

TL071, TL071A, TL071B, TL072  
TL072A, TL072B, TL074, TL074A, TL074B  
**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

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- Low Power Consumption
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Low Total Harmonic Distortion . . . 0.003% Typ
- Low Noise  
 $V_n = 18 \text{ nV}/\sqrt{\text{Hz}}$  Typ at  $f = 1 \text{ kHz}$
- High Input Impedance . . . JFET Input Stage
- Internal Frequency Compensation
- Latch-Up-Free Operation
- High Slew Rate . . .  $13 \text{ V}/\mu\text{s}$  Typ
- Common-Mode Input Voltage Range Includes  $V_{CC+}$

### description/ordering information

The JFET-input operational amplifiers in the TL07x series are similar to the TL08x series, with low input bias and offset currents and fast slew rate. The low harmonic distortion and low noise make the TL07x series ideally suited for high-fidelity and audio preamplifier applications. Each amplifier features JFET inputs (for high input impedance) coupled with bipolar output stages integrated on a single monolithic chip.

The C-suffix devices are characterized for operation from 0°C to 70°C. The I-suffix devices are characterized for operation from –40°C to 85°C. The M-suffix devices are characterized for operation over the full military temperature range of –55°C to 125°C.



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

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



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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

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**description/ordering information (continued)**

**ORDERING INFORMATION**

| TA          | V <sub>IO</sub> max<br>AT 25°C | PACKAGE†   |              | ORDERABLE<br>PART NUMBER | TOP-SIDE<br>MARKING |
|-------------|--------------------------------|------------|--------------|--------------------------|---------------------|
| 0°C to 70°C | 10 mV                          | PDIP (P)   | Tube of 50   | TL071CP                  | TL071CP             |
|             |                                |            | Tube of 50   | TL072CP                  | TL072CP             |
|             |                                | PDIP (N)   | Tube of 25   | TL074CN                  | TL074CN             |
|             |                                |            | Tube of 75   | TL071CD                  | TL071C              |
|             |                                | SOIC (D)   | Reel of 2500 | TL071CDR                 |                     |
|             |                                |            | Tube of 75   | TL072CD                  | TL072C              |
|             |                                |            | Reel of 2500 | TL072CDR                 |                     |
|             |                                |            | Tube of 50   | TL074CD                  | TL074C              |
|             |                                |            | Reel of 2500 | TL074CDR                 |                     |
|             |                                | SOP (NS)   | Reel of 2000 | TL074CNSR                | TL074               |
|             |                                | SOP (PS)   | Reel of 2000 | TL071CPSR                | TL071               |
|             |                                |            | Reel of 2000 | TL072CPSR                | T072                |
|             |                                | TSSOP (PW) | Reel of 2000 | TL072CPWR                | T072                |
|             |                                |            | Tube of 90   | TL074CPW                 | T074                |
|             |                                |            | Reel of 2000 | TL074CPWR                |                     |
|             | 6 mV                           | PDIP (P)   | Tube of 50   | TL071ACP                 | TL071ACP            |
|             |                                |            | Tube of 50   | TL072ACP                 | TL072ACP            |
|             |                                | PDIP (N)   | Tube of 25   | TL074ACN                 | TL074ACN            |
|             |                                |            | Tube of 75   | TL071ACD                 | 071AC               |
|             |                                | SOIC (D)   | Reel of 2500 | TL071ACDR                |                     |
|             |                                |            | Tube of 75   | TL072ACD                 | 072AC               |
|             |                                |            | Reel of 2500 | TL072ACDR                |                     |
|             |                                |            | Tube of 50   | TL074ACD                 | TL074AC             |
|             |                                |            | Reel of 2500 | TL074ACDR                |                     |
|             |                                | SOP (PS)   | Reel of 2000 | TL072ACPSR               | T072A               |
|             |                                | SOP (NS)   | Reel of 2000 | TL074ACNSR               | TL074A              |
|             | 3 mV                           | PDIP (P)   | Tube of 50   | TL071BCP                 | TL071BCP            |
|             |                                |            | Tube of 50   | TL072BCP                 | TL072BCP            |
|             |                                | PDIP (N)   | Tube of 25   | TL074BCN                 | TL074BCN            |
|             |                                |            | Tube of 75   | TL071BCD                 | 071BC               |
|             |                                | SOIC (D)   | Reel of 2500 | TL071BCDR                |                     |
|             |                                |            | Tube of 75   | TL072BCD                 | 072BC               |
|             |                                |            | Reel of 2500 | TL072BCDR                |                     |
|             |                                |            | Tube of 50   | TL074BCD                 | TL074BC             |
|             |                                |            | Reel of 2500 | TL074BCDR                |                     |
|             |                                | SOP (NS)   | Reel of 2000 | TL074BCNSR               | TL074B              |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

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**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

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description/ordering information (continued)

**ORDERING INFORMATION**

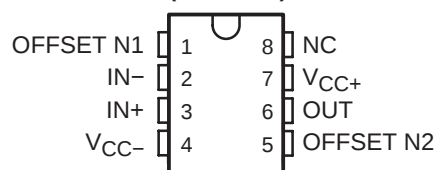
| $T_A$          | $V_{IOmax}$<br>AT 25°C | PACKAGE†  |              | ORDERABLE<br>PART NUMBER | TOP-SIDE<br>MARKING |
|----------------|------------------------|-----------|--------------|--------------------------|---------------------|
| –40°C to 85°C  | 6 mV                   | PDIP (P)  | Tube of 50   | TL071IP                  | TL071IP             |
|                |                        |           | Tube of 50   | TL072IP                  | TL072IP             |
|                |                        | PDIP (N)  | Tube of 25   | TL074IN                  | TL074IN             |
|                |                        | SOIC (D)  | Tube of 75   | TL071ID                  | TL071I              |
|                |                        |           | Reel of 2500 | TL071IDR                 |                     |
|                |                        |           | Tube of 75   | TL072ID                  | TL072I              |
|                |                        |           | Reel of 2500 | TL072IDR                 |                     |
|                |                        |           | Tube of 50   | TL074ID                  | TL074I              |
|                |                        |           | Reel of 2500 | TL074IDR                 |                     |
| –55°C to 125°C | 6 mV                   | CDIP (JG) | Tube of 50   | TL072MJGB                | TL072MJGB           |
|                |                        | CFP (U)   | Tube of 150  | TL072MUB                 | TL072MUB            |
|                |                        | LCCC (FK) | Tube of 55   | TL072MFKB                | TL072MFKB           |
|                | 9 mV                   | CDIP (J)  | Tube of 25   | TL074MJB                 | TL074MJB            |
|                |                        | CFP (W)   | Tube of 25   | TL074MWB                 | TL074MWB            |
|                |                        | LCCC (FK) | Tube of 55   | TL074MFKB                | TL074MFKB           |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

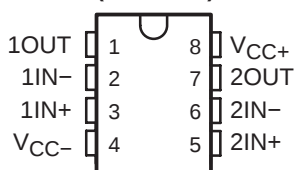
# TL071, TL071A, TL071B, TL072 TL072A, TL072B, TL074, TL074A, TL074B LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS

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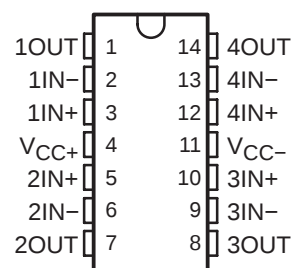
**TL071, TL071A, TL071B**  
D, P, OR PS PACKAGE  
(TOP VIEW)



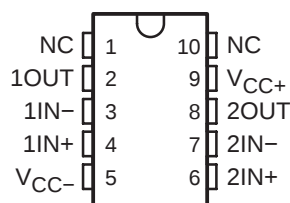
**TL072, TL072A, TL072B**  
D, JG, P, PS, OR PW PACKAGE  
(TOP VIEW)



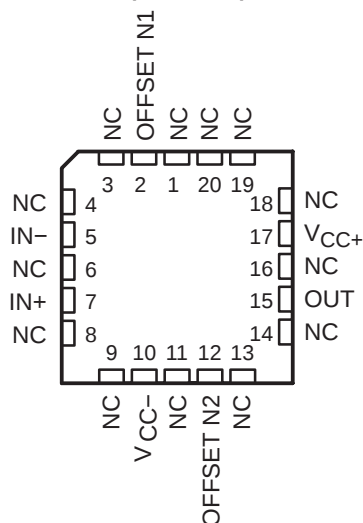
**TL074A, TL074B**  
D, J, N, NS, OR PW PACKAGE  
TL074 . . . D, J, N, NS, PW,  
OR W PACKAGE  
(TOP VIEW)



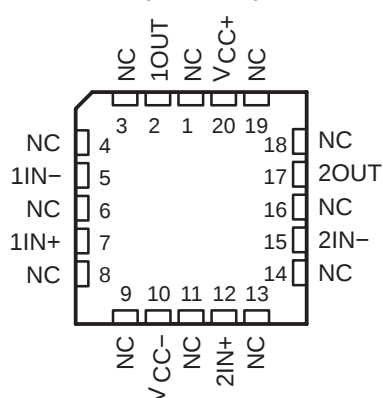
**TL072**  
U PACKAGE  
(TOP VIEW)



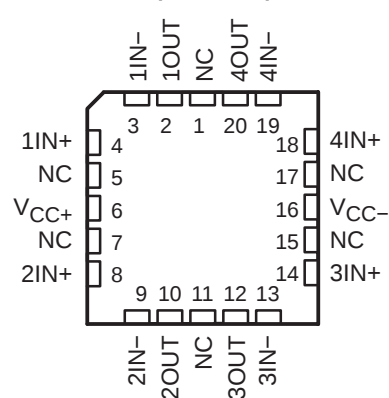
**TL071**  
FK PACKAGE  
(TOP VIEW)



**TL072**  
FK PACKAGE  
(TOP VIEW)

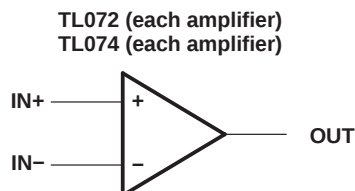
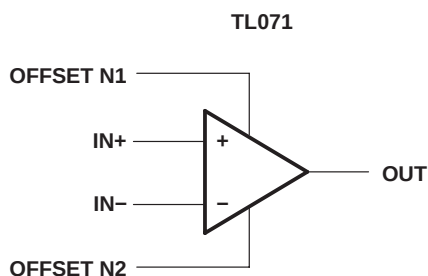


**TL074**  
FK PACKAGE  
(TOP VIEW)



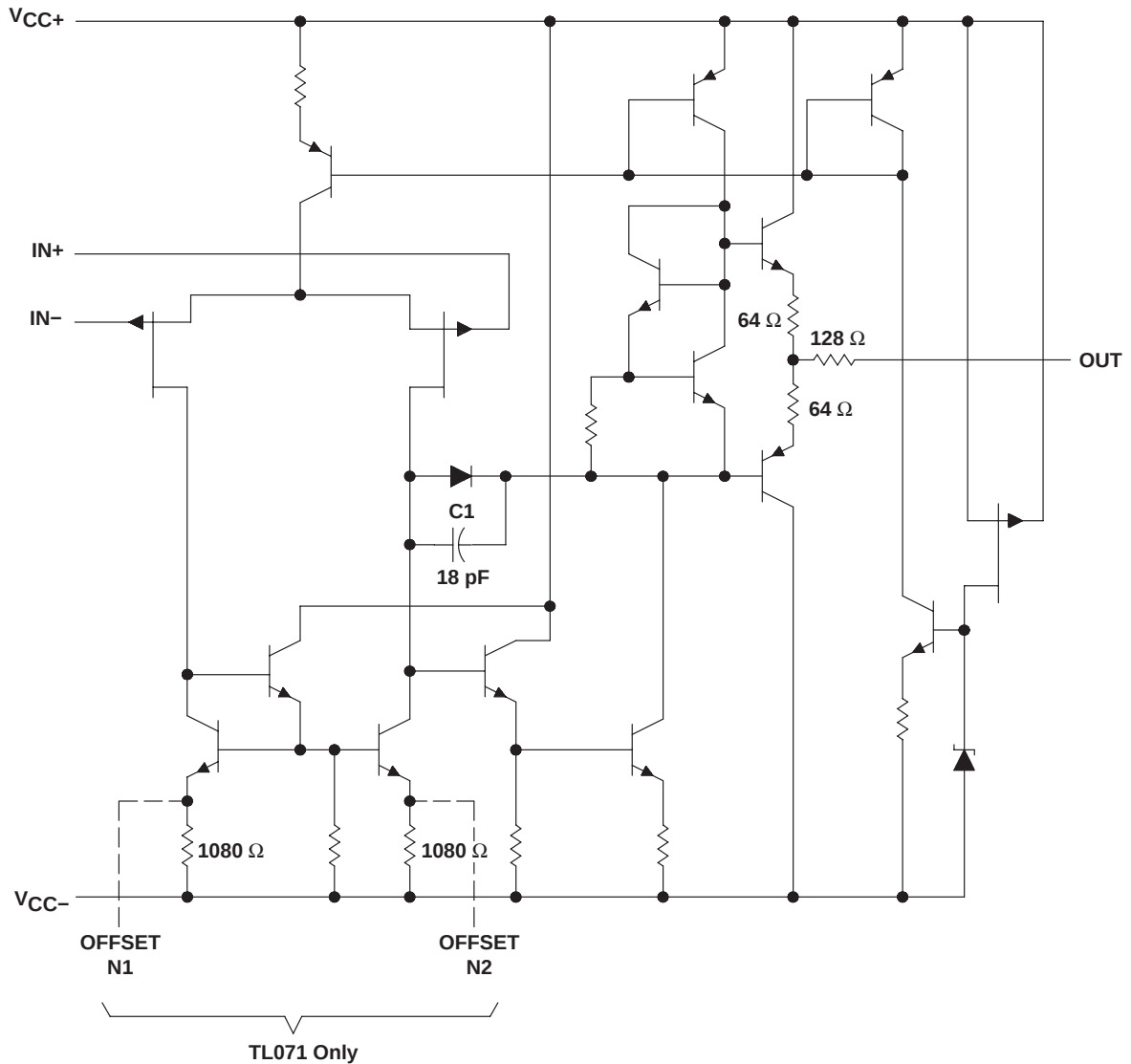
NC – No internal connection

## symbols



TL071, TL071A, TL071B, TL072  
TL072A, TL072B, TL074, TL074A, TL074B  
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schematic (each amplifier)



All component values shown are nominal.

| COMPONENT COUNT† |       |       |       |
|------------------|-------|-------|-------|
| COMPONENT TYPE   | TL071 | TL072 | TL074 |
| Resistors        | 11    | 22    | 44    |
| Transistors      | 14    | 28    | 56    |
| JFET             | 2     | 4     | 6     |
| Diodes           | 1     | 2     | 4     |
| Capacitors       | 1     | 2     | 4     |
| epi-FET          | 1     | 2     | 4     |

† Includes bias and trim circuitry

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

|                                                                                   |                |
|-----------------------------------------------------------------------------------|----------------|
| Supply voltage (see Note 1): $V_{CC+}$                                            | 18 V           |
| $V_{CC-}$                                                                         | –18 V          |
| Differential input voltage, $V_{ID}$ (see Note 2)                                 | ±30 V          |
| Input voltage, $V_I$ (see Notes 1 and 3)                                          | ±15 V          |
| Duration of output short circuit (see Note 4)                                     | Unlimited      |
| Package thermal impedance, $\theta_{JA}$ (see Notes 5 and 6): D package (8 pin)   | 97°C/W         |
| D package (14 pin)                                                                | 86°C/W         |
| N package                                                                         | 80°C/W         |
| NS package                                                                        | 76°C/W         |
| P package                                                                         | 85°C/W         |
| PS package                                                                        | 95°C/W         |
| PW package (8 pin)                                                                | 149°C/W        |
| PW package (14 pin)                                                               | 113°C/W        |
| U package                                                                         | 185°C/W        |
| Package thermal impedance, $\theta_{JC}$ (see Notes 7 and 8): FK package          | 5.61°C/W       |
| J package                                                                         | 15.05°C/W      |
| JG package                                                                        | 14.5°C/W       |
| W package                                                                         | 14.65°C/W      |
| Operating virtual junction temperature, $T_J$                                     | 150°C          |
| Case temperature for 60 seconds: FK package                                       | 260°C          |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: J, JG, or W package | 300°C          |
| Storage temperature range, $T_{stg}$                                              | –65°C to 150°C |

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

- NOTES:
1. All voltage values, except differential voltages, are with respect to the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .
  2. Differential voltages are at  $IN+$ , with respect to  $IN-$ .
  3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
  4. The output may be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.
  5. Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\max) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  6. The package thermal impedance is calculated in accordance with JESD 51-7.
  7. Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JC}$ , and  $T_C$ . The maximum allowable power dissipation at any allowable case temperature is  $P_D = (T_J(\max) - T_C)/\theta_{JC}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  8. The package thermal impedance is calculated in accordance with MIL-STD-883.



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electrical characteristics,  $V_{CC\pm} = \pm 15\text{ V}$  (unless otherwise noted)

| PARAMETER       | TEST CONDITIONS†                                                          | TA‡        | TL071C<br>TL072C<br>TL074C |          |     | TL071AC<br>TL072AC<br>TL074AC |          |     | TL071BC<br>TL072BC<br>TL074BC |          |     | TL071I<br>TL072I<br>TL074I |          |     | UNIT                         |
|-----------------|---------------------------------------------------------------------------|------------|----------------------------|----------|-----|-------------------------------|----------|-----|-------------------------------|----------|-----|----------------------------|----------|-----|------------------------------|
|                 |                                                                           |            | MIN                        | TYP      | MAX | MIN                           | TYP      | MAX | MIN                           | TYP      | MAX | MIN                        | TYP      | MAX |                              |
| $V_{IO}$        | $V_O = 0$ ,<br>$R_S = 50\ \Omega$                                         | 25°C       | 3                          | 10       | 6   | 3                             | 3        | 6   | 2                             | 2        | 3   | 3                          | 3        | 6   | mV                           |
|                 |                                                                           | Full range |                            |          | 13  |                               |          | 7.5 |                               |          | 5   |                            |          | 8   |                              |
| $\alpha V_{IO}$ | $V_O = 0$ ,<br>$R_S = 50\ \Omega$                                         | Full range | 18                         |          |     | 18                            |          |     | 18                            |          |     | 18                         |          |     | $\mu\text{V}/^\circ\text{C}$ |
| $I_{IO}$        | $V_O = 0$                                                                 | 25°C       | 5                          | 100      |     | 5                             | 100      |     | 5                             | 100      |     | 5                          | 100      |     | pA                           |
|                 |                                                                           | Full range |                            |          | 10  |                               |          | 2   |                               |          | 2   |                            |          | 2   | nA                           |
| $I_{IB}$        | $V_O = 0$                                                                 | 25°C       | 65                         | 200      |     | 65                            | 200      |     | 65                            | 200      |     | 65                         | 200      |     | pA                           |
|                 |                                                                           | Full range |                            |          | 7   |                               |          | 7   |                               |          | 7   |                            |          | 20  | nA                           |
| $V_{ICR}$       | Common-mode<br>input voltage range                                        | 25°C       | -12<br>±11                 | to<br>15 |     | -12<br>±11                    | to<br>15 |     | -12<br>±11                    | to<br>15 |     | -12<br>±11                 | to<br>15 |     | V                            |
| $V_{OM}$        | Maximum peak<br>output voltage<br>swing                                   | 25°C       | ±12                        | ±13.5    |     | ±12                           | ±13.5    |     | ±12                           | ±13.5    |     | ±12                        | ±13.5    |     | V                            |
|                 |                                                                           |            | ±12                        |          |     | ±12                           |          |     | ±12                           |          |     | ±12                        |          |     |                              |
|                 |                                                                           | Full range | ±10                        |          |     | ±10                           |          |     | ±10                           |          |     | ±10                        |          |     |                              |
| $A_{VD}$        | Large-signal<br>differential voltage<br>amplification                     | 25°C       | 25                         | 200      |     | 25                            | 200      |     | 25                            | 200      |     | 25                         | 200      |     | V/mV                         |
|                 |                                                                           | Full range | 15                         |          |     | 25                            |          |     | 25                            |          |     | 25                         |          |     |                              |
| $B_1$           | Unity-gain<br>bandwidth                                                   | 25°C       | 3                          |          |     | 3                             |          |     | 3                             |          |     | 3                          |          |     | MHz                          |
| $r_i$           | Input resistance                                                          | 25°C       | 10 <sup>12</sup>           |          |     | 10 <sup>12</sup>              |          |     | 10 <sup>12</sup>              |          |     | 10 <sup>12</sup>           |          |     | $\Omega$                     |
| CMRR            | Common-mode<br>rejection ratio                                            | 25°C       | 70                         | 100      |     | 75                            | 100      |     | 75                            | 100      |     | 75                         | 100      |     | dB                           |
| KSVR            | Supply-voltage<br>rejection ratio<br>( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | 25°C       | 70                         | 100      |     | 80                            | 100      |     | 80                            | 100      |     | 80                         | 100      |     | dB                           |
| $I_{CC}$        | Supply current<br>(each amplifier)                                        | 25°C       | 1.4                        | 2.5      |     | 1.4                           | 2.5      |     | 1.4                           | 2.5      |     | 1.4                        | 2.5      |     | mA                           |
| $V_{O1}/V_{O2}$ | Crosstalk<br>attenuation                                                  | 25°C       | 120                        |          |     | 120                           |          |     | 120                           |          |     | 120                        |          |     | dB                           |

† All characteristics are measured under open-loop conditions with zero common-mode voltage, unless otherwise specified.  
‡ Full range is  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$  for TL07\_C, TL07\_AC, TL07\_BC and is  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$  for TL07\_I.

§ Input bias currents of an FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive, as shown in Figure 4. Pulse techniques must be used that maintain the junction temperature as close to the ambient temperature as possible.

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**electrical characteristics,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

| PARAMETER                                                                     | TEST CONDITIONS†                                             | $T_A$ ‡    | TL071M<br>TL072M |            |     | TL074M   |            |     | UNIT             |
|-------------------------------------------------------------------------------|--------------------------------------------------------------|------------|------------------|------------|-----|----------|------------|-----|------------------|
|                                                                               |                                                              |            | MIN              | TYP        | MAX | MIN      | TYP        | MAX |                  |
| $V_{IO}$ Input offset voltage                                                 | $V_O = 0, R_S = 50 \Omega$                                   | 25°C       |                  | 3          | 6   |          | 3          | 9   | mV               |
|                                                                               |                                                              | Full range |                  |            | 9   |          |            | 15  |                  |
| $\alpha V_{IO}$ Temperature coefficient of input offset voltage               | $V_O = 0, R_S = 50 \Omega$                                   | Full range |                  | 18         |     |          | 18         |     | $\mu V/^\circ C$ |
| $I_{IO}$ Input offset current                                                 | $V_O = 0$                                                    | 25°C       |                  | 5          | 100 |          | 5          | 100 | pA               |
|                                                                               |                                                              | Full range |                  |            | 20  |          |            | 20  | nA               |
| $I_{IB}$ Input bias current‡                                                  | $V_O = 0$                                                    | 25°C       |                  | 65         | 200 |          | 65         | 200 | pA               |
|                                                                               |                                                              |            |                  |            | 50  |          |            | 50  | nA               |
| $V_{ICR}$ Common-mode input voltage range                                     |                                                              | 25°C       | $\pm 11$         | -12 to 15  |     | $\pm 11$ | -12 to 15  |     | V                |
| $V_{OM}$ Maximum peak output voltage swing                                    | $R_L = 10 k\Omega$                                           | 25°C       | $\pm 12$         | $\pm 13.5$ |     | $\pm 12$ | $\pm 13.5$ |     | V                |
|                                                                               | $R_L \geq 10 k\Omega$                                        | Full range | $\pm 12$         |            |     | $\pm 12$ |            |     |                  |
|                                                                               | $R_L \geq 2 k\Omega$                                         |            | $\pm 10$         |            |     | $\pm 10$ |            |     |                  |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10$ V, $R_L \geq 2 k\Omega$                       | 25°C       | 35               | 200        |     | 35       | 200        |     | V/mV             |
|                                                                               |                                                              |            | 15               |            |     | 15       |            |     |                  |
| $B_1$ Unity-gain bandwidth                                                    | $T_A = 25^\circ C$                                           |            |                  | 3          |     |          | 3          |     | MHz              |
| $r_i$ Input resistance                                                        | $T_A = 25^\circ C$                                           |            |                  | $10^{12}$  |     |          | $10^{12}$  |     | $\Omega$         |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICRmin}, V_O = 0, R_S = 50 \Omega$              | 25°C       | 80               | 86         |     | 80       | 86         |     | dB               |
| $k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{CC\pm}/\Delta V_{IO}$ ) | $V_{CC} = \pm 9$ V to $\pm 15$ V, $V_O = 0, R_S = 50 \Omega$ | 25°C       | 80               | 86         |     | 80       | 86         |     | dB               |
| $I_{CC}$ Supply current (each amplifier)                                      | $V_O = 0, \text{No load}$                                    | 25°C       |                  | 1.4        | 2.5 |          | 1.4        | 2.5 | mA               |
| $V_{O1}/V_{O2}$ Crosstalk attenuation                                         | $A_{VD} = 100$                                               | 25°C       |                  | 120        |     |          | 120        |     | dB               |

† Input bias currents of an FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive, as shown in Figure 4. Pulse techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

‡ All characteristics are measured under open-loop conditions with zero common-mode voltage, unless otherwise specified. Full range is  $T_A = -55^\circ C$  to  $125^\circ C$ .

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operating characteristics,  $V_{CC\pm} = \pm 15\text{ V}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER                            | TEST CONDITIONS                                                                                                                          | TL07xM                              |     |     | ALL OTHERS |     |     | UNIT                         |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----|-----|------------|-----|-----|------------------------------|
|                                      |                                                                                                                                          | MIN                                 | TYP | MAX | MIN        | TYP | MAX |                              |
| SR Slew rate at unity gain           | $V_I = 10\text{ V}$ ,<br>$C_L = 100\text{ pF}$ ,<br>$R_L = 2\text{ k}\Omega$ ,<br>See Figure 1                                           | 5                                   | 13  |     | 8          | 13  |     | $\text{V}/\mu\text{s}$       |
| $t_r$ Rise-time overshoot factor     | $V_I = 20\text{ mV}$ ,<br>$C_L = 100\text{ pF}$ ,<br>$R_L = 2\text{ k}\Omega$ ,<br>See Figure 1                                          | 0.1                                 |     |     | 0.1        |     |     | $\mu\text{s}$                |
|                                      |                                                                                                                                          | 20%                                 |     |     | 20%        |     |     |                              |
| $V_n$ Equivalent input noise voltage | $R_S = 20\text{ }\Omega$                                                                                                                 | $f = 1\text{ kHz}$                  |     |     | 18         |     |     | $\text{nV}/\sqrt{\text{Hz}}$ |
|                                      |                                                                                                                                          | $f = 10\text{ Hz to }10\text{ kHz}$ |     |     | 4          |     |     | $\mu\text{V}$                |
| $I_n$ Equivalent input noise current | $R_S = 20\text{ }\Omega$ ,<br>$f = 1\text{ kHz}$                                                                                         | 0.01                                |     |     | 0.01       |     |     | $\text{pA}/\sqrt{\text{Hz}}$ |
| THD Total harmonic distortion        | $V_{I\text{rms}} = 6\text{ V}$ ,<br>$R_L \geq 2\text{ k}\Omega$ ,<br>$f = 1\text{ kHz}$<br>$A_{VD} = 1$ ,<br>$R_S \leq 1\text{ k}\Omega$ | 0.003 %                             |     |     | 0.003%     |     |     |                              |

### PARAMETER MEASUREMENT INFORMATION

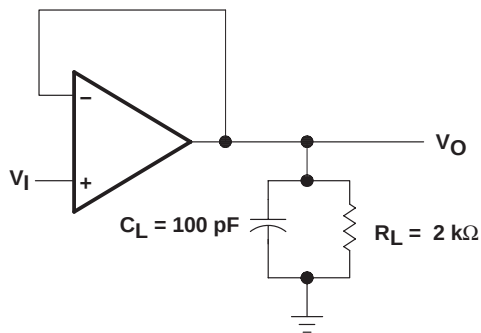


Figure 1. Unity-Gain Amplifier

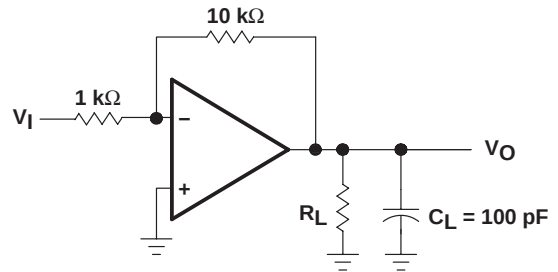


Figure 2. Gain-of-10 Inverting Amplifier

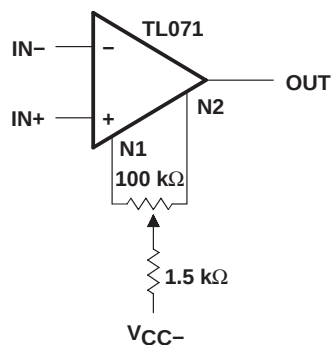


Figure 3. Input Offset-Voltage Null Circuit

**TL071, TL071A, TL071B, TL072  
TL072A, TL072B, TL074, TL074A, TL074B  
LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

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**TYPICAL CHARACTERISTICS**

**Table of Graphs**

|          |                                                 |                         | FIGURE  |
|----------|-------------------------------------------------|-------------------------|---------|
| $I_{IB}$ | Input bias current                              | vs Free-air temperature | 4       |
| $V_{OM}$ | Maximum output voltage                          | vs Frequency            | 5, 6, 7 |
|          |                                                 | vs Free-air temperature | 8       |
|          |                                                 | vs Load resistance      | 9       |
|          |                                                 | vs Supply voltage       | 10      |
| $A_{VD}$ | Large-signal differential voltage amplification | vs Free-air temperature | 11      |
|          |                                                 | vs Frequency            | 12      |
|          | Phase shift                                     | vs Frequency            | 12      |
|          | Normalized unity-gain bandwidth                 | vs Free-air temperature | 13      |
|          | Normalized phase shift                          | vs Free-air temperature | 13      |
| CMRR     | Common-mode rejection ratio                     | vs Free-air temperature | 14      |
| $I_{CC}$ | Supply current                                  | vs Supply voltage       | 15      |
|          |                                                 | vs Free-air temperature | 16      |
| $P_D$    | Total power dissipation                         | vs Free-air temperature | 17      |
|          | Normalized slew rate                            | vs Free-air temperature | 18      |
| $V_n$    | Equivalent input noise voltage                  | vs Frequency            | 19      |
| THD      | Total harmonic distortion                       | vs Frequency            | 20      |
|          | Large-signal pulse response                     | vs Time                 | 21      |
| $V_O$    | Output voltage                                  | vs Elapsed time         | 22      |

TL071, TL071A, TL071B, TL072  
TL072A, TL072B, TL074, TL074A, TL074B  
**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

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**TYPICAL CHARACTERISTICS†**

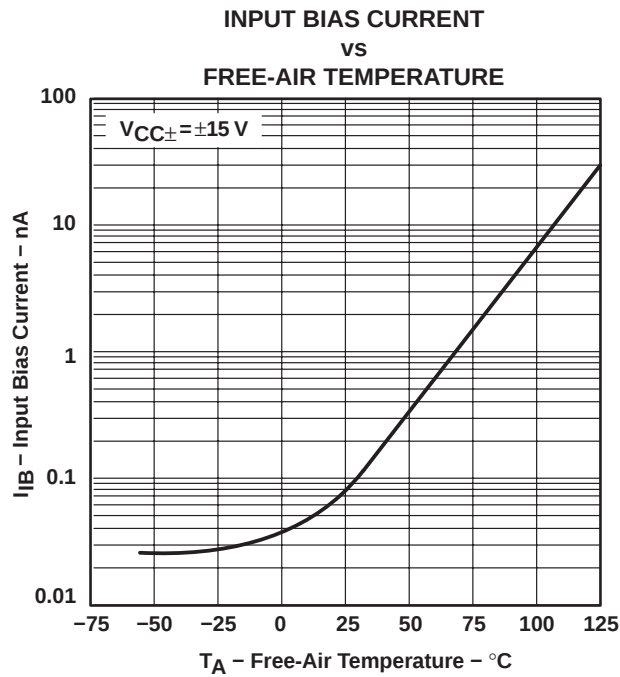


Figure 4

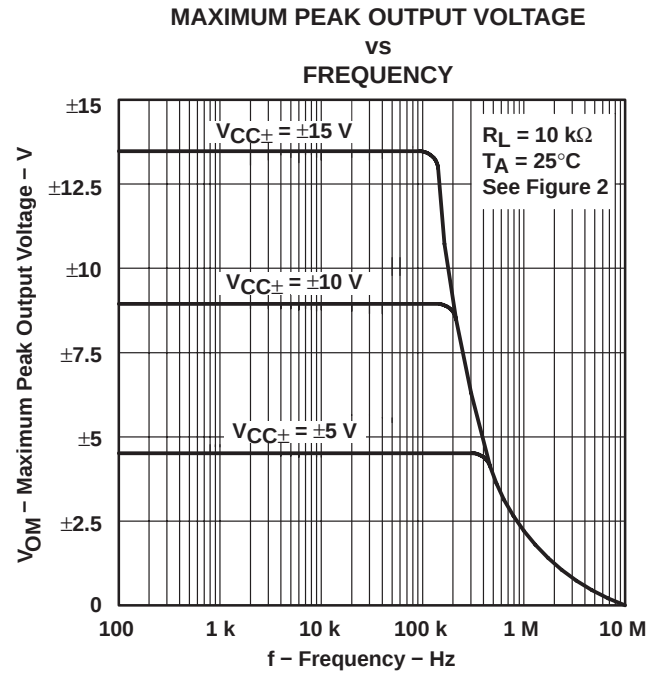


Figure 5

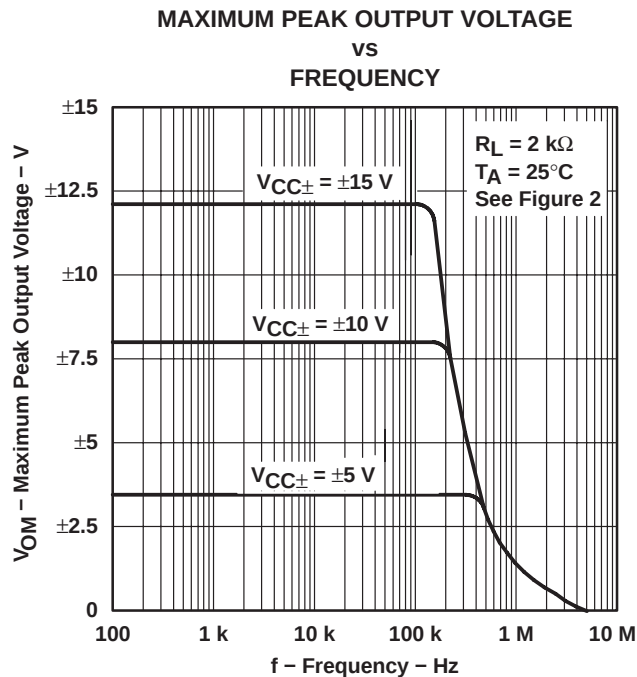


Figure 6

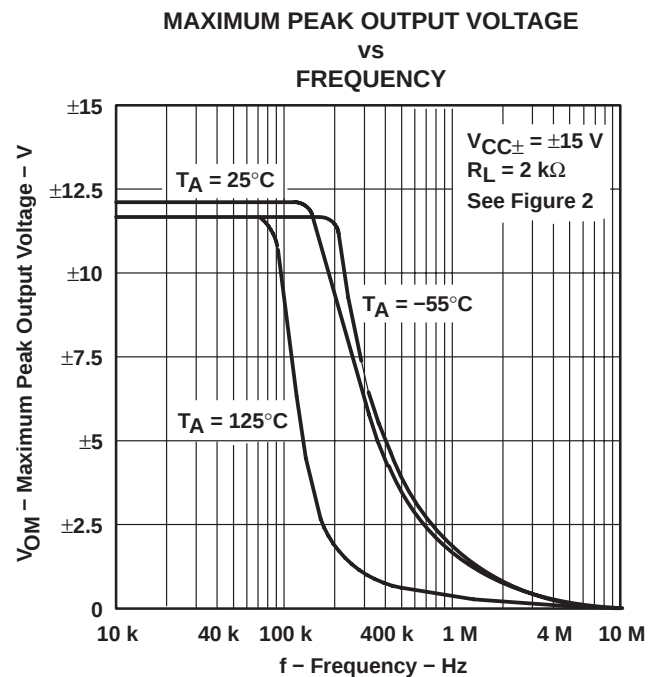


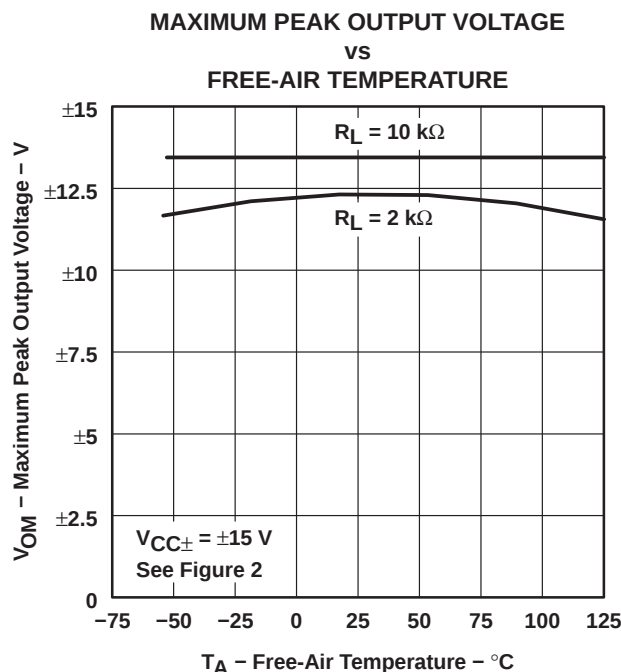
Figure 7

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

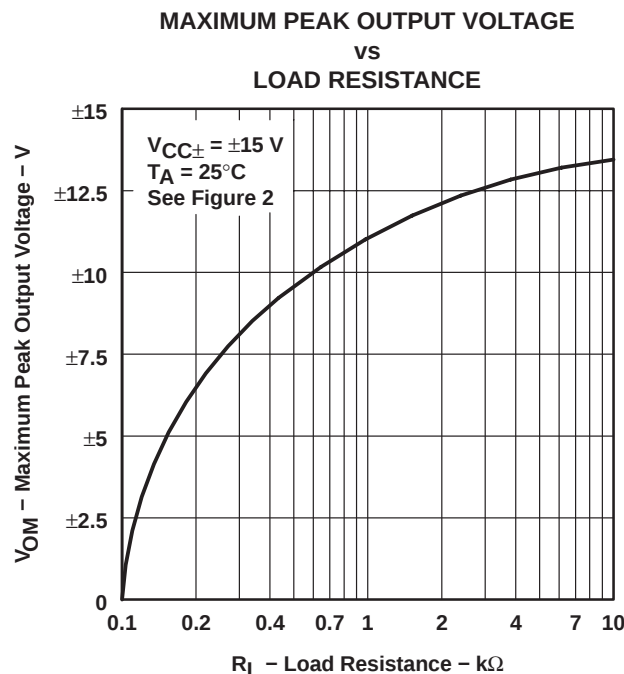
**TL071, TL071A, TL071B, TL072  
TL072A, TL072B, TL074, TL074A, TL074B  
LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

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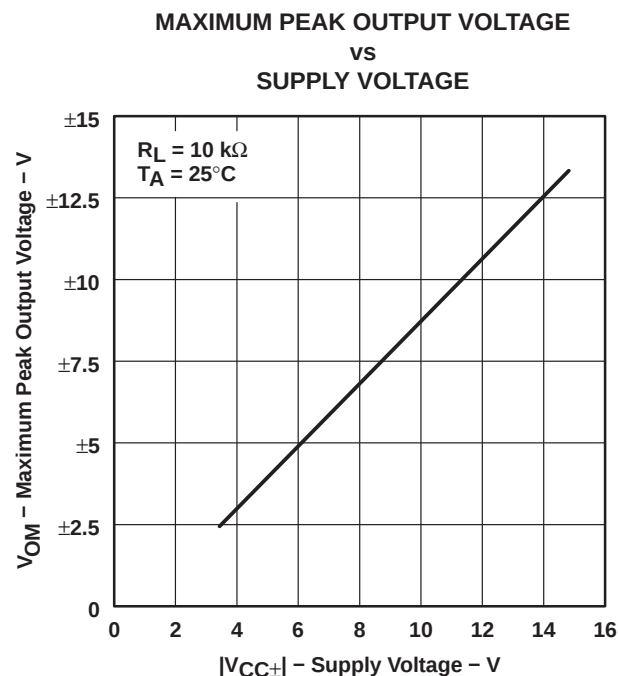
**TYPICAL CHARACTERISTICS†**



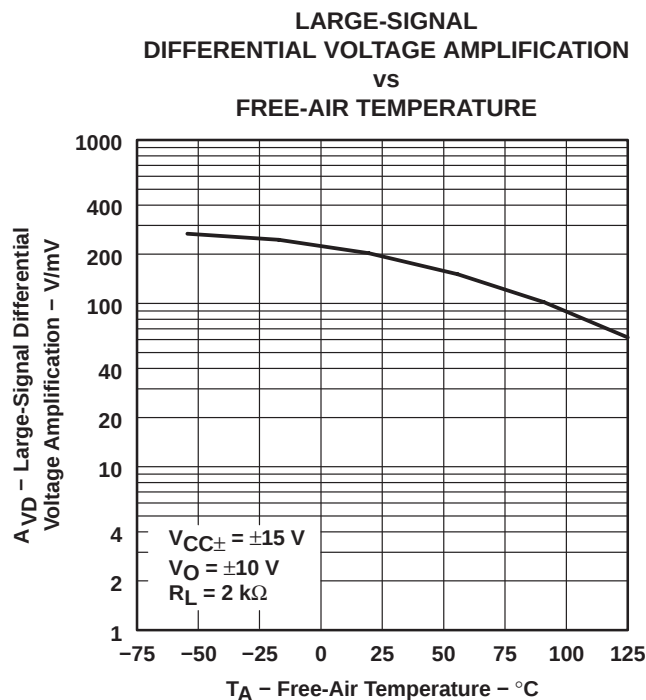
**Figure 8**



**Figure 9**



**Figure 10**



**Figure 11**

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

TYPICAL CHARACTERISTICS†

LARGE-SIGNAL  
DIFFERENTIAL VOLTAGE AMPLIFICATION  
AND PHASE SHIFT  
VS  
FREQUENCY

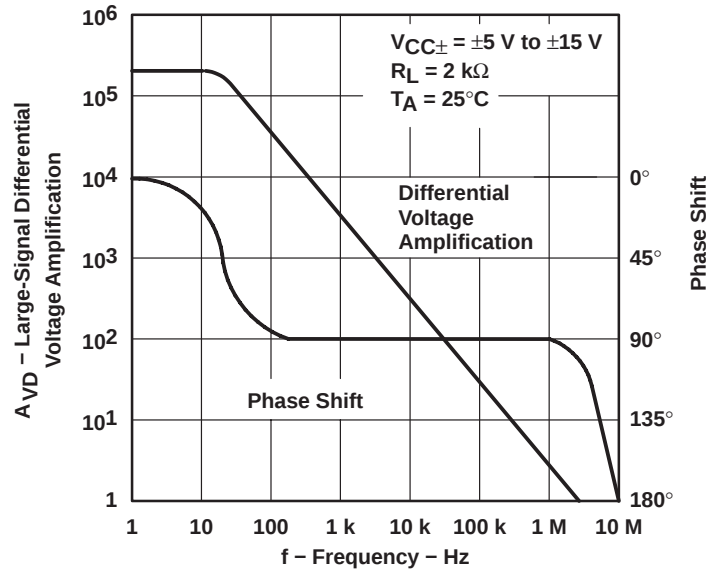


Figure 12

NORMALIZED UNITY-GAIN BANDWIDTH  
AND PHASE SHIFT  
VS  
FREE-AIR TEMPERATURE

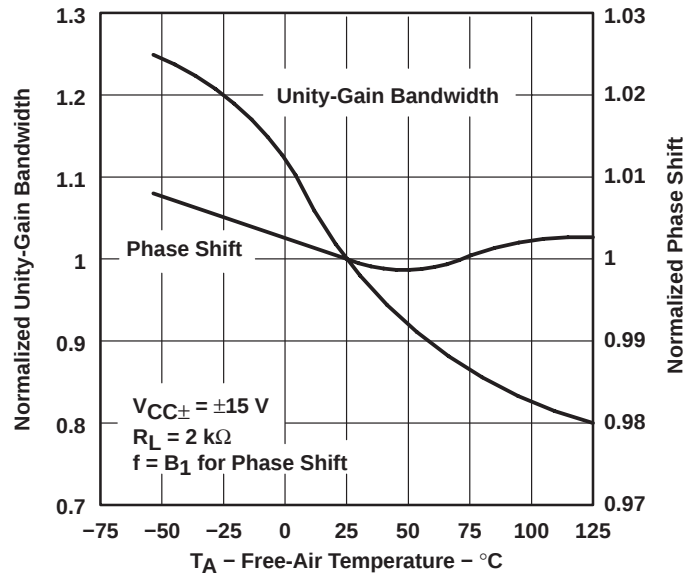


Figure 13

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

# TL071, TL071A, TL071B, TL072 TL072A, TL072B, TL074, TL074A, TL074B LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS†

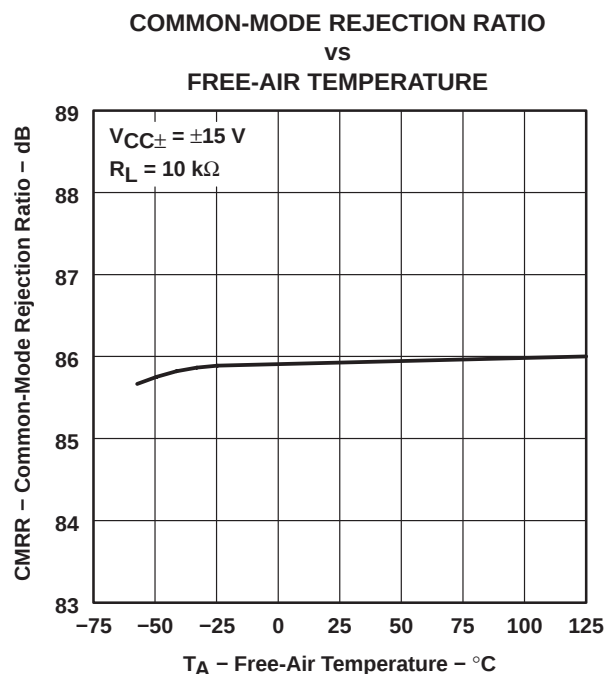


Figure 14

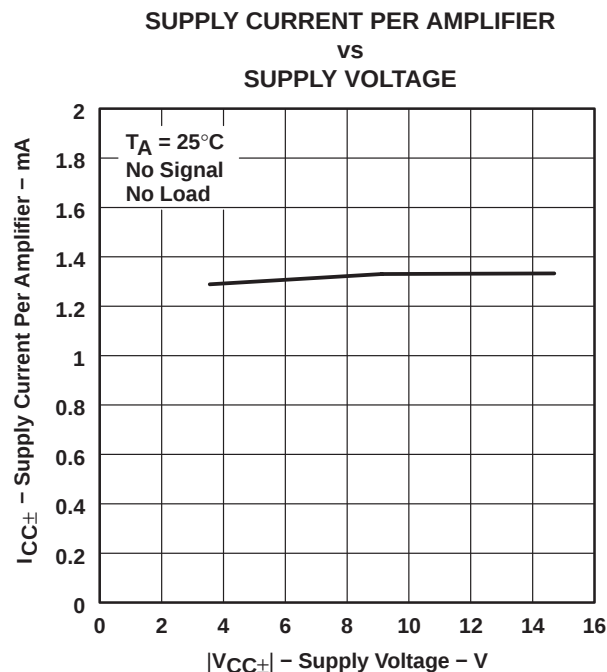


Figure 15

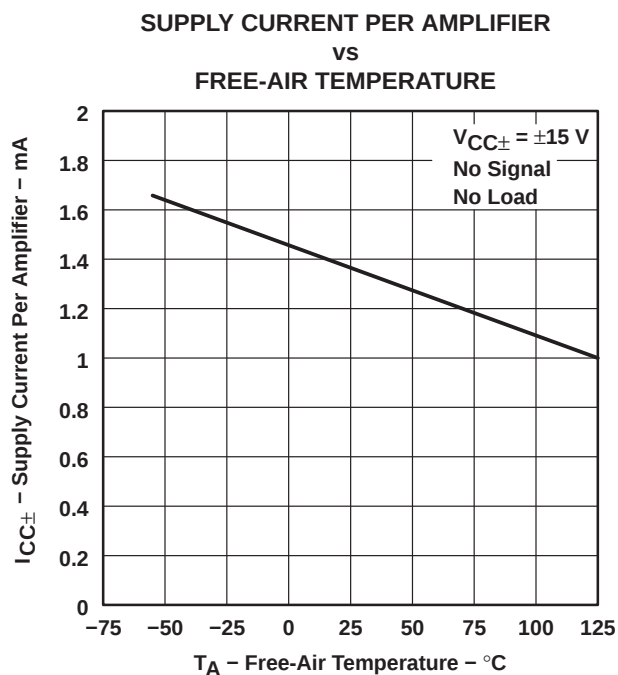


Figure 16

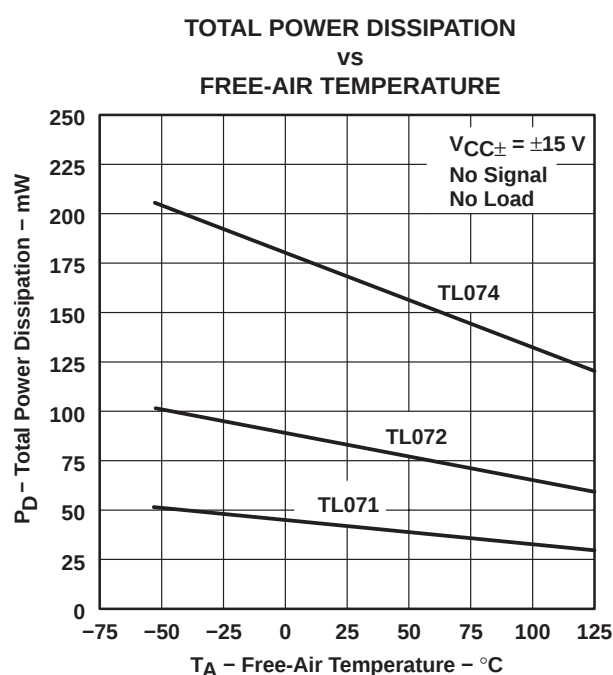


Figure 17

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

## TYPICAL CHARACTERISTICS

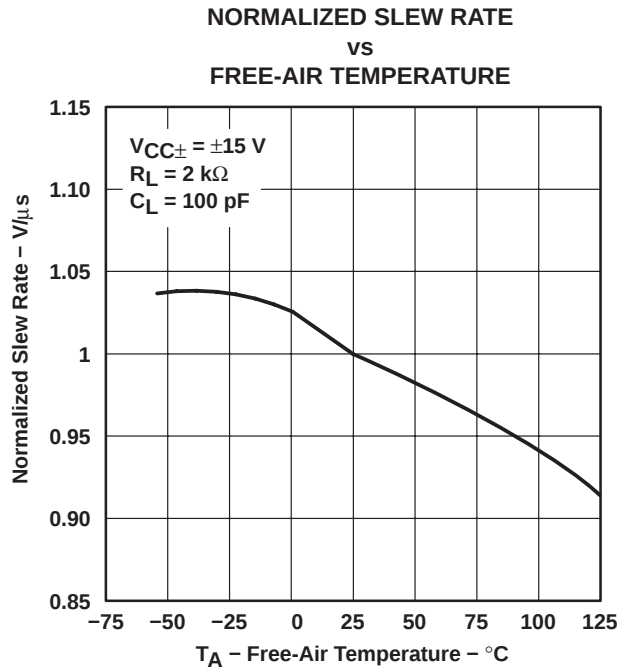


Figure 18

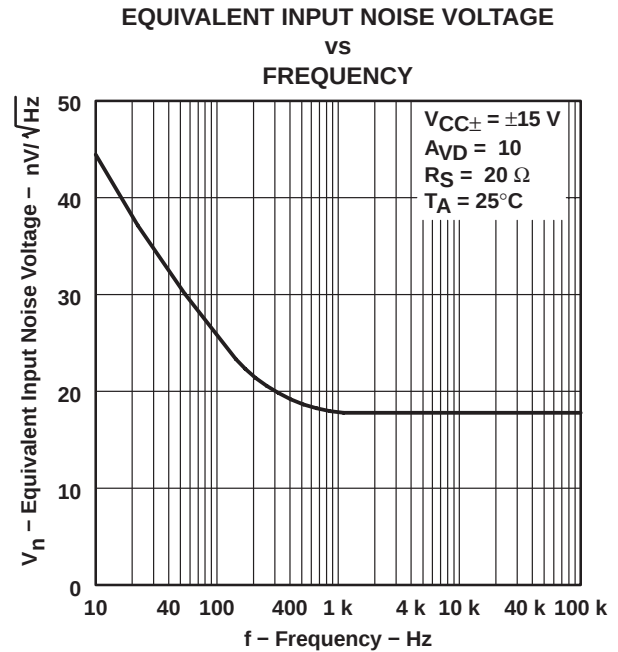


Figure 19

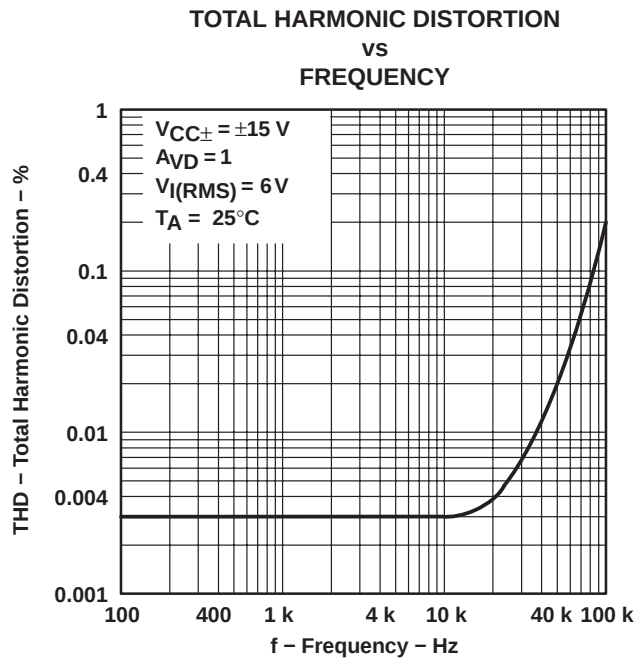


Figure 20

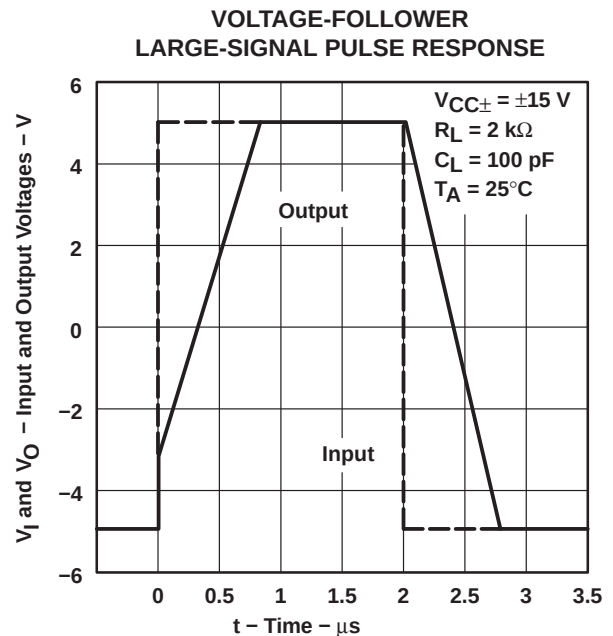


Figure 21

## TYPICAL CHARACTERISTICS

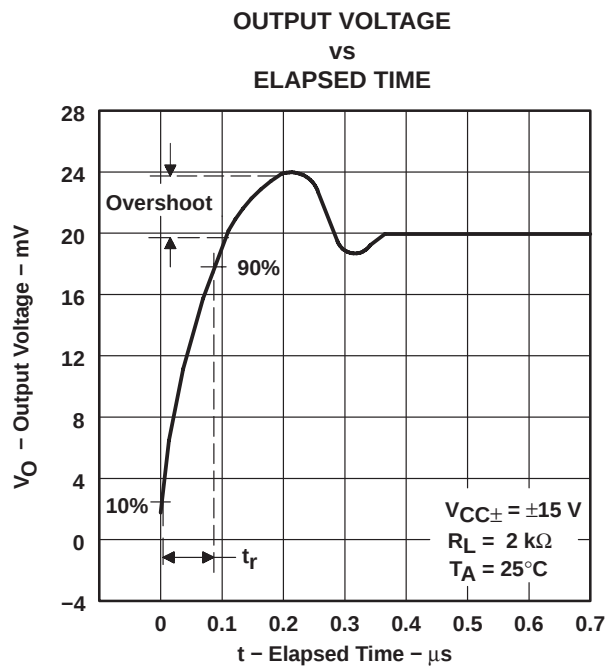
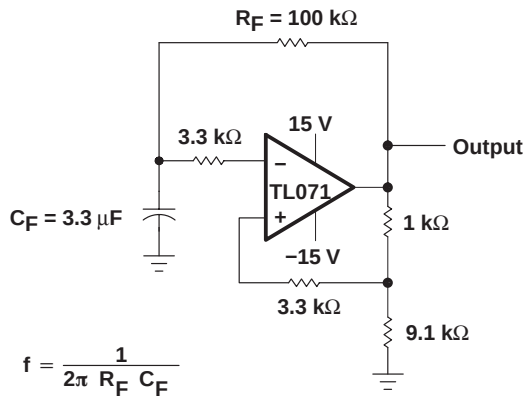


Figure 22

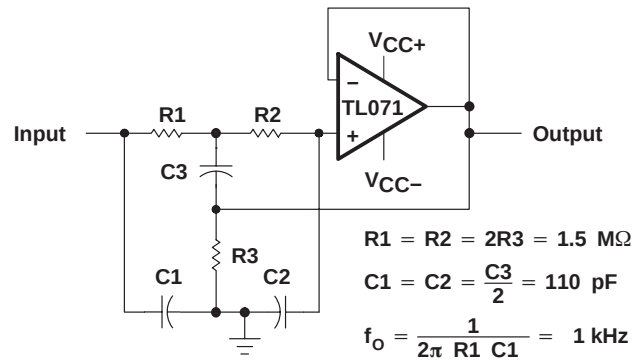
## APPLICATION INFORMATION

**Table of Application Diagrams**

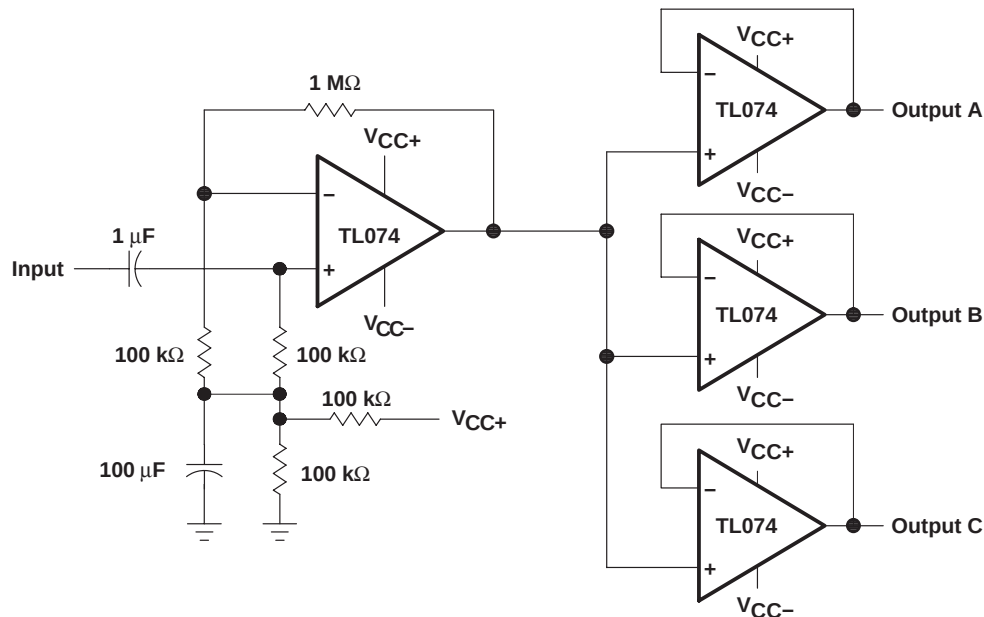
| APPLICATION DIAGRAM           | PART NUMBER | FIGURE |
|-------------------------------|-------------|--------|
| 0.5-Hz square-wave oscillator | TL071       | 23     |
| High-Q notch filter           | TL071       | 24     |
| Audio-distribution amplifier  | TL074       | 25     |
| 100-kHz quadrature oscillator | TL072       | 26     |
| AC amplifier                  | TL071       | 27     |



**Figure 23. 0.5-Hz Square-Wave Oscillator**



**Figure 24. High-Q Notch Filter**

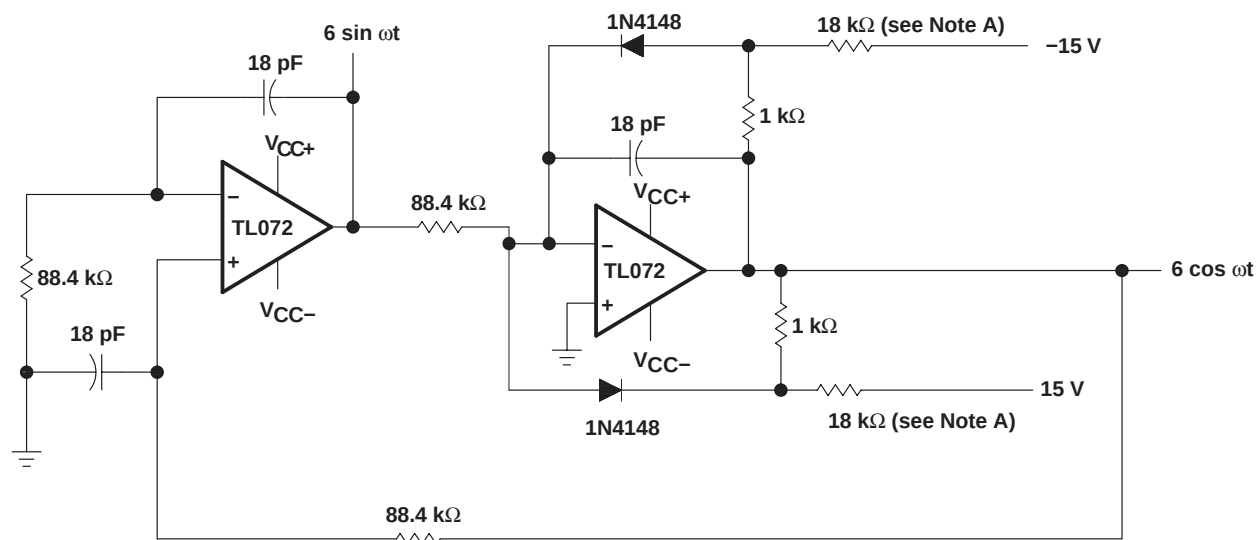


**Figure 25. Audio-Distribution Amplifier**

**TL071, TL071A, TL071B, TL072**  
**TL072A, TL072B, TL074, TL074A, TL074B**  
**LOW-NOISE JFET-INPUT OPERATIONAL AMPLIFIERS**

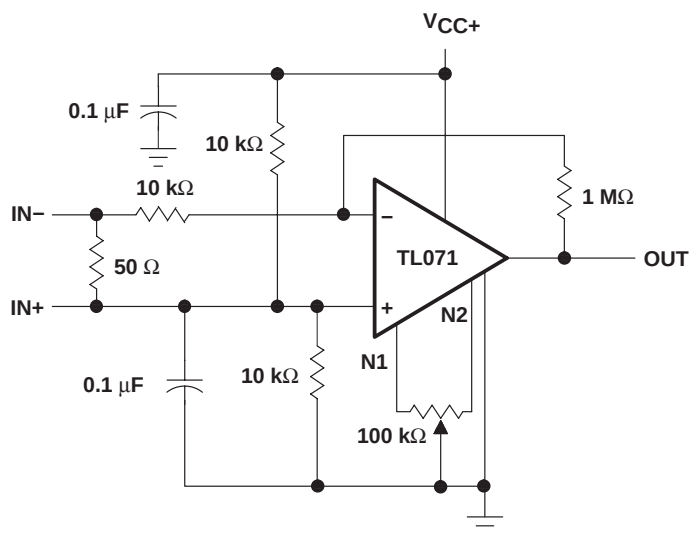
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**APPLICATION INFORMATION**



NOTE A: These resistor values may be adjusted for a symmetrical output.

**Figure 26. 100-kHz Quadrature Oscillator**



**Figure 27. AC Amplifier**

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 8102304HA        | OBSOLETE              |              |                 | 10   |             | TBD                     | Call TI          | Call TI                      |
| 81023052A        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | Level-NC-NC-NC               |
| 8102305HA        | ACTIVE                | CFP          | U               | 10   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| 8102305PA        | ACTIVE                | CDIP         | JG              | 8    | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| 81023062A        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | Level-NC-NC-NC               |
| 8102306CA        | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| 8102306DA        | ACTIVE                | CFP          | W               | 14   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| JM38510/11905BPA | ACTIVE                | CDIP         | JG              | 8    | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| JM38510/11906BCA | OBSOLETE              | CDIP         | J               | 14   |             | TBD                     | Call TI          | Call TI                      |
| TL071ACD         | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071ACDE4       | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071ACDR        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071ACDRE4      | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071ACP         | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL071ACPE4       | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL071BCD         | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071BCDE4       | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071BCDR        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071BCDRE4      | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071BCP         | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL071BCPE4       | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL071CD          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071CDE4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071CDR         | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071CDRE4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071CP          | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL071CPE4        | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL071CPSR        | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071CPSRE4      | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| no Sb/Br)        |                       |              |                 |      |             |                         |                  |                              |
| TL071CPWLE       | OBSOLETE              | TSSOP        | PW              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL071ID          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071IDE4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071IDR         | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071IDRE4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL071IJG         | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL071IP          | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL071IPE4        | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL071MFKB        | OBSOLETE              | LCCC         | FK              | 20   |             | TBD                     | Call TI          | Call TI                      |
| TL071MJG         | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL071MJGB        | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL072ACD         | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072ACDE4       | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072ACDR        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072ACDRE4      | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072ACJG        | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL072ACP         | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL072ACPE4       | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL072ACPSR       | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL072ACPSRE4     | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL072BCD         | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL072BCDE4       | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL072BCDR        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL072BCDRE4      | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL072BCP         | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL072BCPE4       | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL072CD          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072CDE4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| no Sb/Br)        |                       |              |                 |      |             |                         |                  |                              |
| TL072CDG4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072CDR         | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072CDRE4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072CDRG4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072CP          | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL072CPE4        | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL072CPSLE       | OBSOLETE              | SO           | PS              | 8    |             | TBD                     | Call TI          | Call TI                      |
| TL072CPSR        | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL072CPSRE4      | ACTIVE                | SO           | PS              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL072CPWR        | ACTIVE                | TSSOP        | PW              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL072CPWRE4      | ACTIVE                | TSSOP        | PW              | 8    | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL072ID          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072IDE4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072IDG4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072IDR         | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072IDRE4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072IDRG4       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| TL072IP          | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL072IPE4        | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL072MFKB        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | Level-NC-NC-NC               |
| TL072MJG         | ACTIVE                | CDIP         | JG              | 8    | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| TL072MJGB        | ACTIVE                | CDIP         | JG              | 8    | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| TL072MUB         | ACTIVE                | CFP          | U               | 10   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| TL074ACD         | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074ACDE4       | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074ACDR        | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074ACDRE4      | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TL074ACJ         | OBSOLETE              | CDIP         | J               | 14   |             | TBD                     | Call TI          | Call TI                      |
| TL074ACN         | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL074ACNE4       | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL074ACNSR       | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074ACNSRE4     | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074BCD         | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074BCDE4       | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074BCDR        | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074BCDRE4      | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074BCN         | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL074BCNE4       | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL074BCNSR       | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074BCNSRE4     | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074CD          | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074CDE4        | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074CDR         | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074CDRE4       | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074CN          | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL074CNSR        | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074CNSRE4      | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074CPW         | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074CPWE4       | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074CPWLE       | OBSOLETE              | TSSOP        | PW              | 14   |             | TBD                     | Call TI          | Call TI                      |
| TL074CPWR        | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074CPWRE4      | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074ID          | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074IDE4        | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| no Sb/Br)        |                       |              |                 |      |             |                         |                  |                              |
| TL074IDR         | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074IDRE4       | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TL074IJ          | OBSOLETE              | CDIP         | J               | 14   |             | TBD                     | Call TI          | Call TI                      |
| TL074IN          | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL074INE4        | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| TL074MFK         | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | Level-NC-NC-NC               |
| TL074MFKB        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | Level-NC-NC-NC               |
| TL074MJ          | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| TL074MJB         | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |
| TL074MWB         | ACTIVE                | CFP          | W               | 14   | 1           | TBD                     | A42 SNPB         | Level-NC-NC-NC               |

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

**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)

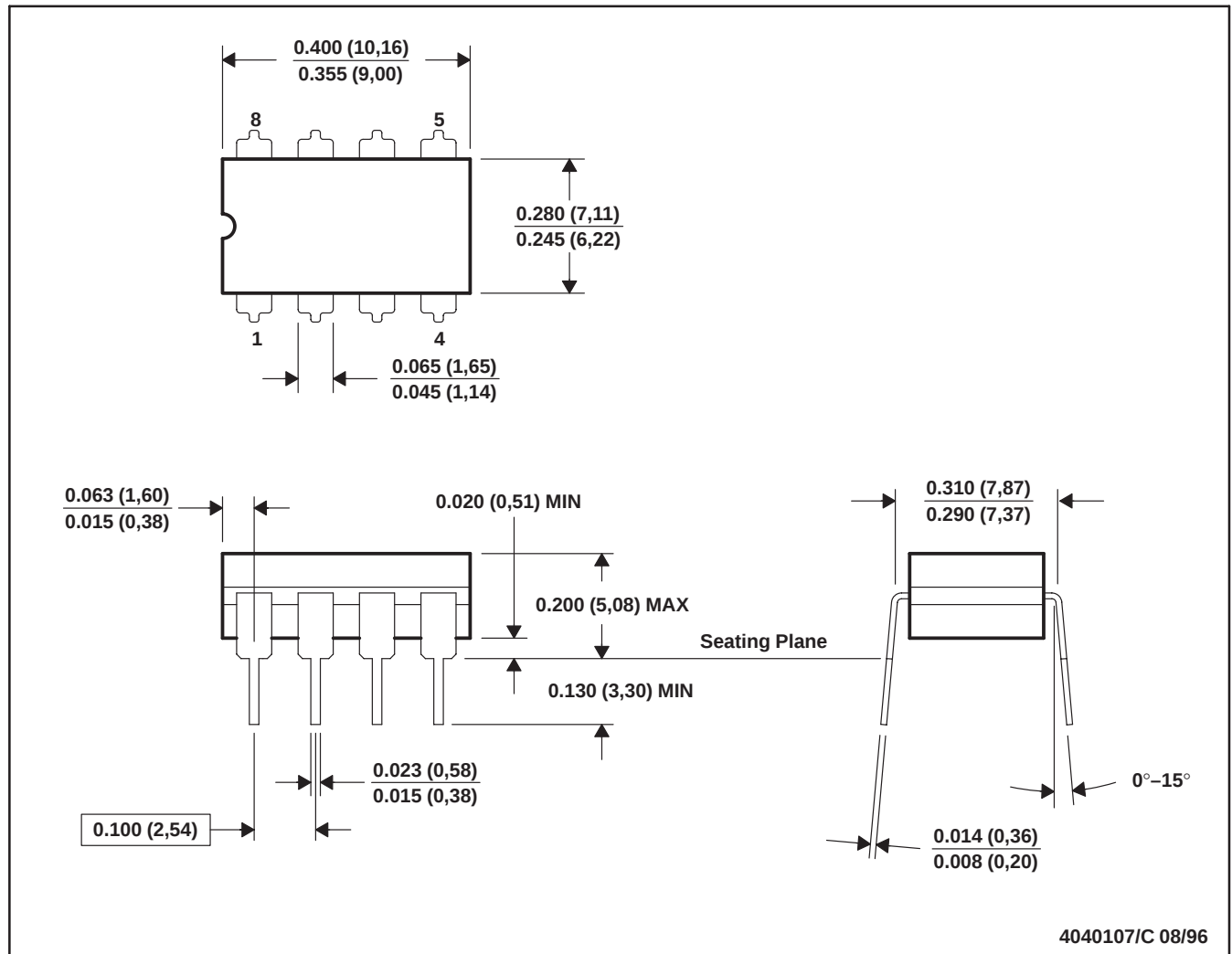
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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## JG (R-GDIP-T8)

## CERAMIC DUAL-IN-LINE



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

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

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



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

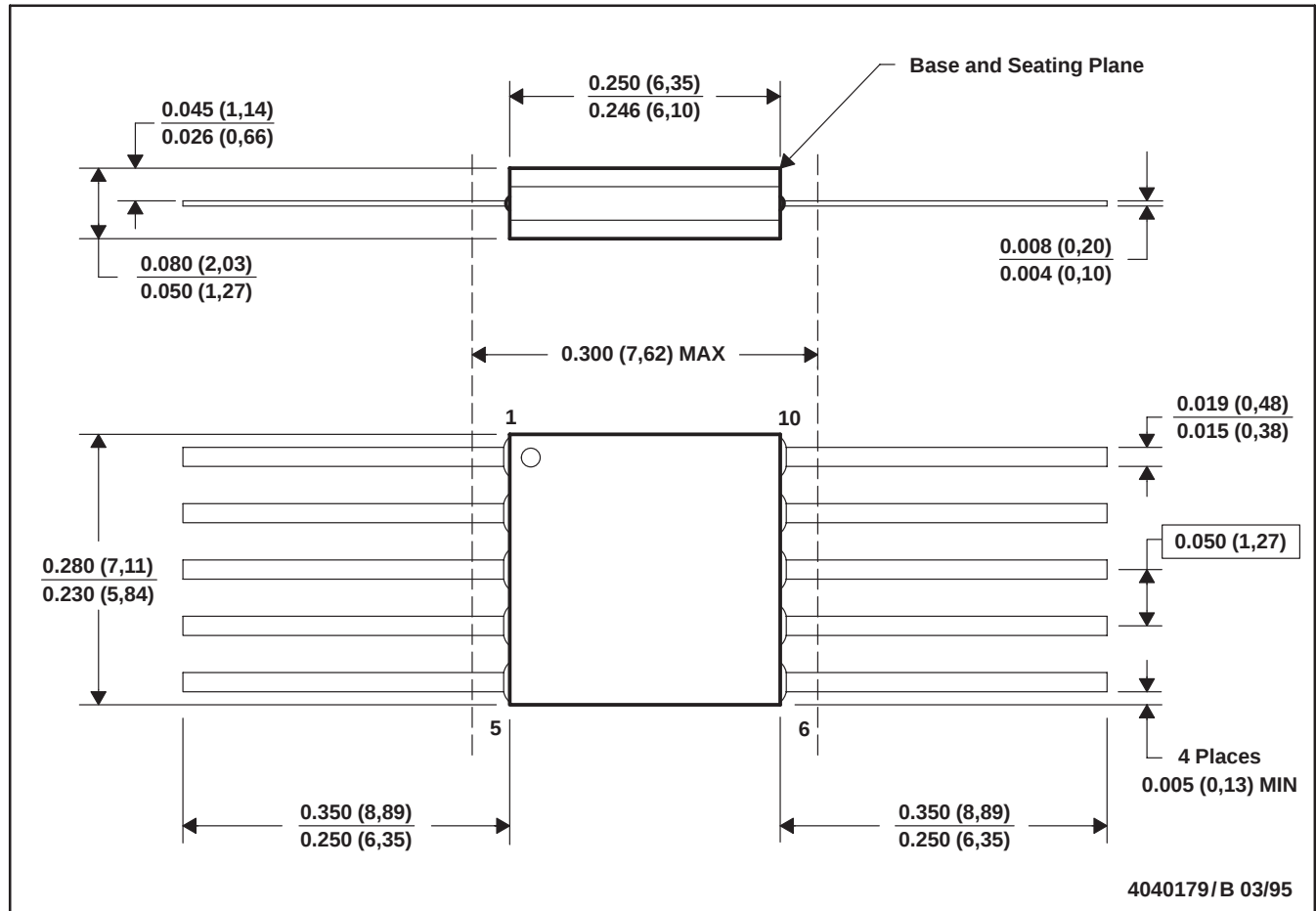


4040083/F 03/03

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

## U (S-GDFP-F10)

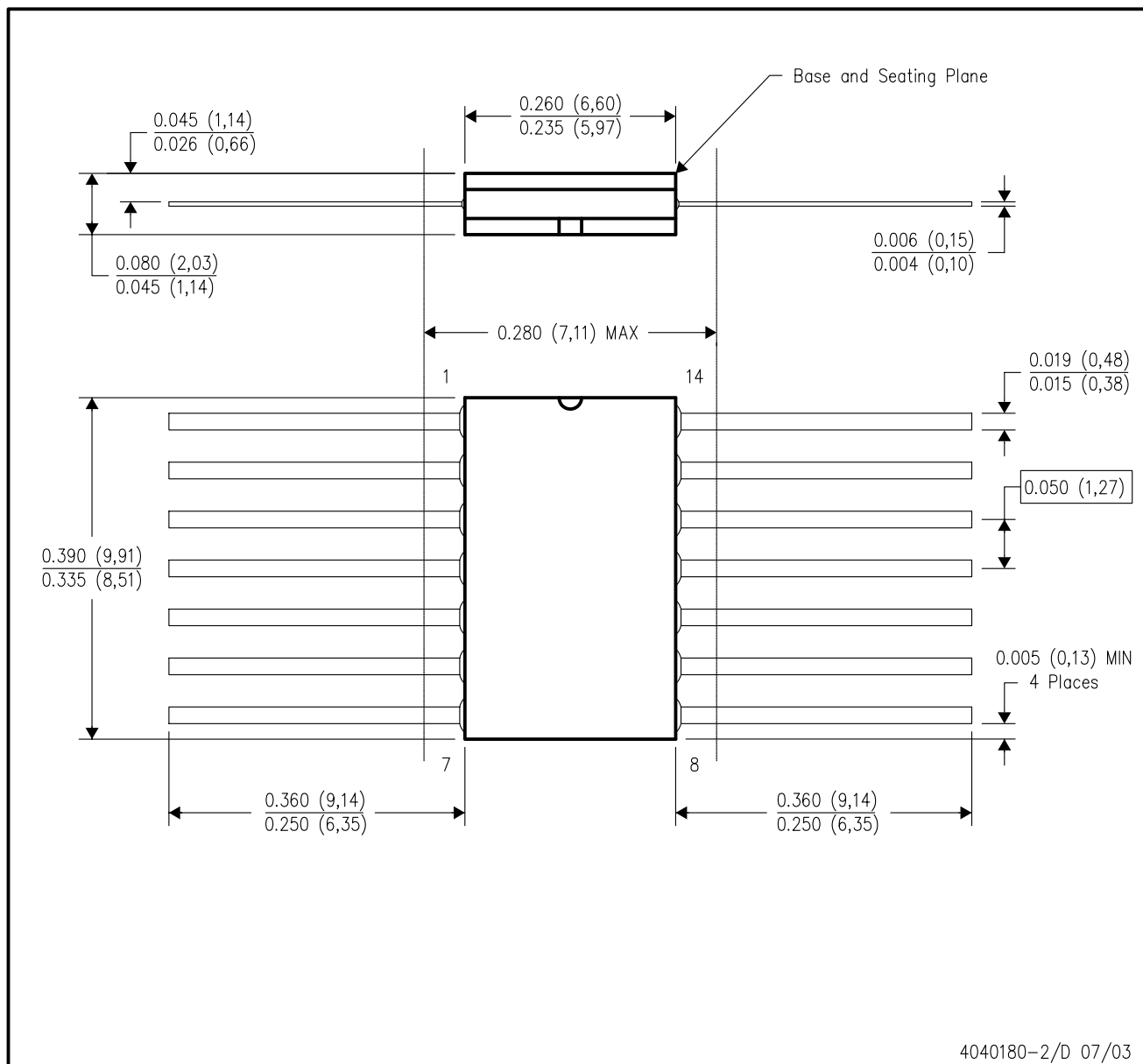
## CERAMIC DUAL FLATPACK



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

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK

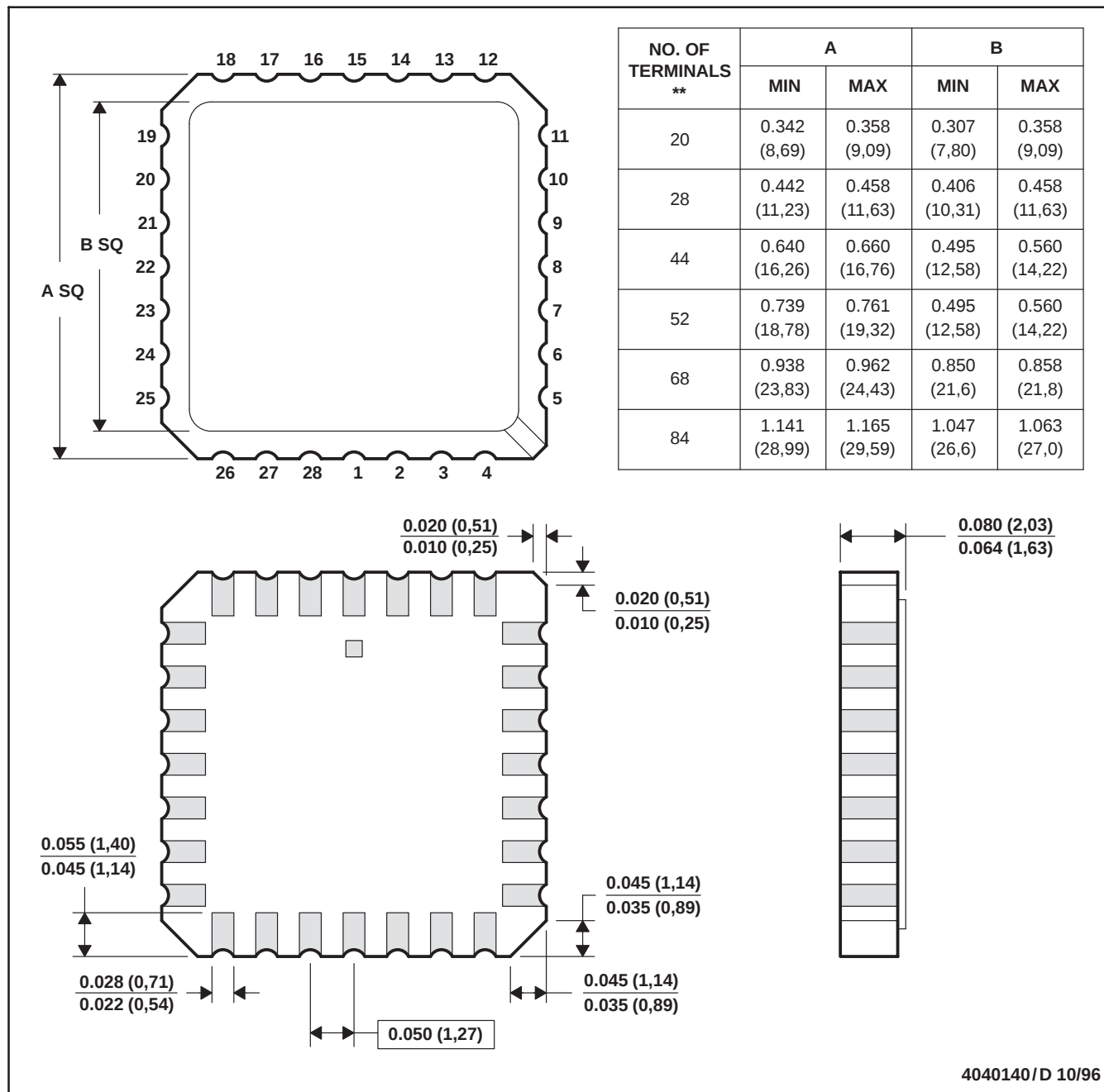


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within MIL STD 1835 GDFP1-F14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

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

LEADLESS CERAMIC CHIP CARRIER

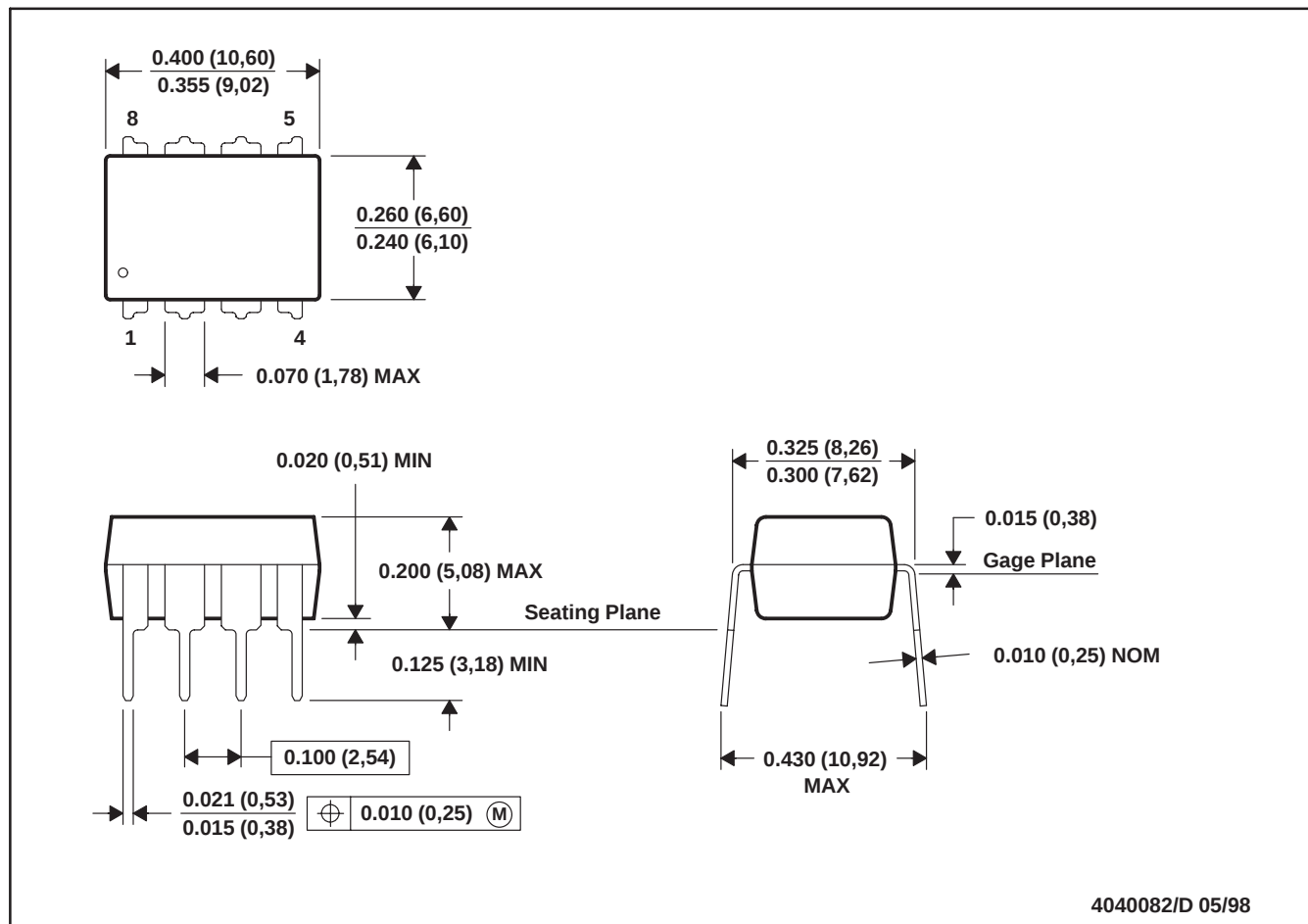
28 TERMINAL SHOWN



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

## P (R-PDIP-T8)

## PLASTIC DUAL-IN-LINE



- 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](http://www.ti.com/sc/docs/package/pkg_info.htm)



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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



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



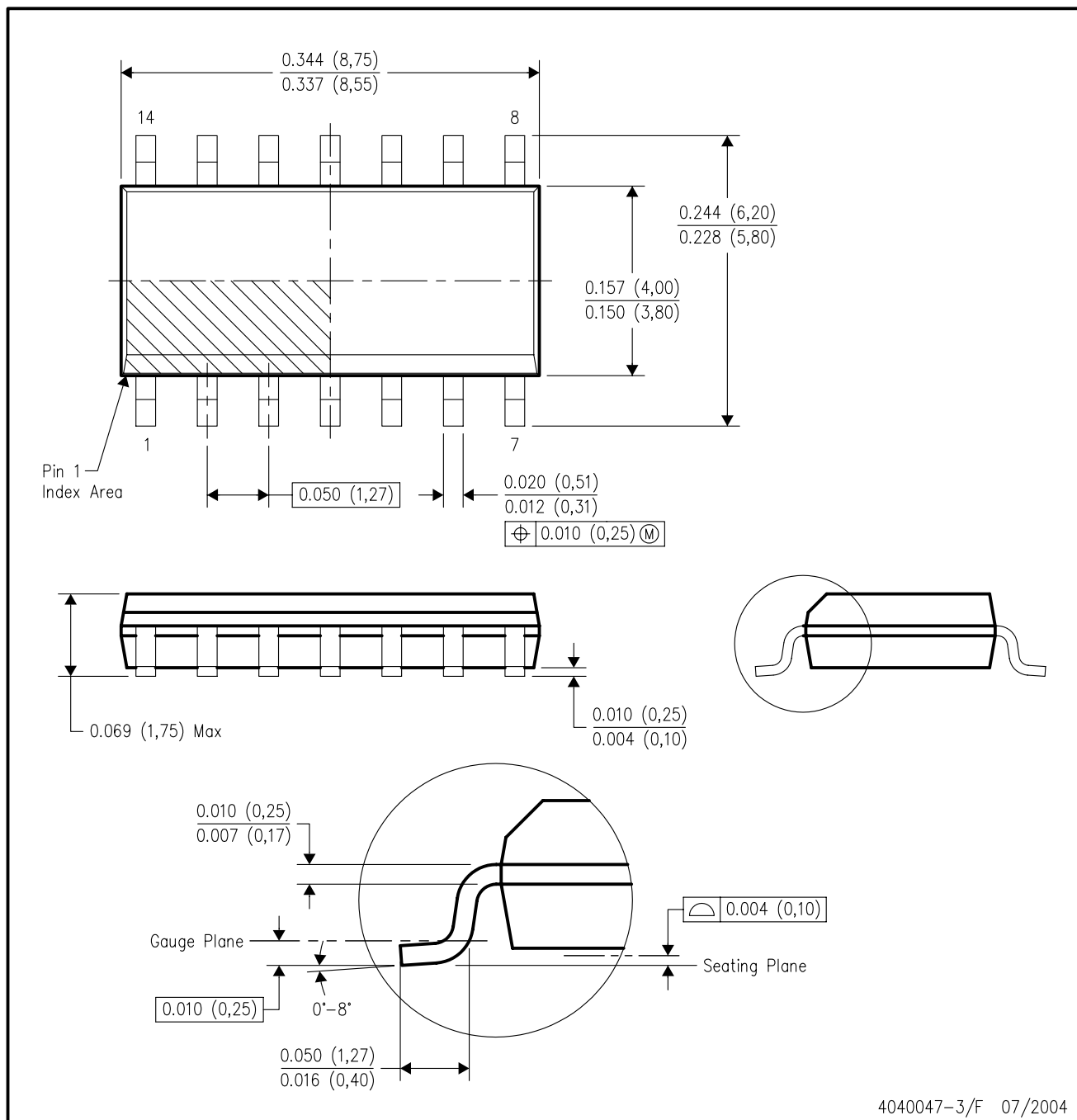
4040049/E 12/2002

NOTES:

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

## D (R-PDSO-G14)

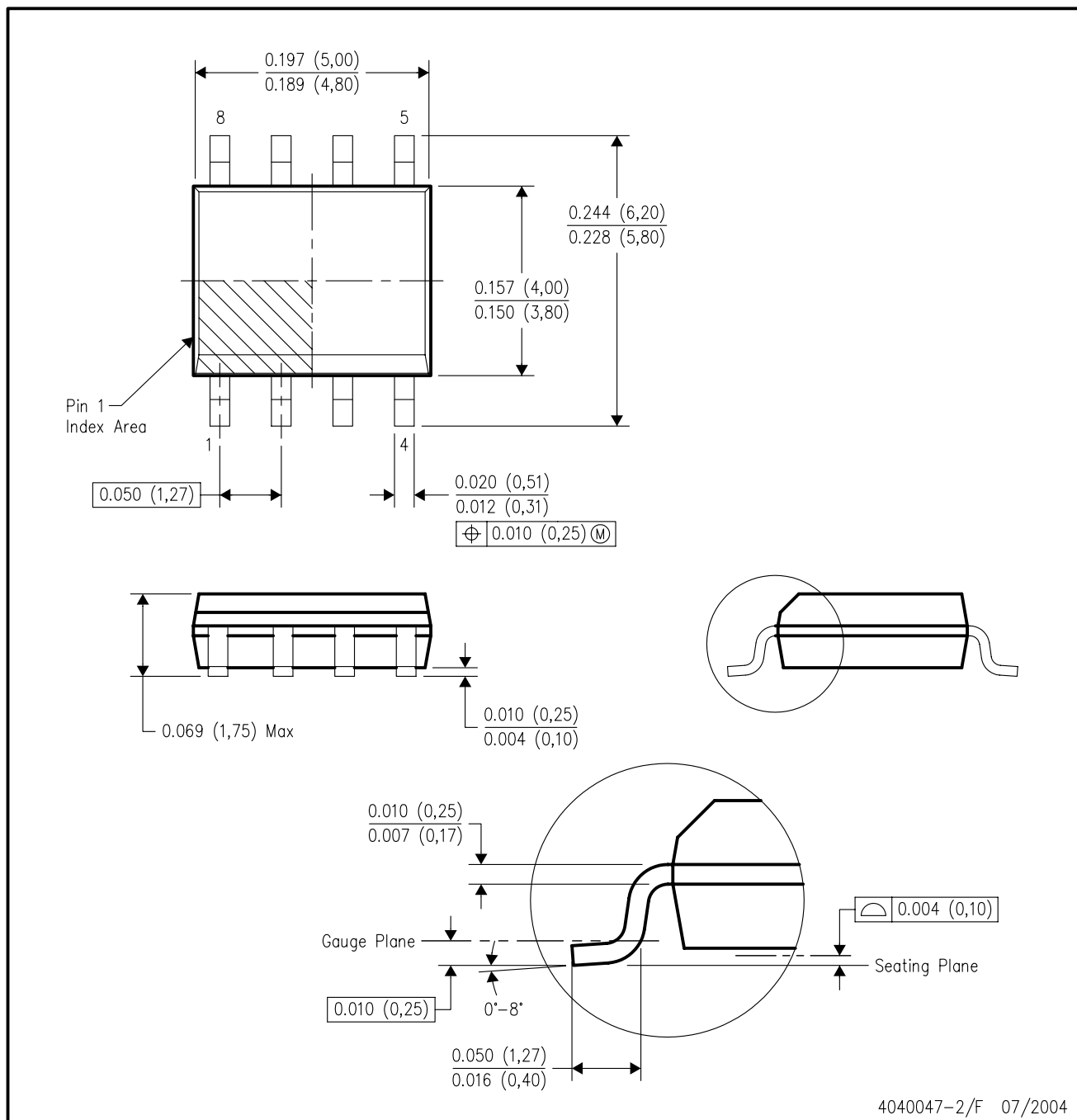
## PLASTIC SMALL-OUTLINE PACKAGE



4040047-3/F 07/2004

## D (R-PDSO-G8)

## PLASTIC SMALL-OUTLINE PACKAGE

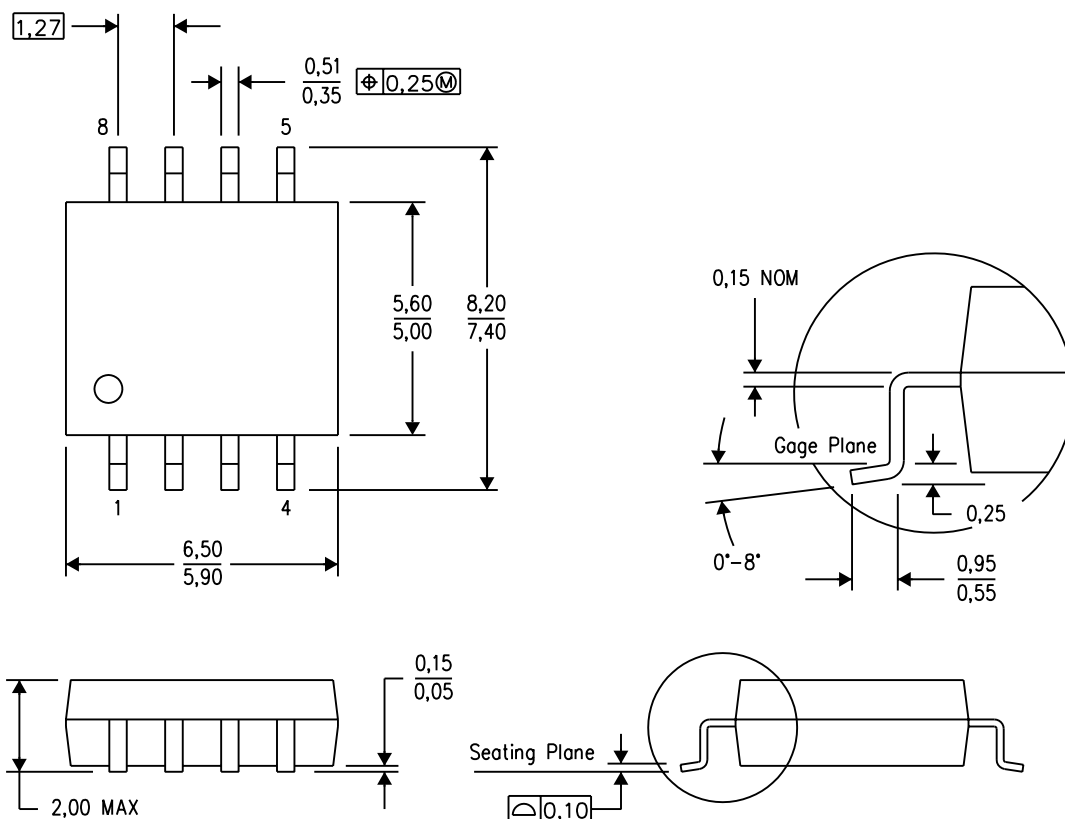


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-012 variation AA.

## MECHANICAL DATA

PS (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



4040063/C 03/03

- 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.

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

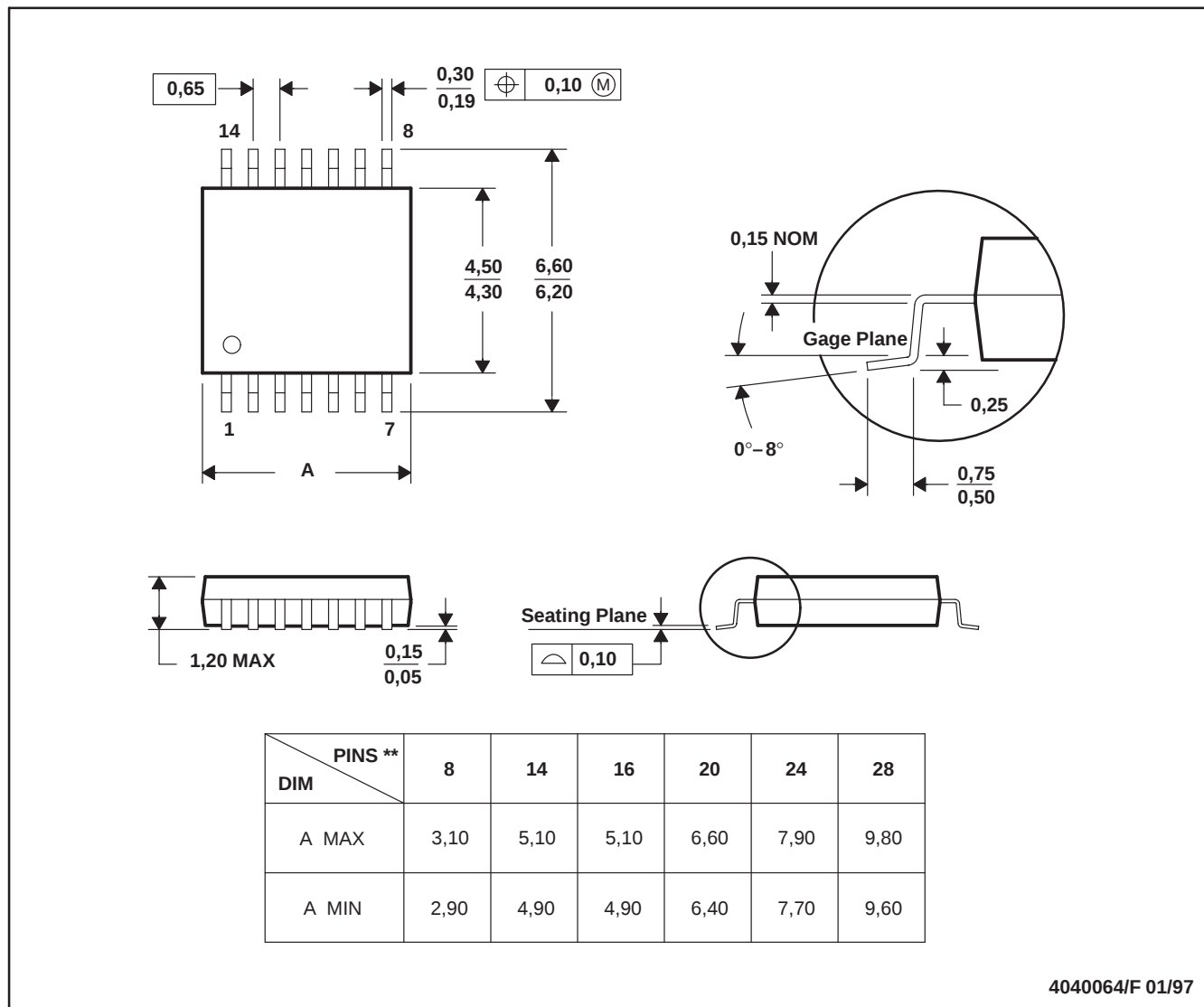


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

## PW (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



- 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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