Large-signal differential voltage amplification | vs Frequency<br>vs Free-air temperature | 26, 27<br>28, 29 |
| $z_o$ | Output impedance | vs Frequency | 30, 31 |
| CMRR | Common-mode rejection ratio | vs Frequency<br>vs Free-air temperature | 32<br>33 |
| $k_{SVR}$ | Supply-voltage rejection ratio | vs Frequency<br>vs Free-air temperature | 34, 35<br>36 |
| $I_{DD}$ | Supply current | vs Supply voltage<br>vs Free-air temperature | 37, 38<br>39, 40 |
| SR | Slew rate | vs Load capacitance<br>vs Free-air temperature | 41<br>42 |
| $V_O$ | Inverting large-signal pulse response | | 43, 44 |
| | Voltage-follower large-signal pulse response | | 45, 46 |
| | Inverting small-signal pulse response | | 47, 48 |
| | Voltage-follower small-signal pulse response | | 49, 50 |
| $V_n$ | Equivalent input noise voltage | vs Frequency | 51, 52 |
| | Noise voltage (referred to input) | Over a 10-second period | 53 |
| | Integrated noise voltage | vs Frequency | 54 |
| THD + N | Total harmonic distortion plus noise | vs Frequency | 55 |
| | Gain-bandwidth product | vs Supply voltage<br>vs Free-air temperature | 56<br>57 |
| $\phi_m$ | Phase margin | vs Frequency<br>vs Load capacitance | 26, 27<br>58 |
| | Gain margin | vs Load capacitance | 59 |
| $B_1$ | Unity-gain bandwidth | vs Load capacitance | 60 |
| | Overestimation of phase margin | vs Load capacitance | 61 |

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**TYPICAL CHARACTERISTICS**

DISTRIBUTION OF TLC2262
INPUT OFFSET VOLTAGE
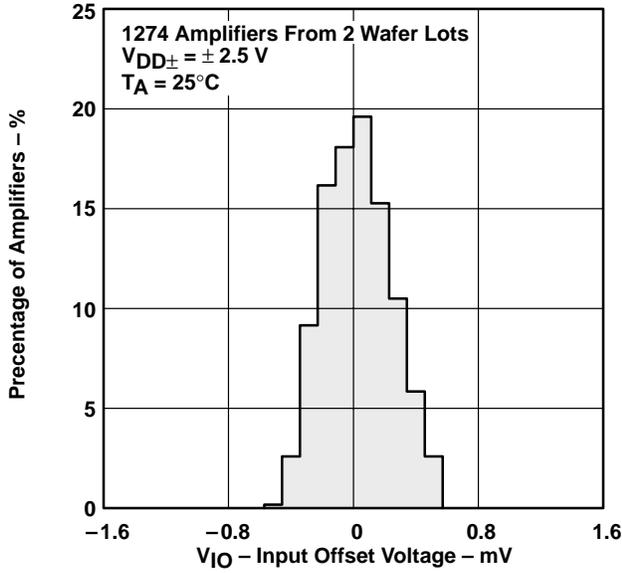


Figure 2

DISTRIBUTION OF TLC2262
INPUT OFFSET VOLTAGE
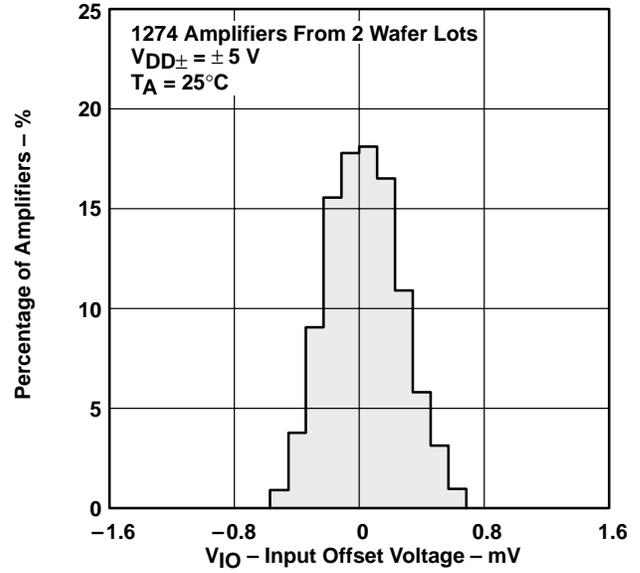


Figure 3

DISTRIBUTION OF TLC2264
INPUT OFFSET VOLTAGE
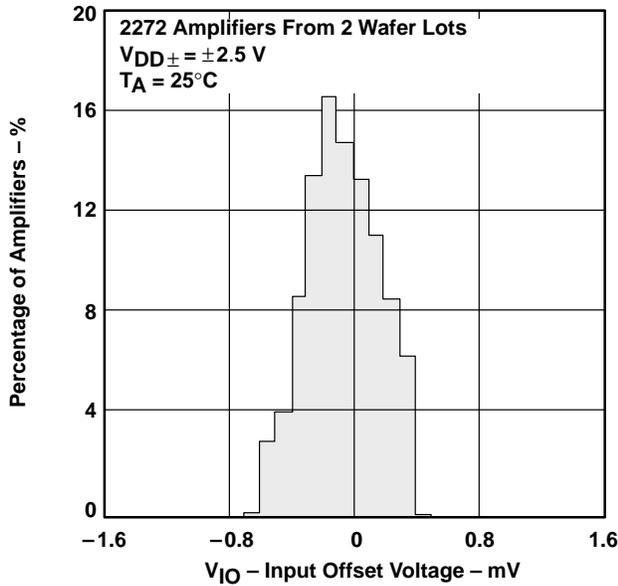


Figure 4

DISTRIBUTION OF TLC2264
INPUT OFFSET VOLTAGE
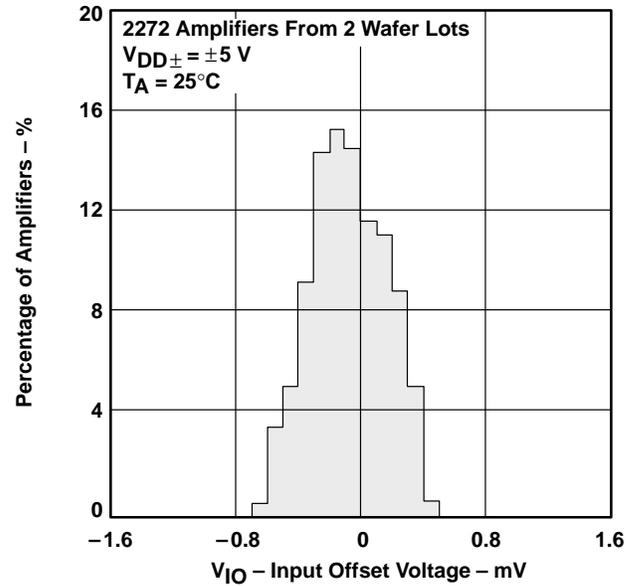


Figure 5

## TYPICAL CHARACTERISTICS
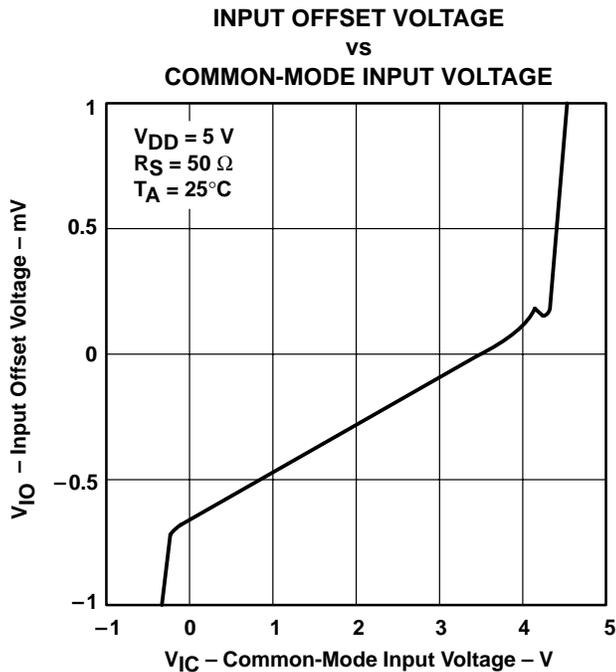
**INPUT OFFSET VOLTAGE**
**vs**
**COMMON-MODE INPUT VOLTAGE**

$V_{DD}$ = 5 V
$R_S$ = 50 Ω
$T_A$ = 25°C

† For curves where $V_{DD}$ = 5 V, all loads are referenced to 2.5 V.

**Figure 6**

**INPUT OFFSET VOLTAGE**
**vs**
**COMMON-MODE INPUT VOLTAGE**

$V_{DD\pm}$ = ±5 V
$R_S$ = 50 Ω
$T_A$ = 25°C

**Figure 7**

**DISTRIBUTION OF TLC2262 INPUT OFFSET**
**VOLTAGE TEMPERATURE COEFFICIENT†**

128 Amplifiers From 2 Wafer Lots
$V_{DD\pm}$ = ± 2.5 V
P Package
$T_A$ = 25°C to 125°C

**Figure 8**

**DISTRIBUTION OF TLC2262 INPUT OFFSET**
**VOLTAGE TEMPERATURE COEFFICIENT†**

128 Amplifiers From 2 Wafer Lots
$V_{DD\pm}$ = ± 5 V
P Package
$T_A$ = 25°C to 125°C
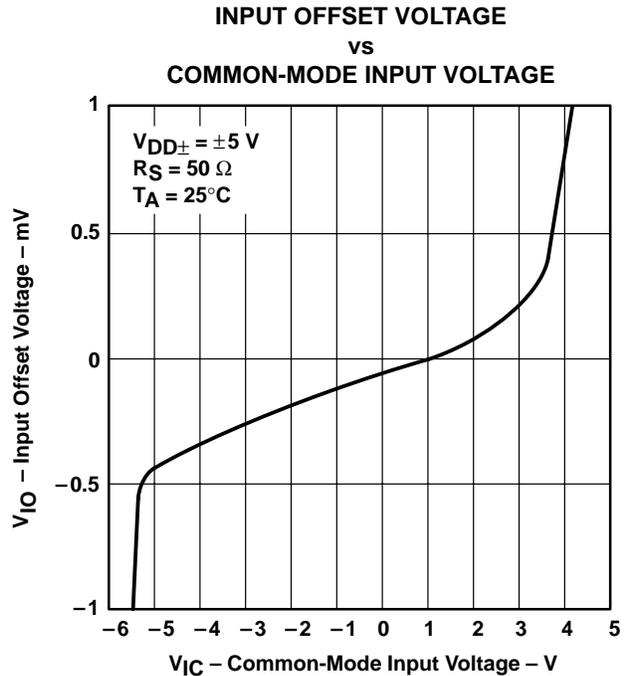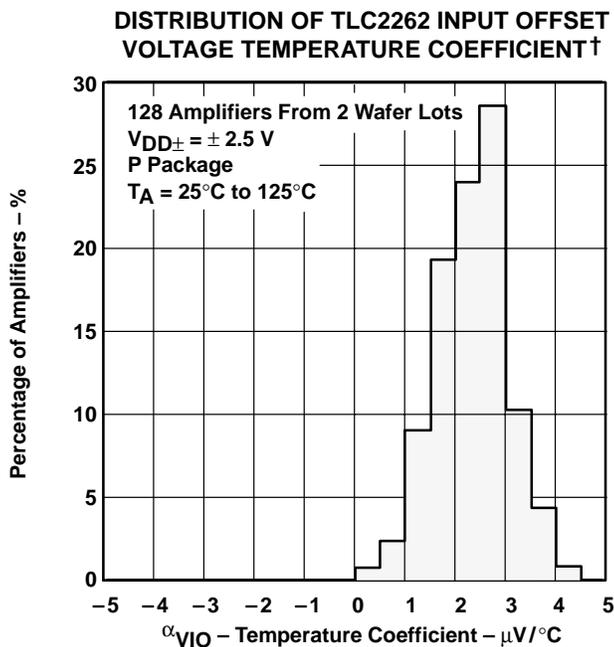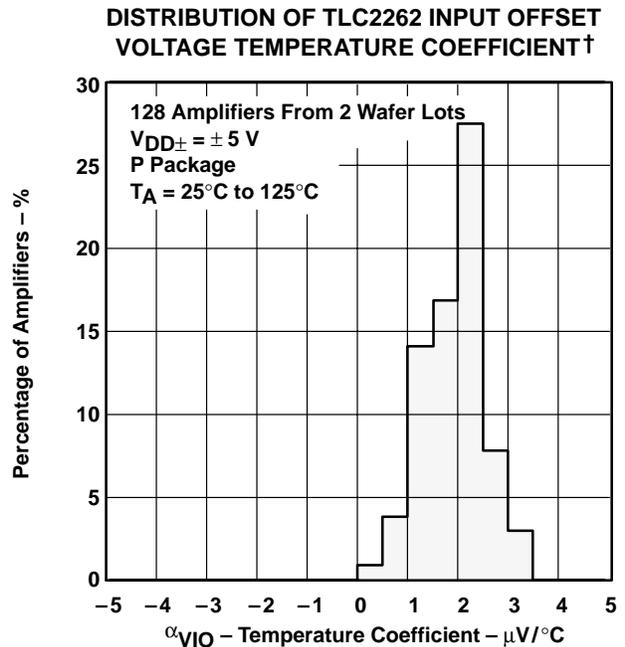
**Figure 9**

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

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## TYPICAL CHARACTERISTICS

DISTRIBUTION OF TLC2264 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT†



**Figure 10**

DISTRIBUTION OF TLC2264 INPUT OFFSET
VOLTAGE TEMPERATURE COEFFICIENT†



**Figure 11**

INPUT BIAS AND INPUT OFFSET CURRENTS†
vs
FREE-AIR TEMPERATURE
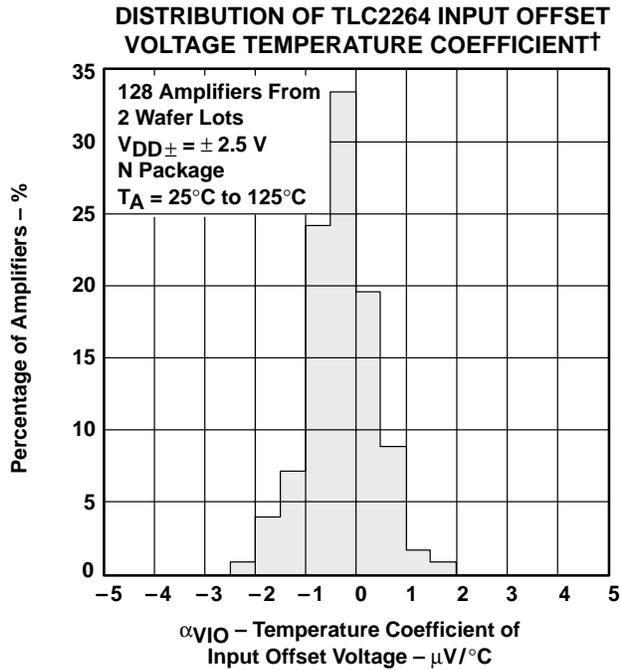


**Figure 12**
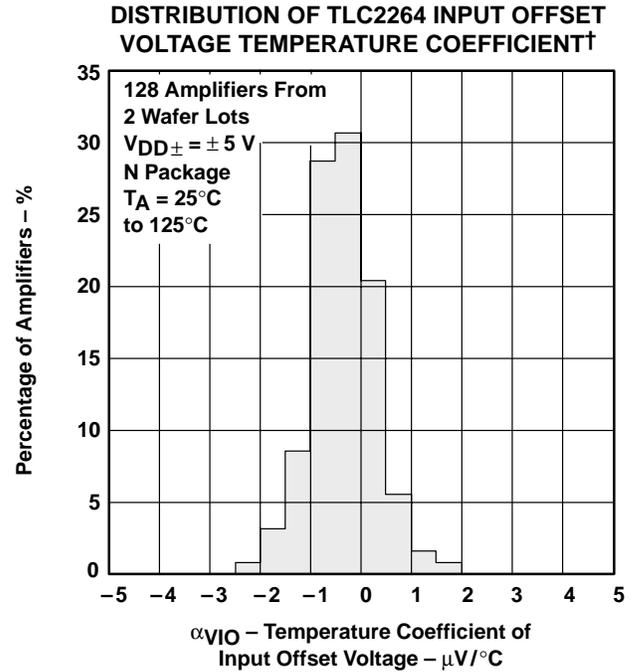
INPUT VOLTAGE RANGE
vs
SUPPLY VOLTAGE
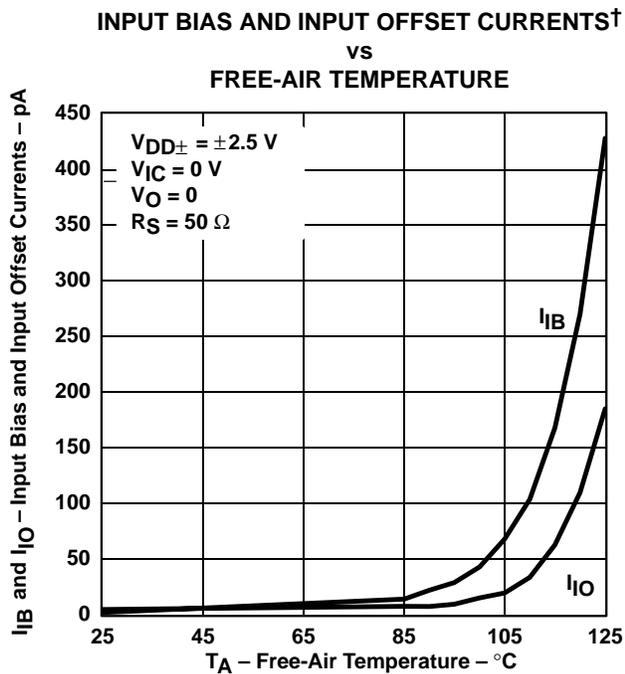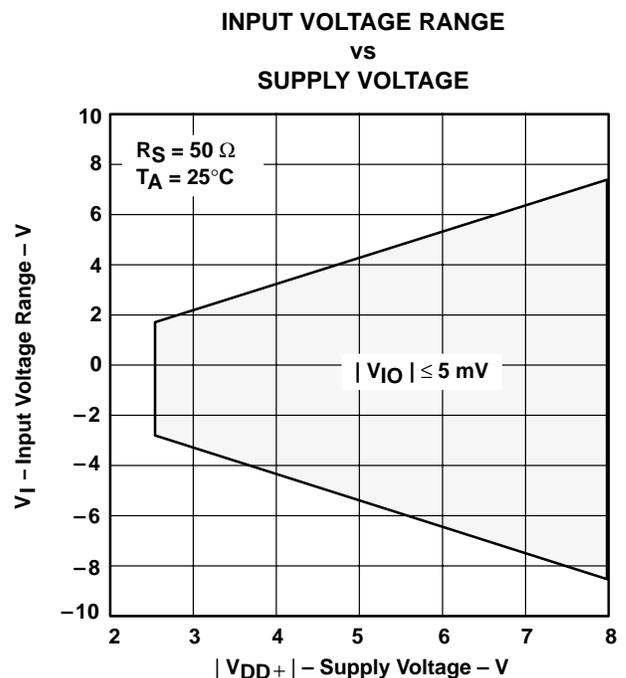


**Figure 13**

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

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INSTRUMENTS**

## TYPICAL CHARACTERISTICS

**INPUT VOLTAGE RANGE†‡**
**vs**
**FREE-AIR TEMPERATURE**
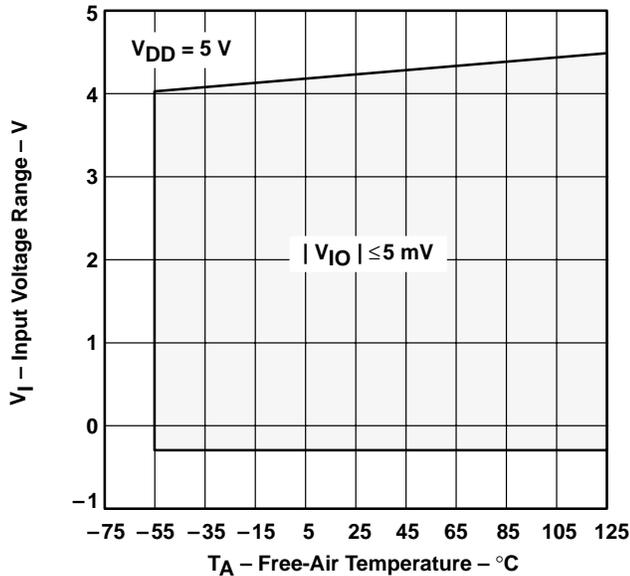


**Figure 14**

**HIGH-LEVEL OUTPUT VOLTAGE†‡**
**vs**
**HIGH-LEVEL OUTPUT CURRENT**
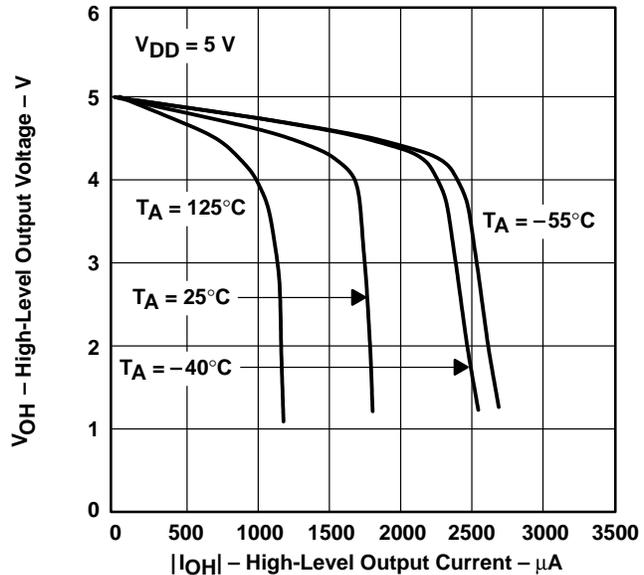


**Figure 15**

**LOW-LEVEL OUTPUT VOLTAGE‡**
**vs**
**LOW-LEVEL OUTPUT CURRENT**
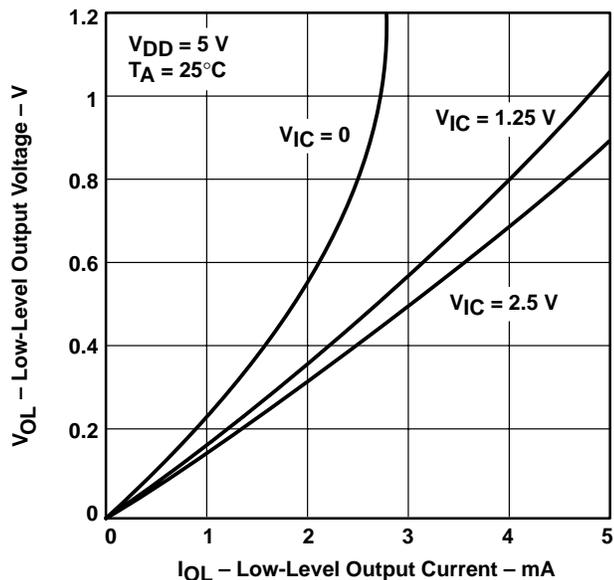


**Figure 16**

**LOW-LEVEL OUTPUT VOLTAGE†‡**
**vs**
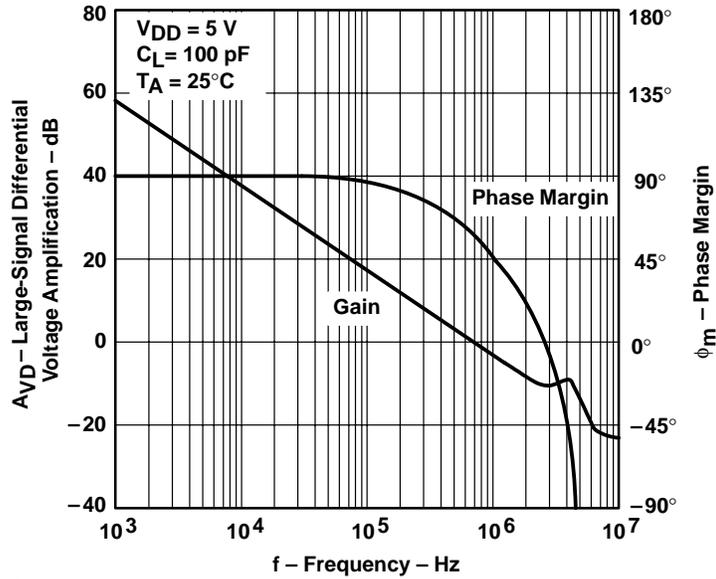**LOW-LEVEL OUTPUT CURRENT**
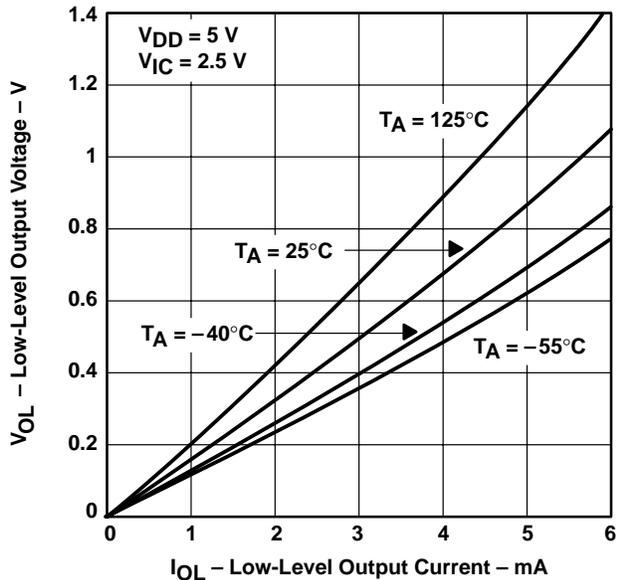


**Figure 17**

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
‡ For curves where $V_{DD}$ = 5 V, all loads are referenced to 2.5 V.

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## TYPICAL CHARACTERISTICS

**MAXIMUM POSITIVE OUTPUT VOLTAGE†**
**vs**
**OUTPUT CURRENT**
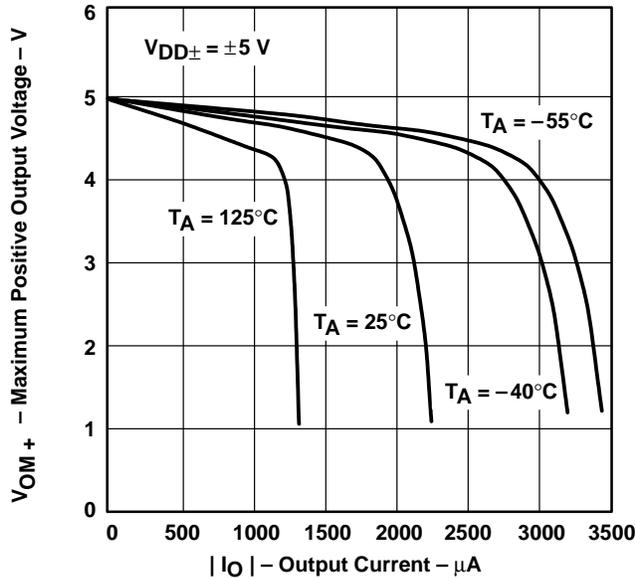


**Figure 18**

**MAXIMUM NEGATIVE OUTPUT VOLTAGE†**
**vs**
**OUTPUT CURRENT**



**Figure 19**

**MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE†‡**
**vs**
**FREQUENCY**
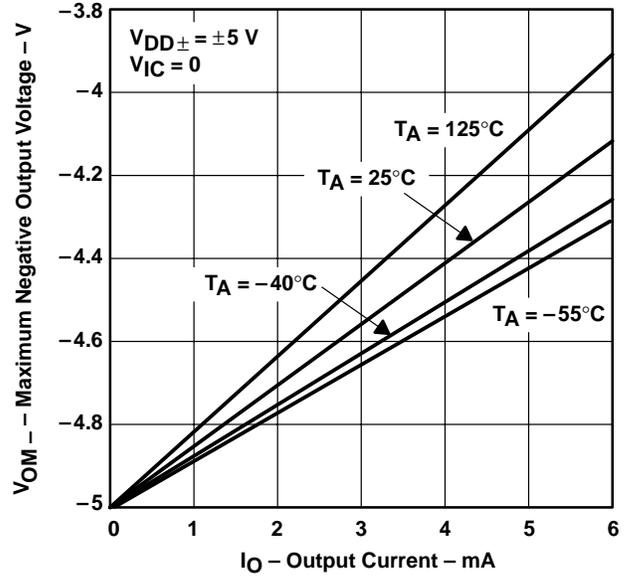


‡ For curves where $V_{DD}$ = 5 V, all loads are referenced to 2.5 V.
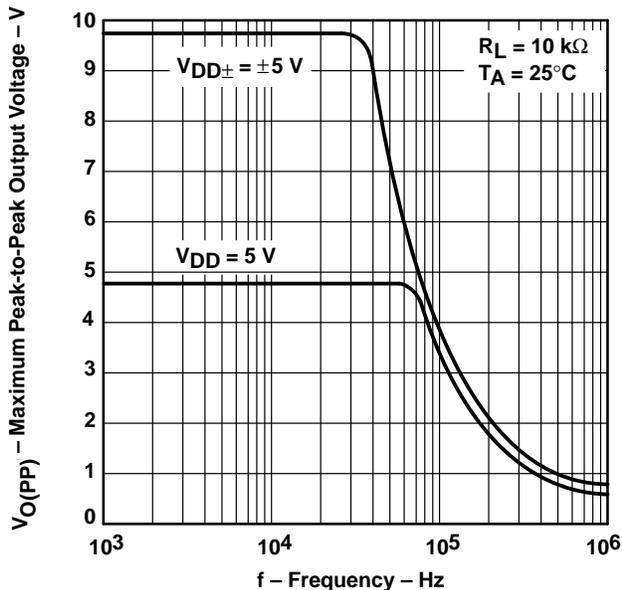
**Figure 20**

**SHORT-CIRCUIT OUTPUT CURRENT**
**vs**
**SUPPLY VOLTAGE**



**Figure 21**

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

## TYPICAL CHARACTERISTICS

**SHORT-CIRCUIT OUTPUT CURRENT†**
**vs**
**FREE-AIR TEMPERATURE**



**Figure 22**

**OUTPUT VOLTAGE‡**
**vs**
**DIFFERENTIAL INPUT VOLTAGE**



**Figure 23**

**OUTPUT VOLTAGE**
**vs**
**DIFFERENTIAL INPUT VOLTAGE**



**Figure 24**

**DIFFERENTIAL GAIN‡**
**vs**
**LOAD RESISTANCE**



**Figure 25**

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
‡ For curves where $V_{DD}$ = 5 V, all loads are referenced to 2.5 V.

**TEXAS INSTRUMENTS**
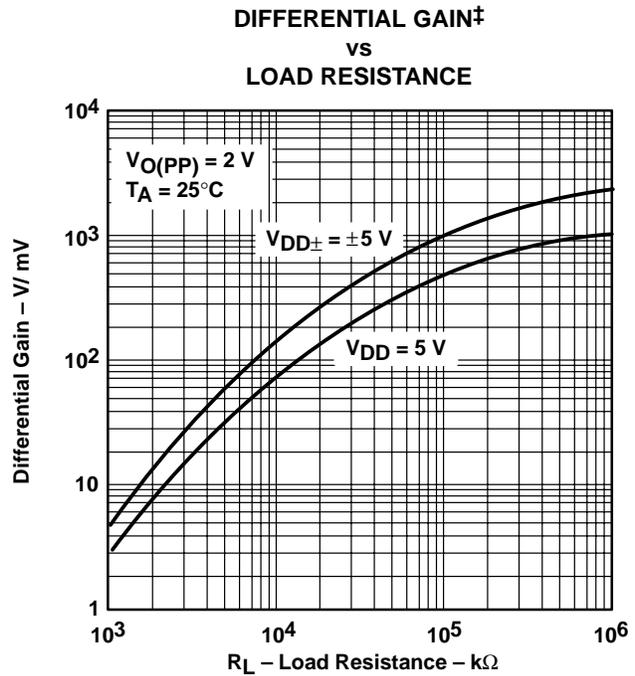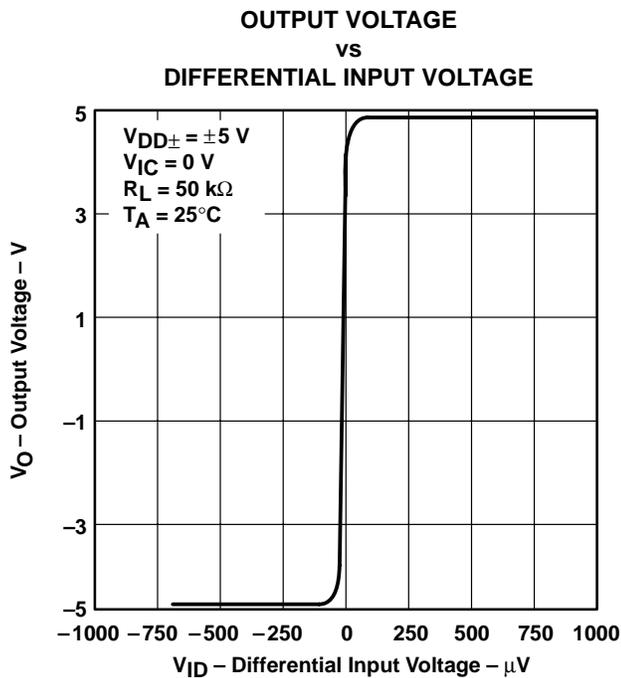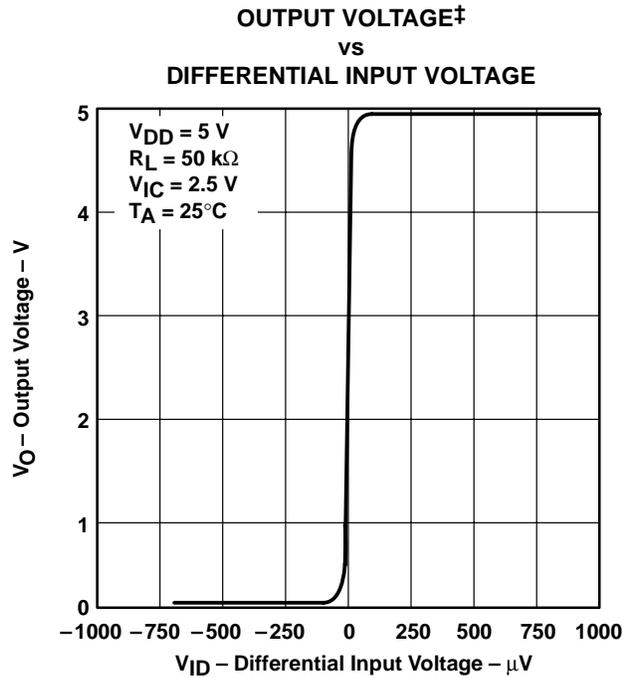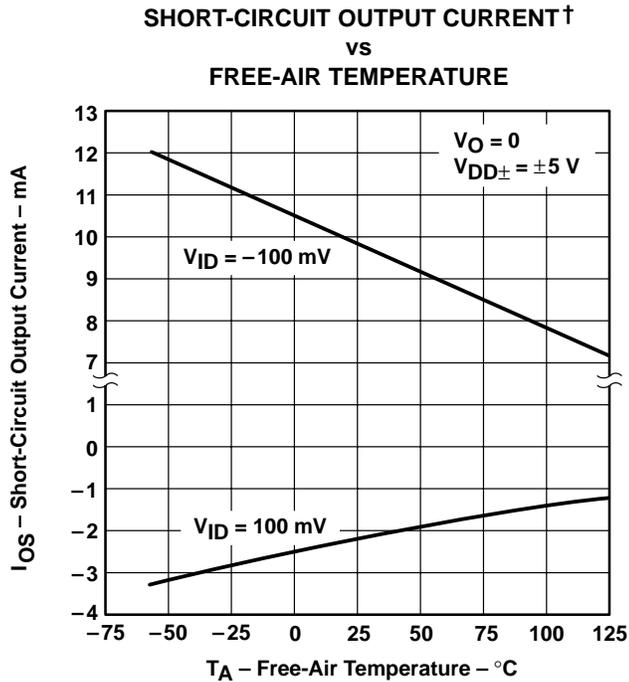
## TYPICAL CHARACTERISTICS

**LARGE-SIGNAL DIFFERENTIAL VOLTAGE†**
**AMPLIFICATION AND PHASE MARGIN**
**vs**
**FREQUENCY**



† For curves where $V_{DD}$ = 5 V, all loads are referenced to 2.5 V.

**Figure 26**

**LARGE-SIGNAL DIFFERENTIAL VOLTAGE**
**AMPLIFICATION AND PHASE MARGIN**
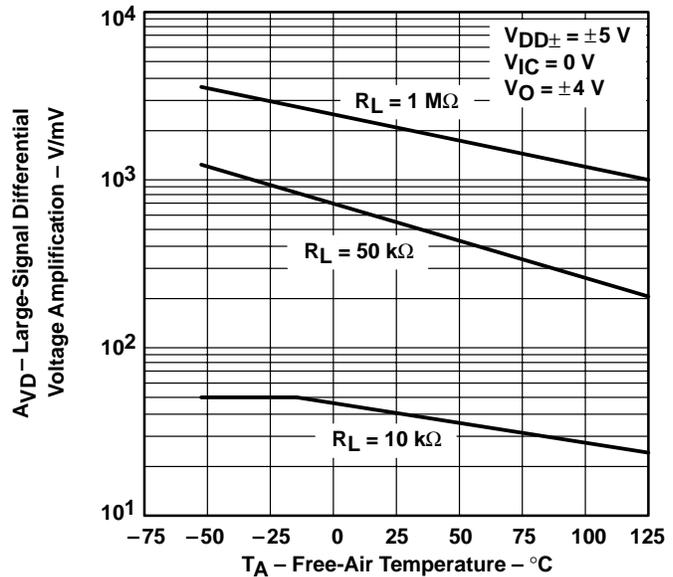**vs**
**FREQUENCY**
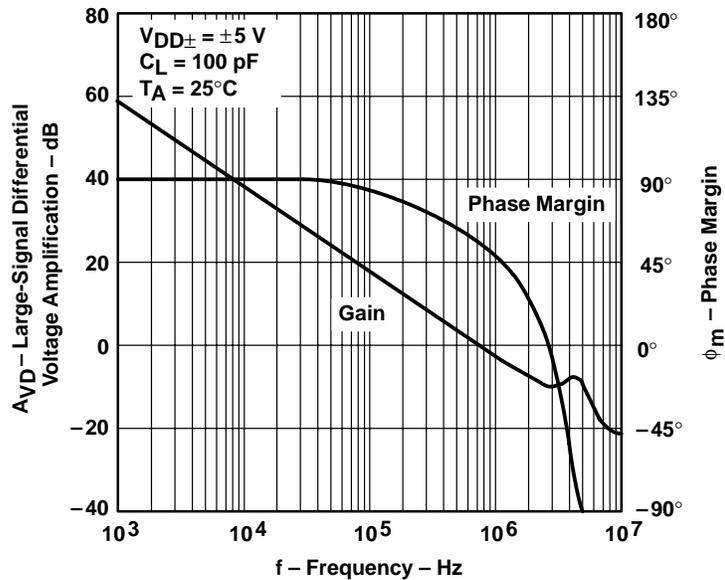


**Figure 27**

**TEXAS**
**INSTRUMENTS**

## TYPICAL CHARACTERISTICS

LARGE-SIGNAL DIFFERENTIAL
VOLTAGE AMPLIFICATION†‡
vs
FREE-AIR TEMPERATURE
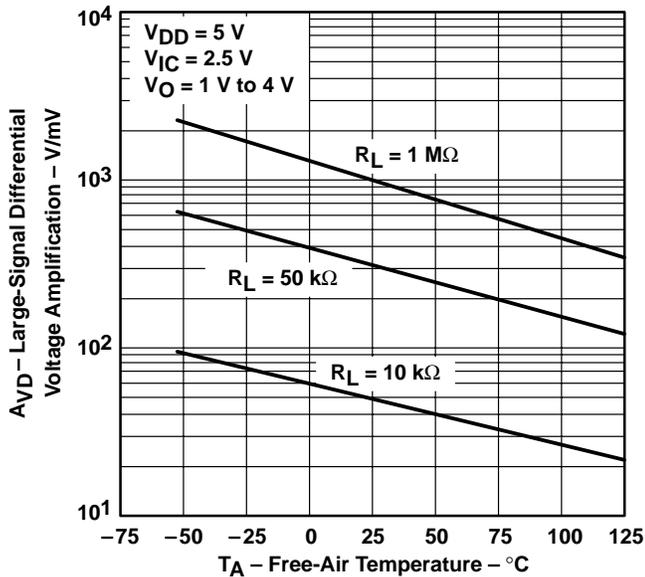


**Figure 28**

LARGE-SIGNAL DIFFERENTIAL
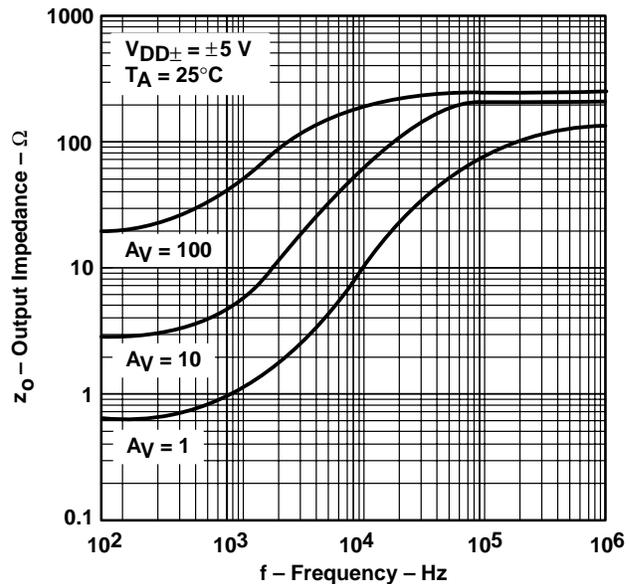VOLTAGE AMPLIFICATION†
vs
FREE-AIR TEMPERATURE



**Figure 29**

OUTPUT IMPEDANCE‡
vs
FREQUENCY
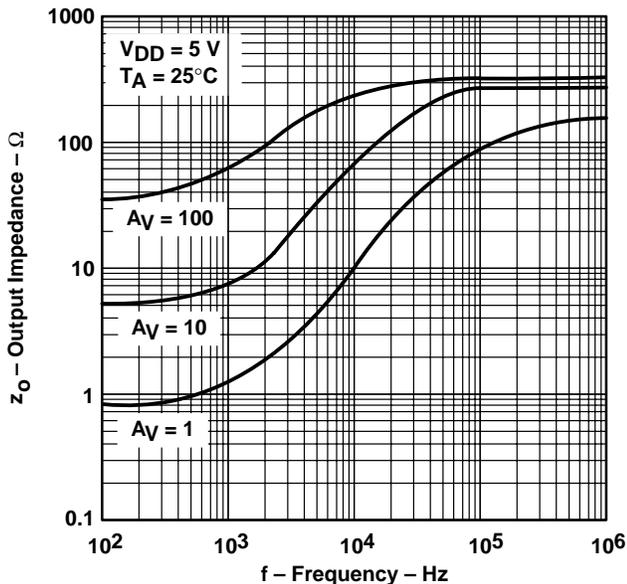


**Figure 30**

OUTPUT IMPEDANCE
vs
FREQUENCY



**Figure 31**

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
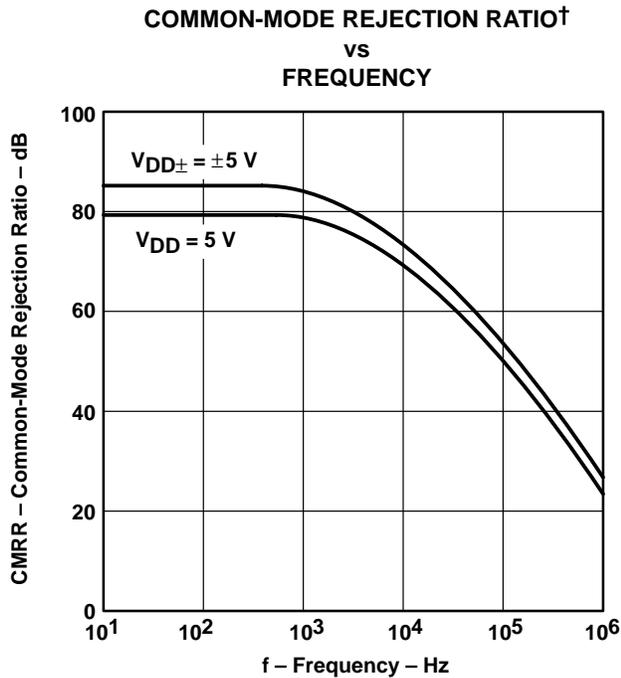‡ For curves where $V_{DD}$ = 5 V, all loads are referenced to 2.5 V.

**TEXAS**
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## TYPICAL CHARACTERISTICS

**COMMON-MODE REJECTION RATIO†**
**vs**
**FREQUENCY**



**Figure 32**

**COMMON-MODE REJECTION RATIO†‡**
**vs**
**FREE-AIR TEMPERATURE**



**Figure 33**

**SUPPLY-VOLTAGE REJECTION RATIO†**
**vs**
**FREQUENCY**



**Figure 34**

**SUPPLY-VOLTAGE REJECTION RATIO**
**vs**
**FREQUENCY**
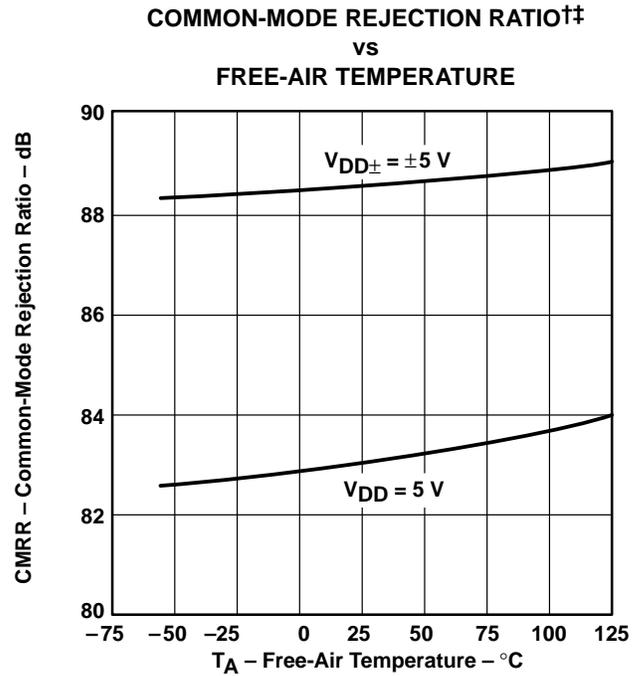


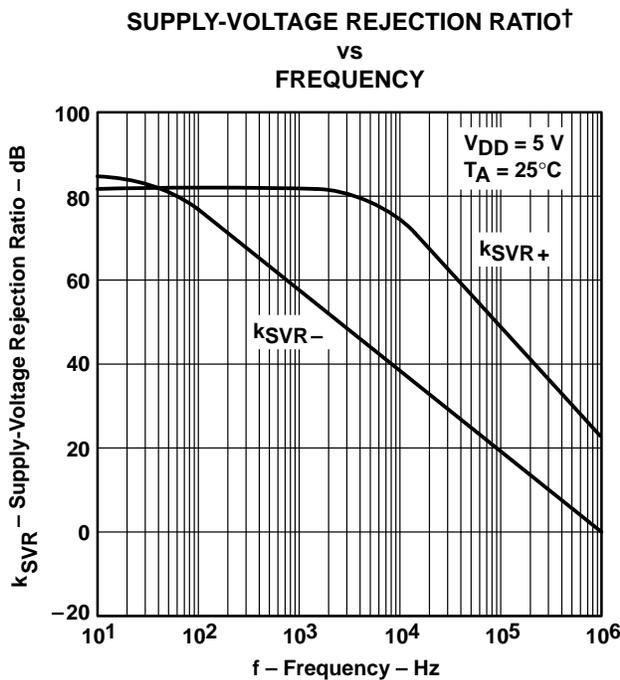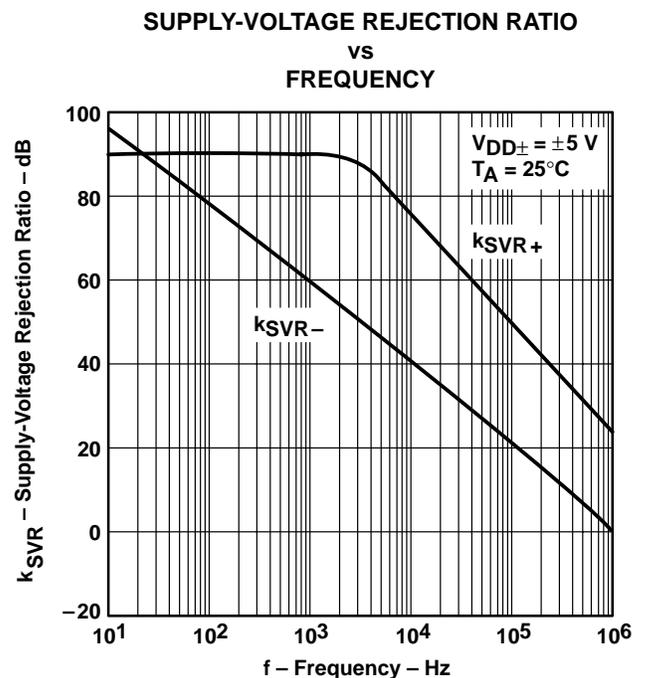**Figure 35**

† For curves where $V_{DD}$ = 5 V, all loads are referenced to 2.5 V.
‡ Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

**TEXAS INSTRUMENTS**

## TYPICAL CHARACTERISTICS

**SUPPLY-VOLTAGE REJECTION RATIO[†]
vs
FREE-AIR TEMPERATURE**

$V_{DD\pm} = \pm 2.2$ V to $\pm 8$ V
$V_O = 0$

$k_{SVR}$ – Supply-Voltage Rejection Ratio – dB

$T_A$ – Free-Air Temperature – °C
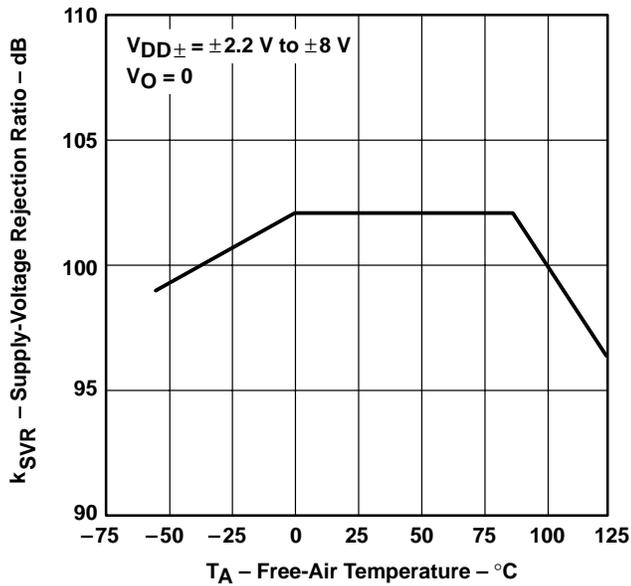
**Figure 36**

**TLC2262
SUPPLY CURRENT[†]
vs
SUPPLY VOLTAGE**

$V_O = 0$
No Load

$T_A = -55°C$
$T_A = 125°C$
$T_A = 25°C$
$T_A = 40°C$

$I_{DD}$ – Supply Current – μA

$|V_{DD\pm}|$ – Supply Voltage – V
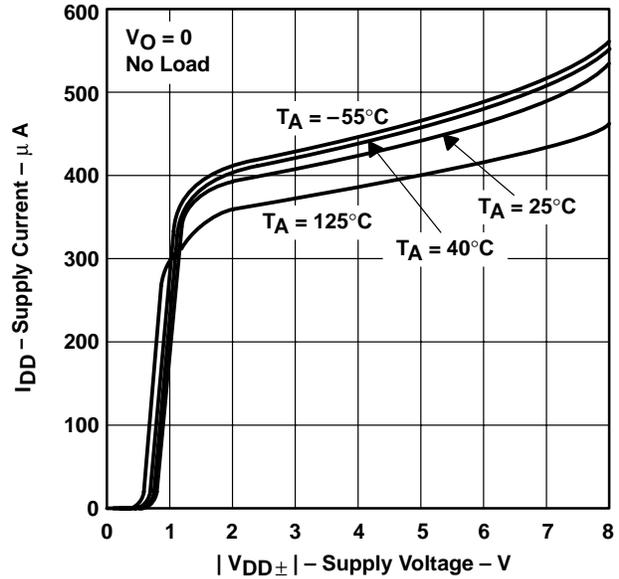
**Figure 37**

**TLC2264
SUPPLY CURRENT[†]
vs
SUPPLY VOLTAGE**

$V_O = 0$
No Load

$T_A = -55°C$
$T_A = 125°C$
$T_A = 25°C$
$T_A = 40°C$

$I_{DD}$ – Supply Current – μA

$|V_{DD\pm}|$ – Supply Voltage – V

**Figure 38**

**TLC2262
SUPPLY CURRENT[†‡]
vs
FREE-AIR TEMPERATURE**

$V_{DD\pm} = \pm 5$ V
$V_O = 0$

$V_{DD} = 5$ V
$V_O = 2.5$ V

$I_{DD}$ – Supply Current – μA

$T_A$ – Free-Air Temperature – °C
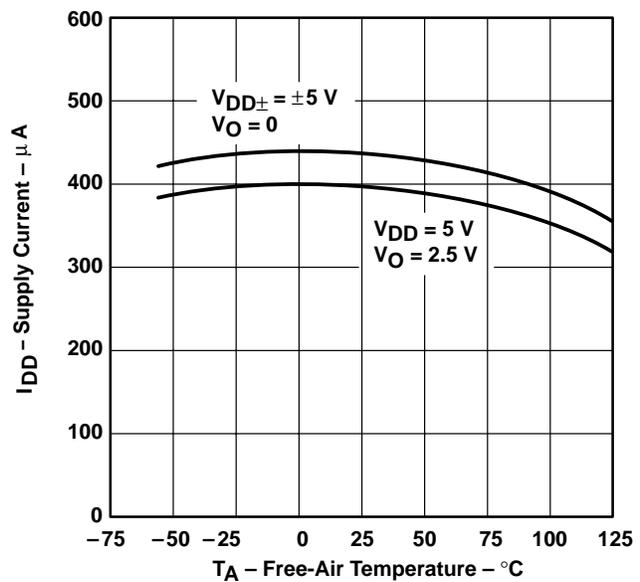
**Figure 39**

[†] Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
[‡] For curves where $V_{DD} = 5$ V, all loads are referenced to 2.5 V.

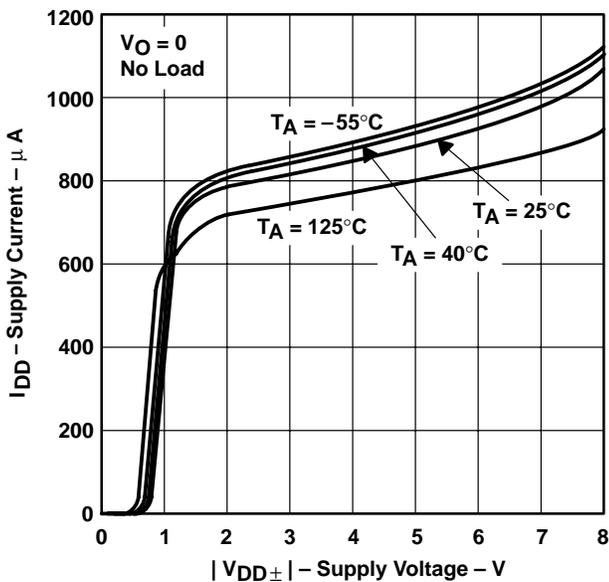![Texas Instruments logo]

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## TYPICAL CHARACTERISTICS

TLC2264
SUPPLY CURRENT†‡
vs
FREE-AIR TEMPERATURE



**Figure 40**

SLEW RATE‡
vs
LOAD CAPACITANCE



**Figure 41**
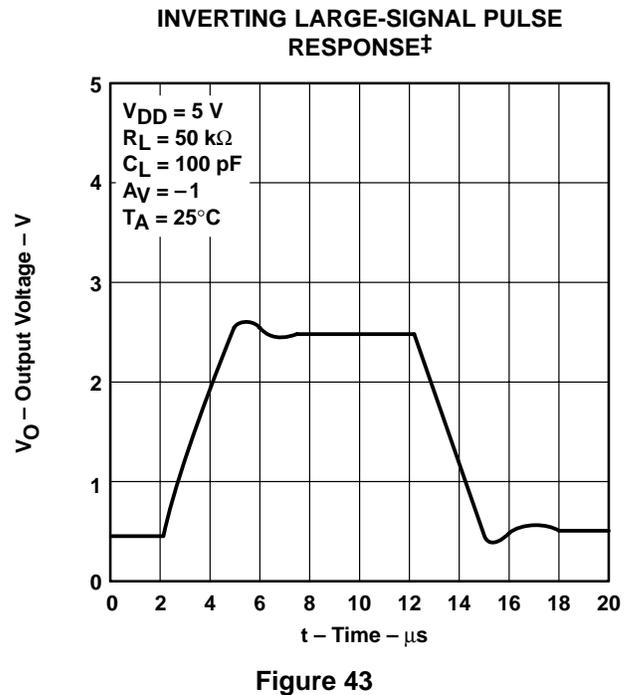
SLEW RATE†‡
vs
FREE-AIR TEMPERATURE



**Figure 42**

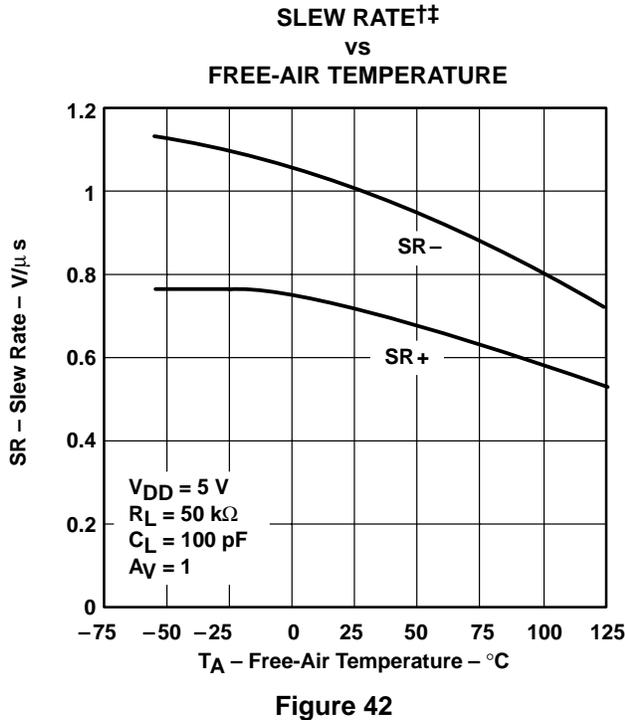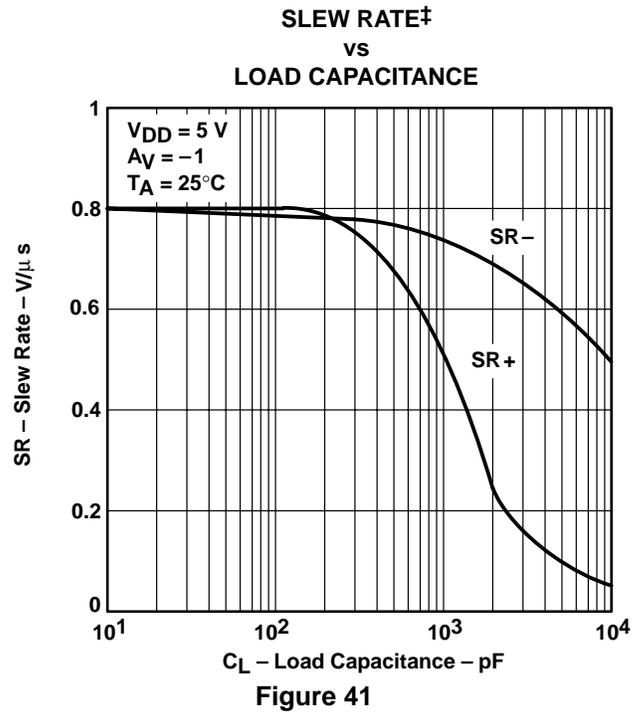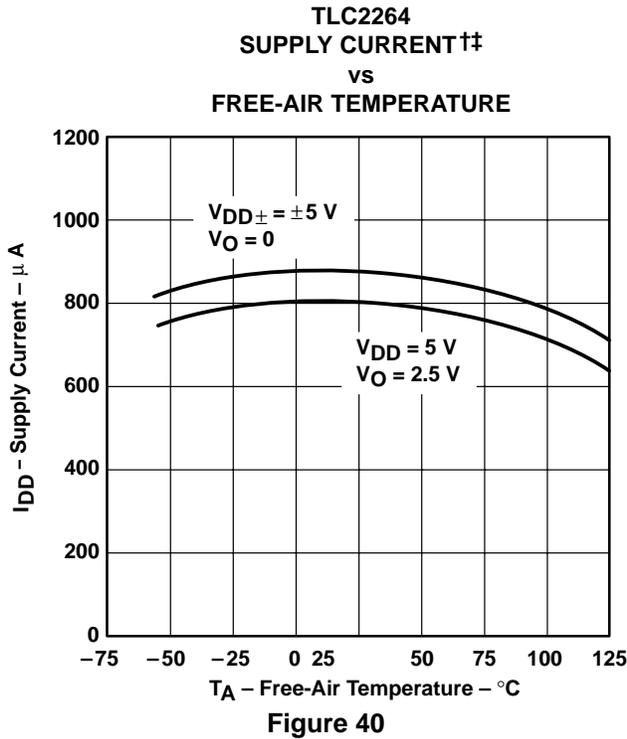INVERTING LARGE-SIGNAL PULSE
RESPONSE‡



**Figure 43**

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
‡ For curves where $V_{DD}$ = 5 V, all loads are referenced to 2.5 V.

## TYPICAL CHARACTERISTICS

### INVERTING LARGE-SIGNAL PULSE RESPONSE

$V_{DD\pm} = \pm 5$ V
$R_L = 50$ kΩ
$C_L = 100$ pF
$A_V = -1$
$T_A = 25°C$

**Figure 44**

### VOLTAGE-FOLLOWER LARGE-SIGNAL PULSE RESPONSE†

$V_{DD} = 5$ V
$R_L = 50$ kΩ
$C_L = 100$ pF
$A_V = 1$
$T_A = 25°C$
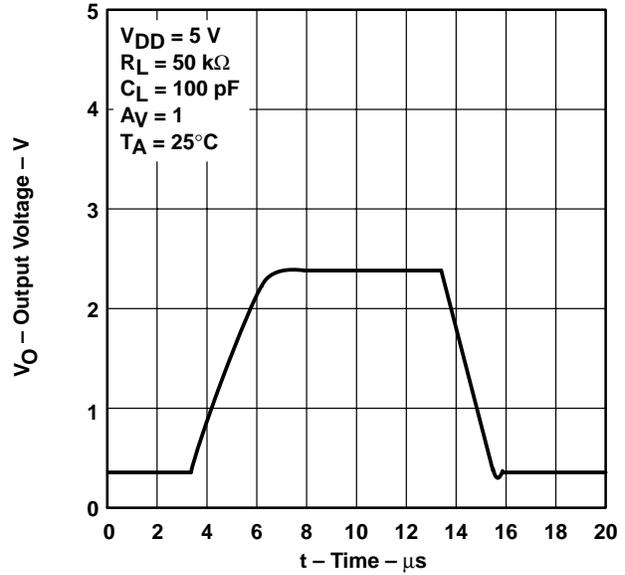
**Figure 45**

### VOLTAGE-FOLLOWER LARGE-SIGNAL PULSE RESPONSE

$V_{DD\pm} = \pm 5$ V
$R_L = 50$ kΩ
$C_L = 100$ pF
$A_V = 1$
$T_A = 25°C$
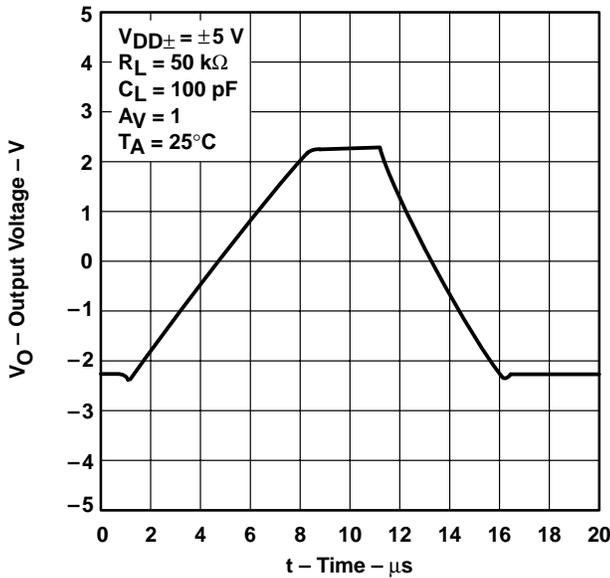
**Figure 46**

### INVERTING SMALL-SIGNAL PULSE RESPONSE†

$V_{DD} = 5$ V
$R_L = 50$ kΩ
$C_L = 100$ pF
$A_V = -1$
$T_A = 25°C$
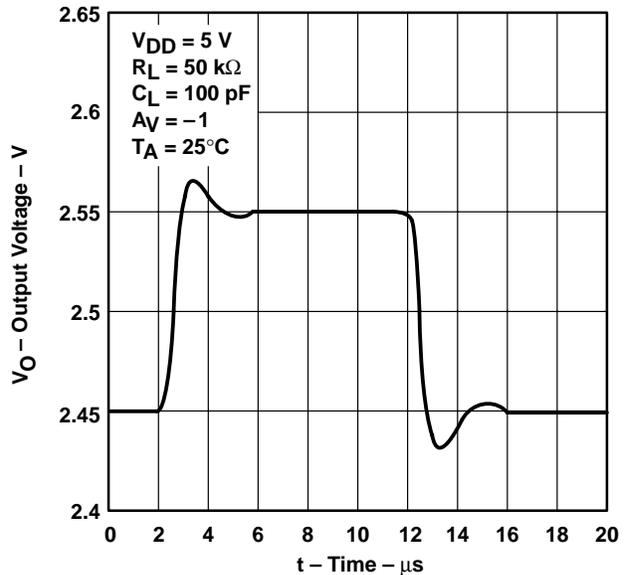
**Figure 47**

† For curves where $V_{DD} = 5$ V, all loads are referenced to 2.5 V.

## TYPICAL CHARACTERISTICS

### INVERTING SMALL-SIGNAL PULSE RESPONSE

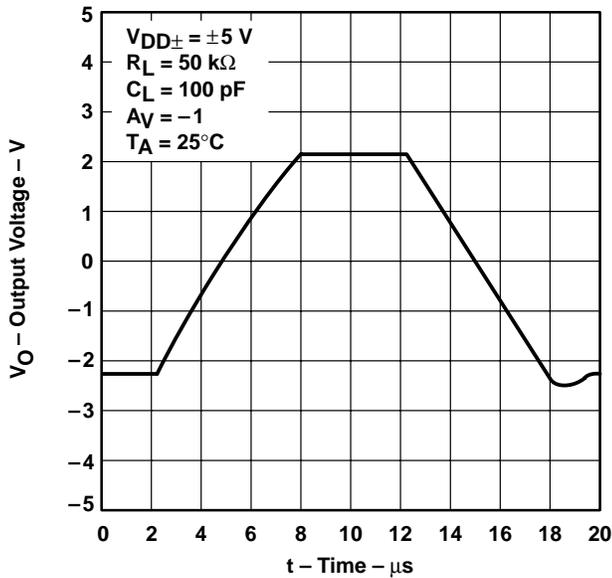$V_{DD\pm} = \pm5$ V
$R_L = 50$ k$\Omega$
$C_L = 100$ pF
$A_V = -1$
$T_A = 25°$C

**Figure 48**

### VOLTAGE-FOLLOWER SMALL-SIGNAL PULSE RESPONSE†

$V_{DD} = 5$ V
$R_L = 50$ k$\Omega$
$C_L = 100$ pF
$A_V = 1$
$T_A = 25°$C

**Figure 49**

### VOLTAGE-FOLLOWER SMALL-SIGNAL PULSE RESPONSE

$V_{DD\pm} = \pm5$ V
$R_L = 50$ k$\Omega$
$C_L = 100$ pF
$A_V = 1$
$T_A = 25°$C

**Figure 50**

### EQUIVALENT INPUT NOISE VOLTAGE† vs FREQUENCY
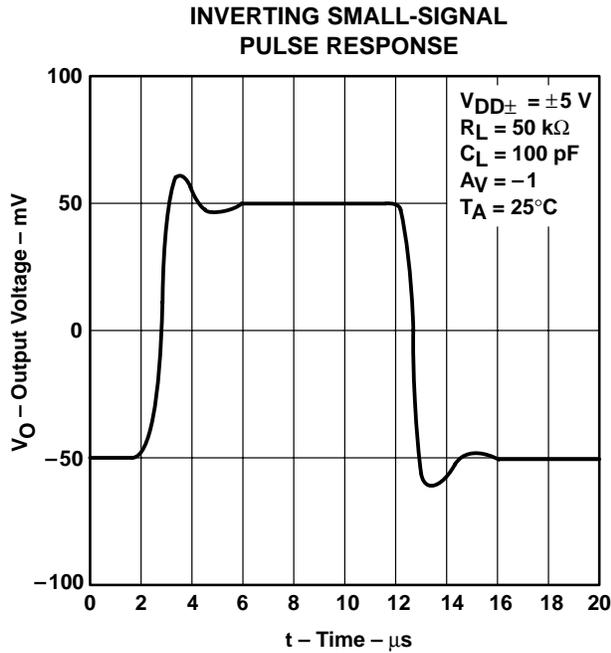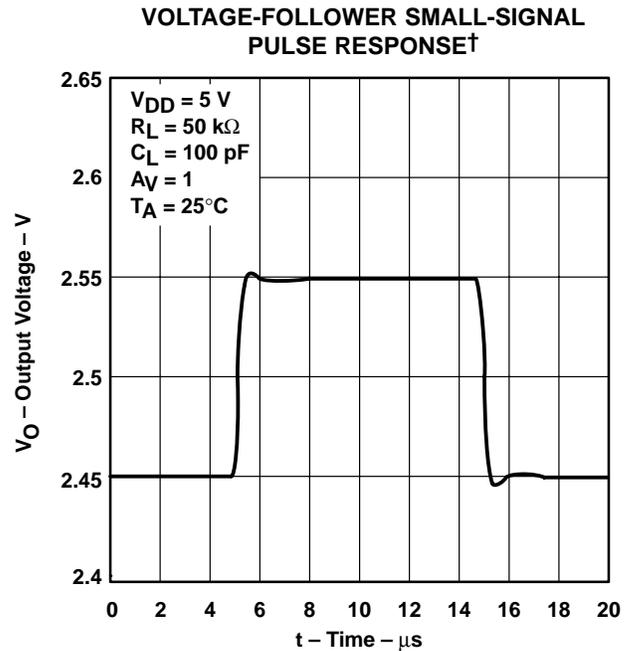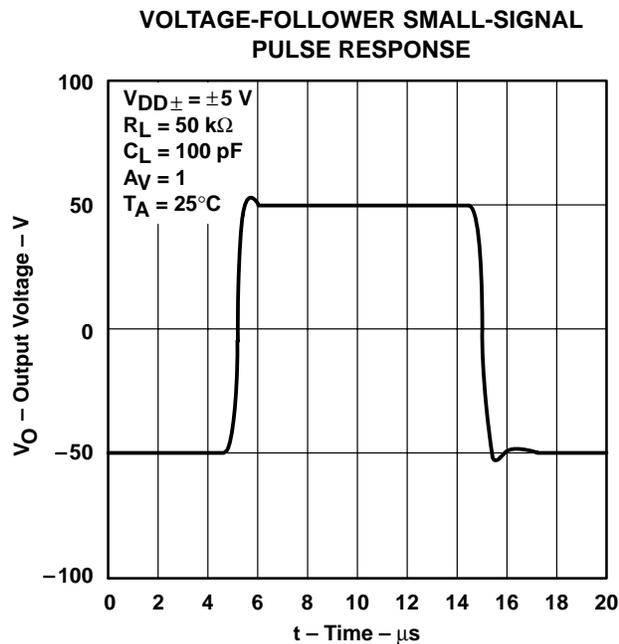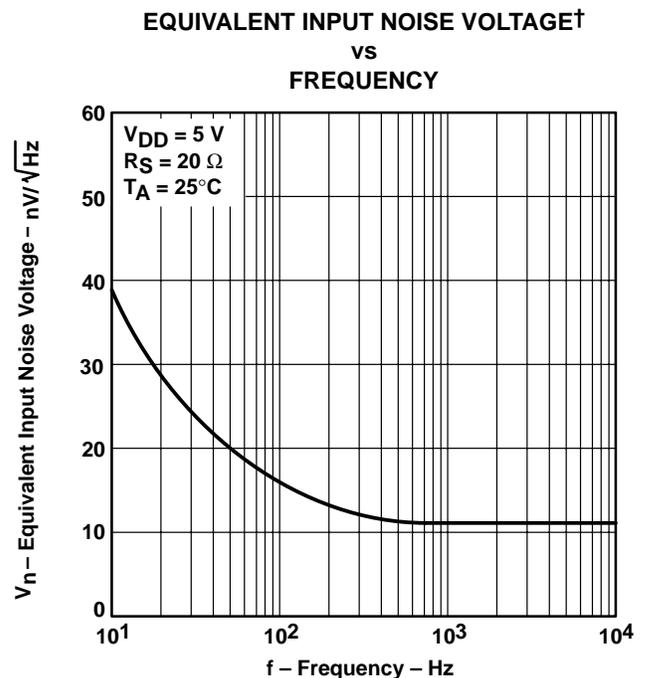
$V_{DD} = 5$ V
$R_S = 20$ $\Omega$
$T_A = 25°$C

**Figure 51**

† For curves where $V_{DD}$ = 5 V, all loads are referenced to 2.5 V.

**TEXAS INSTRUMENTS**

## TYPICAL CHARACTERISTICS

**EQUIVALENT INPUT NOISE VOLTAGE**
**vs**
**FREQUENCY**
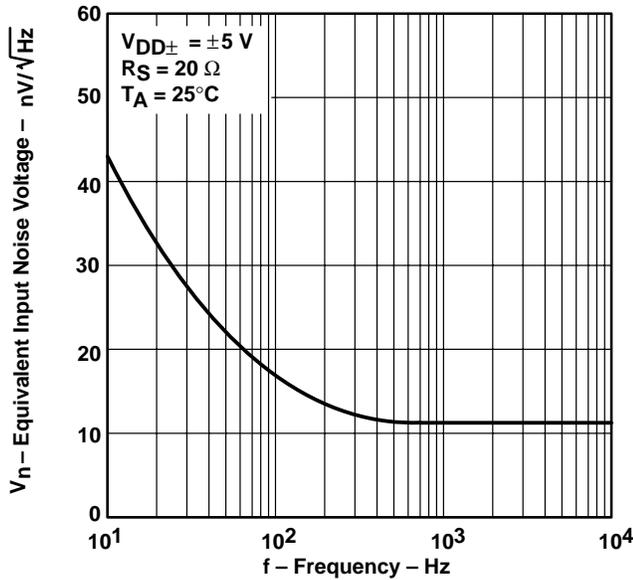
$V_{DD\pm} = \pm 5\text{ V}$
$R_S = 20\ \Omega$
$T_A = 25°C$



**Figure 52**

**EQUIVALENT INPUT NOISE VOLTAGE OVER**
**A 10-SECOND PERIOD†**

$V_{DD} = 5\text{ V}$
f = 0.1 Hz to 10 Hz
$T_A = 25°C$
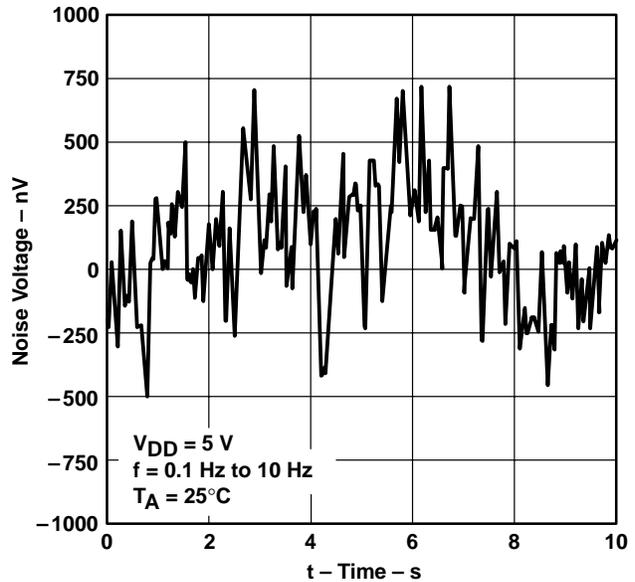


**Figure 53**

**INTEGRATED NOISE VOLTAGE**
**vs**
**FREQUENCY**

**Calculated Using Ideal Pass-Band Filter**
**Low Frequency = 1 Hz**
$T_A = 25°C$
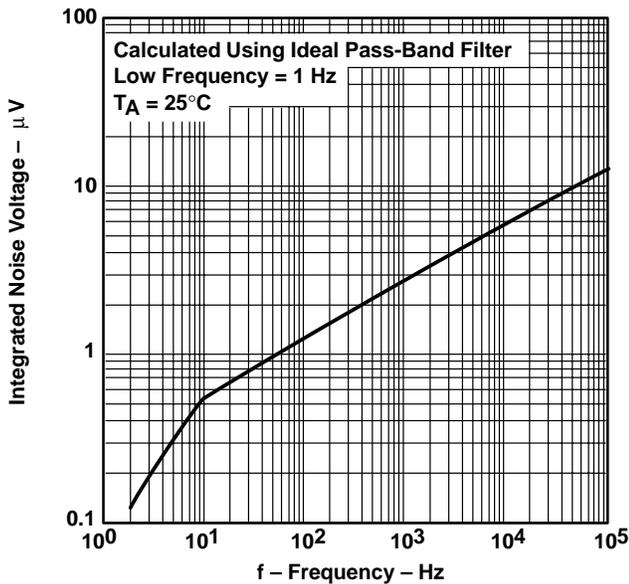


**Figure 54**

**TOTAL HARMONIC DISTORTION PLUS NOISE†**
**vs**
**FREQUENCY**

$A_V = 100$
$A_V = 10$
$A_V = 1$
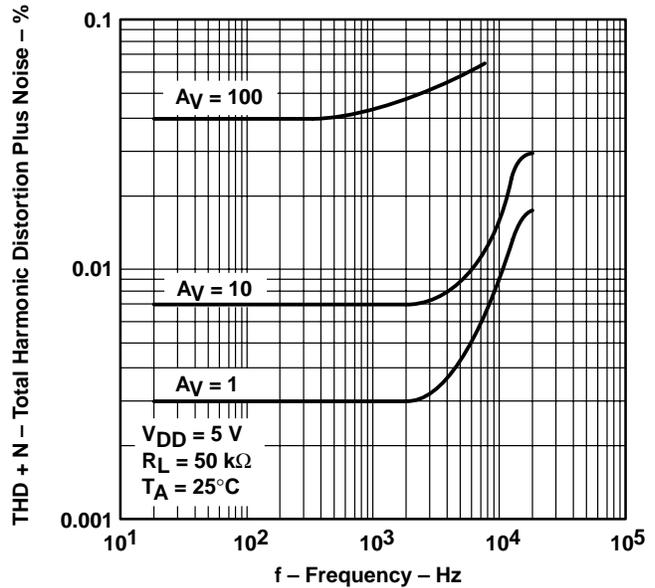
$V_{DD} = 5\text{ V}$
$R_L = 50\text{ k}\Omega$
$T_A = 25°C$



**Figure 55**

† For curves where $V_{DD} = 5$ V, all loads are referenced to 2.5 V.

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## TYPICAL CHARACTERISTICS

**GAIN-BANDWIDTH PRODUCT**
**vs**
**SUPPLY VOLTAGE**



f = 10 kHz
$R_L$ = 50 kΩ
$C_L$ = 100 pF
$T_A$ = 25°C
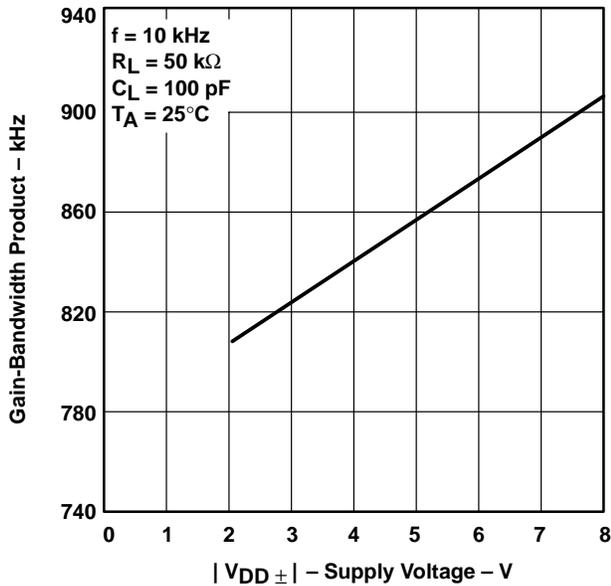
**Figure 56**

**GAIN-BANDWIDTH PRODUCT†‡**
**vs**
**FREE-AIR TEMPERATURE**



$V_{DD}$ = 5 V
f = 10 kHz
$C_L$ = 100 pF
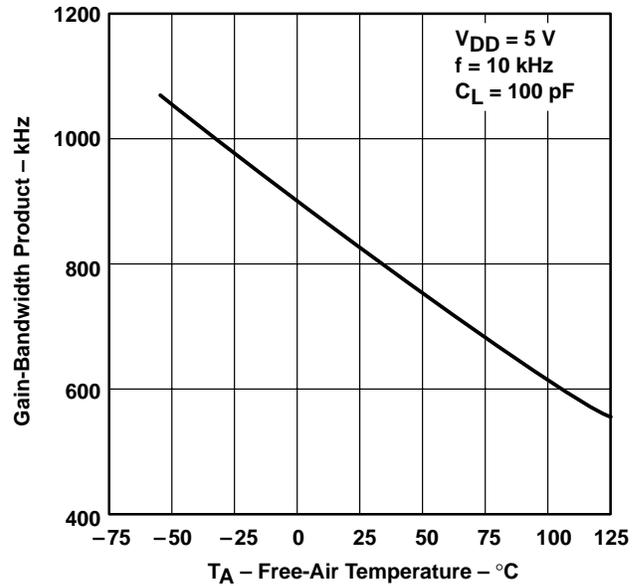
**Figure 57**

**PHASE MARGIN**
**vs**
**LOAD CAPACITANCE**



$T_A$ = 25°C

$R_{null}$ = 100 Ω
$R_{null}$ = 50 Ω
$R_{null}$ = 20 Ω
$R_{null}$ = 10 Ω
$R_{null}$ = 0
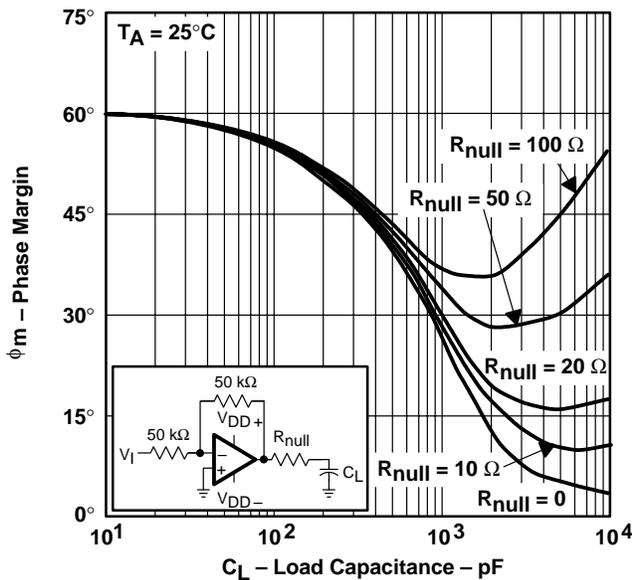
**Figure 58**

**GAIN MARGIN**
**vs**
**LOAD CAPACITANCE**



$T_A$ = 25°C

$R_{null}$ = 100 Ω
$R_{null}$ = 50 Ω
$R_{null}$ = 20 Ω
$R_{null}$ = 10 Ω
$R_{null}$ = 0
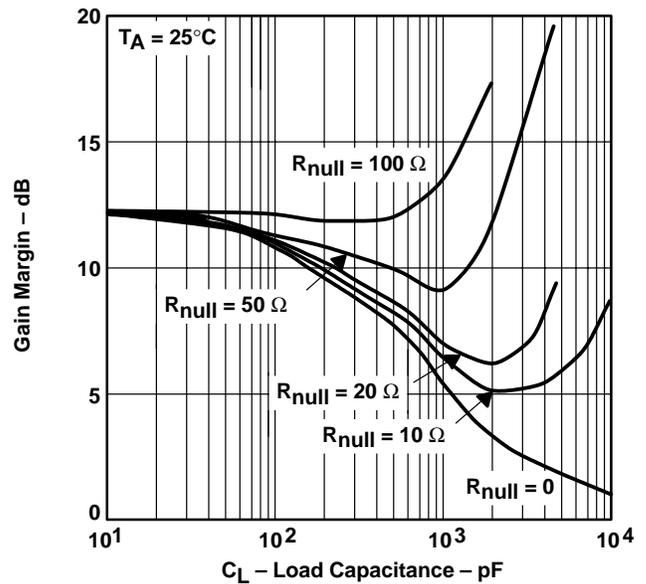
**Figure 59**

† Data at high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.
‡ For curves where $V_{DD}$ = 5 V, all loads are referenced to 2.5 V.

**TEXAS**
**INSTRUMENTS**

## TYPICAL CHARACTERISTICS

**UNITY-GAIN BANDWIDTH†**
**vs**
**LOAD CAPACITANCE**



**Figure 60**

**OVERESTIMATION OF PHASE MARGIN†**
**vs**
**LOAD CAPACITANCE**
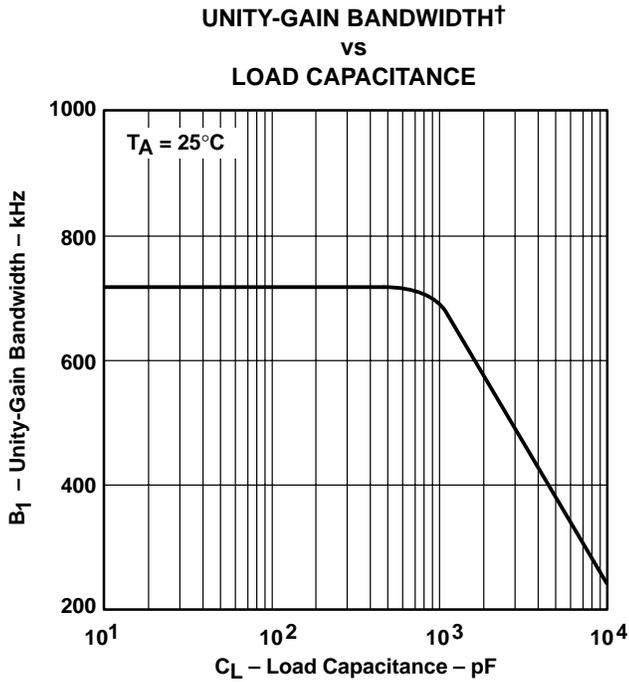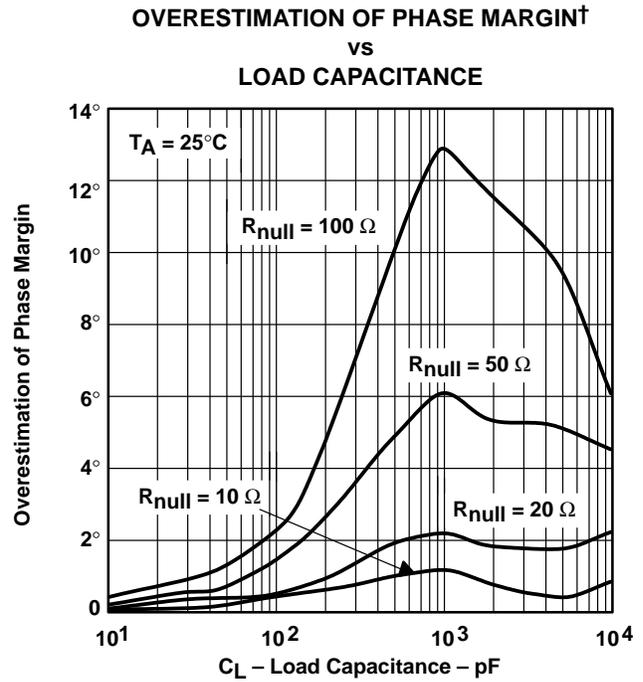


**Figure 61**

† See application information

## APPLICATION INFORMATION

### driving large capacitive loads

The TLC226x is designed to drive larger capacitive loads than most CMOS operational amplifiers. Figure 58 and Figure 59 illustrate its ability to drive loads greater than 400 pF while maintaining good gain and phase margins ($R_{null} = 0$).

A smaller series resistor ($R_{null}$) at the output of the device (see Figure 62) improves the gain and phase margins when driving large capacitive loads. Figure 58 and Figure 59 show the effects of adding series resistances of 10 Ω, 20 Ω, 50 Ω, and 100 Ω. The addition of this series resistor has two effects: the first is that it adds a zero to the transfer function and the second is that it reduces the frequency of the pole associated with the output load in the transfer function.

The zero introduced to the transfer function is equal to the series resistance times the load capacitance. To calculate the improvement in phase margin, equation 1 can be used.

$$\Delta\Theta_{m1} = \tan^{-1}\left(2 \times \pi \times UGBW \times R_{null} \times C_L\right) \tag{1}$$

Where :

$\Delta\Theta_{m1}$ = improvement in phase margin
$UGBW$ = unity-gain bandwidth frequency
$R_{null}$ = output series resistance
$C_L$ = load capacitance

The unity-gain bandwidth (UGBW) frequency decreases as the capacitive load increases (see Figure 60). To use equation 1, UGBW must be approximated from Figure 60.

Using equation 1 alone overestimates the improvement in phase margin, as illustrated in Figure 61. The overestimation is caused by the decrease in the frequency of the pole associated with the load, thus providing additional phase shift and reducing the overall improvement in phase margin. The pole associated with the load is reduced by the factor calculated in equation 2.

$$F = \frac{1}{1 + g_m \times R_{null}} \tag{2}$$

Where :

$F$ = factor reducing frequency of pole
$g_m$ = small-signal output transconductance (typically $4.83 \times 10^{-3}$ mhos)
$R_{null}$ = output series resistance

For the TLC226x, the pole associated with the load is typically 7 MHz with 100-pF load capacitance. This value varies inversely with $C_L$: at $C_L = 10$ pF, use 70 MHz, at $C_L = 1000$ pF, use 700 kHz, and so on.

Reducing the pole associated with the load introduces phase shift, thereby reducing phase margin. This results in an error in the increase in phase margin expected by considering the zero alone (equation 1). Equation 3 approximates the reduction in phase margin due to the movement of the pole associated with the load. The result of this equation can be subtracted from the result of the equation in equation 1 to better approximate the improvement in phase margin.

**TEXAS**
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## APPLICATION INFORMATION

**driving large capacitive loads (continued)**

$$\Delta\Theta_{m2} = \tan^{-1}\left[\frac{UGBW}{\left(F \times P_2\right)}\right] - \tan^{-1}\left(\frac{UGBW}{P_2}\right) \tag{3}$$

Where :

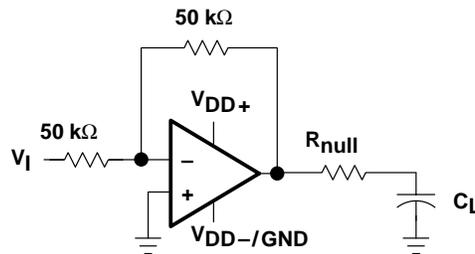$\Delta\Theta_{m2}$ = reduction in phase margin

UGBW = unity-gain bandwidth frequency

F = factor from equation 2

$P_2$ = unadjusted pole (70 MHz @ 10 pF, 7 MHz @ 100 pF, etc.)

Using these equations with Figure 60 and Figure 61 enables the designer to choose the appropriate output series resistance to optimize the design of circuits driving large capacitive loads.



**Figure 62. Series-Resistance Circuit**

## APPLICATION INFORMATION

### macromodel information

Macromodel information provided was derived using Microsim *Parts*™, the model generation software used with Microsim *PSpice*™. The Boyle macromodel (see Note 5) and subcircuit in Figure 63 are generated using the TLC226x typical electrical and operating characteristics at $T_A$ = 25°C. Using this information, output simulations of the following key parameters can be generated to a tolerance of 20% (in most cases):

- Maximum positive output voltage swing
- Maximum negative output voltage swing
- Slew rate
- Quiescent power dissipation
- Input bias current
- Open-loop voltage amplification

- Unity-gain frequency
- Common-mode rejection ratio
- Phase margin
- DC output resistance
- AC output resistance
- Short-circuit output current limit

NOTE 5: G. R. Boyle, B. M. Cohn, D. O. Pederson, and J. E. Solomon, "Macromodeling of Integrated Circuit Operational Amplifiers," *IEEE Journal of Solid-State Circuits,* SC-9, 353 (1974).



```
.SUBCKT TLC226x 1 2 3 4 5
        C1      11      12      3.560E–12
        C2      6       7       15.00E–12
        DC      5       53      DX
        DE      54      5       DX
        DLP     90      91      DX
        DLN     92      90      DX
        DP      4       3       DX
        EGND    99      0       POLY (2) (3,0) (4,0) 0 .5 .5
        FB      7       99      POLY (5) VB VC VE VLP
+ VLN 0 21.04E6 –30E6 30E6 30E6 –30E6
        GA      6       0       11      12 47.12E–6
        GCM     0       6       10      99 4.9E–9
        ISS     3       10      DC 8.250E–6
        HLIM    90      0       VLIM 1K
        J1      11      2       10 JX
        J2      12      1       10 JX
        R2      6       9       100.0E3
```

```
        RD1     60      11      21.22E3
        RD2     60      12      21.22E3
        R01     8       5       120
        R02     7       99      120
        RP      3       4       26.04E3
        RSS     10      99      24.24E6
        VAD     60      4       –.6
        VB      9       0       DC 0
        VC      3       53      DC .65
        VE      54      4       DC .65
        VLIM    7       8       DC 0
        VLP     91      0       DC 1.4
        VLN     0       92      DC 9.4
.MODEL DX D (IS=800.0E–18)
.MODEL JX PJF (IS=500.0E–15 BETA=281E–6
+ VTO=–.065)
.ENDS
```

**Figure 63. Boyle Macromodel and Subcircuit**

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

# MECHANICAL INFORMATION

**D (R-PDSO-G**)**                                              **PLASTIC SMALL-OUTLINE PACKAGE**
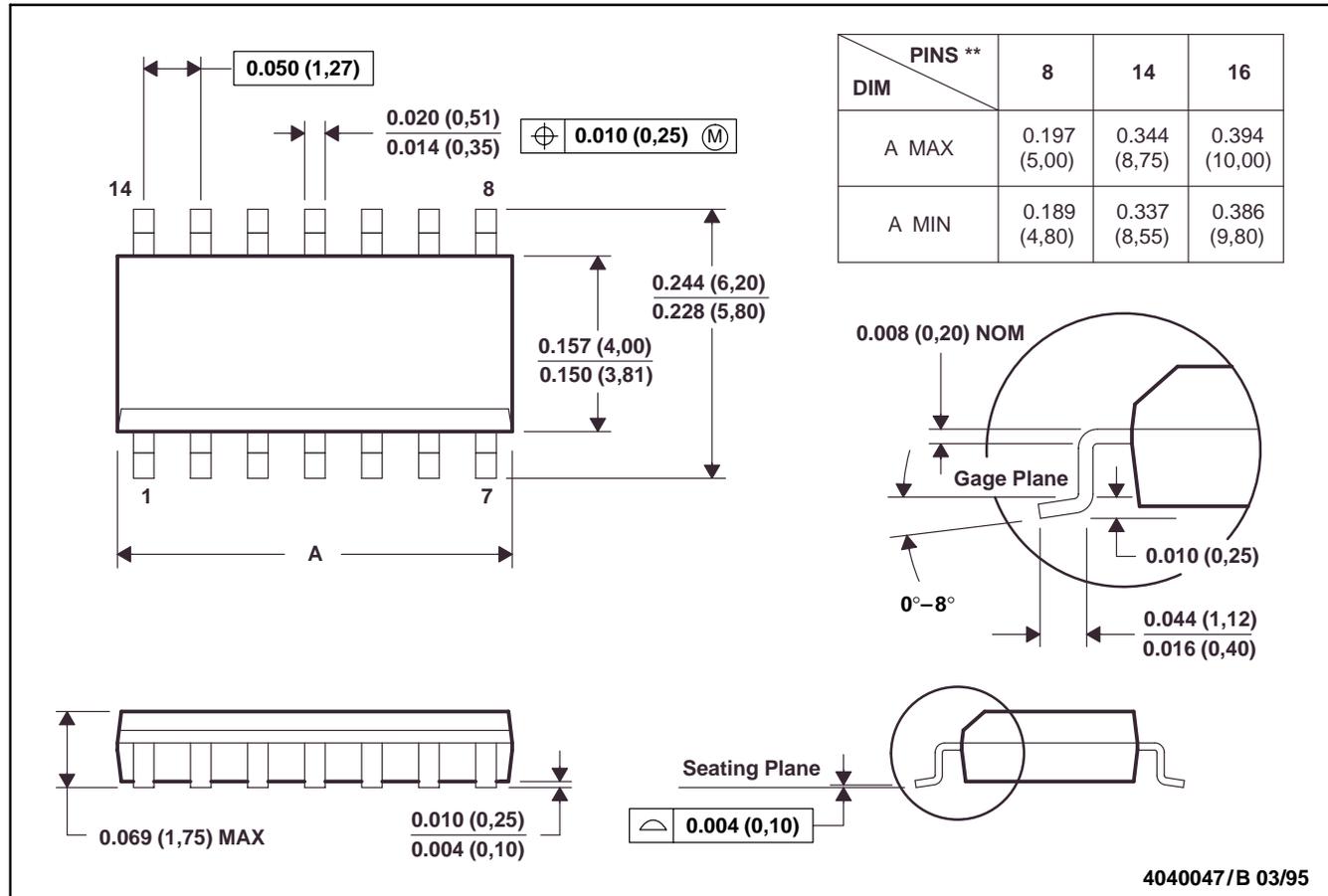
**14 PIN SHOWN**

| DIM \ PINS ** | 8 | 14 | 16 |
|---|---|---|---|
| A MAX | 0.197 (5,00) | 0.344 (8,75) | 0.394 (10,00) |
| A MIN | 0.189 (4,80) | 0.337 (8,55) | 0.386 (9,80) |

0.050 (1,27)

0.020 (0,51) / 0.014 (0,35)    ⊕ 0.010 (0,25) Ⓜ

14    8

0.244 (6,20) / 0.228 (5,80)

0.157 (4,00) / 0.150 (3,81)

1    7

A

0.008 (0,20) NOM

Gage Plane

0.010 (0,25)

0°−8°

0.044 (1,12) / 0.016 (0,40)

0.069 (1,75) MAX

0.010 (0,25) / 0.004 (0,10)

Seating Plane

△ 0.004 (0,10)

**4040047 / B 03/95**

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
D. Four center pins are connected to die mount pad.
E. Falls within JEDEC MS-012

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## MECHANICAL INFORMATION

**FK (S-CQCC-N\*\*)**  **LEADLESS CERAMIC CHIP CARRIER**

**28 TERMINAL SHOWN**

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

4040140/C 11/95

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004

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## MECHANICAL INFORMATION

**J (R-GDIP-T**)**                                      **CERAMIC DUAL-IN-LINE PACKAGE**

**14 PIN SHOWN**



| DIM \ PINS ** | 14 | 16 | 18 | 20 | 22 |
|---|---|---|---|---|---|
| A MAX | 0.310 (7,87) | 0.310 (7,87) | 0.310 (7,87) | 0.310 (7,87) | 0.410 (10,41) |
| A MIN | 0.290 (7,37) | 0.290 (7,37) | 0.290 (7,37) | 0.290 (7,37) | 0.390 (9,91) |
| B MAX | 0.785 (19,94) | 0.785 (19,94) | 0.910 (23,10) | 0.975 (24,77) | 1.100 (28,00) |
| B MIN | 0.755 (19,18) | 0.755 (19,18) | ——— | 0.930 (23,62) | ——— |
| C MAX | 0.280 (7,11) | 0.300 (7,62) | 0.300 (7,62) | 0.300 (7,62) | 0.388 (9,65) |
| C MIN | 0.245 (6,22) | 0.245 (6,22) | 0.245 (6,22) | 0.245 (6,22) | ——— |
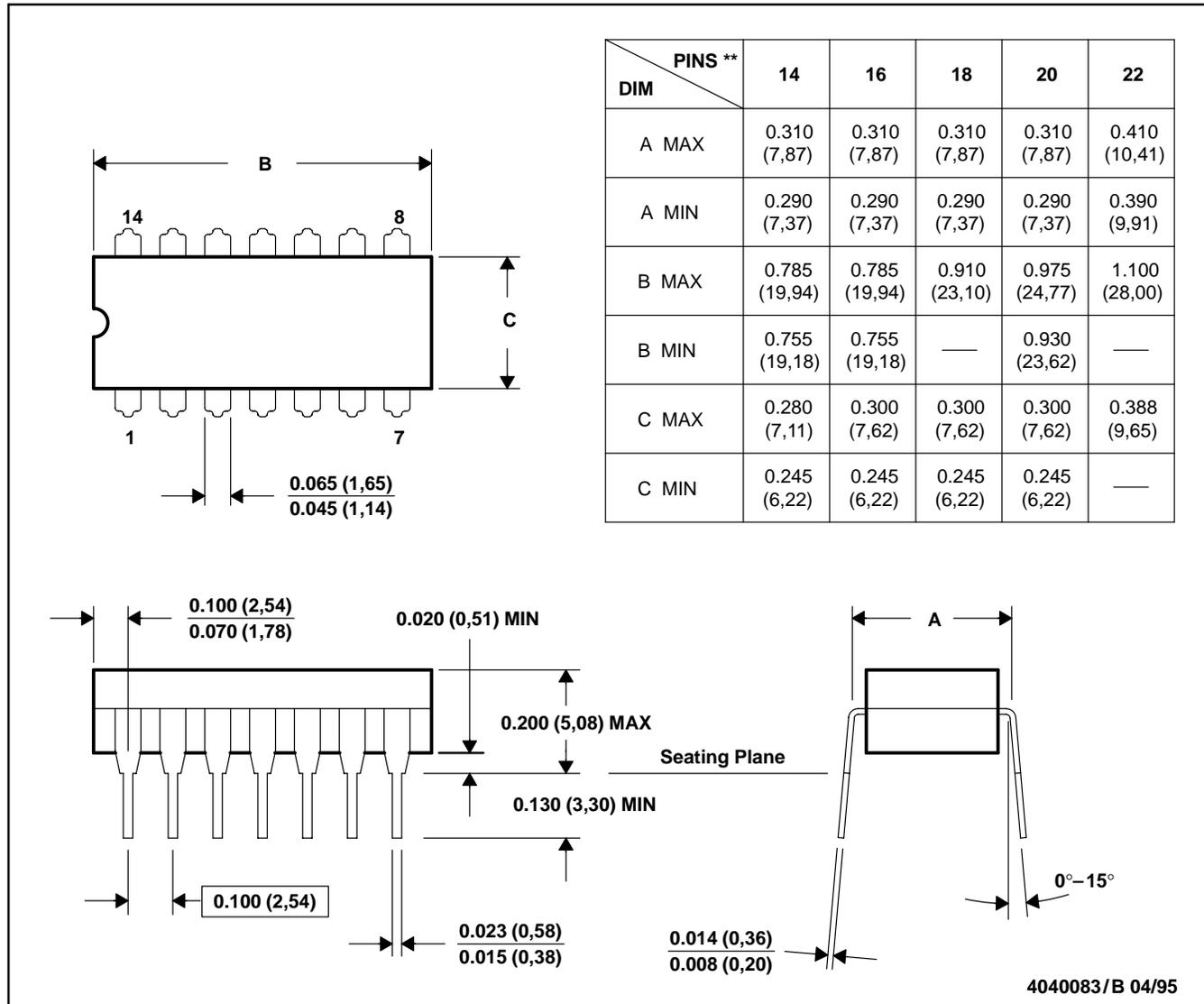
4040083 / B 04/95
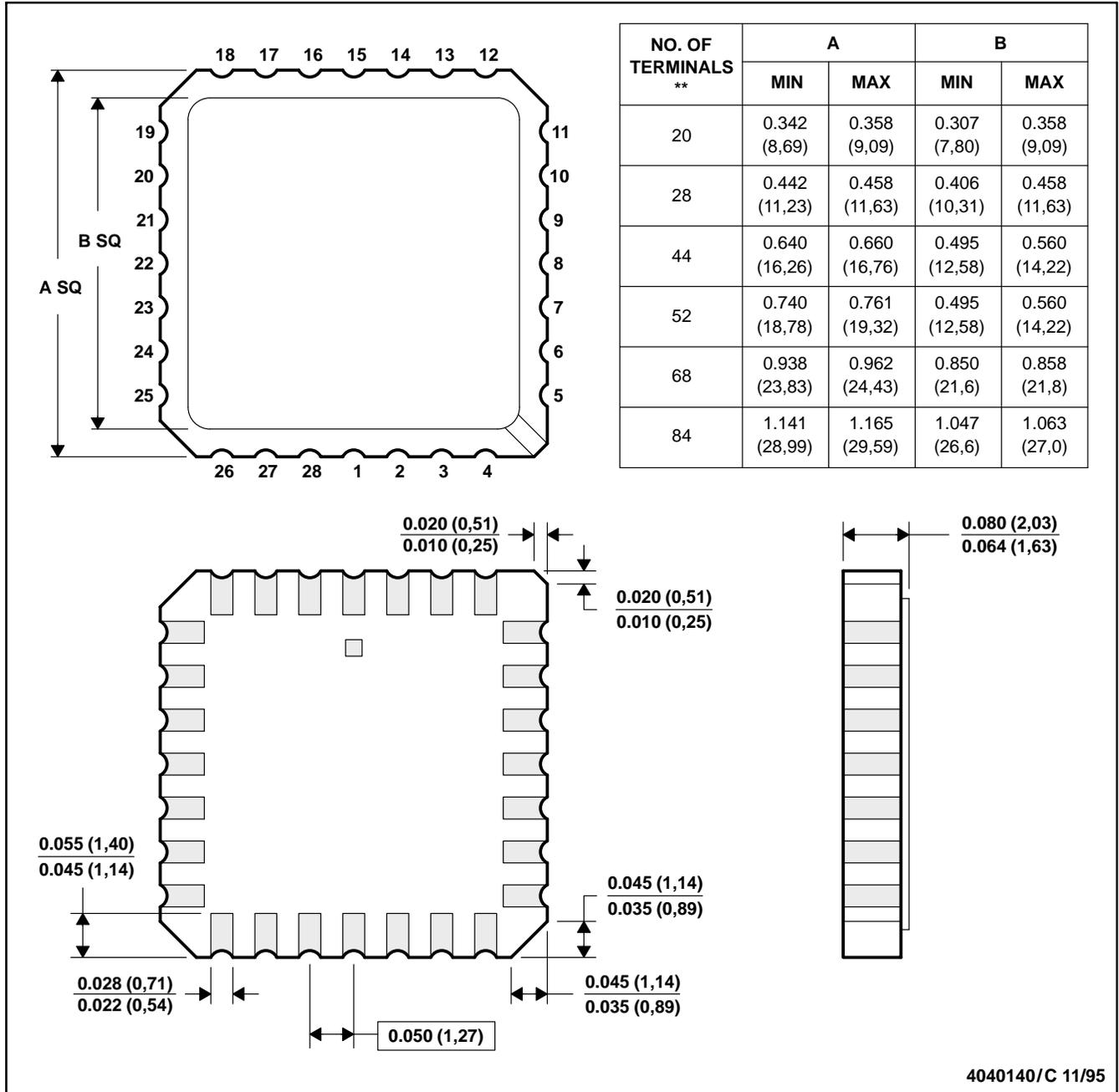
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification on press ceramic glass frit seal only.
E. Falls within MIL-STD-1835 GDIP1-T14, GDIP1-T16, GDIP1-T18, GDIP1-T20, and GDIP1-T22

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## MECHANICAL INFORMATION

**JG (R-GDIP-T8)**                                    **CERAMIC DUAL-IN-LINE PACKAGE**
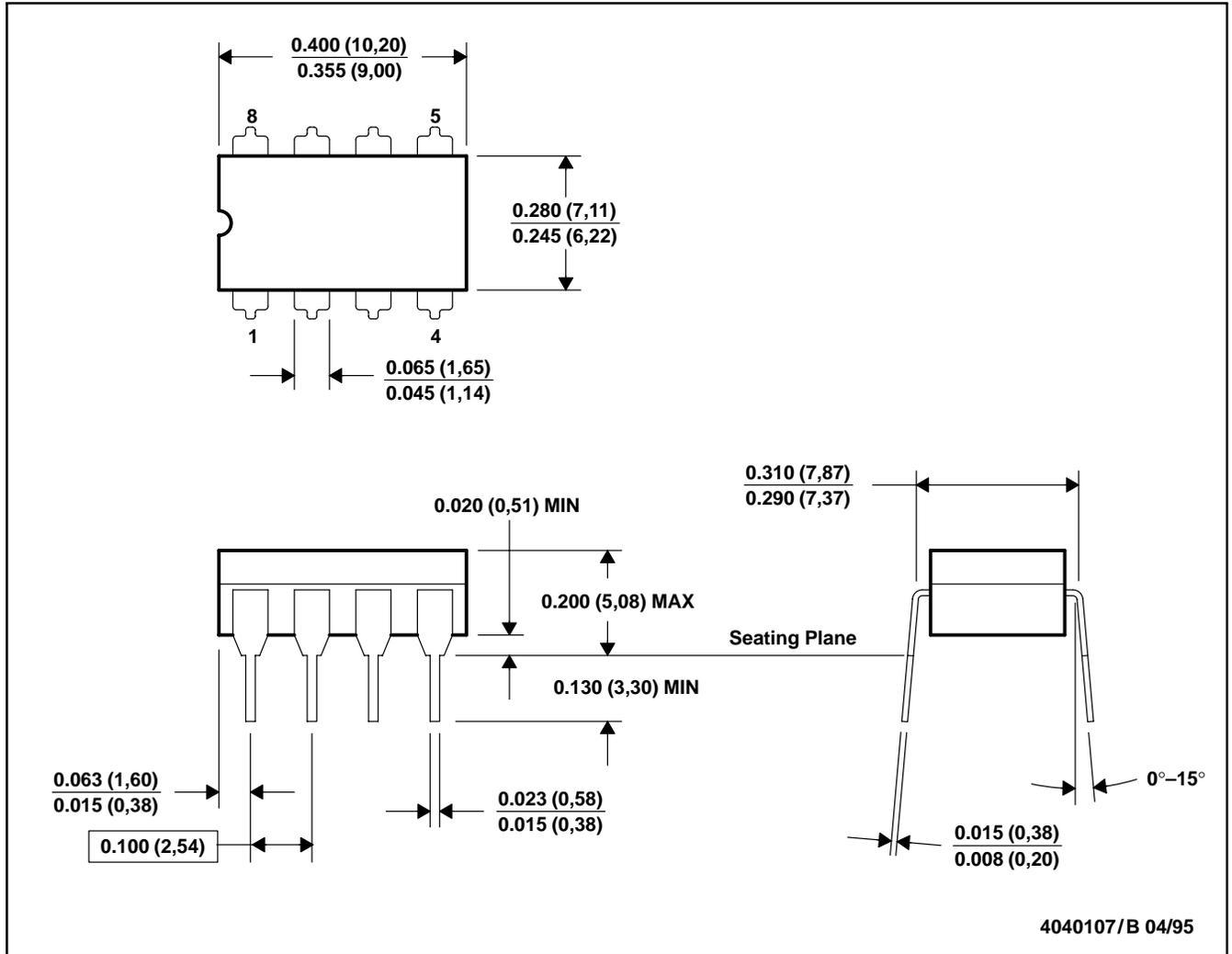


4040107 / B 04/95

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

## MECHANICAL INFORMATION

**N (R-PDIP-T\*\*)**                                                **PLASTIC DUAL-IN-LINE PACKAGE**

**16 PIN SHOWN**
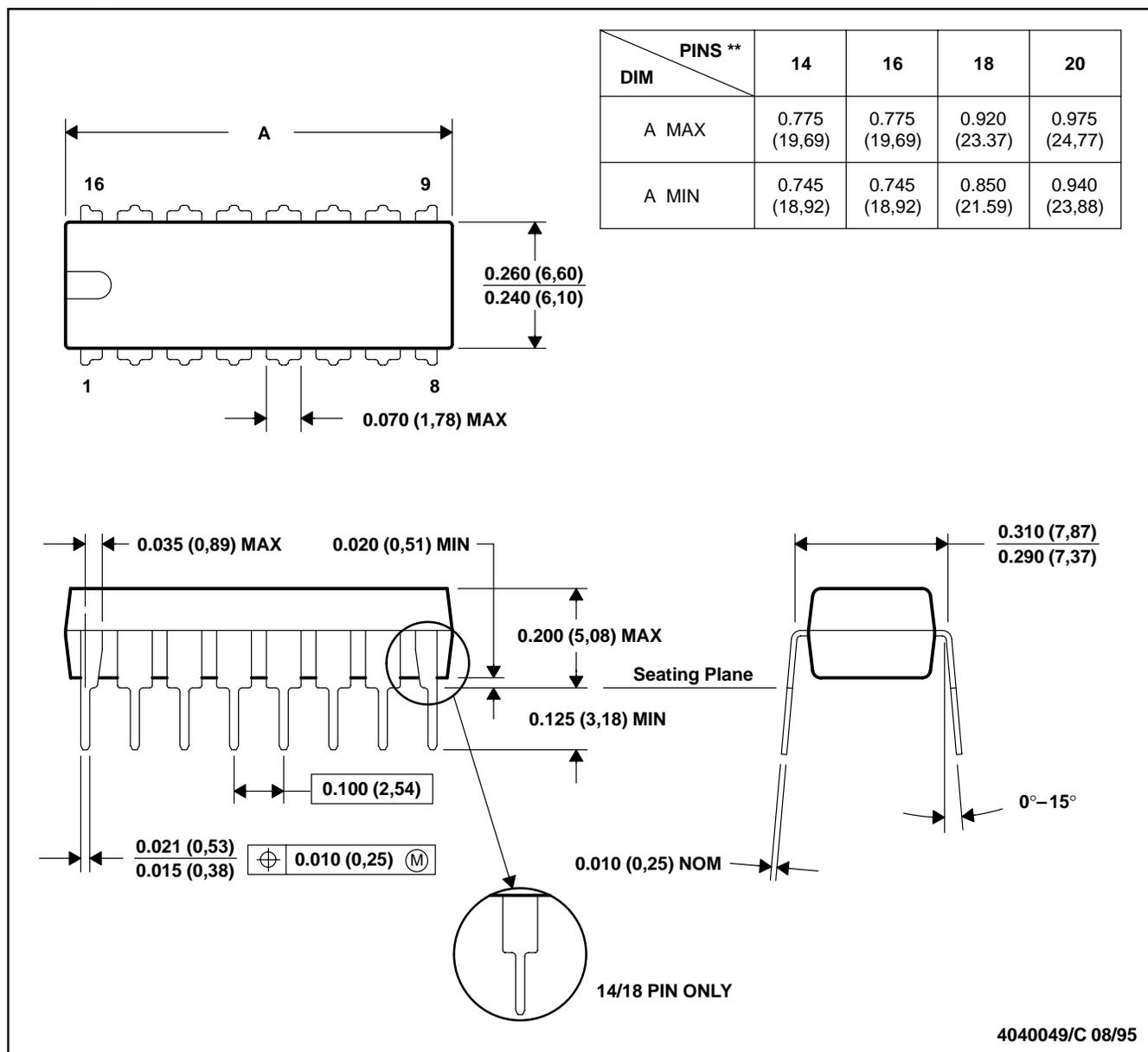
| DIM \ PINS \*\* | 14 | 16 | 18 | 20 |
|---|---|---|---|---|
| A  MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23.37) | 0.975 (24,77) |
| A  MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21.59) | 0.940 (23,88) |

A

16        9

0.260 (6,60)
0.240 (6,10)

1        8

0.070 (1,78) MAX

0.035 (0,89) MAX      0.020 (0,51) MIN

0.310 (7,87)
0.290 (7,37)

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.100 (2,54)

0°–15°

0.021 (0,53)
0.015 (0,38)     ⊕ 0.010 (0,25) Ⓜ

0.010 (0,25) NOM

**14/18 PIN ONLY**

**4040049/C 08/95**

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

## MECHANICAL INFORMATION

**P (R-PDIP-T8)**                                              **PLASTIC DUAL-IN-LINE PACKAGE**



$$\frac{0.400\ (10,60)}{0.355\ (9,02)}$$

$$\frac{0.260\ (6,60)}{0.240\ (6,10)}$$

0.070 (1,78) MAX

0.020 (0,51) MIN

0.200 (5,08) MAX

0.125 (3,18) MIN

Seating Plane

0.100 (2,54)

$$\frac{0.021\ (0,53)}{0.015\ (0,38)}$$   ⊕  0.010 (0,25)  Ⓜ

$$\frac{0.310\ (7,87)}{0.290\ (7,37)}$$

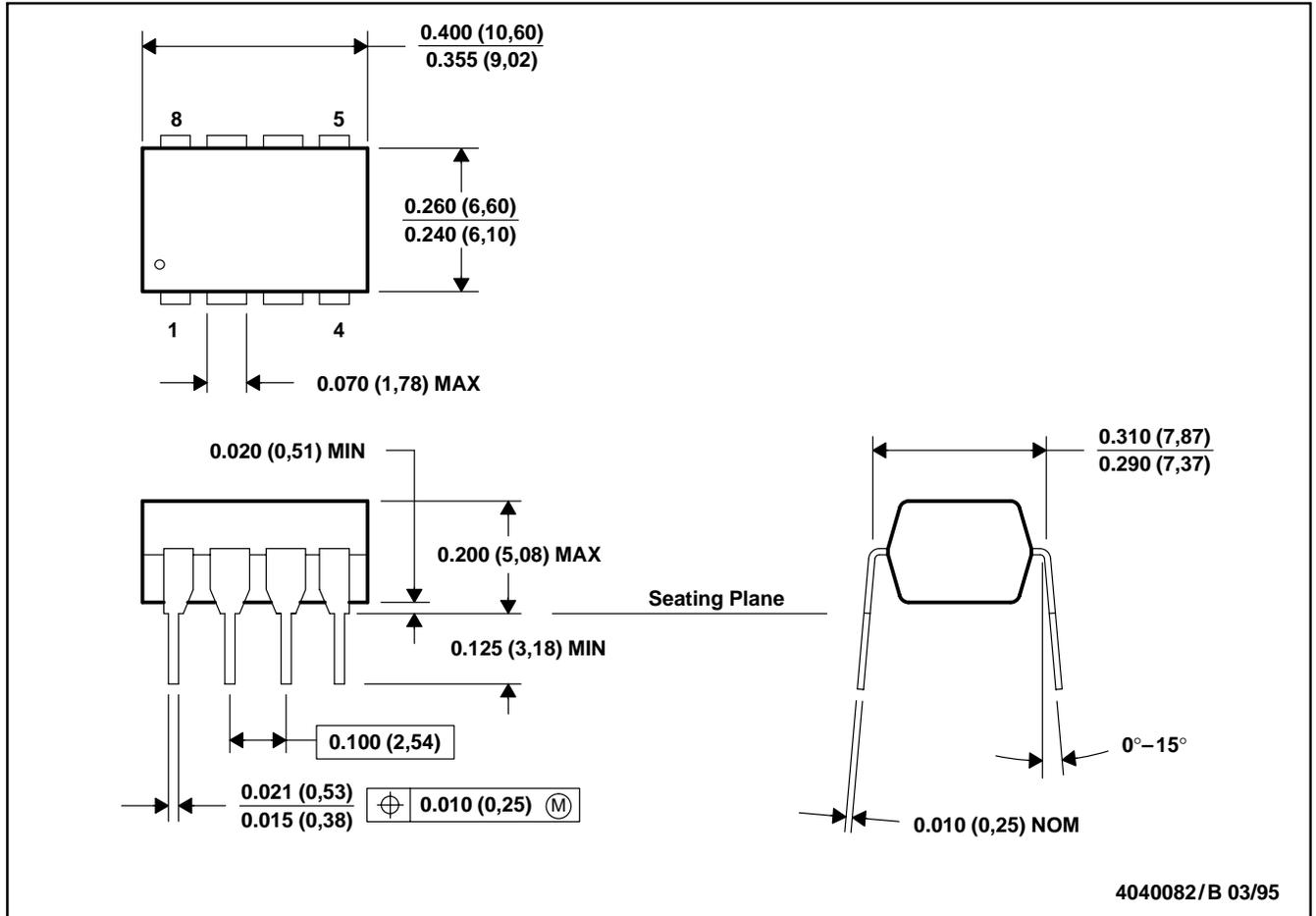0°–15°

0.010 (0,25) NOM

4040082 / B 03/95

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

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## MECHANICAL INFORMATION

**PW (R-PDSO-G**)**                                  **PLASTIC SMALL-OUTLINE PACKAGE**

**14 PIN SHOWN**



| PINS ** DIM | 8 | 14 | 16 | 20 | 24 | 28 |
|---|---|---|---|---|---|---|
| A MAX | 3,10 | 5,10 | 5,10 | 6,60 | 7,90 | 9,80 |
| A MIN | 2,90 | 4,90 | 4,90 | 6,40 | 7,70 | 9,60 |
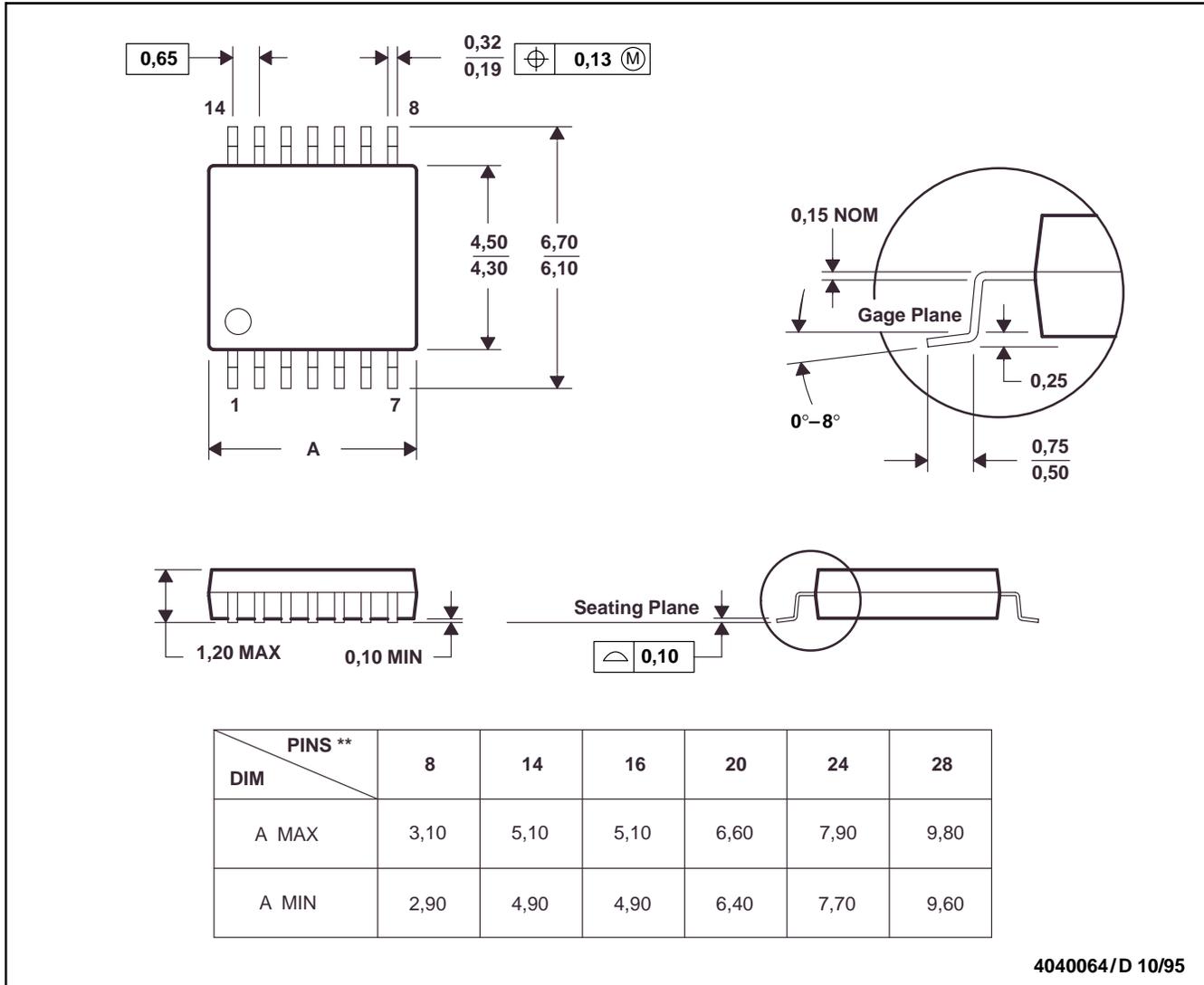
4040064 / D 10/95

NOTES:  A.  All linear dimensions are in millimeters.
        B.  This drawing is subject to change without notice.
        C.  Body dimensions do not include mold flash or protrusion not to exceed 0,15.
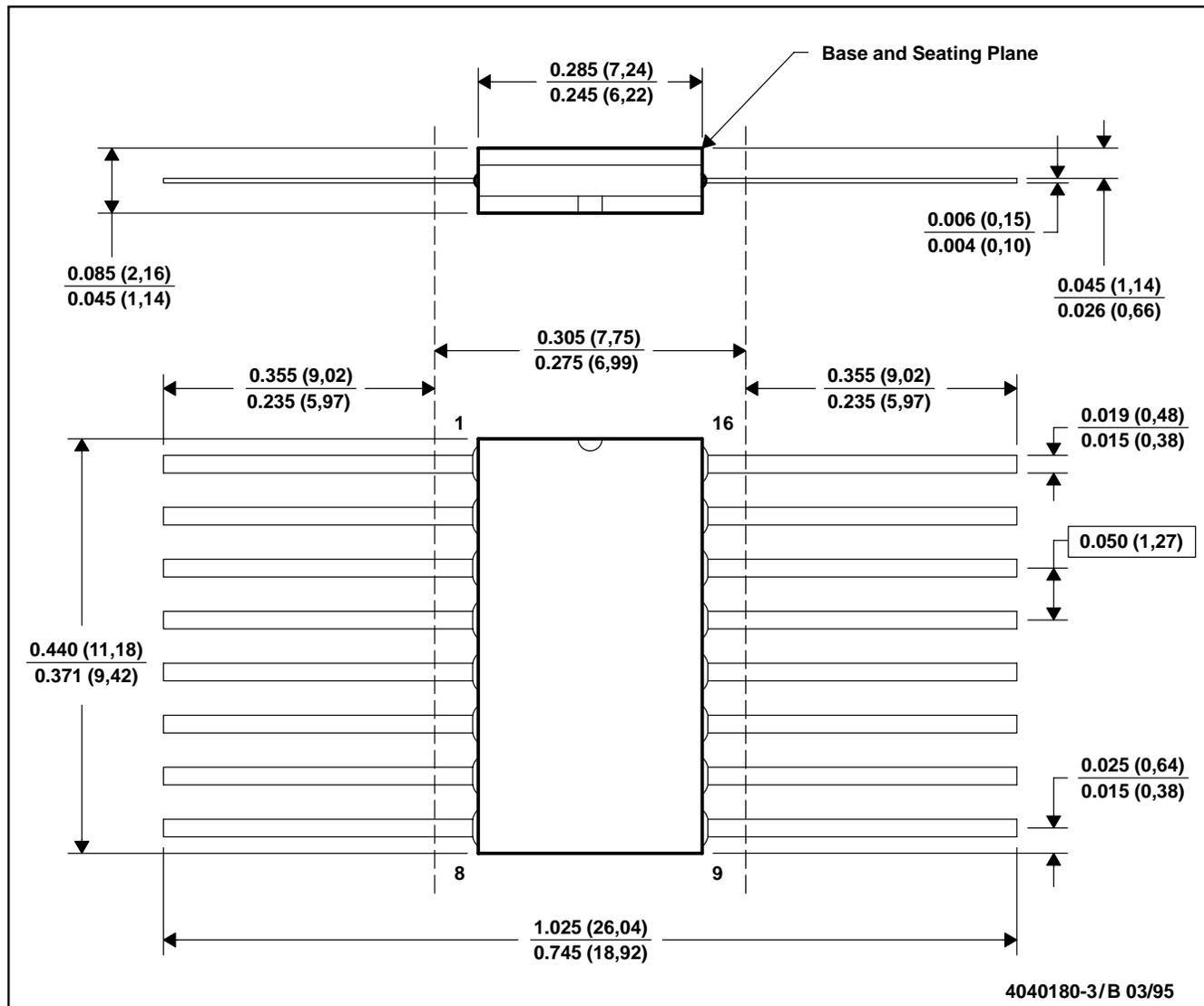        D.  Falls within JEDEC MO-153

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## MECHANICAL INFORMATION

**U (S-GDFP-F10)**                                                                    **CERAMIC DUAL FLATPACK**



4040179/B 03/95

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

## MECHANICAL INFORMATION

**W (R-GDFP-F16)**                                    **CERAMIC DUAL FLATPACK**



0.285 (7,24)
0.245 (6,22)

Base and Seating Plane

0.006 (0,15)
0.004 (0,10)

0.085 (2,16)
0.045 (1,14)

0.045 (1,14)
0.026 (0,66)

0.305 (7,75)
0.275 (6,99)

0.355 (9,02)
0.235 (5,97)

0.355 (9,02)
0.235 (5,97)

0.019 (0,48)
0.015 (0,38)

1          16

0.050 (1,27)

0.440 (11,18)
0.371 (9,42)

0.025 (0,64)
0.015 (0,38)

8          9

1.025 (26,04)
0.745 (18,92)

4040180-3 / B 03/95

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-F16 and JEDEC MO-092AC

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## PACKAGING INFORMATION

| Orderable Device | Status [1] | Package Type | Package Drawing | Pins | Package Qty | Eco Plan [2] | Lead/Ball Finish | MSL Peak Temp [3] |
|---|---|---|---|---|---|---|---|---|
| 5962-9469201Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| 5962-9469201QHA | ACTIVE | CFP | U | 10 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| 5962-9469201QPA | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| 5962-9469202Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| 5962-9469202QCA | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| 5962-9469202QDA | ACTIVE | CFP | W | 14 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| 5962-9469203Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| 5962-9469203QHA | ACTIVE | CFP | U | 10 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| 5962-9469203QPA | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| 5962-9469204Q2A | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| 5962-9469204QCA | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| 5962-9469204QDA | ACTIVE | CFP | W | 14 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2262AID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262AIDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262AIDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262AIDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262AIP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2262AIPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2262AIPW | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262AIPWG4 | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262AIPWLE | OBSOLETE | TSSOP | PW | 8 | | TBD | Call TI | Call TI |
| TLC2262AIPWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262AIPWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262AMFKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| TLC2262AMJG | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2262AMJGB | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2262AMUB | ACTIVE | CFP | U | 10 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2262AQD | NRND | SOIC | D | 8 | 75 | TBD | CU NIPDAU | Level-1-220C-UNLIM |
| TLC2262AQDG4 | NRND | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262AQDR | NRND | SOIC | D | 8 | 2500 | Pb-Free (RoHS) | CU NIPDAU | Level-2-250C-1 YEAR/ Level-1-235C-UNLIM |
| TLC2262AQDRG4 | NRND | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262CD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

| Orderable Device | Status [1] | Package Type | Package Drawing | Pins | Package Qty | Eco Plan [2] | Lead/Ball Finish | MSL Peak Temp [3] |
|---|---|---|---|---|---|---|---|---|
| TLC2262CDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262CDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262CDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262CP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2262CPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2262CPW | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262CPWG4 | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262CPWLE | OBSOLETE | TSSOP | PW | 8 | | TBD | Call TI | Call TI |
| TLC2262CPWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262CPWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262ID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262IDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262IDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262IDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262IP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2262IPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2262MFKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| TLC2262MJG | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2262MJGB | ACTIVE | CDIP | JG | 8 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2262MUB | ACTIVE | CFP | U | 10 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2262QD | NRND | SOIC | D | 8 | 75 | TBD | CU NIPDAU | Level-1-220C-UNLIM |
| TLC2262QDG4 | NRND | SOIC | D | 8 | 1500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2262QDR | NRND | SOIC | D | 8 | 2500 | TBD | CU NIPDAU | Level-1-220C-UNLIM |
| TLC2262QDRG4 | NRND | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AID | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AIDG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AIDR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AIDRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AIN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free | CU NIPDAU | N / A for Pkg Type |

| Orderable Device | Status [1] | Package Type | Package Drawing | Pins | Package Qty | Eco Plan [2] | Lead/Ball Finish | MSL Peak Temp [3] |
|---|---|---|---|---|---|---|---|---|
| | | | | | | (RoHS) | | |
| TLC2264AINE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2264AIPW | ACTIVE | TSSOP | PW | 14 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AIPWG4 | ACTIVE | TSSOP | PW | 14 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AIPWLE | OBSOLETE | TSSOP | PW | 14 | | TBD | Call TI | Call TI |
| TLC2264AIPWR | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AIPWRG4 | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AMFKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| TLC2264AMJ | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2264AMJB | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2264AMWB | ACTIVE | CFP | W | 14 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2264AQD | ACTIVE | SOIC | D | 14 | 50 | TBD | CU NIPDAU | Level-1-220C-UNLIM |
| TLC2264AQDG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AQDR | ACTIVE | SOIC | D | 14 | 2500 | TBD | CU NIPDAU | Level-1-220C-UNLIM |
| TLC2264AQDRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264AQPWRG4Q1 | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264CD | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264CDG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264CDR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264CDRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264CN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2264CNE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2264CPW | ACTIVE | TSSOP | PW | 14 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264CPWG4 | ACTIVE | TSSOP | PW | 14 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264CPWLE | OBSOLETE | TSSOP | PW | 14 | | TBD | Call TI | Call TI |
| TLC2264CPWR | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264CPWRG4 | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264ID | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264IDG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264IDR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & | CU NIPDAU | Level-1-260C-UNLIM |

| Orderable Device | Status [1] | Package Type | Package Drawing | Pins | Package Qty | Eco Plan [2] | Lead/Ball Finish | MSL Peak Temp [3] |
|---|---|---|---|---|---|---|---|---|
| | | | | | | no Sb/Br) | | |
| TLC2264IDRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264IN | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2264INE4 | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| TLC2264MFKB | ACTIVE | LCCC | FK | 20 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| TLC2264MJ | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2264MJB | ACTIVE | CDIP | J | 14 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2264MWB | ACTIVE | CFP | W | 14 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| TLC2264QD | ACTIVE | SOIC | D | 14 | 50 | TBD | CU NIPDAU | Level-1-220C-UNLIM |
| TLC2264QDG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| TLC2264QDR | ACTIVE | SOIC | D | 14 | 2500 | TBD | CU NIPDAU | Level-1-220C-UNLIM |
| TLC2264QDRG4 | ACTIVE | SOIC | D | 14 | 1500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

[1] The marketing status values are defined as follows:
**ACTIVE:** Product device recommended for new designs.
**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.
**OBSOLETE:** TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
**TBD:** The Pb-Free/Green conversion plan has not been defined.
**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
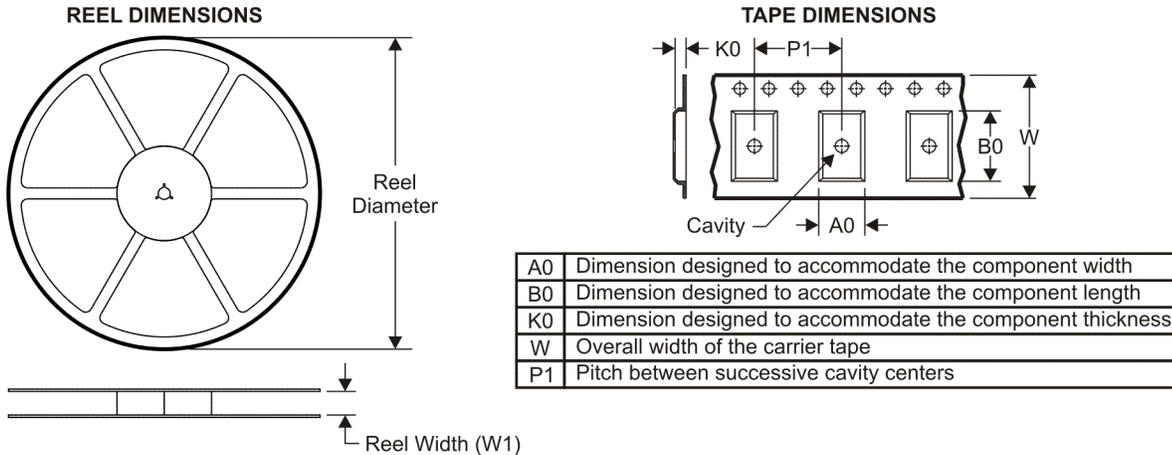**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.
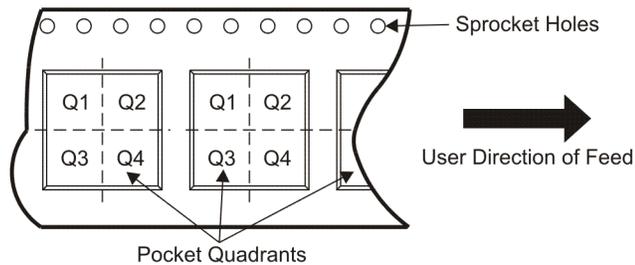
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## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

**TAPE DIMENSIONS**

Reel Diameter

Reel Width (W1)

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

Cavity

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

Sprocket Holes

| Q1 | Q2 |
|---|---|
| Q3 | Q4 |

| Q1 | Q2 |
|---|---|
| Q3 | Q4 |

User Direction of Feed

Pocket Quadrants

*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TLC2262AIDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLC2262AIDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLC2262AIPWR | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |
| TLC2262CDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLC2262CDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLC2262CPWR | TSSOP | PW | 8 | 2000 | 330.0 | 12.4 | 7.0 | 3.6 | 1.6 | 8.0 | 12.0 | Q1 |
| TLC2262IDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLC2262IDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TLC2264AIDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLC2264AIDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLC2264AIPWR | TSSOP | PW | 14 | 2000 | 330.0 | 12.4 | 7.0 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| TLC2264CDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLC2264CDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLC2264CPWR | TSSOP | PW | 14 | 2000 | 330.0 | 12.4 | 7.0 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| TLC2264IDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TLC2264IDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |

**TAPE AND REEL BOX DIMENSIONS**
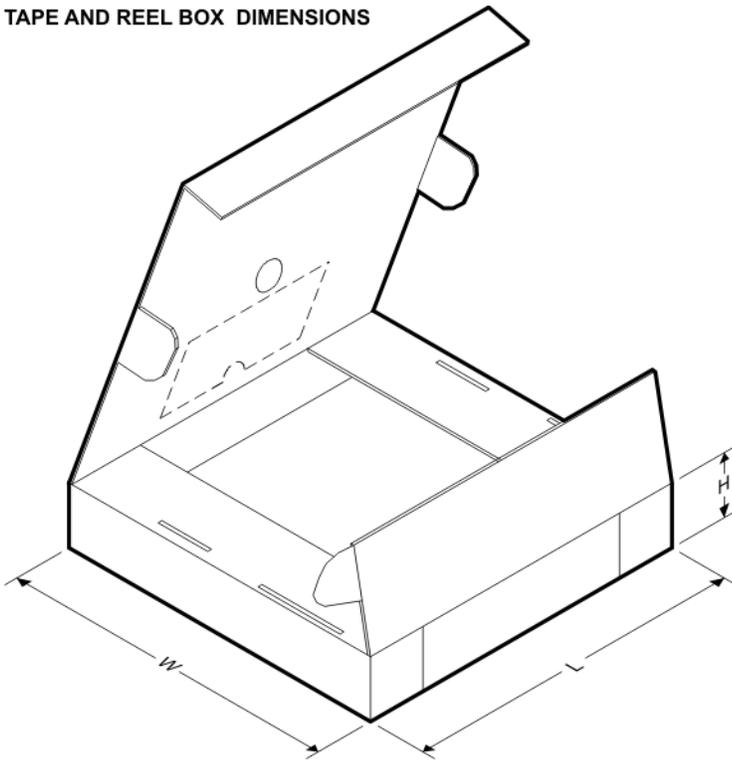
*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------|--------------|-----------------|------|-----|-------------|------------|-------------|
| TLC2262AIDR | SOIC | D | 8 | 2500 | 346.0 | 346.0 | 29.0 |
| TLC2262AIDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TLC2262AIPWR | TSSOP | PW | 8 | 2000 | 346.0 | 346.0 | 29.0 |
| TLC2262CDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TLC2262CDR | SOIC | D | 8 | 2500 | 346.0 | 346.0 | 29.0 |
| TLC2262CPWR | TSSOP | PW | 8 | 2000 | 346.0 | 346.0 | 29.0 |
| TLC2262IDR | SOIC | D | 8 | 2500 | 346.0 | 346.0 | 29.0 |
| TLC2262IDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TLC2264AIDR | SOIC | D | 14 | 2500 | 333.2 | 345.9 | 28.6 |
| TLC2264AIDR | SOIC | D | 14 | 2500 | 346.0 | 346.0 | 33.0 |
| TLC2264AIPWR | TSSOP | PW | 14 | 2000 | 346.0 | 346.0 | 29.0 |
| TLC2264CDR | SOIC | D | 14 | 2500 | 333.2 | 345.9 | 28.6 |
| TLC2264CDR | SOIC | D | 14 | 2500 | 346.0 | 346.0 | 33.0 |
| TLC2264CPWR | TSSOP | PW | 14 | 2000 | 346.0 | 346.0 | 29.0 |
| TLC2264IDR | SOIC | D | 14 | 2500 | 333.2 | 345.9 | 28.6 |
| TLC2264IDR | SOIC | D | 14 | 2500 | 346.0 | 346.0 | 33.0 |

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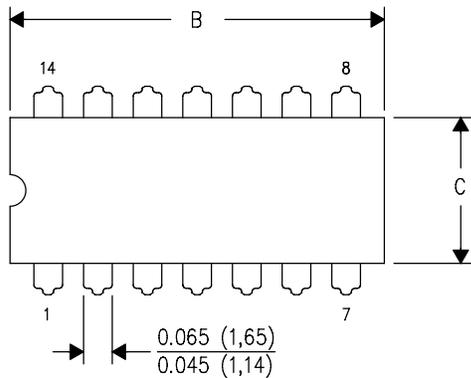
B

14                    8

C

1                    7

0.065 (1,65)
0.045 (1,14)

0.005 (0,13) MIN

0.060 (1,52)
0.015 (0,38)

0.200 (5,08) MAX

A

Seating Plane

0.130 (3,30) MIN

0.026 (0,66)
0.014 (0,36)

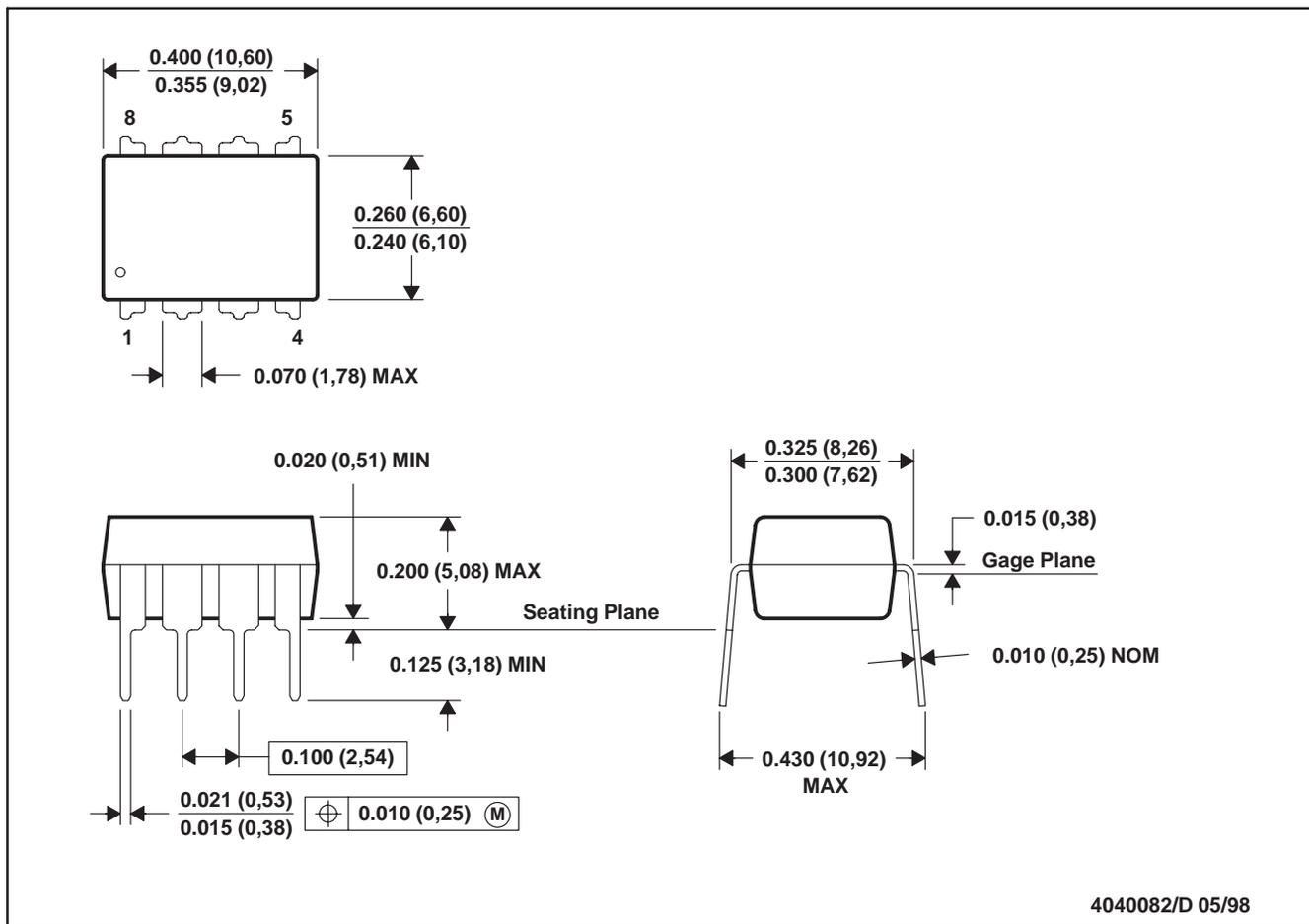0.100 (2,54)

0°−15°

0.014 (0,36)
0.008 (0,20)
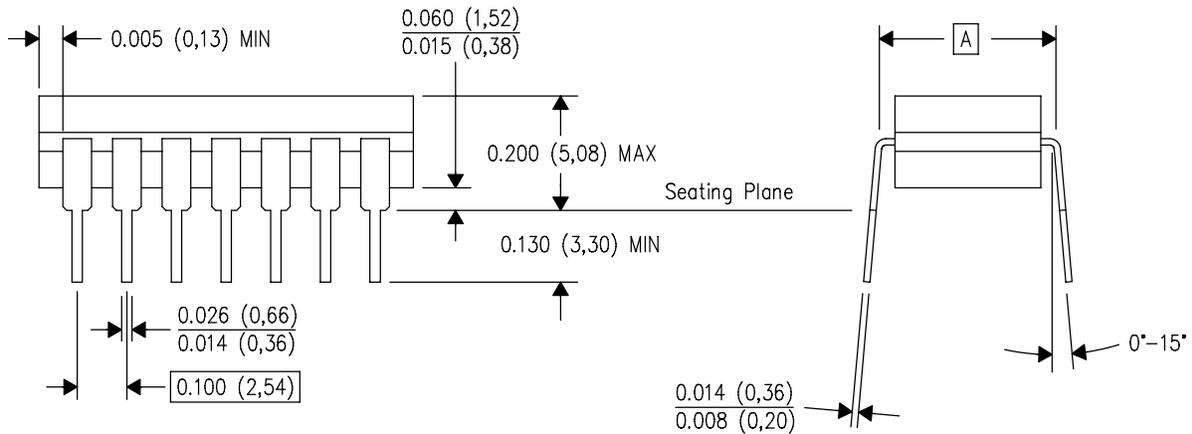
4040083/F 03/03

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

**PW (R-PDSO-G\*\*)**                                        **PLASTIC SMALL-OUTLINE PACKAGE**

**14 PINS SHOWN**

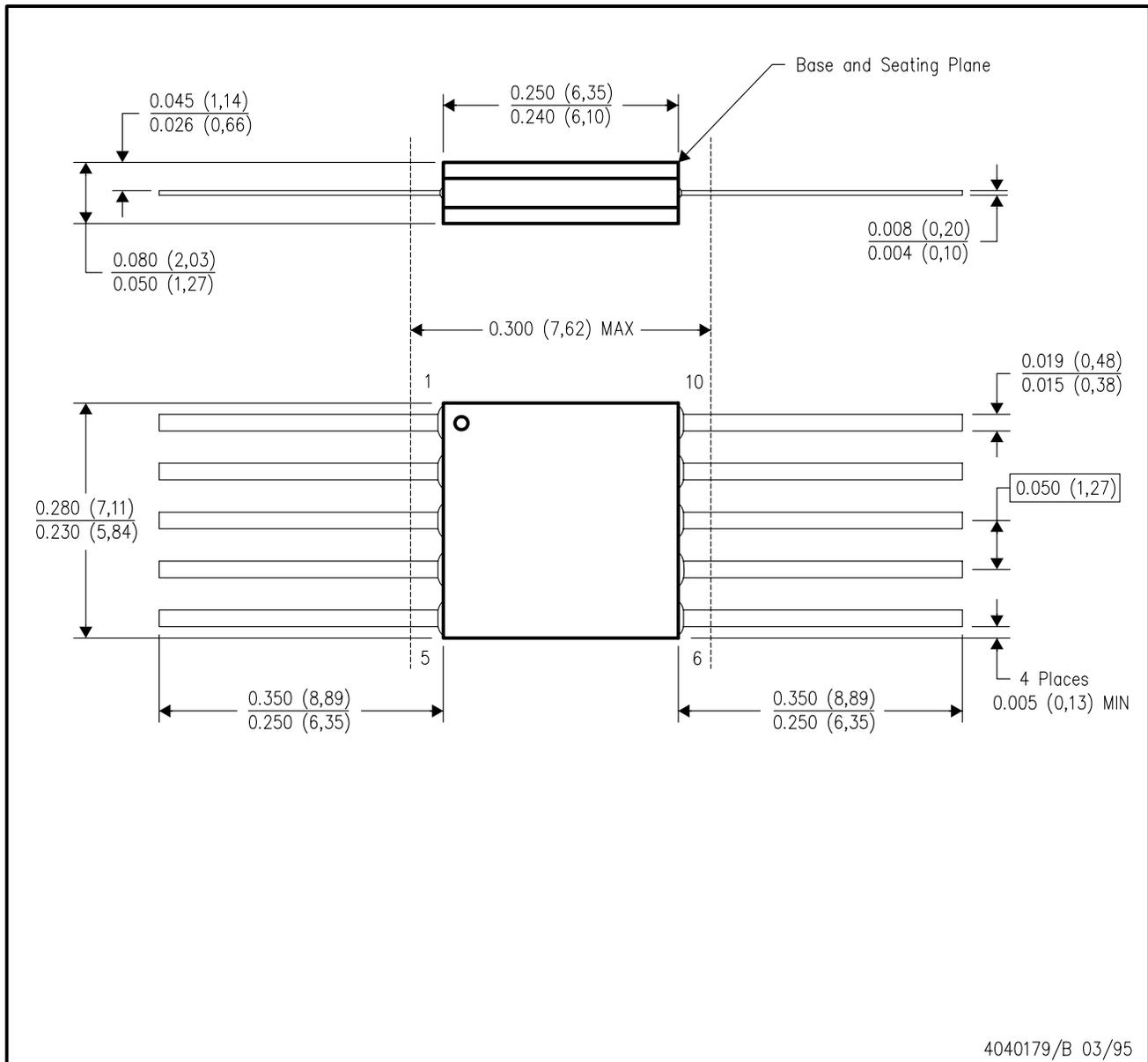| PINS \*\* DIM | 8 | 14 | 16 | 20 | 24 | 28 |
|---|---|---|---|---|---|---|
| A MAX | 3,10 | 5,10 | 5,10 | 6,60 | 7,90 | 9,80 |
| A MIN | 2,90 | 4,90 | 4,90 | 6,40 | 7,70 | 9,60 |
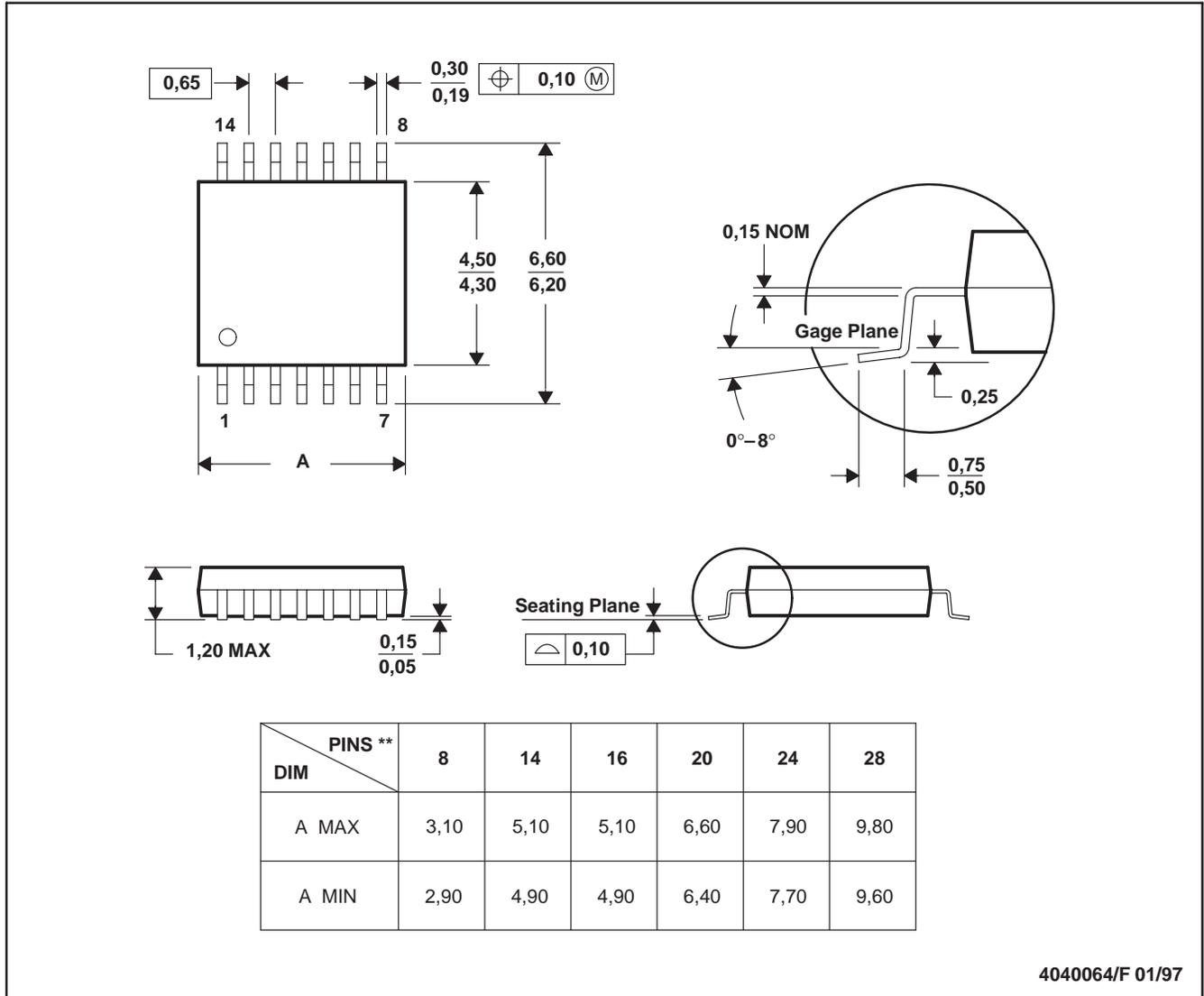
4040064/F 01/97

NOTES:   A.  All linear dimensions are in millimeters.
         B.  This drawing is subject to change without notice.
         C.  Body dimensions do not include mold flash or protrusion not to exceed 0,15.
         D.  Falls within JEDEC MO-153

**D (R–PDSO–G8)**                    PLASTIC SMALL–OUTLINE PACKAGE
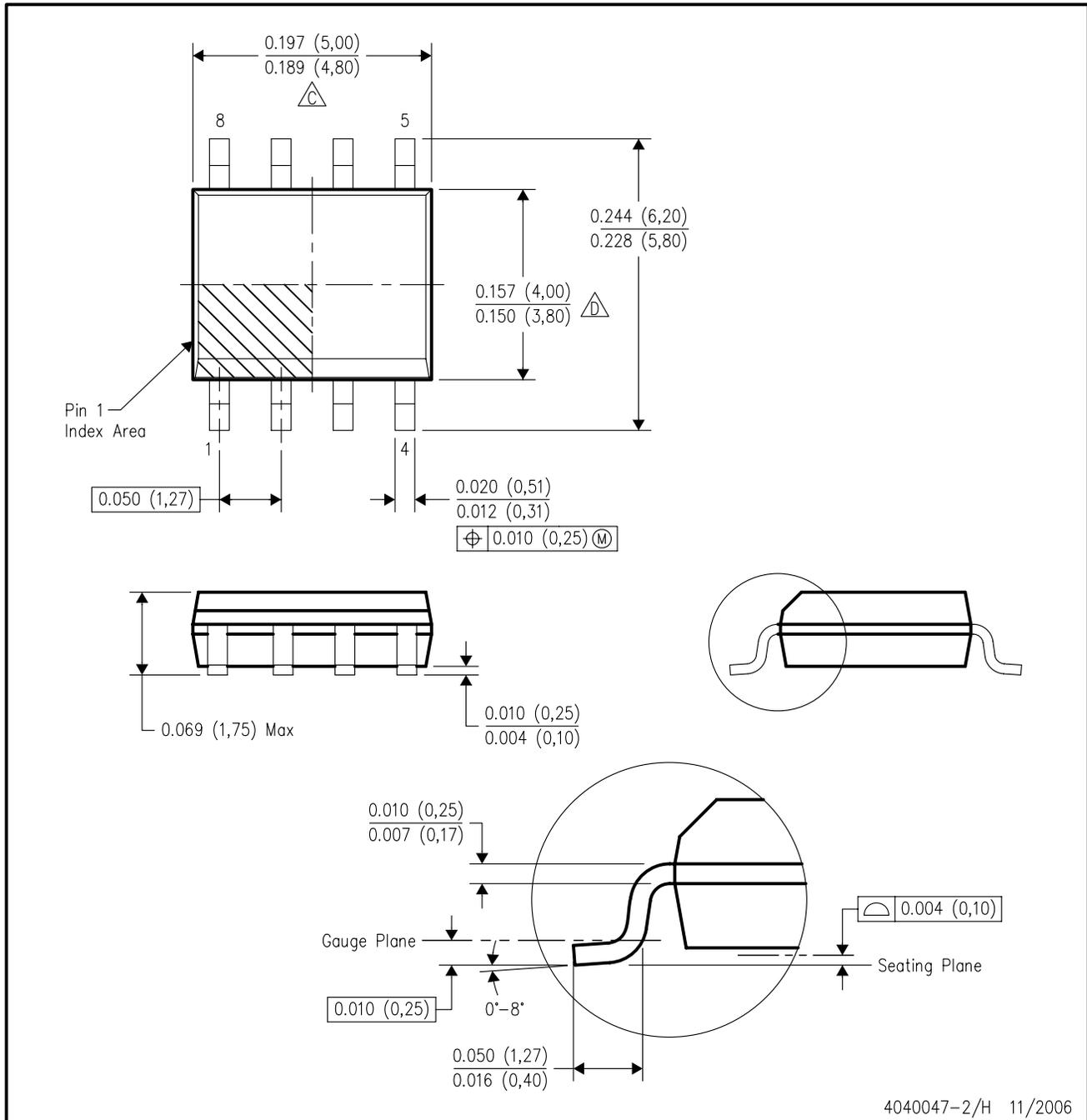
0.197 (5,00)
0.189 (4,80)
△C

8          5

0.244 (6,20)
0.228 (5,80)

0.157 (4,00)
0.150 (3,80)   △D

Pin 1
Index Area

1          4

0.050 (1,27)          0.020 (0,51)
0.012 (0,31)

⊕ 0.010 (0,25) Ⓜ

0.069 (1,75) Max

0.010 (0,25)
0.004 (0,10)

0.010 (0,25)
0.007 (0,17)

0.004 (0,10)

Gauge Plane

Seating Plane

0.010 (0,25)          0°–8°

0.050 (1,27)
0.016 (0,40)

4040047–2/H  11/2006

NOTES:   A.   All linear dimensions are in inches (millimeters).
         B.   This drawing is subject to change without notice.
        △C   Body length does not include mold flash, protrusions, or gate burrs.  Mold flash, protrusions, or gate burrs shall
              not exceed .006 (0,15) per end.
        △D   Body width does not include interlead flash.  Interlead flash shall not exceed .017 (0,43) per side.
         E.   Reference JEDEC MS–012 variation AA.

## FK (S-CQCC-N**)                    LEADLESS CERAMIC CHIP CARRIER
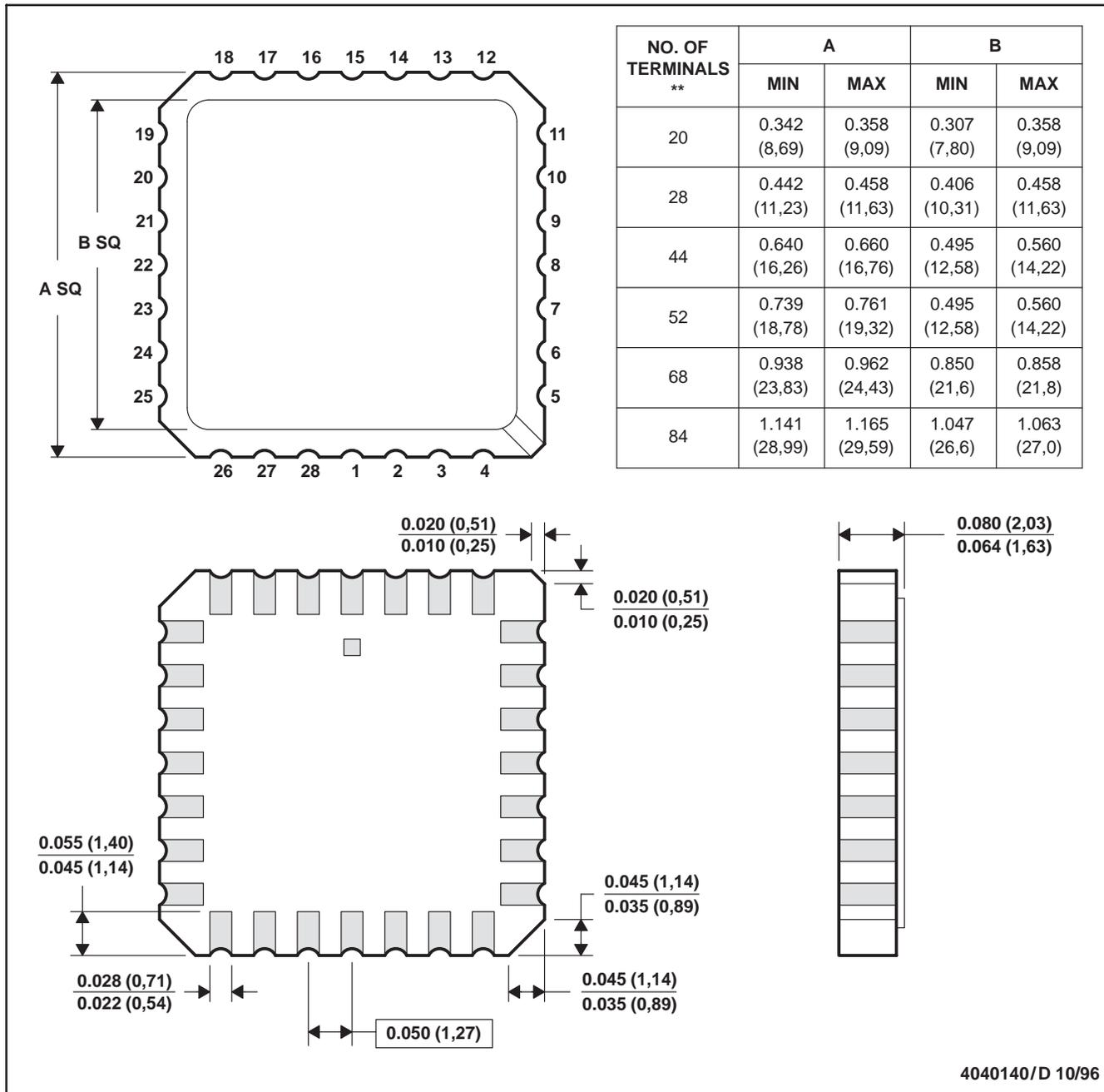
**28 TERMINAL SHOWN**

| NO. OF TERMINALS ** | A | | B | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| 20 | 0.342 (8,69) | 0.358 (9,09) | 0.307 (7,80) | 0.358 (9,09) |
| 28 | 0.442 (11,23) | 0.458 (11,63) | 0.406 (10,31) | 0.458 (11,63) |
| 44 | 0.640 (16,26) | 0.660 (16,76) | 0.495 (12,58) | 0.560 (14,22) |
| 52 | 0.739 (18,78) | 0.761 (19,32) | 0.495 (12,58) | 0.560 (14,22) |
| 68 | 0.938 (23,83) | 0.962 (24,43) | 0.850 (21,6) | 0.858 (21,8) |
| 84 | 1.141 (28,99) | 1.165 (29,59) | 1.047 (26,6) | 1.063 (27,0) |

4040140 / D 10/96

NOTES:  A.  All linear dimensions are in inches (millimeters).
        B.  This drawing is subject to change without notice.
        C.  This package can be hermetically sealed with a metal lid.
        D.  The terminals are gold plated.
        E.  Falls within JEDEC MS-004

![Texas Instruments logo]

**TEXAS INSTRUMENTS**

POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

**D (R−PDSO−G14)**            **PLASTIC SMALL−OUTLINE PACKAGE**
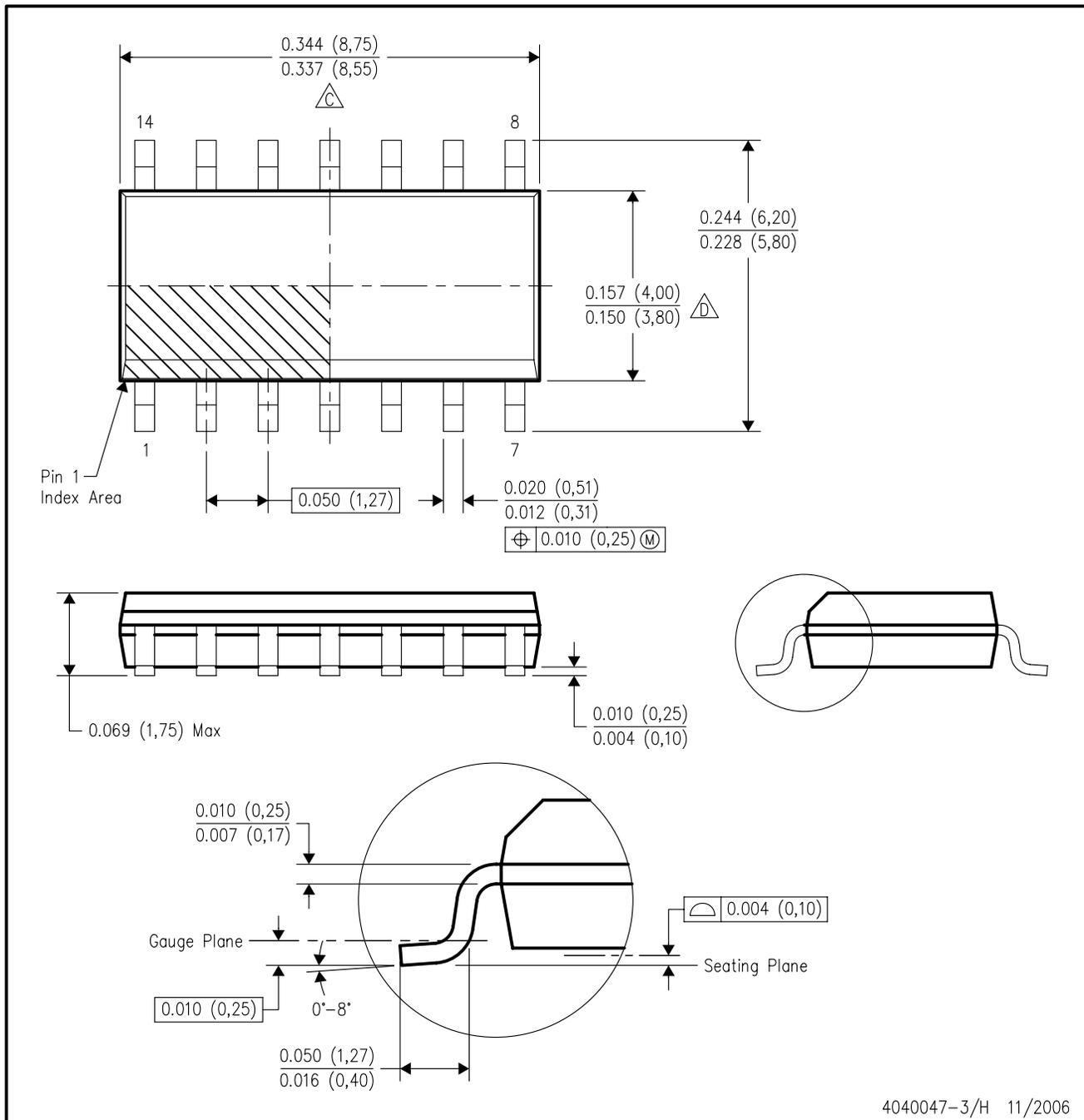


$\dfrac{0.344\ (8,75)}{0.337\ (8,55)}$

14   8

$\dfrac{0.244\ (6,20)}{0.228\ (5,80)}$

$\dfrac{0.157\ (4,00)}{0.150\ (3,80)}$

1   7

Pin 1
Index Area

0.050 (1,27)

$\dfrac{0.020\ (0,51)}{0.012\ (0,31)}$

0.010 (0,25) M

0.069 (1,75) Max

$\dfrac{0.010\ (0,25)}{0.004\ (0,10)}$

$\dfrac{0.010\ (0,25)}{0.007\ (0,17)}$

Gauge Plane

0.004 (0,10)

Seating Plane

0.010 (0,25)

0°−8°

$\dfrac{0.050\ (1,27)}{0.016\ (0,40)}$

4040047−3/H   11/2006

NOTES:   A.   All linear dimensions are in inches (millimeters).
        B.   This drawing is subject to change without notice.
        C.   Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
        D.   Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
        E.   Reference JEDEC MS−012 variation AB.

TEXAS
INSTRUMENTS
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W (R−GDFP−F14)                                    CERAMIC DUAL FLATPACK
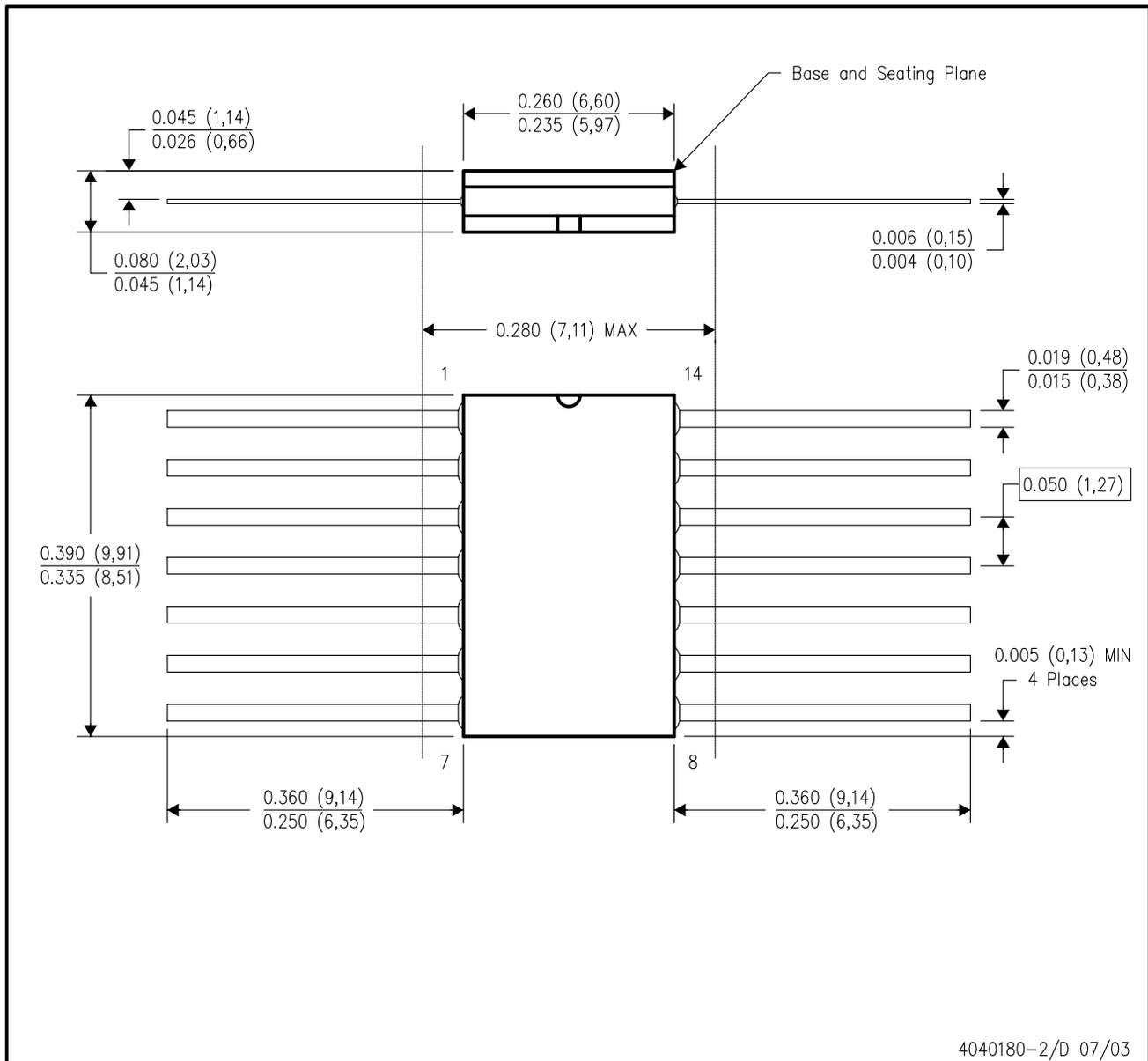
Base and Seating Plane

0.260 (6,60)
0.235 (5,97)

0.045 (1,14)
0.026 (0,66)

0.006 (0,15)
0.004 (0,10)

0.080 (2,03)
0.045 (1,14)

0.280 (7,11) MAX

0.019 (0,48)
0.015 (0,38)

1        14

0.050 (1,27)

0.390 (9,91)
0.335 (8,51)

0.005 (0,13) MIN
4 Places

7        8

0.360 (9,14)
0.250 (6,35)

0.360 (9,14)
0.250 (6,35)

4040180−2/D 07/03

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 and JEDEC MO−092AB

**P (R-PDIP-T8)**                                                      **PLASTIC DUAL-IN-LINE**

0.400 (10,60)
0.355 (9,02)

8          5

0.260 (6,60)
0.240 (6,10)

1          4

0.070 (1,78) MAX

0.020 (0,51) MIN

0.325 (8,26)
0.300 (7,62)

0.015 (0,38)

Gage Plane

0.200 (5,08) MAX

Seating Plane

0.010 (0,25) NOM

0.125 (3,18) MIN

0.100 (2,54)

0.021 (0,53)
0.015 (0,38)          ⊕ | 0.010 (0,25) | Ⓜ

0.430 (10,92)
MAX

4040082/D 05/98

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

For the latest package information, go to http://www.ti.com/sc/docs/package/pkg_info.htm

**JG (R-GDIP-T8)**                                                    **CERAMIC DUAL-IN-LINE**
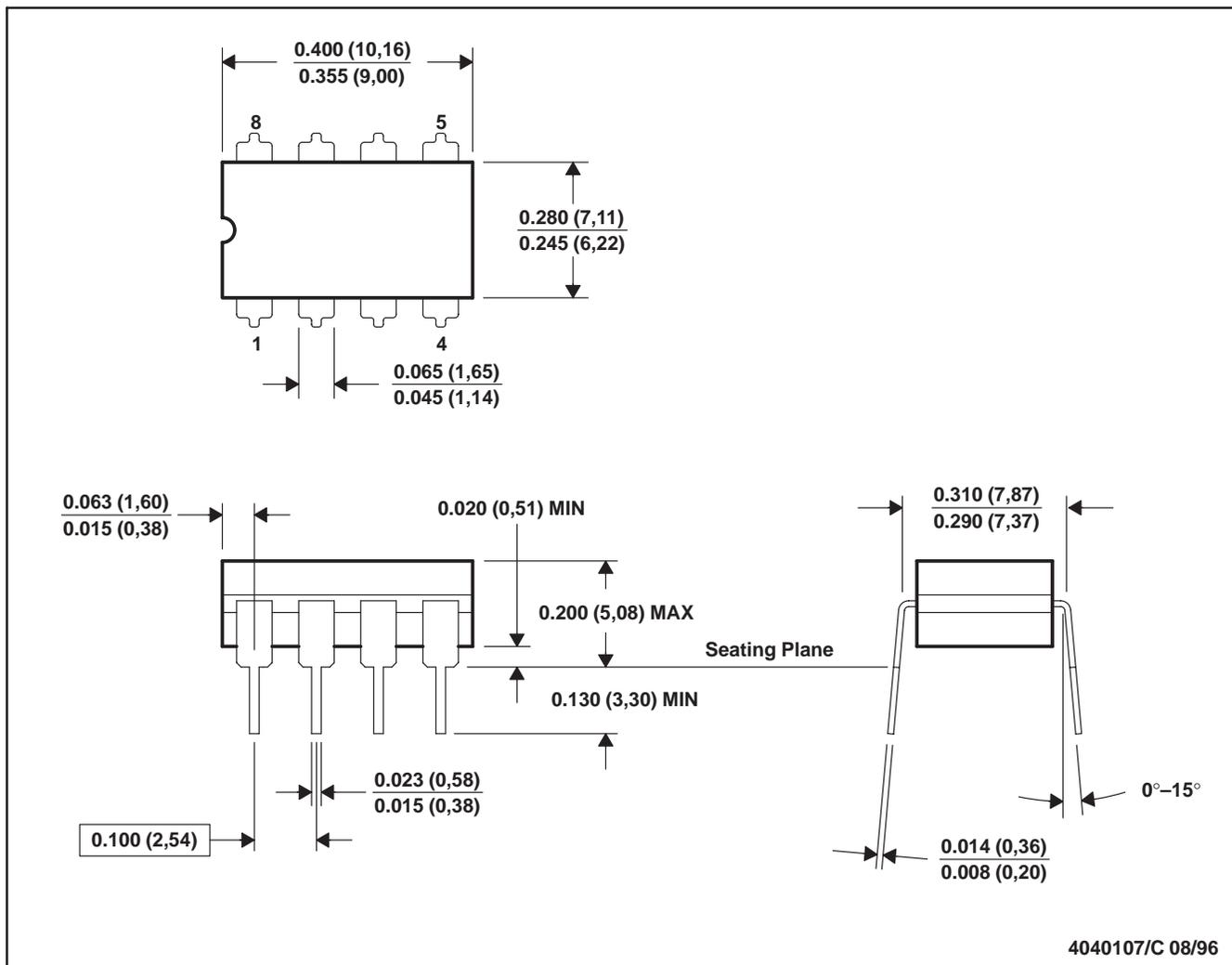
0.400 (10,16)
0.355 (9,00)

8        5

0.280 (7,11)
0.245 (6,22)

1        4

0.065 (1,65)
0.045 (1,14)

0.063 (1,60)
0.015 (0,38)

0.020 (0,51) MIN

0.310 (7,87)
0.290 (7,37)

0.200 (5,08) MAX

Seating Plane

0.130 (3,30) MIN

0.023 (0,58)
0.015 (0,38)

0.100 (2,54)

0°–15°

0.014 (0,36)
0.008 (0,20)

4040107/C 08/96

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

## N (R−PDIP−T**)

16 PINS SHOWN

## PLASTIC DUAL−IN−LINE PACKAGE



| 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 | AA | BB | AC | AD |

0.260 (6,60) / 0.240 (6,10)

0.070 (1,78) / 0.045 (1,14) ⚠D

0.045 (1,14) / 0.030 (0,76) ⚠D

0.020 (0,51) MIN

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.100 (2,54)

0.021 (0,53) / 0.015 (0,38)

⊕ 0.010 (0,25) Ⓜ

14/18 Pin Only
20 Pin vendor option ⚠D

0.325 (8,26) / 0.300 (7,62)

0.015 (0,38)

Gauge Plane

0.010 (0,25) NOM

0.430 (10,92) MAX

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.

U (S–GDFP–F10)                                            CERAMIC DUAL FLATPACK

Base and Seating Plane

$\dfrac{0.045\ (1,14)}{0.026\ (0,66)}$

$\dfrac{0.250\ (6,35)}{0.240\ (6,10)}$

$\dfrac{0.080\ (2,03)}{0.050\ (1,27)}$

$\dfrac{0.008\ (0,20)}{0.004\ (0,10)}$

0.300 (7,62) MAX

$\dfrac{0.019\ (0,48)}{0.015\ (0,38)}$

1                              10

$\dfrac{0.280\ (7,11)}{0.230\ (5,84)}$

0.050 (1,27)

5                              6

$\dfrac{0.350\ (8,89)}{0.250\ (6,35)}$

$\dfrac{0.350\ (8,89)}{0.250\ (6,35)}$

4 Places
0.005 (0,13) MIN

4040179/B 03/95

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

## IMPORTANT NOTICE