

## TL06xx Low-Power JFET-Input Operational Amplifiers

Check for Samples: [TL061](#), [TL061A](#), [TL061B](#), [TL062](#), [TL062A](#), [TL062B](#), [TL064](#), [TL064A](#), [TL064B](#)

### FEATURES

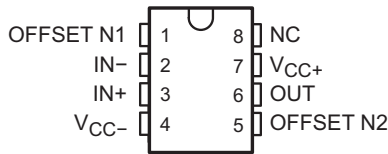
- Very Low Power Consumption
- Typical Supply Current: 200  $\mu$ A (Per Amplifier)
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Common-Mode Input Voltage Range Includes  $V_{CC+}$
- Output Short-Circuit Protection
- High Input Impedance: JFET-Input Stage
- Internal Frequency Compensation
- Latch-Up-Free Operation
- High Slew Rate: 3.5 V/ $\mu$ s Typ
- 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.

### DESCRIPTION

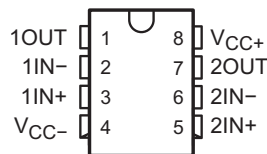
The JFET-input operational amplifiers of the TL06x series are designed as low-power versions of the TL08x series amplifiers. They feature high input impedance, wide bandwidth, high slew rate, and low input offset and input bias currents. The TL06x series features the same terminal assignments as the TL07x and TL08x series. Each of these JFET-input operational amplifiers incorporates well-matched, high-voltage JFET and bipolar transistors in an integrated circuit.

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, and the M-suffix devices are characterized for operation over the full military temperature range of –55°C to 125°C.

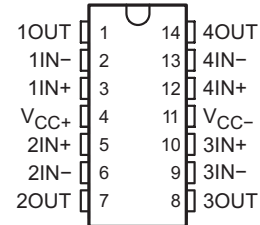
TL061, TL061A ... D, P, OR PS PACKAGE  
TL061B ... P PACKAGE  
(TOP VIEW)



TL062 ... D, JG, P, PS, OR PW PACKAGE  
TL062A ... D, P, OR PS PACKAGE  
TL062B ... D OR P PACKAGE  
(TOP VIEW)

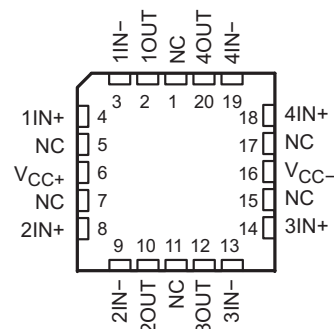


TL064 ... D, J, N, NS, PW, OR W PACKAGE  
TL064A, TL064B ... D OR N PACKAGE  
(TOP VIEW)

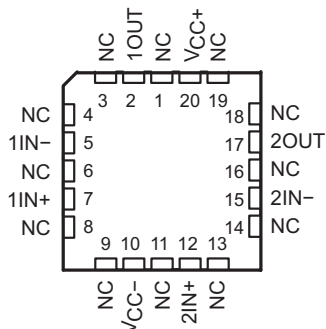


NC – No internal connection

TL064 ... FK PACKAGE  
(TOP VIEW)

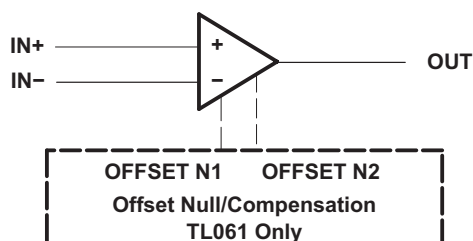


TL062 ... FK PACKAGE  
(TOP VIEW)

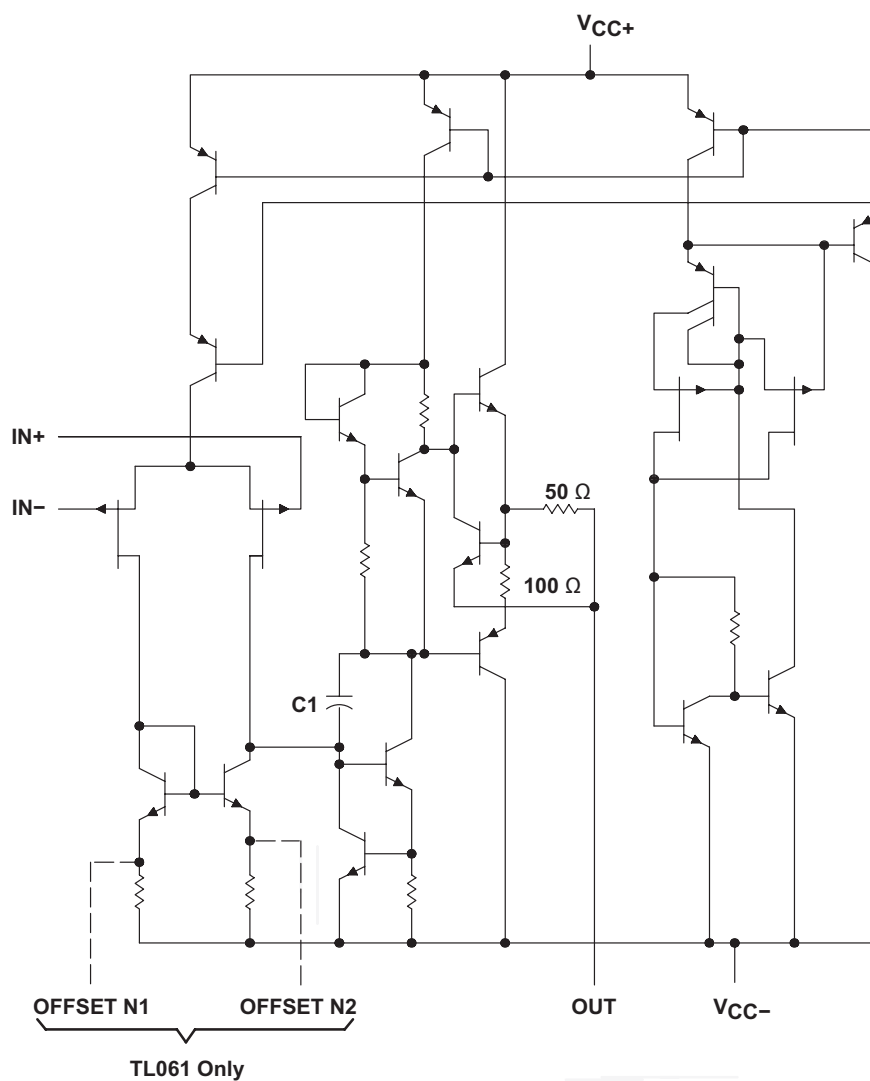


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## Symbols



## Schematic (Each Amplifier)



C1 = 10 pF on TL061, TL062, and TL064  
Component values shown are nominal.

## Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                                                 |                                                              | TL06_C<br>TL06_AC<br>TL06_BC   | TL06_I     | TL06_M     | UNIT |
|-------------------------------------------------|--------------------------------------------------------------|--------------------------------|------------|------------|------|
| V <sub>CC+</sub>                                | Supply voltage <sup>(2)</sup>                                | 18                             | 18         | 18         | V    |
| V <sub>CC-</sub>                                |                                                              | –18                            | –18        | –18        |      |
| V <sub>ID</sub>                                 | Differential input voltage <sup>(3)</sup>                    | ±30                            | ±30        | ±30        | V    |
| V <sub>I</sub>                                  | Input voltage <sup>(2)(4)</sup>                              | ±15                            | ±15        | ±15        | V    |
| Duration of output short circuit <sup>(5)</sup> |                                                              | Unlimited                      | Unlimited  | Unlimited  |      |
| $\theta_{JA}$                                   | Package thermal impedance <sup>(6)(7)</sup>                  | D package (8 pin)              | 97         | 97         | °C/W |
|                                                 |                                                              | D package (14 pin)             | 86         | 86         |      |
|                                                 |                                                              | N package                      | 80         | 80         |      |
|                                                 |                                                              | NS package                     | 76         | 76         |      |
|                                                 |                                                              | P package                      | 85         | 85         |      |
|                                                 |                                                              | PS package                     | 95         | 95         |      |
|                                                 |                                                              | PW (8 pin) package             | 149        | 149        |      |
|                                                 |                                                              | PW (14 pin) package            | 113        | 113        |      |
| $\theta_{JC}$                                   | Package thermal impedance <sup>(8)(9)</sup>                  | FK package                     |            | 5.61       | °C/W |
|                                                 |                                                              | J package                      |            | 15.05      |      |
|                                                 |                                                              | JG package                     |            | 14.5       |      |
|                                                 |                                                              | W package                      |            | 14.65      |      |
| T <sub>J</sub>                                  | Operating virtual junction temperature                       | 150                            | 150        | 150        | °C   |
|                                                 | Case temperature for 60 seconds                              | FK package                     |            | 260        | °C   |
|                                                 | Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds | J, JG, U, or W package         |            | 300        | °C   |
|                                                 | Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | D, N, NS, P, PS, or PW package | 260        | 260        | °C   |
| T <sub>stg</sub>                                | Storage temperature range                                    | –65 to 150                     | –65 to 150 | –65 to 150 | °C   |

- (1) 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.
- (2) All voltage values, except differential voltages, are with respect to the midpoint between V<sub>CC+</sub> and V<sub>CC-</sub>.
- (3) Differential voltages are at IN+, with respect to IN–.
- (4) The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
- (5) 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.
- (6) Maximum power dissipation is a function of T<sub>J(max)</sub>,  $\theta_{JA}$ , and T<sub>A</sub>. The maximum allowable power dissipation at any allowable ambient temperature is P<sub>D</sub> = (T<sub>J(max)</sub> – T<sub>A</sub>)/ $\theta_{JA}$ . Operating at the absolute maximum T<sub>J</sub> of 150°C can affect reliability.
- (7) The package thermal impedance is calculated in accordance with JESD 51-7.
- (8) Maximum power dissipation is a function of T<sub>J(max)</sub>,  $\theta_{JC}$ , and T<sub>C</sub>. The maximum allowable power dissipation at any allowable ambient temperature is P<sub>D</sub> = (T<sub>J(max)</sub> – T<sub>C</sub>)/ $\theta_{JC}$ . Operating at the absolute maximum T<sub>J</sub> of 150°C can affect reliability.
- (9) The package thermal impedance is calculated in accordance with MIL-STD-883.

## Electrical Characteristics

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

| PARAMETER                        |                                                                          | TEST CONDITIONS <sup>(1)</sup>                                                                              |                             | TL061C<br>TL062C<br>TL064C |                 |     | TL061AC<br>TL062AC<br>TL064AC |                 |     | UNIT  |
|----------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------|-----------------|-----|-------------------------------|-----------------|-----|-------|
|                                  |                                                                          |                                                                                                             |                             | MIN                        | TYP             | MAX | MIN                           | TYP             | MAX |       |
| V <sub>IO</sub>                  | Input offset voltage                                                     | V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω                                                                   | T <sub>A</sub> = 25°C       | 3                          |                 | 15  | 3                             |                 | 6   | mV    |
|                                  |                                                                          |                                                                                                             | T <sub>A</sub> = Full range |                            |                 | 20  |                               |                 | 7.5 |       |
| α <sub>VIO</sub>                 | Temperature coefficient of input offset voltage                          | V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω, T <sub>A</sub> = Full range                                      |                             | 10                         |                 |     | 10                            |                 |     | μV/°C |
| I <sub>IO</sub>                  | Input offset current                                                     | V <sub>O</sub> = 0                                                                                          | T <sub>A</sub> = 25°C       | 5                          |                 | 200 | 5                             |                 | 100 | pA    |
|                                  |                                                                          |                                                                                                             | T <sub>A</sub> = Full range |                            |                 | 5   |                               |                 | 3   | nA    |
| I <sub>IB</sub>                  | Input bias current <sup>(2)</sup>                                        | V <sub>O</sub> = 0                                                                                          | T <sub>A</sub> = 25°C       | 30                         |                 | 400 | 30                            |                 | 200 | pA    |
|                                  |                                                                          |                                                                                                             | T <sub>A</sub> = Full range |                            |                 | 10  |                               |                 | 7   | nA    |
| V <sub>ICR</sub>                 | Common-mode input voltage range                                          | T <sub>A</sub> = 25°C                                                                                       |                             | ±11                        | −12<br>to<br>15 |     | ±11                           | −12<br>to<br>15 |     | V     |
| V <sub>OM</sub>                  | Maximum peak output voltage swing                                        | R <sub>L</sub> = 10 kΩ, T <sub>A</sub> = 25°C                                                               |                             | ±10                        | ±13.5           |     | ±10                           | ±13.5           |     | V     |
|                                  |                                                                          | R <sub>L</sub> ≥ 10 kΩ, T <sub>A</sub> = Full range                                                         |                             | ±10                        |                 |     | ±10                           |                 |     |       |
| A <sub>VD</sub>                  | Large-signal differential voltage amplification                          | V <sub>O</sub> = ±10 V,<br>R <sub>L</sub> ≥ 2 kΩ                                                            | T <sub>A</sub> = 25°C       | 3                          | 6               |     | 4                             | 6               |     | V/mV  |
|                                  |                                                                          |                                                                                                             | T <sub>A</sub> = Full range | 3                          |                 |     | 4                             |                 |     |       |
| B <sub>1</sub>                   | Unity-gain bandwidth                                                     | R <sub>L</sub> = 10 kΩ, T <sub>A</sub> = 25°C                                                               |                             | 1                          |                 |     | 1                             |                 |     | MHz   |
| r <sub>i</sub>                   | Input resistance                                                         | T <sub>A</sub> = 25°C                                                                                       |                             | 10 <sup>12</sup>           |                 |     | 10 <sup>12</sup>              |                 |     | Ω     |
| CMRR                             | Common-mode rejection ratio                                              | V <sub>IC</sub> = V <sub>ICRmin</sub> ,<br>V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω, T <sub>A</sub> = 25°C |                             | 70                         | 86              |     | 80                            | 86              |     | dB    |
| k <sub>SVR</sub>                 | Supply-voltage rejection ratio<br>(ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> ) | V <sub>CC</sub> = ±9 V to ±15 V,<br>V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω, T <sub>A</sub> = 25°C        |                             | 70                         | 95              |     | 80                            | 95              |     | dB    |
| P <sub>D</sub>                   | Total power dissipation (each amplifier)                                 | V <sub>O</sub> = 0, No load, T <sub>A</sub> = 25°C                                                          |                             | 6                          |                 | 7.5 | 6                             |                 | 7.5 | mW    |
| I <sub>CC</sub>                  | Supply current (each amplifier)                                          | V <sub>O</sub> = 0, No load, T <sub>A</sub> = 25°C                                                          |                             | 200                        |                 | 250 | 200                           |                 | 250 | μA    |
| V <sub>O1</sub> /V <sub>O2</sub> | Crosstalk attenuation                                                    | A <sub>VD</sub> = 100, T <sub>A</sub> = 25°C                                                                |                             | 120                        |                 |     | 120                           |                 |     | dB    |

- (1) All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. Full range for  $T_A$  is  $0^\circ\text{C}$  to  $70^\circ\text{C}$  for TL06xC, TL06xAC, and TL06xBC and  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  for TL06xI.
- (2) Input bias currents of an FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive, as shown in Figure 15. Pulse techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

## Electrical Characteristics

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

| PARAMETER                        |                                                                       | TEST CONDITIONS <sup>(1)</sup>                                                                              |                                                      | TL061BC<br>TL062BC<br>TL064BC |                 |     | TL061I<br>TL062I<br>TL064I |                 |     | UNIT |
|----------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------|-----------------|-----|----------------------------|-----------------|-----|------|
|                                  |                                                                       |                                                                                                             |                                                      | MIN                           | TYP             | MAX | MIN                        | TYP             | MAX |      |
| V <sub>IO</sub>                  | Input offset voltage                                                  | V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω                                                                   | T <sub>A</sub> = 25°C<br>T <sub>A</sub> = Full range | 2                             |                 | 3   | 3                          |                 | 6   | mV   |
| α <sub>VIO</sub>                 | Temperature coefficient of input offset voltage                       | V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω, T <sub>A</sub> = Full range                                      |                                                      | 10                            |                 |     | 10                         |                 |     |      |
| I <sub>IO</sub>                  | Input offset current                                                  | V <sub>O</sub> = 0                                                                                          | T <sub>A</sub> = 25°C<br>T <sub>A</sub> = Full range | 5                             |                 | 100 | 5                          |                 | 100 | pA   |
| I <sub>IB</sub>                  | Input bias current <sup>(2)</sup>                                     |                                                                                                             | T <sub>A</sub> = 25°C<br>T <sub>A</sub> = Full range | 30                            |                 | 200 | 30                         |                 | 200 | pA   |
| V <sub>ICR</sub>                 | Common-mode input voltage range                                       | T <sub>A</sub> = 25°C                                                                                       |                                                      | ±11                           | −12<br>to<br>15 |     | ±11                        | −12<br>to<br>15 |     | V    |
| V <sub>OM</sub>                  | Maximum peak output voltage swing                                     | R <sub>L</sub> = 10 kΩ, T <sub>A</sub> = 25°C                                                               |                                                      | ±10                           | ±13.5           |     | ±10                        | ±13.5           |     | V    |
|                                  |                                                                       | R <sub>L</sub> ≥ 10 kΩ, T <sub>A</sub> = Full range                                                         |                                                      | ±10                           |                 | ±10 |                            |                 |     |      |
| A <sub>VD</sub>                  | Large-signal differential voltage amplification                       | V <sub>O</sub> = ±10 V,<br>R <sub>L</sub> ≥ 2 kΩ                                                            | T <sub>A</sub> = 25°C<br>T <sub>A</sub> = Full range | 4                             | 6               |     | 4                          | 6               |     | V/mV |
|                                  |                                                                       |                                                                                                             |                                                      | 4                             |                 |     | 4                          |                 |     |      |
| B <sub>1</sub>                   | Unity-gain bandwidth                                                  | R <sub>L</sub> = 10 kΩ, T <sub>A</sub> = 25°C                                                               |                                                      | 1                             |                 |     | 1                          |                 |     | MHz  |
| r <sub>i</sub>                   | Input resistance                                                      | T <sub>A</sub> = 25°C                                                                                       |                                                      | 10 <sup>12</sup>              |                 |     | 10 <sup>12</sup>           |                 |     | Ω    |
| CMRR                             | Common-mode rejection ratio                                           | V <sub>IC</sub> = V <sub>ICR</sub> min,<br>V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω, T <sub>A</sub> = 25°C |                                                      | 80                            | 86              |     | 80                         | 86              |     | dB   |
| k <sub>SVR</sub>                 | Supply-voltage rejection ratio (ΔV <sub>CC±</sub> /ΔV <sub>IO</sub> ) | V <sub>CC</sub> = ±9 V to ±15 V,<br>V <sub>O</sub> = 0, R <sub>S</sub> = 50 Ω, T <sub>A</sub> = 25°C        |                                                      | 80                            | 95              |     | 80                         | 95              |     | dB   |
| P <sub>D</sub>                   | Total power dissipation (each amplifier)                              | V <sub>O</sub> = 0, No load, T <sub>A</sub> = 25°C                                                          |                                                      | 6                             |                 | 7.5 | 6                          |                 | 7.5 | mW   |
| I <sub>CC</sub>                  | Supply current (each amplifier)                                       | V <sub>O</sub> = 0, No load, T <sub>A</sub> = 25°C                                                          |                                                      | 200                           |                 | 250 | 200                        |                 | 250 | μA   |
| V <sub>O1</sub> /V <sub>O2</sub> | Crosstalk attenuation                                                 | A <sub>VD</sub> = 100, T <sub>A</sub> = 25°C                                                                |                                                      | 120                           |                 |     | 120                        |                 |     | dB   |

- (1) All characteristics are measured under open-loop conditions with zero common-mode input voltage, unless otherwise specified. Full range for  $T_A$  is  $0^\circ\text{C}$  to  $70^\circ\text{C}$  for TL06xC, TL06xAC, and TL06xBC and  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  for TL06xI.
- (2) Input bias currents of an FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive, as shown in Figure 15. Pulse techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

## Electrical Characteristics

$V_{CC\pm} = \pm 15$  V (unless otherwise noted)

| PARAMETER                                                                     | TEST CONDITIONS <sup>(1)</sup>                                                                                                            | TL061M<br>TL062MM |                 |     | TL064M   |                 |     | UNIT                         |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------|-----|----------|-----------------|-----|------------------------------|
|                                                                               |                                                                                                                                           | MIN               | TYP             | MAX | MIN      | TYP             | MAX |                              |
| $V_{IO}$ Input offset voltage                                                 | $V_O = 0$ , $R_S = 50\ \Omega$<br>$T_A = 25^\circ\text{C}$<br>$T_A = -55^\circ\text{C}$ to $125^\circ\text{C}$                            |                   | 3               | 6   |          | 3               | 9   | mV                           |
| $\alpha_{VIO}$ Temperature coefficient of input offset voltage                | $V_O = 0$ , $R_S = 50\ \Omega$ ,<br>$T_A = -55^\circ\text{C}$ to $125^\circ\text{C}$                                                      |                   | 10              |     |          | 10              |     | $\mu\text{V}/^\circ\text{C}$ |
| $I_{IO}$ Input offset current                                                 | $V_O = 0$<br>$T_A = 25^\circ\text{C}$<br>$T_A = -55^\circ\text{C}$<br>$T_A = 125^\circ\text{C}$                                           |                   | 5               | 100 |          | 5               | 100 | pA                           |
| $I_{IB}$ Input bias current <sup>(3)</sup>                                    | $V_O = 0$<br>$T_A = 25^\circ\text{C}$<br>$T_A = -55^\circ\text{C}$<br>$T_A = 125^\circ\text{C}$                                           |                   | 30              | 200 |          | 30              | 200 | pA                           |
| $V_{ICR}$ Common-mode input voltage range                                     | $T_A = 25^\circ\text{C}$                                                                                                                  | $\pm 11$          | -12<br>to<br>15 |     | $\pm 11$ | -12<br>to<br>15 |     | V                            |
| $V_{OM}$ Maximum peak output voltage swing                                    | $R_L = 10\ \text{k}\Omega$ , $T_A = 25^\circ\text{C}$<br>$R_L \geq 10\ \text{k}\Omega$ , $T_A = -55^\circ\text{C}$ to $125^\circ\text{C}$ | $\pm 10$          | $\pm 13.5$      |     | $\pm 10$ | $\pm 13.5$      |     | V                            |
| $A_{VD}$ Large-signal differential voltage amplification                      | $V_O = \pm 10$ V,<br>$R_L \geq 2\ \text{k}\Omega$<br>$T_A = 25^\circ\text{C}$<br>$T_A = -55^\circ\text{C}$ to $125^\circ\text{C}$         | 4                 | 6               |     | 4        | 6               |     | V/mV                         |
| $B_1$ Unity-gain bandwidth                                                    | $R_L = 10\ \text{k}\Omega$ , $T_A = 25^\circ\text{C}$                                                                                     |                   |                 |     |          |                 |     | MHz                          |
| $r_i$ Input resistance                                                        | $T_A = 25^\circ\text{C}$                                                                                                                  |                   | $10^{12}$       |     |          | $10^{12}$       |     | $\Omega$                     |
| CMRR Common-mode rejection ratio                                              | $V_{IC} = V_{ICRmin}$ ,<br>$V_O = 0$ , $R_S = 50\ \Omega$ , $T_A = 25^\circ\text{C}$                                                      | 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,<br>$V_O = 0$ , $R_S = 50\ \Omega$ , $T_A = 25^\circ\text{C}$                                            | 80                | 95              |     | 80       | 95              |     | dB                           |
| $P_D$ Total power dissipation (each amplifier)                                | $V_O = 0$ , No load, $T_A = 25^\circ\text{C}$                                                                                             |                   | 6               | 7.5 |          | 6               | 7.5 | mW                           |
| $I_{CC}$ Supply current (each amplifier)                                      | $V_O = 0$ , No load, $T_A = 25^\circ\text{C}$                                                                                             |                   | 200             | 250 |          | 200             | 250 | $\mu\text{A}$                |
| $V_{O1}/V_{O2}$ Crosstalk attenuation                                         | $A_{VD} = 100$ , $T_A = 25^\circ\text{C}$                                                                                                 |                   | 120             |     |          | 120             |     | dB                           |

- (1) All characteristics are measured under open-loop conditions, with zero common-mode voltage, unless otherwise specified.  
 (2) This parameter is not production tested.  
 (3) Input bias currents of an FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive, as shown in [Figure 15](#). Pulse techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

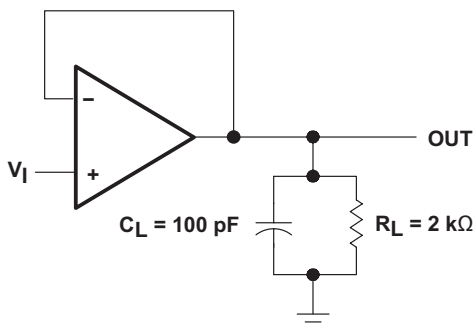
## Operating Characteristics

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

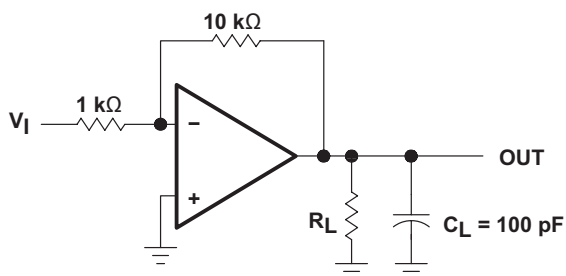
| PARAMETER                                 | TEST CONDITIONS                                                                                           | MIN | TYP | MAX | UNIT                   |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----|-----|-----|------------------------|
| SR Slew rate at unity gain <sup>(1)</sup> | $V_I = 10$ V,<br>$R_L = 10\ \text{k}\Omega$ ,<br>$C_L = 100\ \text{pF}$ ,<br>See <a href="#">Figure 1</a> | 1.5 | 3.5 |     | V/ $\mu\text{s}$       |
| $t_r$ Rise-time                           | $V_I = 20$ V,<br>$R_L = 10\ \text{k}\Omega$ ,<br>$C_L = 100\ \text{pF}$ ,<br>See <a href="#">Figure 1</a> |     | 0.2 |     | $\mu\text{s}$          |
| Overshoot factor                          |                                                                                                           |     | 10  |     | %                      |
| $V_n$ Equivalent input noise voltage      | $R_S = 20\ \Omega$ ,<br>$f = 1\ \text{kHz}$                                                               |     | 42  |     | nV/ $\sqrt{\text{Hz}}$ |

- (1) Slew rate at  $-55^\circ\text{C}$  to  $125^\circ\text{C}$  is 0.7 V/ $\mu\text{s}$  min.

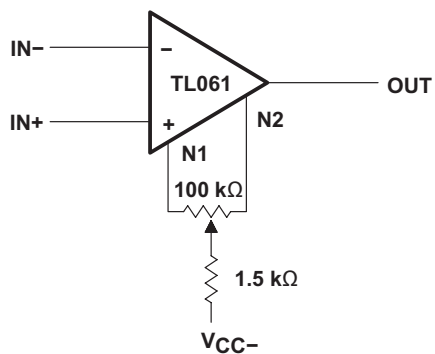
## Parameter Measurement Information



**Figure 1. Unity-Gain Amplifier**



**Figure 2. Gain-of-10 Inverting Amplifier**



**Figure 3. Input Offset-Voltage Null Circuit**

## Typical Characteristics

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

### Table of Graphs

|                                                                  | FIGURE    |
|------------------------------------------------------------------|-----------|
| Maximum peak output voltage versus Supply voltage                | Figure 4  |
| Maximum peak output voltage versus Free-air temperature          | Figure 5  |
| Maximum peak output voltage versus Load resistance               | Figure 6  |
| Maximum peak output voltage versus Frequency                     | Figure 7  |
| Differential voltage amplification versus Free-air temperature   | Figure 8  |
| Large-signal differential voltage amplification versus Frequency | Figure 9  |
| Phase shift versus Frequency                                     | Figure 9  |
| Supply current versus Supply voltage                             | Figure 10 |
| Supply current versus Free-air temperature                       | Figure 11 |
| Total power dissipation versus Free-air temperature              | Figure 12 |
| Common-mode rejection ratio versus Free-air temperature          | Figure 13 |
| Normalized unity-gain bandwidth versus Free-air temperature      | Figure 14 |
| Normalized slew rate versus Free-air temperature                 | Figure 14 |
| Normalized phase shift versus Free-air temperature               | Figure 14 |
| Input bias current versus Free-air temperature                   | Figure 15 |
| Voltage-follower large-signal pulse response versus Time         | Figure 16 |
| Output voltage versus Elapsed time                               | Figure 17 |
| Equivalent input noise voltage versus Frequency                  | Figure 18 |

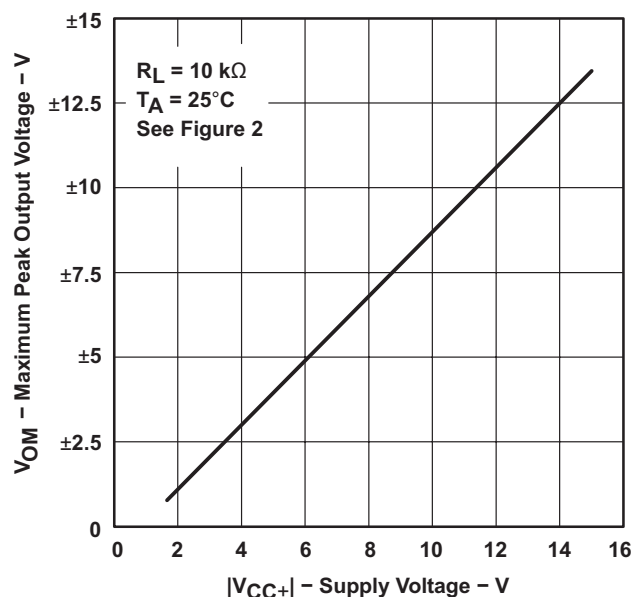


Figure 4. Maximum Peak Output Voltage  
vs  
Supply Voltage

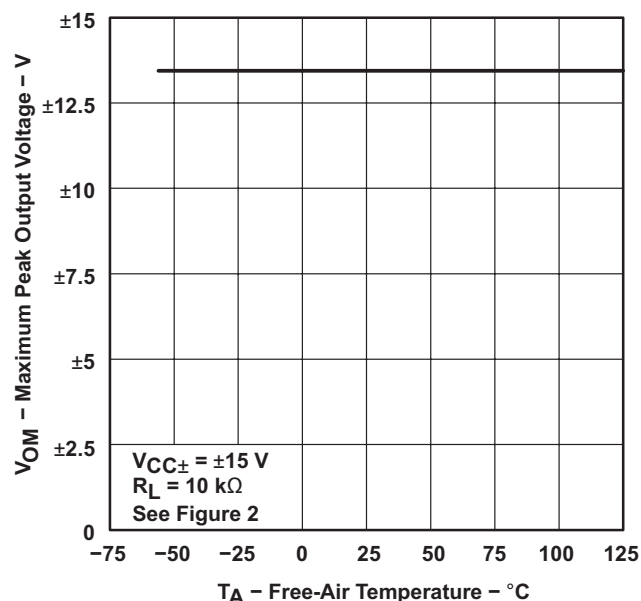
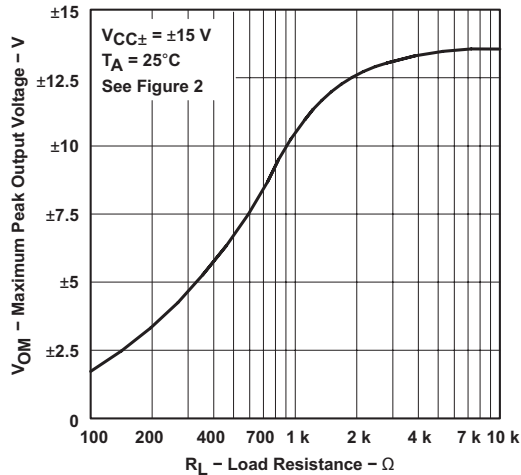
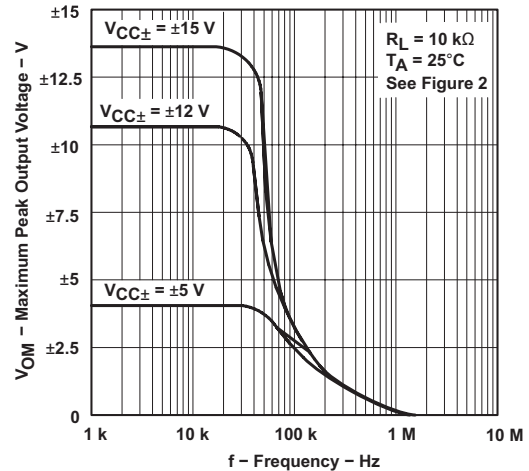


Figure 5. Maximum Peak Output Voltage  
vs  
Free-Air Temperature

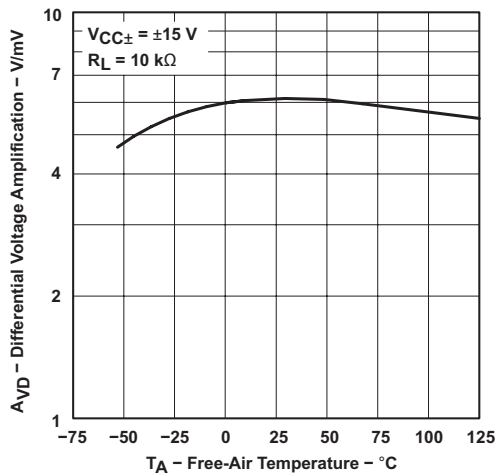




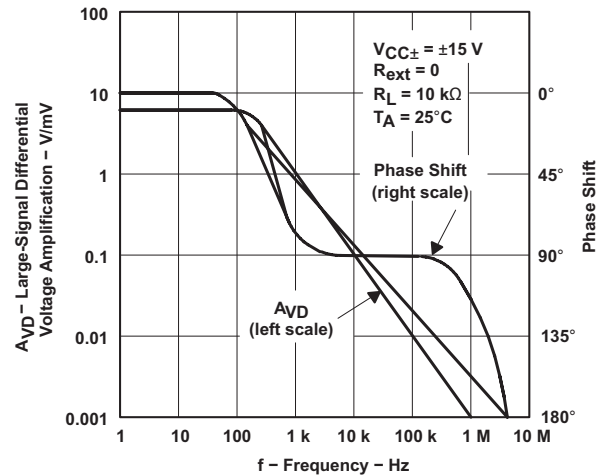
**Figure 6. Maximum Peak Output Voltage  
vs  
Load Resistance**



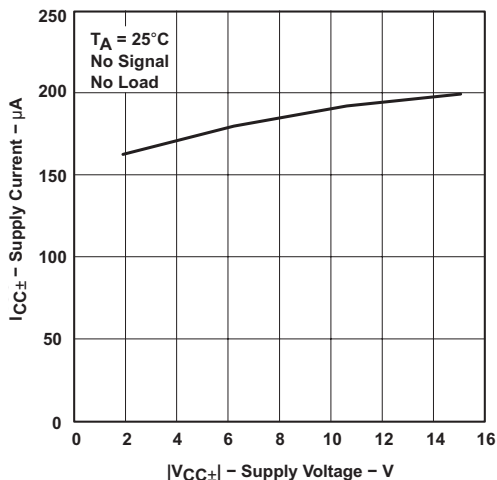
**Figure 7. Maximum Peak Output Voltage  
vs  
Frequency**



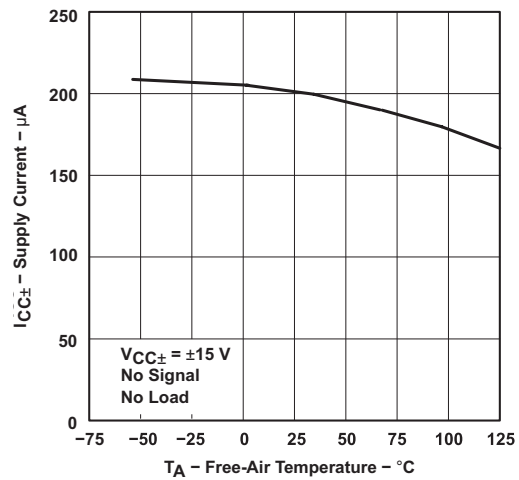
**Figure 8. Differential Voltage Amplification  
vs  
Free-Air Temperature**



**Figure 9. Large-Signal Differential Voltage Amplification and  
Phase Shift  
vs  
Frequency**



**Figure 10. Supply Current  
vs  
Supply Voltage**



**Figure 11. Supply Current  
vs  
Free-Air Temperature**

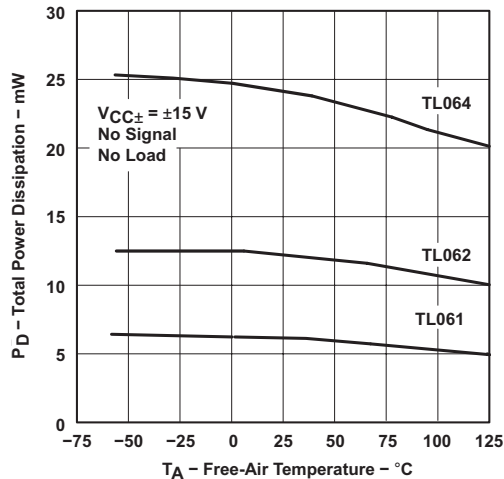


Figure 12. Total Power Dissipation  
vs  
Free-Air Temperature

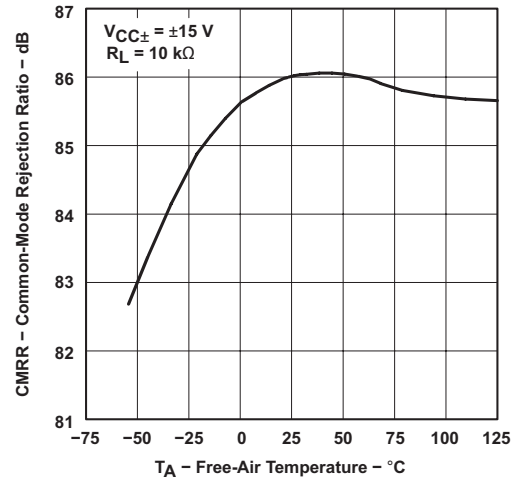


Figure 13. All Except TL06\_C Common-Mode Rejection  
Ratio  
vs  
Free-Air Temperature

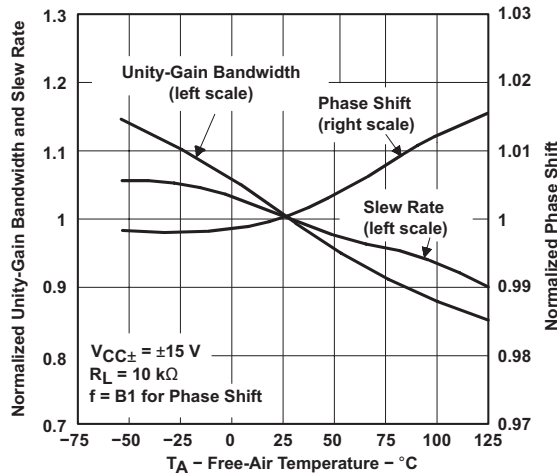


Figure 14. Normalized Unity-Gain Bandwidth, Slew Rate,  
and Phase Shift  
vs  
Free-Air Temperature

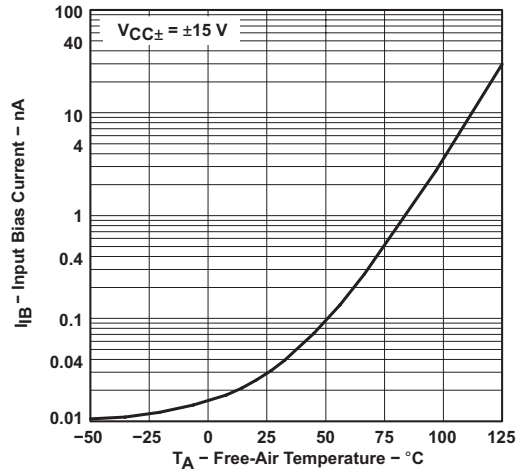


Figure 15. Input Bias Current  
vs  
Free-Air Temperature

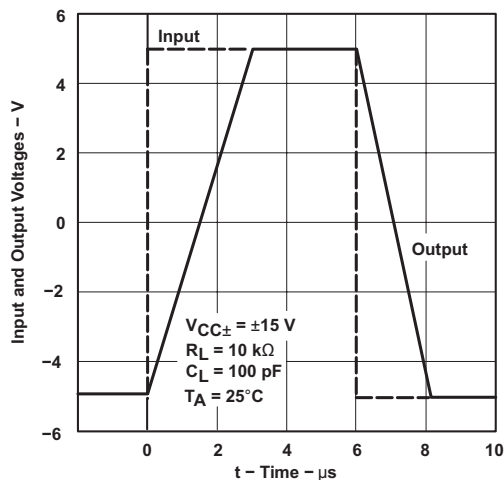


Figure 16. Voltage-Follower Large-Signal  
Pulse Response  
vs Time

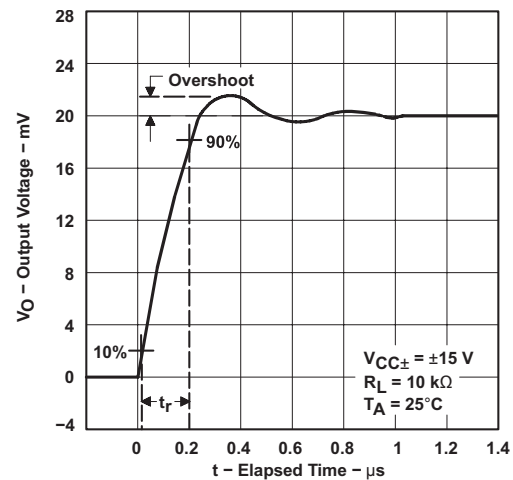
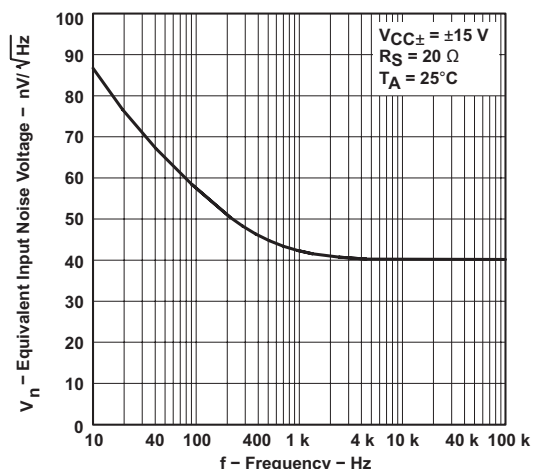


Figure 17. Output Voltage  
vs  
Elapsed Time



**Figure 18. Equivalent Input Noise Voltage  
vs  
Frequency**

## APPLICATION INFORMATION

Table of Application Diagrams

| APPLICATION DIAGRAM                       | PART NUMBER | FIGURE                    |
|-------------------------------------------|-------------|---------------------------|
| Instrumentation amplifier                 | TL064       | <a href="#">Figure 19</a> |
| 0.5-Hz square-wave oscillator             | TL061       | <a href="#">Figure 20</a> |
| High-Q notch filter                       | TL061       | <a href="#">Figure 21</a> |
| Audio-distribution amplifier              | TL064       | <a href="#">Figure 22</a> |
| Low-level light detector preamplifier     | TL061       | <a href="#">Figure 23</a> |
| AC amplifier                              | TL061       | <a href="#">Figure 24</a> |
| Microphone preamplifier with tone control | TL061       | <a href="#">Figure 25</a> |
| Instrumentation amplifier                 | TL062       | <a href="#">Figure 26</a> |
| IC preamplifier                           | TL062       | <a href="#">Figure 27</a> |

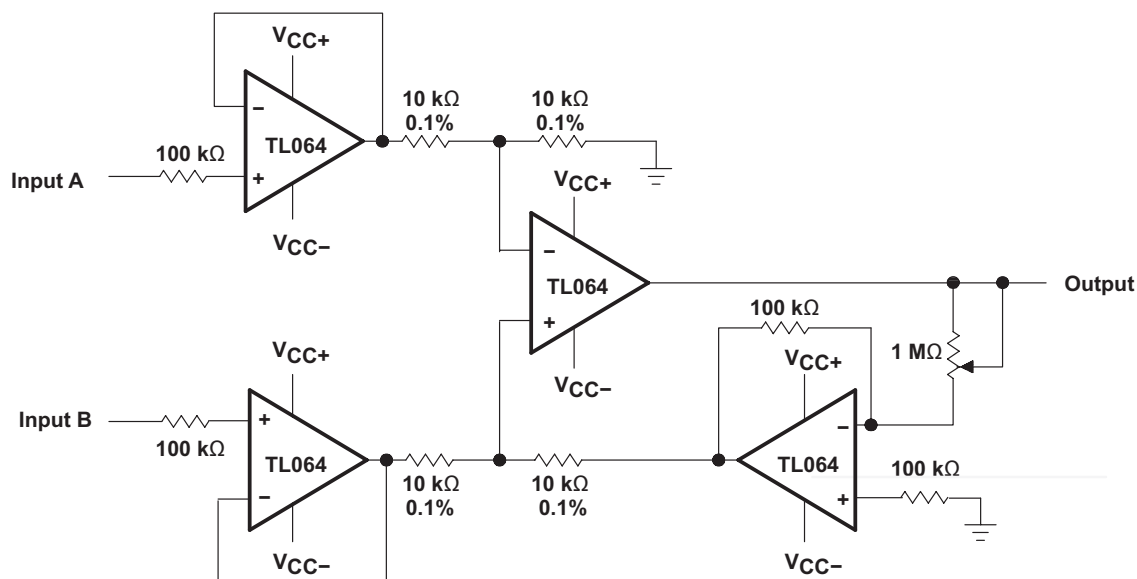


Figure 19. Instrumentation Amplifier

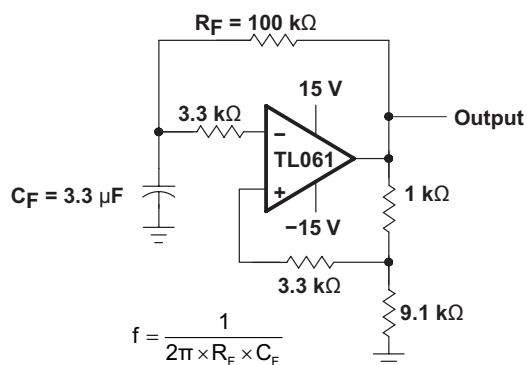
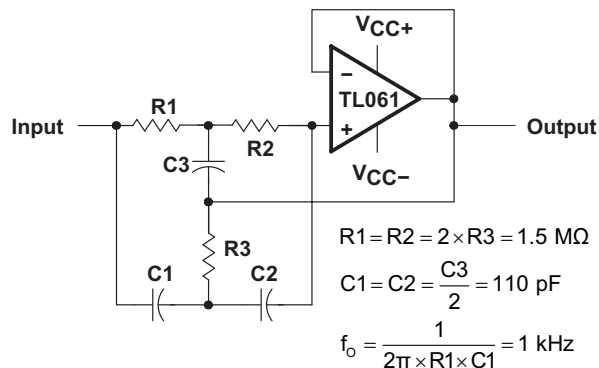
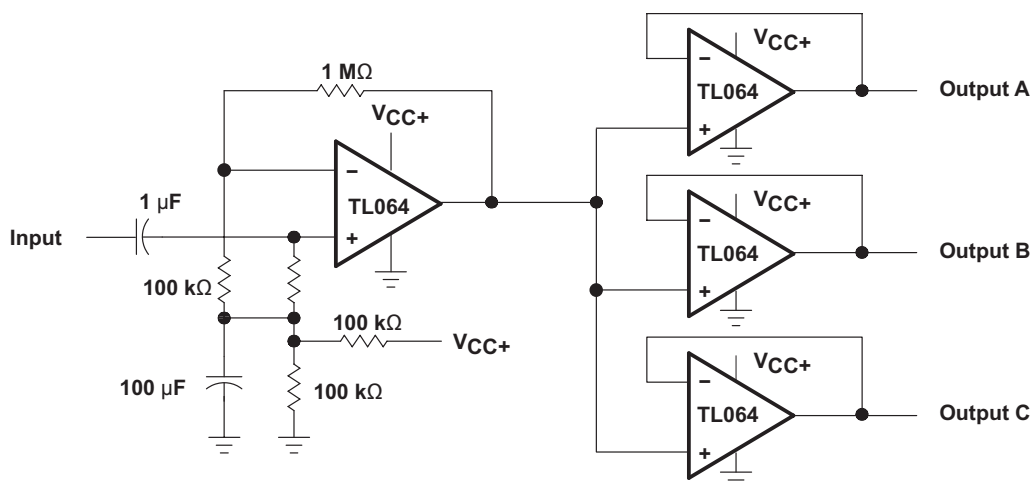


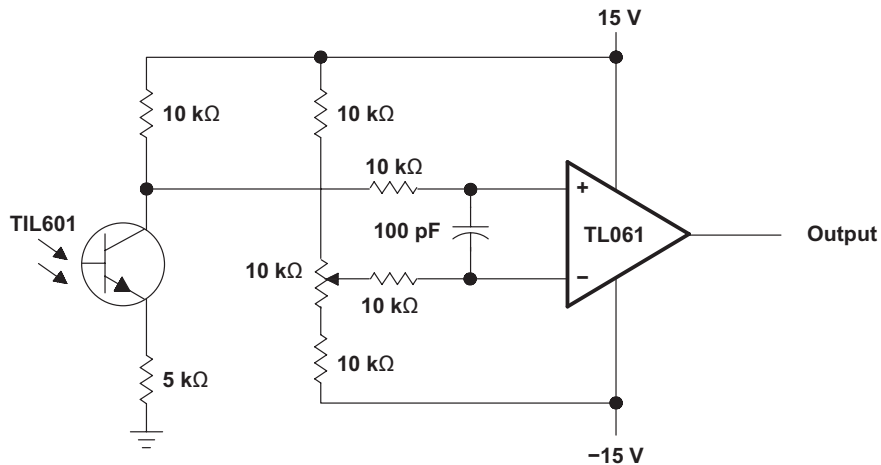
Figure 20. 0.5-Hz Square-Wave Oscillator



**Figure 21. High-Q Notch Filter**



**Figure 22. Audio-Distribution Amplifier**



**Figure 23. Low-Level Light Detector Preamplifier**



# IC PREAMPLIFIER RESPONSE CHARACTERISTICS

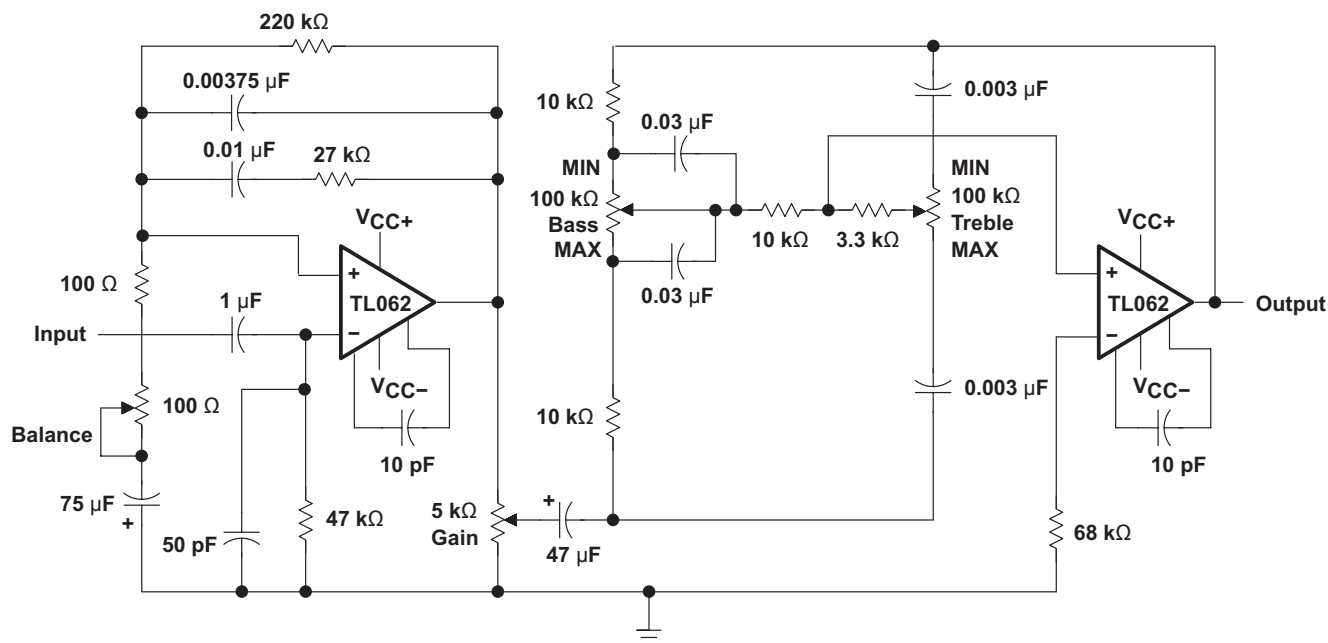
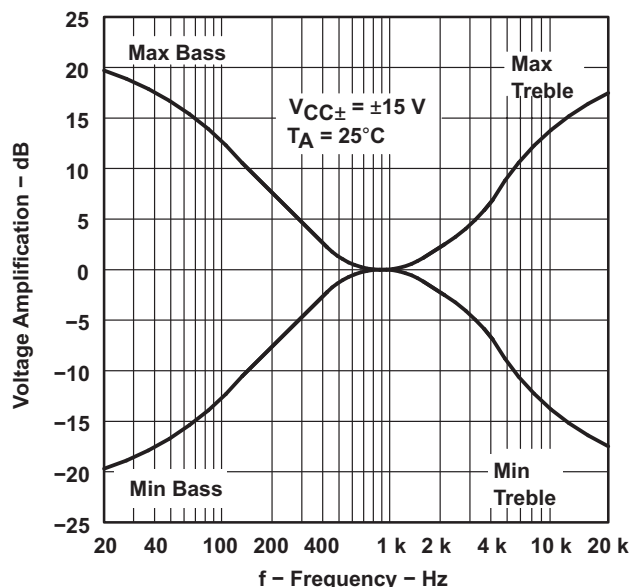


Figure 27. IC Preamplifier

## REVISION HISTORY

| Changes from Revision J (September 2004) to Revision K                          | Page              |
|---------------------------------------------------------------------------------|-------------------|
| • Updated document to new TI data sheet format - no specification changes. .... | <a href="#">1</a> |
| • Deleted Ordering Information table. ....                                      | <a href="#">1</a> |
| • Updated Features. ....                                                        | <a href="#">1</a> |



**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| 81023012A        | OBSOLETE      | LCCC         | FK                 | 20   |                | TBD                        | Call TI                 | Call TI              | -55 to 125   |                         |                         |
| 81023022A        | ACTIVE        | LCCC         | FK                 | 20   | 1              | TBD                        | POST-PLATE              | N / A for Pkg Type   | -55 to 125   | 81023022A<br>TL062MFKB  | <a href="#">Samples</a> |
| 8102302HA        | ACTIVE        | CFP          | U                  | 10   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 8102302HA<br>TL062M     | <a href="#">Samples</a> |
| 8102302PA        | ACTIVE        | CDIP         | JG                 | 8    | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 8102302PA<br>TL062M     | <a href="#">Samples</a> |
| 81023032A        | ACTIVE        | LCCC         | FK                 | 20   | 1              | TBD                        | POST-PLATE              | N / A for Pkg Type   | -55 to 125   | 81023032A<br>TL064MFKB  | <a href="#">Samples</a> |
| 8102303CA        | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 8102303CA<br>TL064MJB   | <a href="#">Samples</a> |
| 8102303DA        | ACTIVE        | CFP          | W                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 8102303DA<br>TL064MWB   | <a href="#">Samples</a> |
| TL061ACD         | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 061AC                   | <a href="#">Samples</a> |
| TL061ACDE4       | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 061AC                   | <a href="#">Samples</a> |
| TL061ACDR        | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 061AC                   | <a href="#">Samples</a> |
| TL061ACP         | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL061ACP                | <a href="#">Samples</a> |
| TL061ACPE4       | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL061ACP                | <a href="#">Samples</a> |
| TL061BCD         | OBSOLETE      | SOIC         | D                  | 8    |                | TBD                        | Call TI                 | Call TI              | 0 to 70      |                         |                         |
| TL061BCP         | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL061BCP                | <a href="#">Samples</a> |
| TL061BCPE4       | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL061BCP                | <a href="#">Samples</a> |
| TL061CD          | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL061C                  | <a href="#">Samples</a> |
| TL061CDR         | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL061C                  | <a href="#">Samples</a> |
| TL061CP          | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL061CP                 | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| TL061CPE4        | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL061CP                 | <a href="#">Samples</a> |
| TL061CPSR        | ACTIVE        | SO           | PS                 | 8    | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T061                    | <a href="#">Samples</a> |
| TL061CPWLE       | OBSOLETE      | TSSOP        | PW                 | 8    |                | TBD                        | Call TI                 | Call TI              | 0 to 70      |                         |                         |
| TL061ID          | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL061I                  | <a href="#">Samples</a> |
| TL061IDR         | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL061I                  | <a href="#">Samples</a> |
| TL061IDRG4       | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL061I                  | <a href="#">Samples</a> |
| TL061IP          | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | -40 to 85    | TL061IP                 | <a href="#">Samples</a> |
| TL061IPE4        | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | -40 to 85    | TL061IP                 | <a href="#">Samples</a> |
| TL061MJG         | OBSOLETE      | CDIP         | JG                 | 8    |                | TBD                        | Call TI                 | Call TI              | -55 to 125   |                         |                         |
| TL061MJGB        | OBSOLETE      | CDIP         | JG                 | 8    |                | TBD                        | Call TI                 | Call TI              | -55 to 125   |                         |                         |
| TL062ACD         | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 062AC                   | <a href="#">Samples</a> |
| TL062ACDE4       | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 062AC                   | <a href="#">Samples</a> |
| TL062ACDR        | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 062AC                   | <a href="#">Samples</a> |
| TL062ACDRE4      | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 062AC                   | <a href="#">Samples</a> |
| TL062ACDRG4      | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 062AC                   | <a href="#">Samples</a> |
| TL062ACJG        | OBSOLETE      | CDIP         | JG                 | 8    |                | TBD                        | Call TI                 | Call TI              | 0 to 70      |                         |                         |
| TL062ACP         | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL062ACP                | <a href="#">Samples</a> |
| TL062ACPE4       | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL062ACP                | <a href="#">Samples</a> |
| TL062ACPSR       | ACTIVE        | SO           | PS                 | 8    | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T062A                   | <a href="#">Samples</a> |
| TL062ACPSRG4     | ACTIVE        | SO           | PS                 | 8    | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T062A                   | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| TL062BCD         | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 062BC                   | <a href="#">Samples</a> |
| TL062BCDG4       | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 062BC                   | <a href="#">Samples</a> |
| TL062BCDR        | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | 062BC                   | <a href="#">Samples</a> |
| TL062BCP         | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL062BCP                | <a href="#">Samples</a> |
| TL062BCPE4       | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL062BCP                | <a href="#">Samples</a> |
| TL062CD          | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL062C                  | <a href="#">Samples</a> |
| TL062CDE4        | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL062C                  | <a href="#">Samples</a> |
| TL062CDG4        | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL062C                  | <a href="#">Samples</a> |
| TL062CDR         | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL062C                  | <a href="#">Samples</a> |
| TL062CDRE4       | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL062C                  | <a href="#">Samples</a> |
| TL062CDRG4       | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL062C                  | <a href="#">Samples</a> |
| TL062CJG         | OBSOLETE      | CDIP         | JG                 | 8    |                | TBD                        | Call TI                 | Call TI              | 0 to 70      |                         |                         |
| TL062CP          | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL062CP                 | <a href="#">Samples</a> |
| TL062CPE4        | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL062CP                 | <a href="#">Samples</a> |
| TL062CPSLE       | OBSOLETE      | SO           | PS                 | 8    |                | TBD                        | Call TI                 | Call TI              | 0 to 70      |                         |                         |
| TL062CPSR        | ACTIVE        | SO           | PS                 | 8    | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T062                    | <a href="#">Samples</a> |
| TL062CPSRG4      | ACTIVE        | SO           | PS                 | 8    | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T062                    | <a href="#">Samples</a> |
| TL062CPW         | ACTIVE        | TSSOP        | PW                 | 8    | 150            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T062                    | <a href="#">Samples</a> |
| TL062CPWG4       | ACTIVE        | TSSOP        | PW                 | 8    | 150            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T062                    | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| TL062CPWLE       | OBSOLETE      | TSSOP        | PW                 | 8    |                | TBD                        | Call TI                 | Call TI              | 0 to 70      |                         |                         |
| TL062CPWR        | ACTIVE        | TSSOP        | PW                 | 8    | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T062                    | <a href="#">Samples</a> |
| TL062CPWRG4      | ACTIVE        | TSSOP        | PW                 | 8    | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T062                    | <a href="#">Samples</a> |
| TL062ID          | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL062I                  | <a href="#">Samples</a> |
| TL062IDG4        | ACTIVE        | SOIC         | D                  | 8    | 75             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL062I                  | <a href="#">Samples</a> |
| TL062IDR         | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL062I                  | <a href="#">Samples</a> |
| TL062IDRG4       | ACTIVE        | SOIC         | D                  | 8    | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL062I                  | <a href="#">Samples</a> |
| TL062IJG         | OBSOLETE      | CDIP         | JG                 | 8    |                | TBD                        | Call TI                 | Call TI              | -40 to 85    |                         |                         |
| TL062IP          | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | -40 to 85    | TL062IP                 | <a href="#">Samples</a> |
| TL062IPE4        | ACTIVE        | PDIP         | P                  | 8    | 50             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | -40 to 85    | TL062IP                 | <a href="#">Samples</a> |
| TL062IPWR        | ACTIVE        | TSSOP        | PW                 | 8    | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | Z062                    | <a href="#">Samples</a> |
| TL062IPWRG4      | ACTIVE        | TSSOP        | PW                 | 8    | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | Z062                    | <a href="#">Samples</a> |
| TL062MFKB        | ACTIVE        | LCCC         | FK                 | 20   | 1              | TBD                        | POST-PLATE              | N / A for Pkg Type   | -55 to 125   | 81023022A<br>TL062MFKB  | <a href="#">Samples</a> |
| TL062MJG         | ACTIVE        | CDIP         | JG                 | 8    | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | TL062MJG                | <a href="#">Samples</a> |
| TL062MJGB        | ACTIVE        | CDIP         | JG                 | 8    | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 8102302PA<br>TL062M     | <a href="#">Samples</a> |
| TL064ACD         | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064AC                 | <a href="#">Samples</a> |
| TL064ACDE4       | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064AC                 | <a href="#">Samples</a> |
| TL064ACDR        | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064AC                 | <a href="#">Samples</a> |
| TL064ACDRE4      | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064AC                 | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| TL064ACN         | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL064ACN                | <a href="#">Samples</a> |
| TL064ACP         | LIFEBUY       | PDIP         | NFF                | 14   | 25             | TBD                        | Call TI                 | Call TI              | 0 to 70      | LF444ACN                |                         |
| TL064BCD         | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064BC                 | <a href="#">Samples</a> |
| TL064BCDG4       | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064BC                 | <a href="#">Samples</a> |
| TL064BCDR        | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064BC                 | <a href="#">Samples</a> |
| TL064BCN         | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL064BCN                | <a href="#">Samples</a> |
| TL064BCNE4       | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL064BCN                | <a href="#">Samples</a> |
| TL064BCP         | LIFEBUY       | PDIP         | NFF                | 14   | 25             | TBD                        | Call TI                 | Call TI              | 0 to 70      | LF444ACN                |                         |
| TL064CD          | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064C                  | <a href="#">Samples</a> |
| TL064CDE4        | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064C                  | <a href="#">Samples</a> |
| TL064CDR         | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064C                  | <a href="#">Samples</a> |
| TL064CDRE4       | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064C                  | <a href="#">Samples</a> |
| TL064CDRG4       | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064C                  | <a href="#">Samples</a> |
| TL064CN          | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL064CN                 | <a href="#">Samples</a> |
| TL064CNE4        | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | TL064CN                 | <a href="#">Samples</a> |
| TL064CNSR        | ACTIVE        | SO           | NS                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064                   | <a href="#">Samples</a> |
| TL064CNSRG4      | ACTIVE        | SO           | NS                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | TL064                   | <a href="#">Samples</a> |
| TL064CP          | LIFEBUY       | PDIP         | NFF                | 14   | 25             | TBD                        | Call TI                 | Call TI              | 0 to 70      | LF444CN                 |                         |
| TL064CPW         | ACTIVE        | TSSOP        | PW                 | 14   | 90             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T064                    | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| TL064CPWE4       | ACTIVE        | TSSOP        | PW                 | 14   | 90             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T064                    | <a href="#">Samples</a> |
| TL064CPWG4       | ACTIVE        | TSSOP        | PW                 | 14   | 90             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T064                    | <a href="#">Samples</a> |
| TL064CPWLE       | OBSOLETE      | TSSOP        | PW                 | 14   |                | TBD                        | Call TI                 | Call TI              | 0 to 70      |                         |                         |
| TL064CPWR        | ACTIVE        | TSSOP        | PW                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T064                    | <a href="#">Samples</a> |
| TL064CPWRG4      | ACTIVE        | TSSOP        | PW                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | 0 to 70      | T064                    | <a href="#">Samples</a> |
| TL064ID          | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL064I                  | <a href="#">Samples</a> |
| TL064IDG4        | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL064I                  | <a href="#">Samples</a> |
| TL064IDR         | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU   CU SN       | Level-1-260C-UNLIM   | -40 to 85    | TL064I                  | <a href="#">Samples</a> |
| TL064IDRG4       | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL064I                  | <a href="#">Samples</a> |
| TL064IN          | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | -40 to 85    | TL064IN                 | <a href="#">Samples</a> |
| TL064INE4        | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | -40 to 85    | TL064IN                 | <a href="#">Samples</a> |
| TL064INS         | ACTIVE        | SO           | NS                 | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL064I                  | <a href="#">Samples</a> |
| TL064INSR        | ACTIVE        | SO           | NS                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | TL064I                  | <a href="#">Samples</a> |
| TL064MFK         | ACTIVE        | LCCC         | FK                 | 20   | 1              | TBD                        | POST-PLATE              | N / A for Pkg Type   | -55 to 125   | TL064MFK                | <a href="#">Samples</a> |
| TL064MFKB        | ACTIVE        | LCCC         | FK                 | 20   | 1              | TBD                        | POST-PLATE              | N / A for Pkg Type   | -55 to 125   | 81023032A<br>TL064MFKB  | <a href="#">Samples</a> |
| TL064MJ          | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | TL064MJ                 | <a href="#">Samples</a> |
| TL064MJB         | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 8102303CA<br>TL064MJB   | <a href="#">Samples</a> |
| TL064MWB         | ACTIVE        | CFP          | W                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 8102303DA<br>TL064MWB   | <a href="#">Samples</a> |

<sup>(1)</sup> The marketing status values are defined as follows:

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**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), 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)

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

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF TL062, TL062M, TL064, TL064M :**

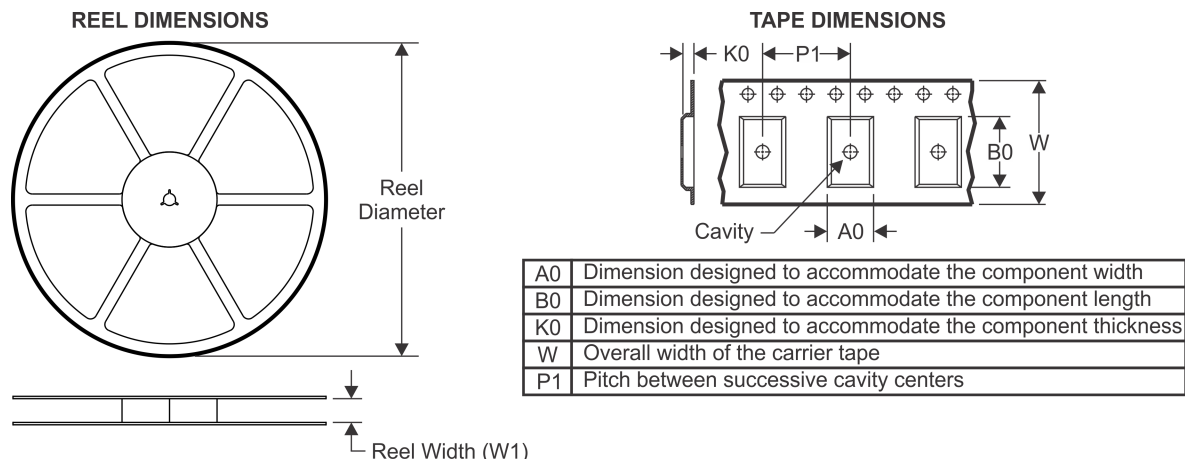
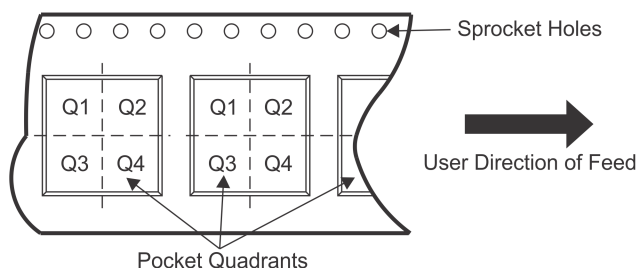
- Catalog: [TL062](#), [TL064](#)

- Military: [TL062M](#), [TL064M](#)

NOTE: Qualified Version Definitions:

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



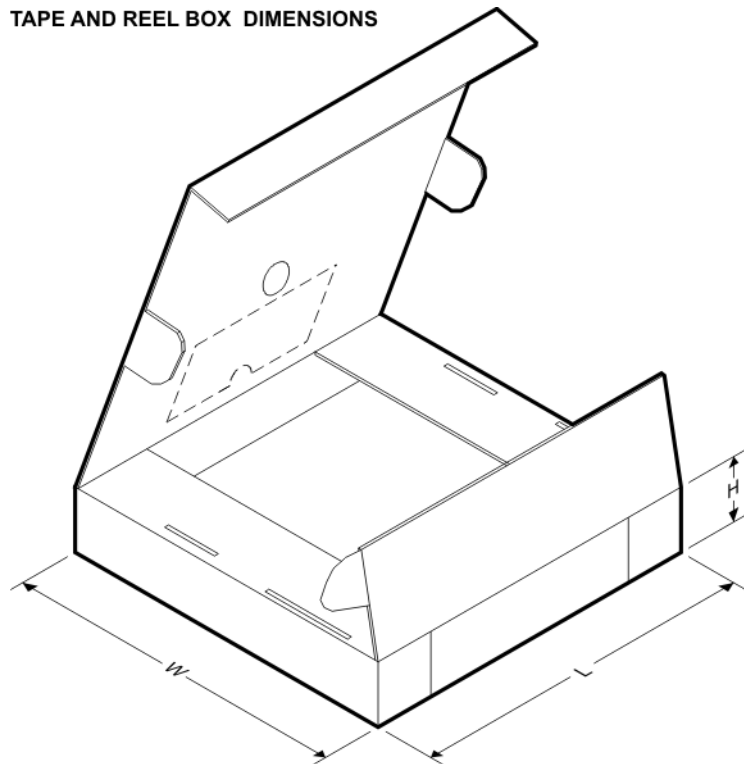
**TAPE AND REEL INFORMATION**

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


\*All dimensions are nominal

| Device     | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TL061ACDR  | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL061CDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL061CDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL061CPSR  | SO           | PS              | 8    | 2000 | 330.0              | 16.4               | 8.2     | 6.6     | 2.5     | 12.0    | 16.0   | Q1            |
| TL061IDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL061IDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL062ACDR  | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL062ACPSR | SO           | PS              | 8    | 2000 | 330.0              | 16.4               | 8.2     | 6.6     | 2.5     | 12.0    | 16.0   | Q1            |
| TL062BCDR  | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL062CDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL062CDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL062CPWR  | TSSOP        | PW              | 8    | 2000 | 330.0              | 12.4               | 7.0     | 3.6     | 1.6     | 8.0     | 12.0   | Q1            |
| TL062IDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL062IDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL062IPWR  | TSSOP        | PW              | 8    | 2000 | 330.0              | 12.4               | 7.0     | 3.6     | 1.6     | 8.0     | 12.0   | Q1            |
| TL064ACDR  | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL064BCDR  | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL064CPWR  | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |

| 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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TL064IDR   | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL064IDRG4 | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL064INSR  | SO           | NS              | 14   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

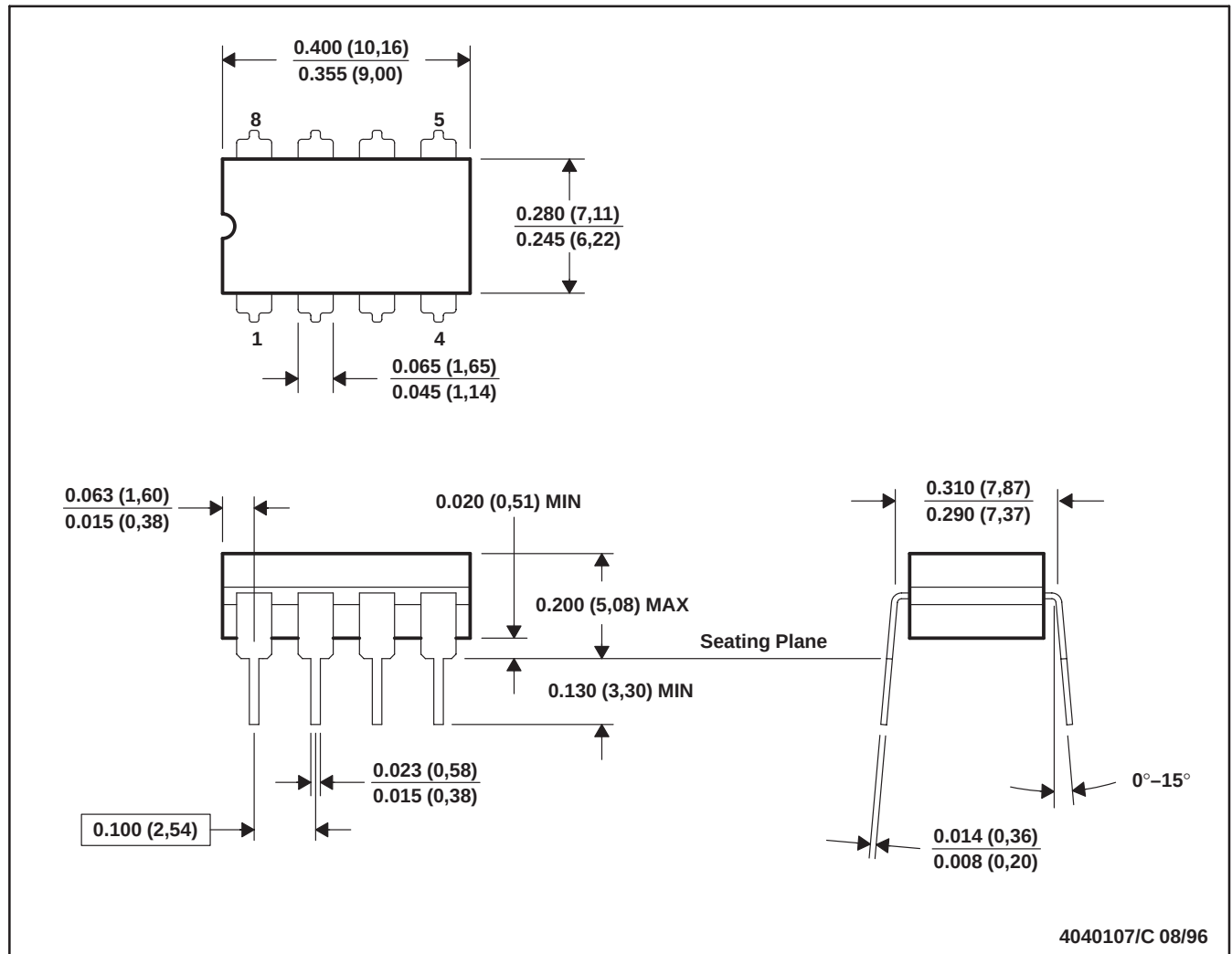
| Device     | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TL061ACDR  | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| TL061CDR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| TL061CDR   | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| TL061CPSR  | SO           | PS              | 8    | 2000 | 367.0       | 367.0      | 38.0        |
| TL061IDR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| TL061IDR   | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| TL062ACDR  | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| TL062ACPSR | SO           | PS              | 8    | 2000 | 367.0       | 367.0      | 38.0        |
| TL062BCDR  | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| TL062CDR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| TL062CDR   | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| TL062CPWR  | TSSOP        | PW              | 8    | 2000 | 367.0       | 367.0      | 35.0        |
| TL062IDR   | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| TL062IDR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |

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| Device     | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TL062IPWR  | TSSOP        | PW              | 8    | 2000 | 367.0       | 367.0      | 35.0        |
| TL064ACDR  | SOIC         | D               | 14   | 2500 | 367.0       | 367.0      | 38.0        |
| TL064BCDR  | SOIC         | D               | 14   | 2500 | 367.0       | 367.0      | 38.0        |
| TL064CPWR  | TSSOP        | PW              | 14   | 2000 | 367.0       | 367.0      | 35.0        |
| TL064IDR   | SOIC         | D               | 14   | 2500 | 367.0       | 367.0      | 38.0        |
| TL064IDRG4 | SOIC         | D               | 14   | 2500 | 367.0       | 367.0      | 38.0        |
| TL064INSR  | SO           | NS              | 14   | 2000 | 367.0       | 367.0      | 38.0        |

## JG (R-GDIP-T8)

## CERAMIC DUAL-IN-LINE

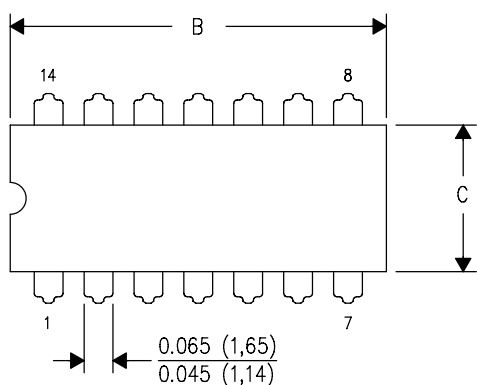


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification.
  - E. Falls within MIL STD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

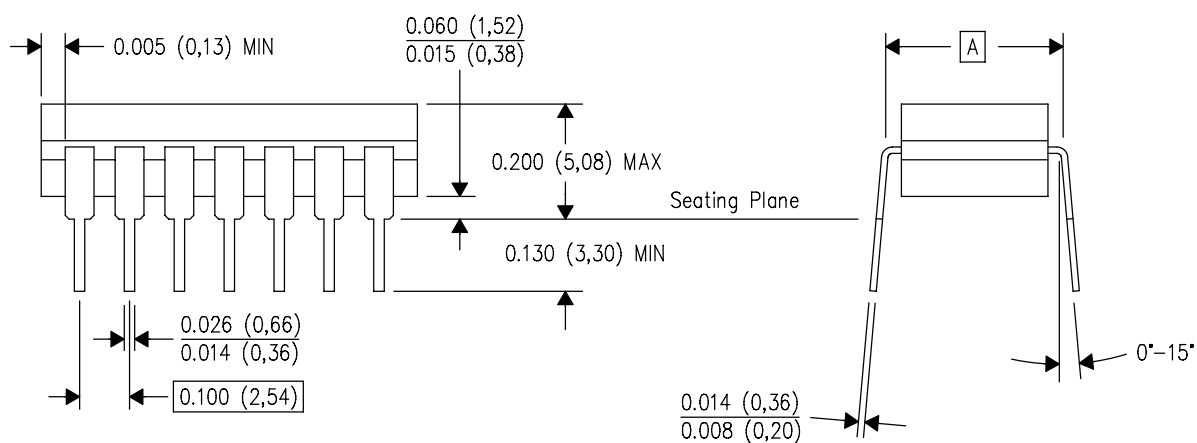
J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<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)        |

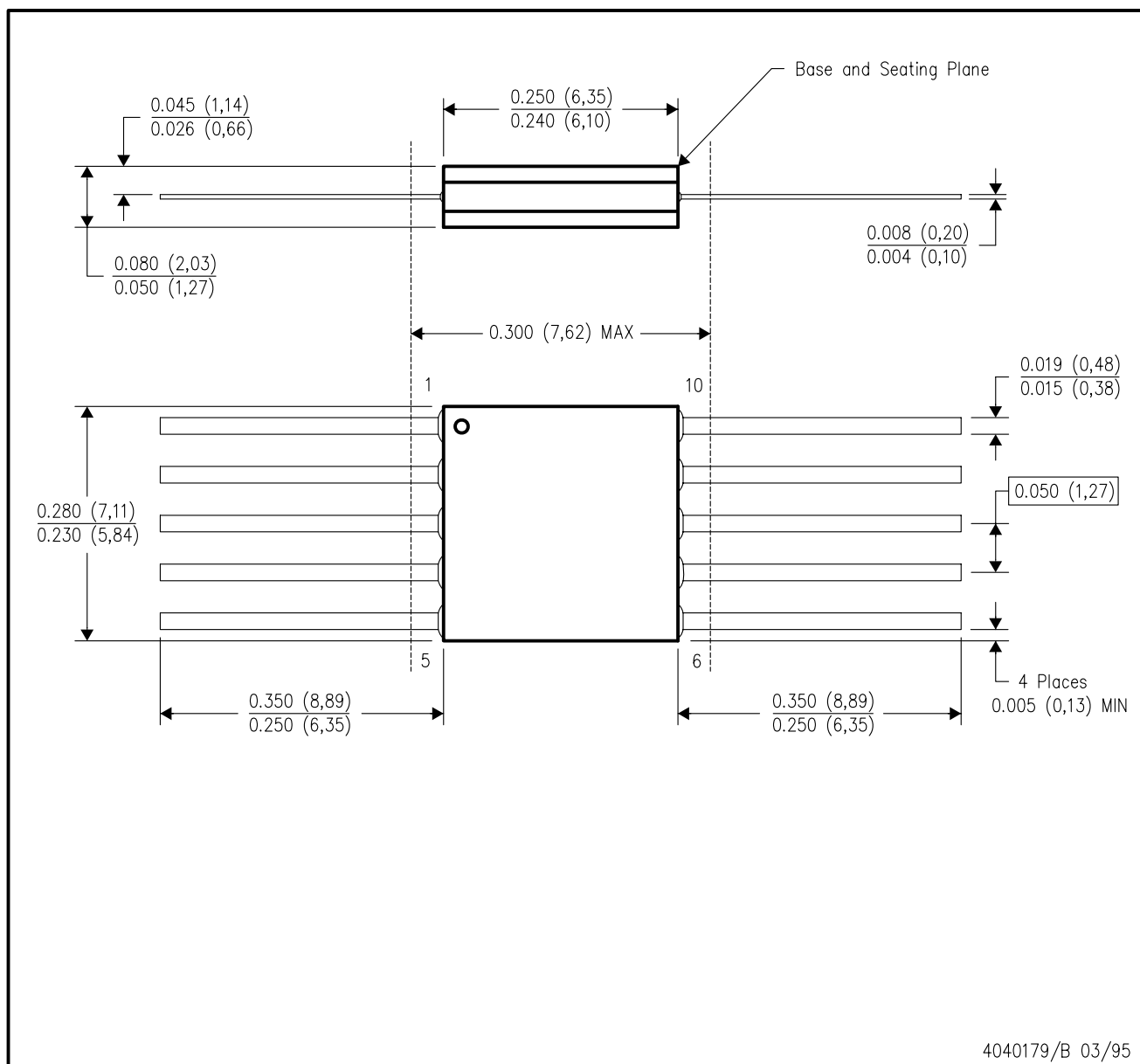


4040083/F 03/03

- 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)

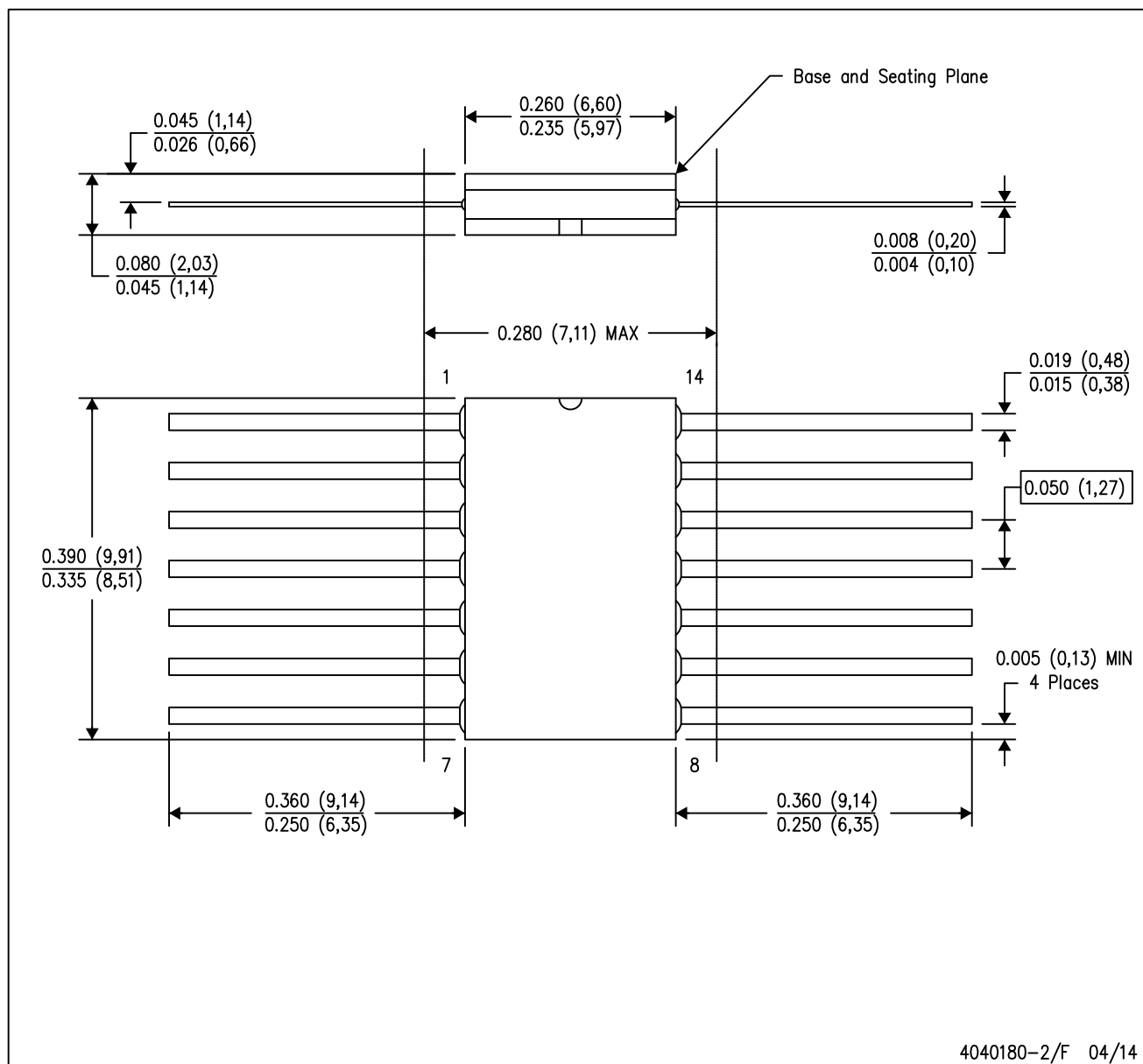
CERAMIC DUAL FLATPACK



4040179/B 03/95

W (R-GDFP-F14)

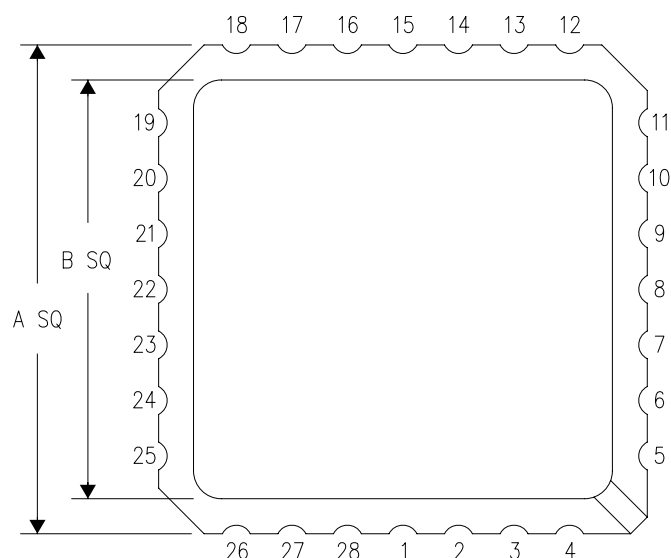
CERAMIC DUAL FLATPACK



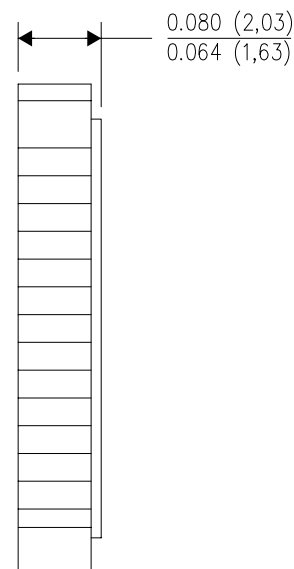
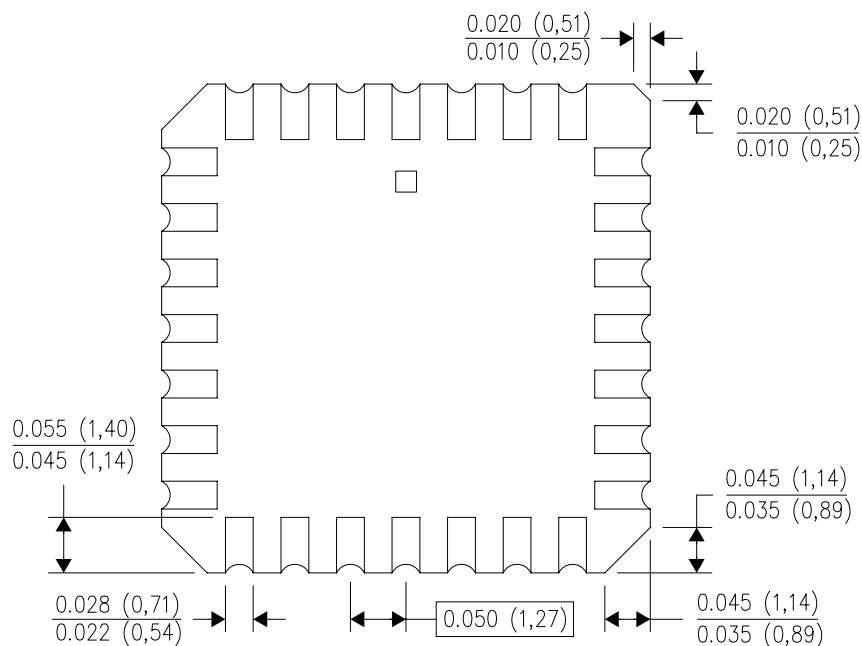
FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



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



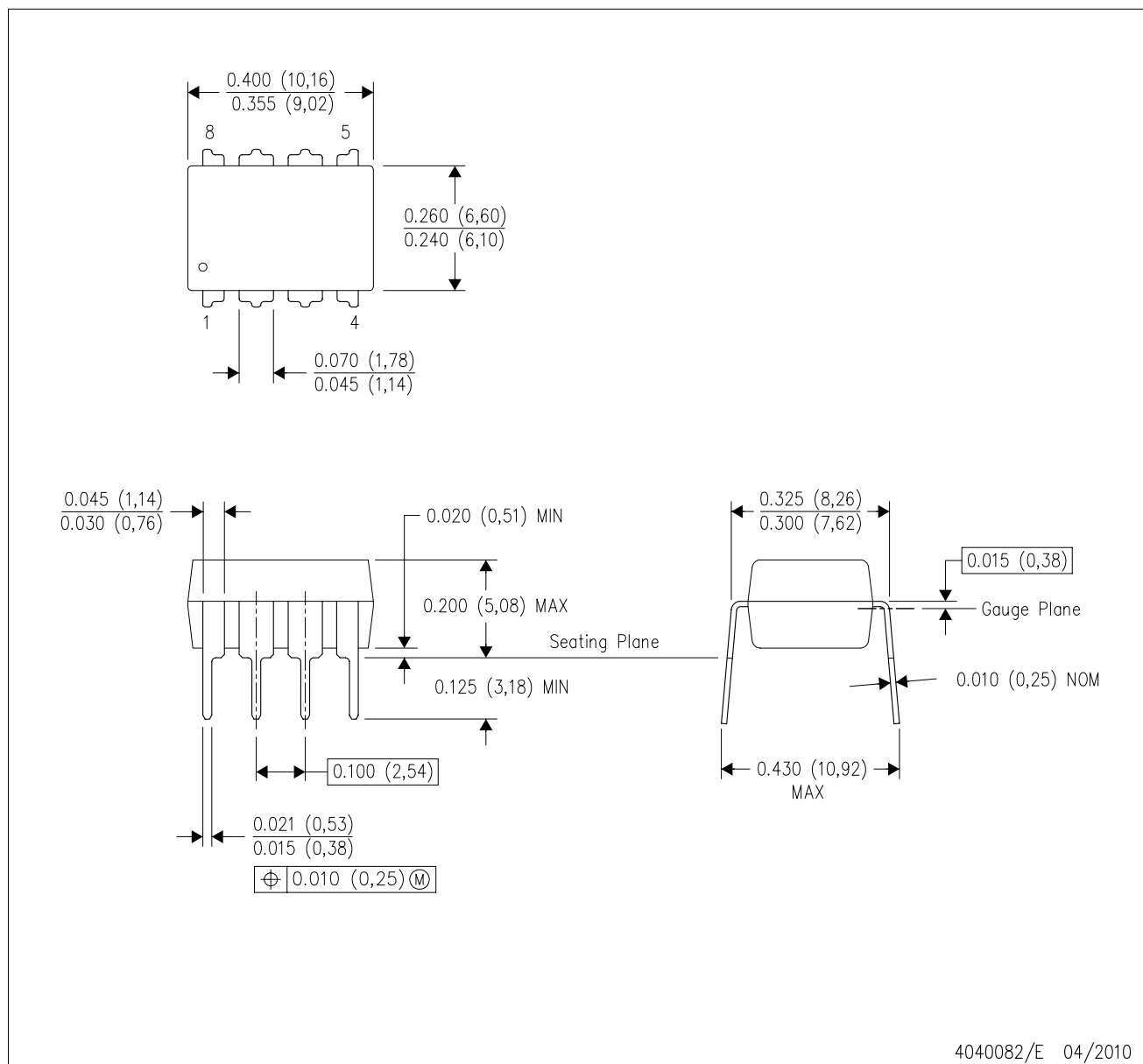
4040140/D 01/11

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



P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE

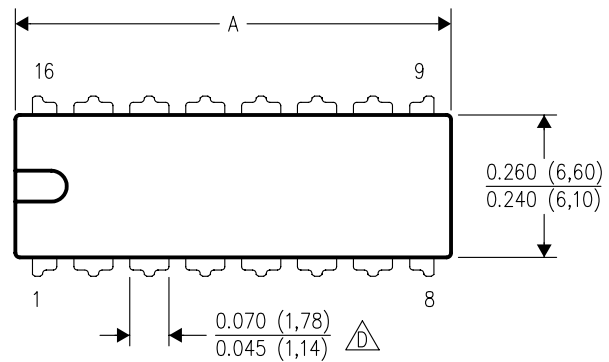


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MS-001 variation BA.

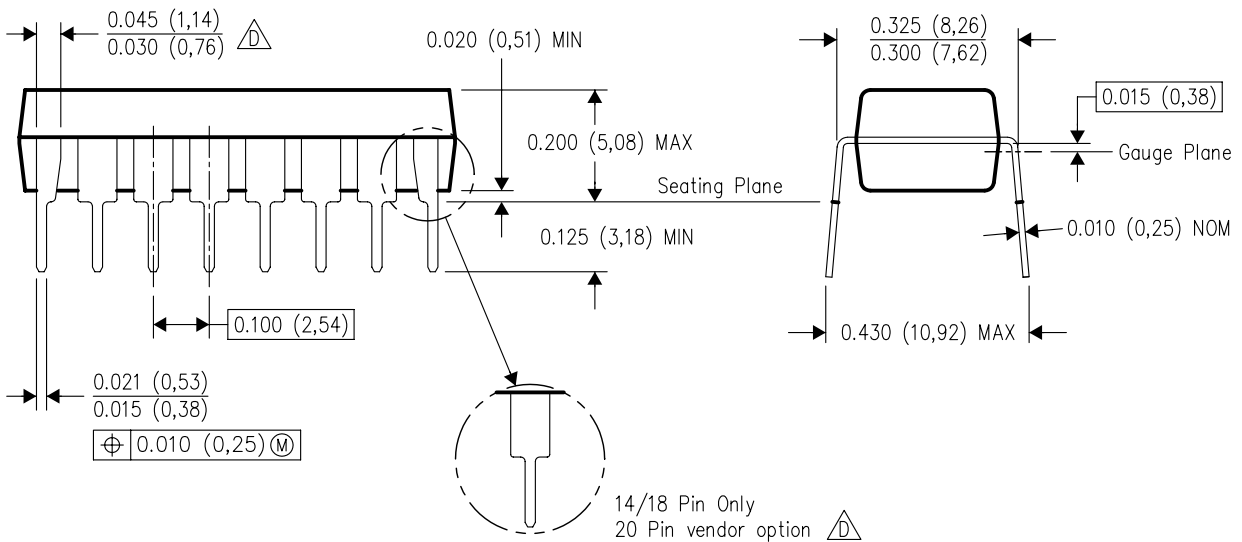
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| A MAX               | 0.775<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               |

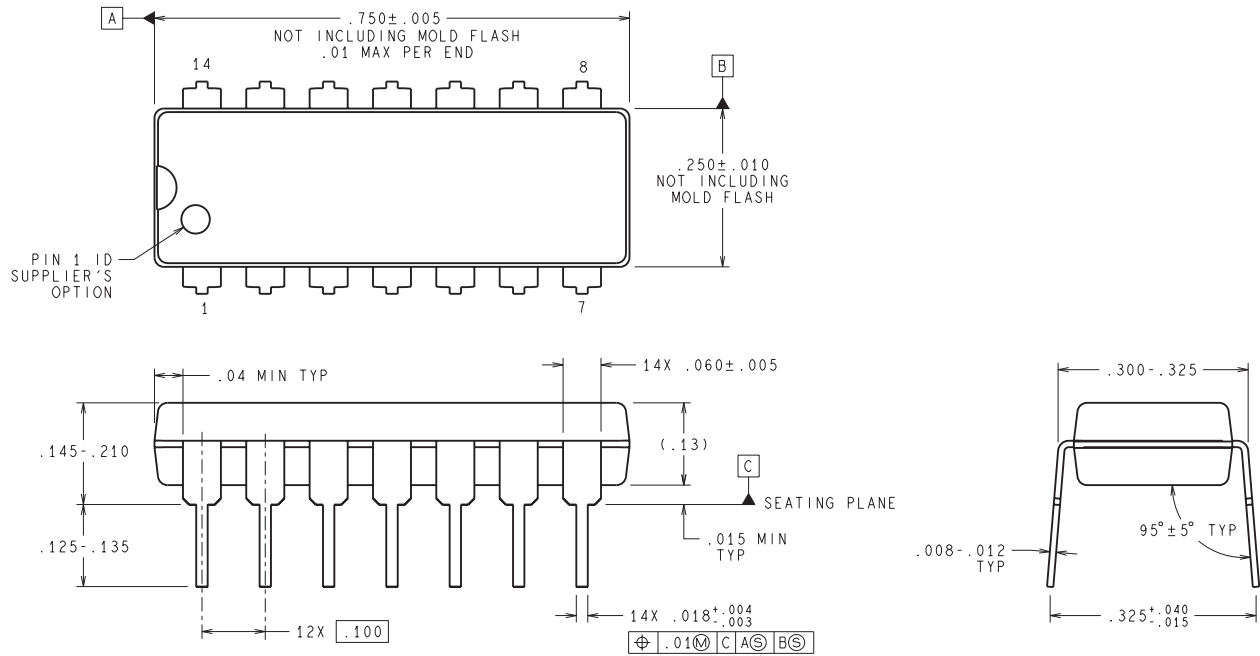


14/18 Pin Only  
20 Pin vendor option

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.

NFF0014A

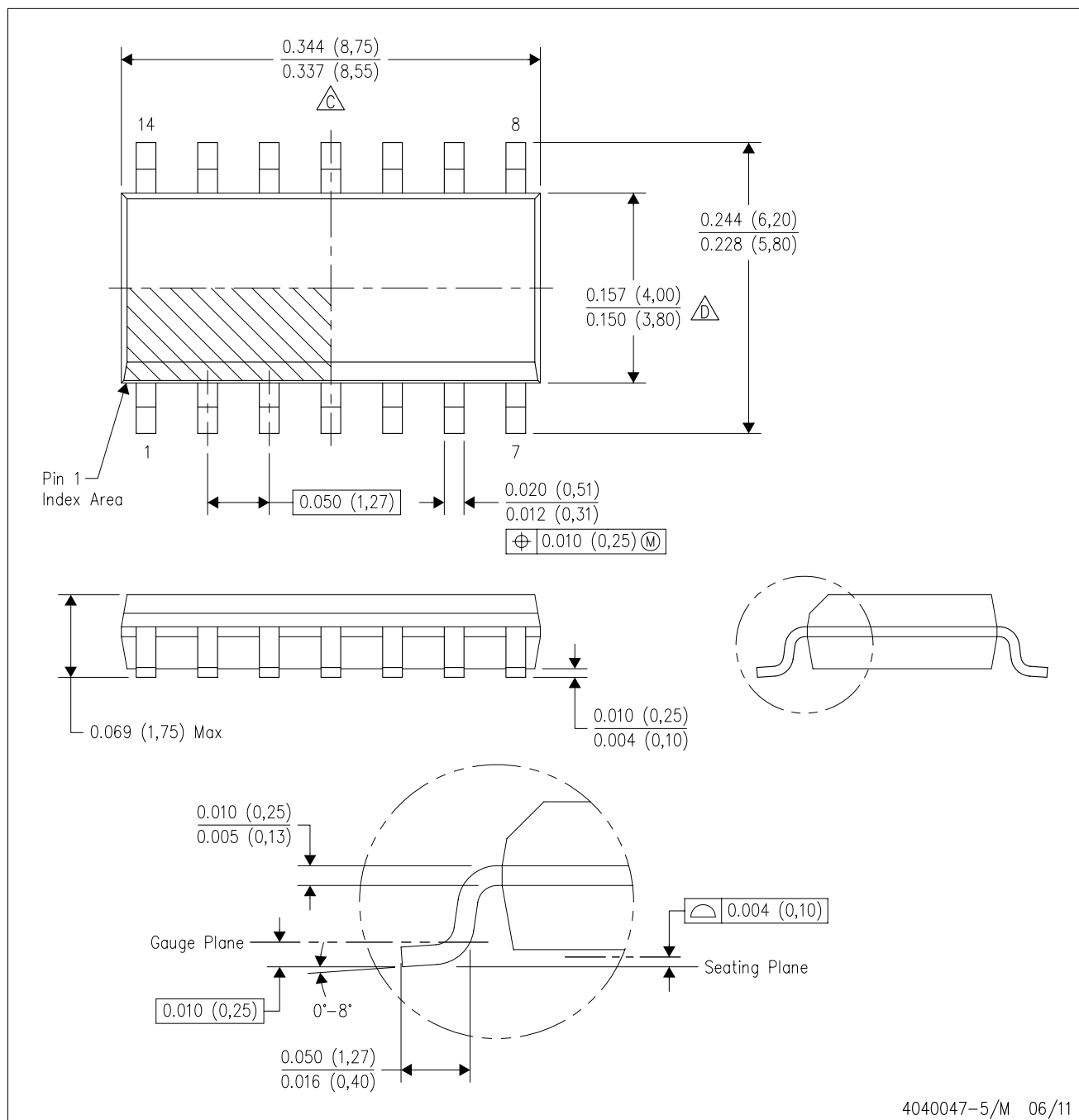


**DIMENSIONS ARE IN INCHES**  
DIMENSIONS IN ( ) FOR REFERENCE ONLY

N14A (Rev G)

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



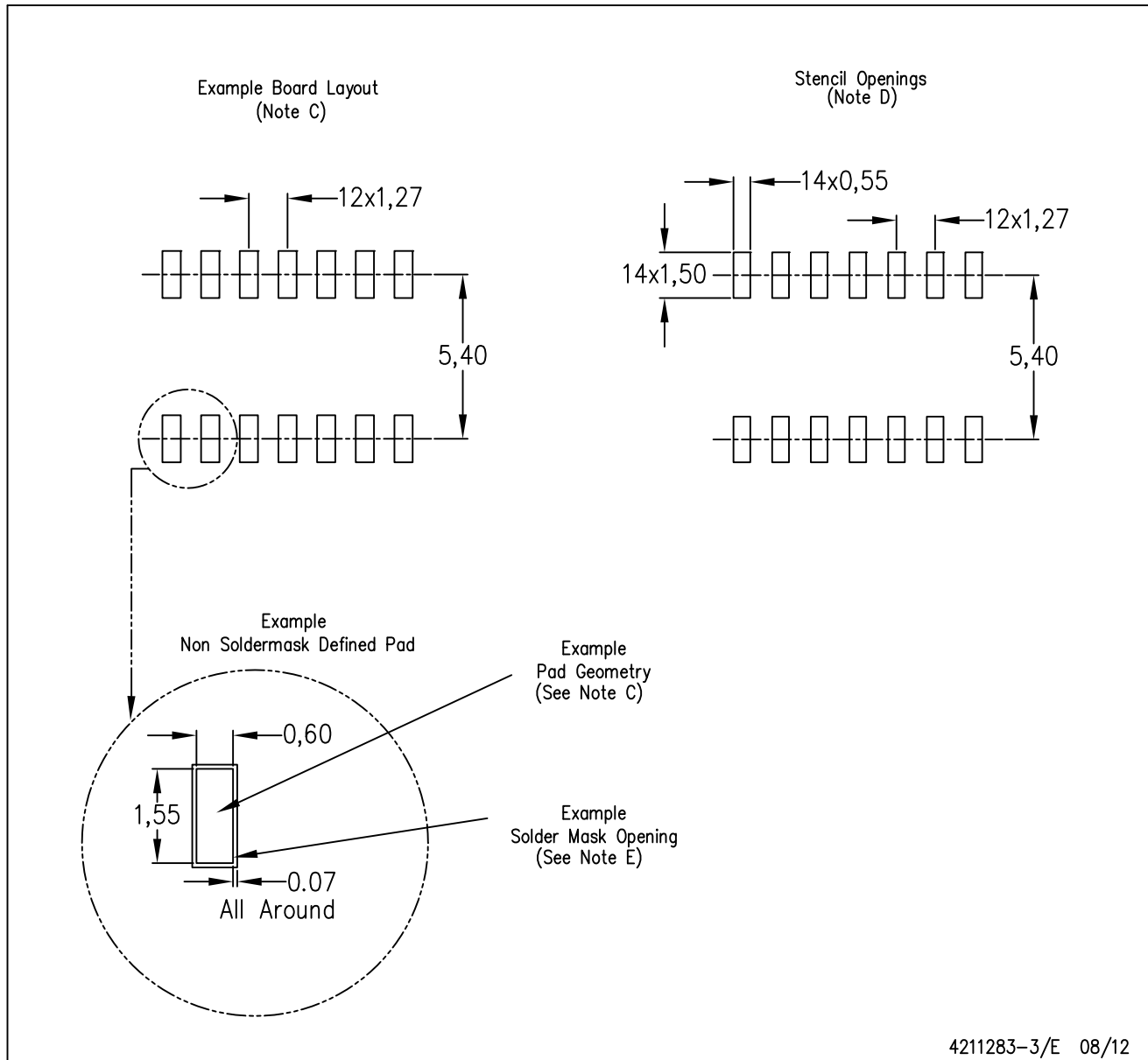
4040047-5/M 06/11

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 0.006 (0,15) each side.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

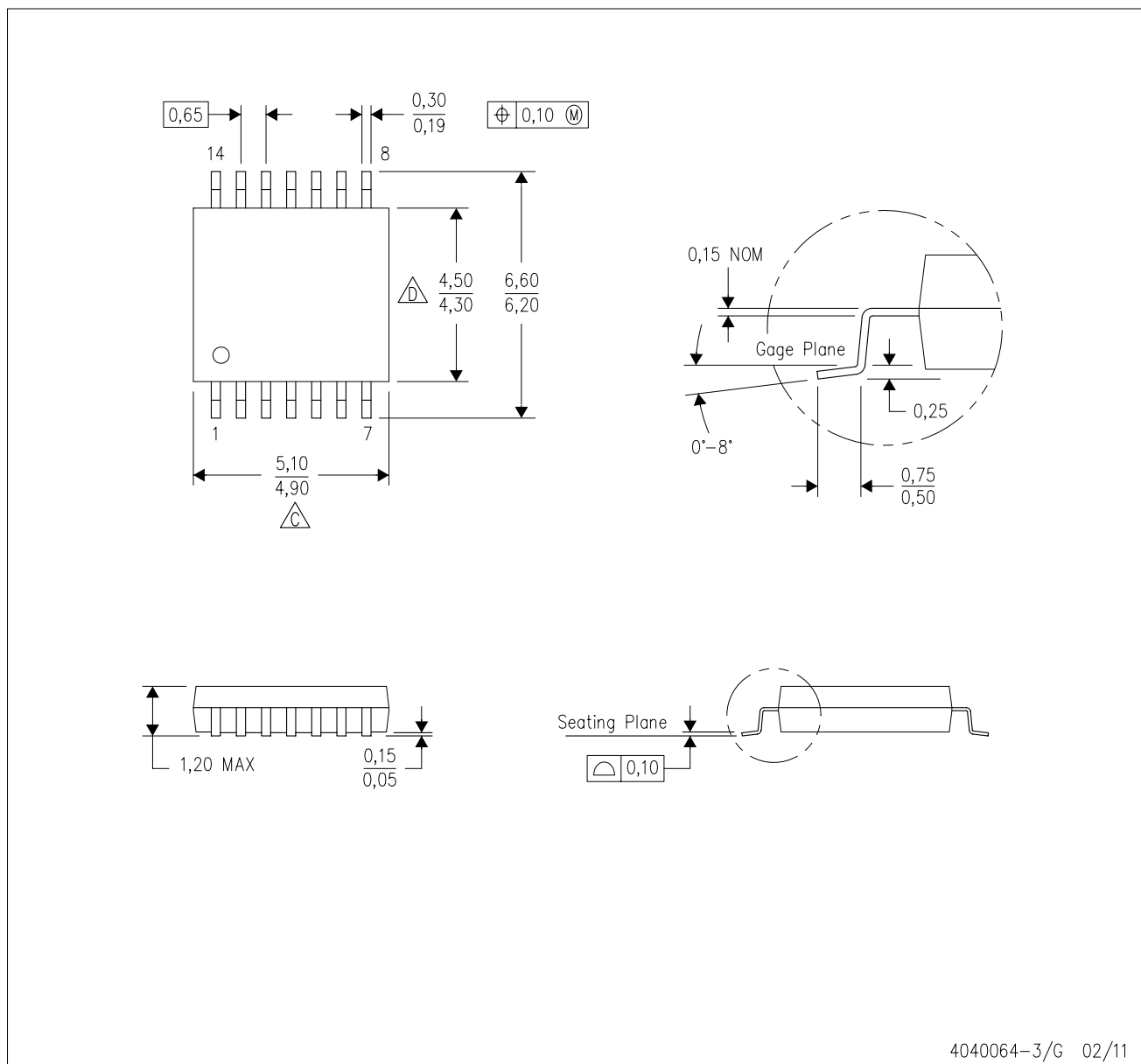
PLASTIC SMALL OUTLINE



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

PW (R-PDSO-G14)

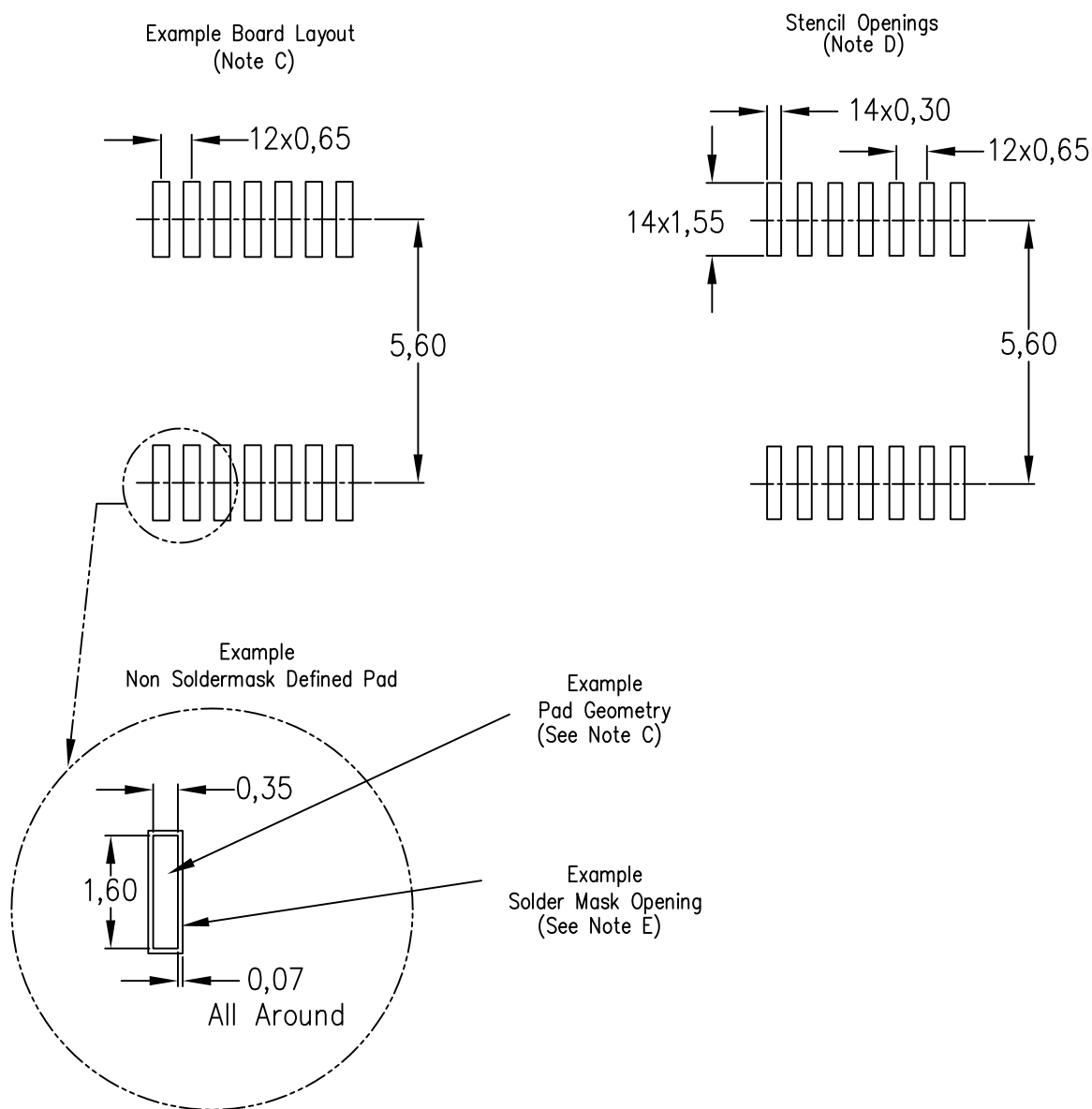
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - 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 0,15 each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE

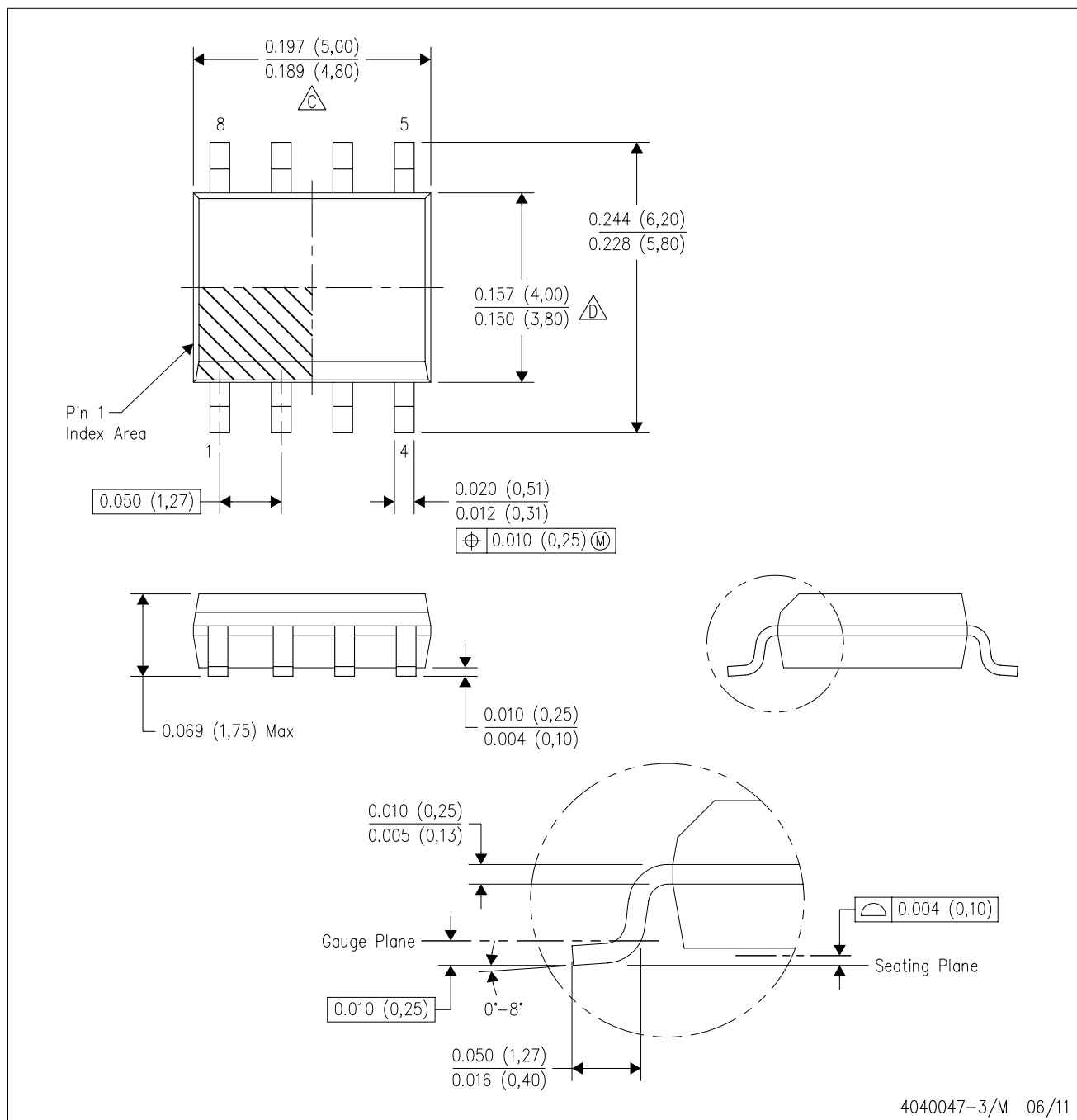


4211284-2/F 12/12

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

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE

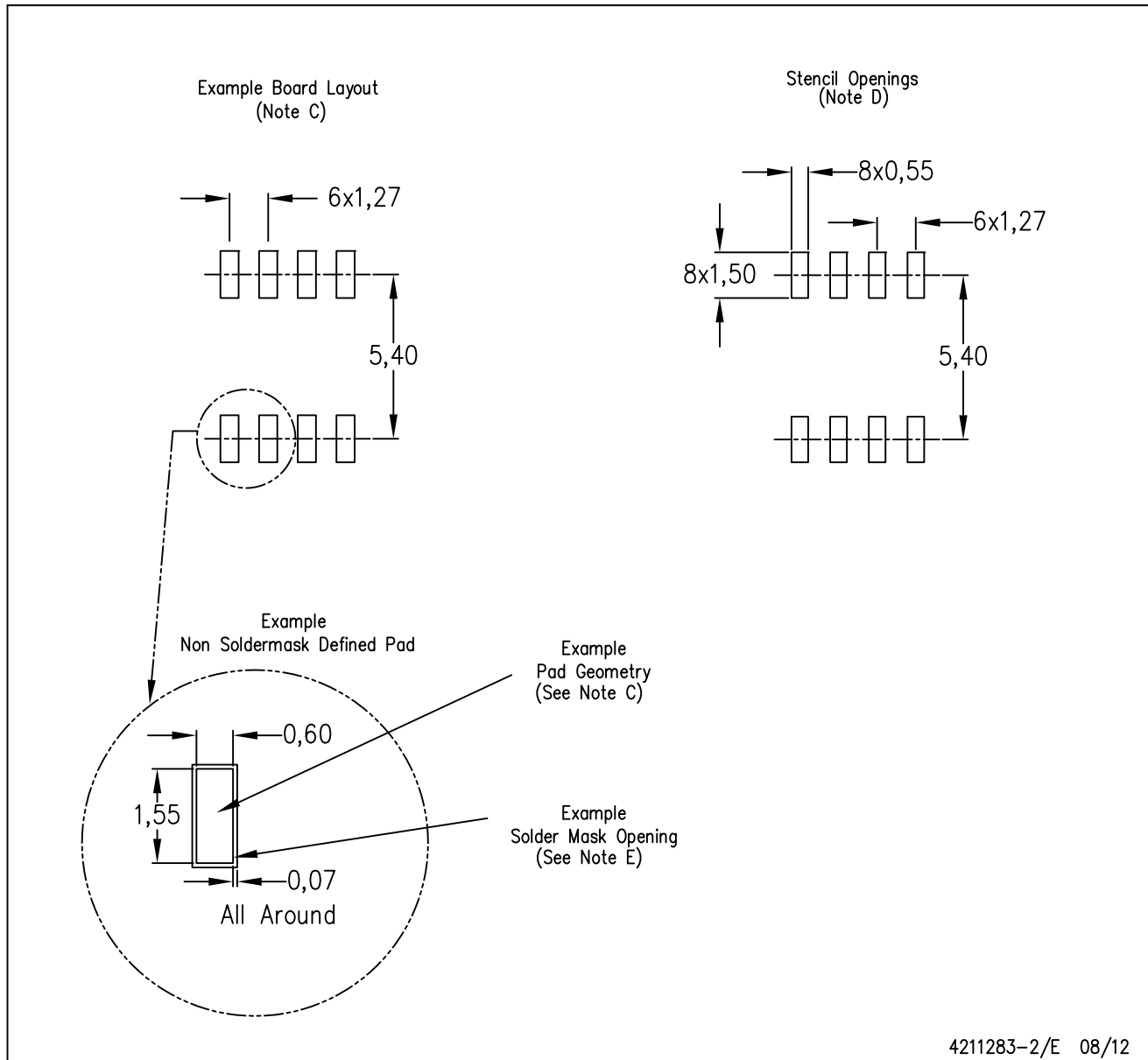


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - $\triangle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



D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



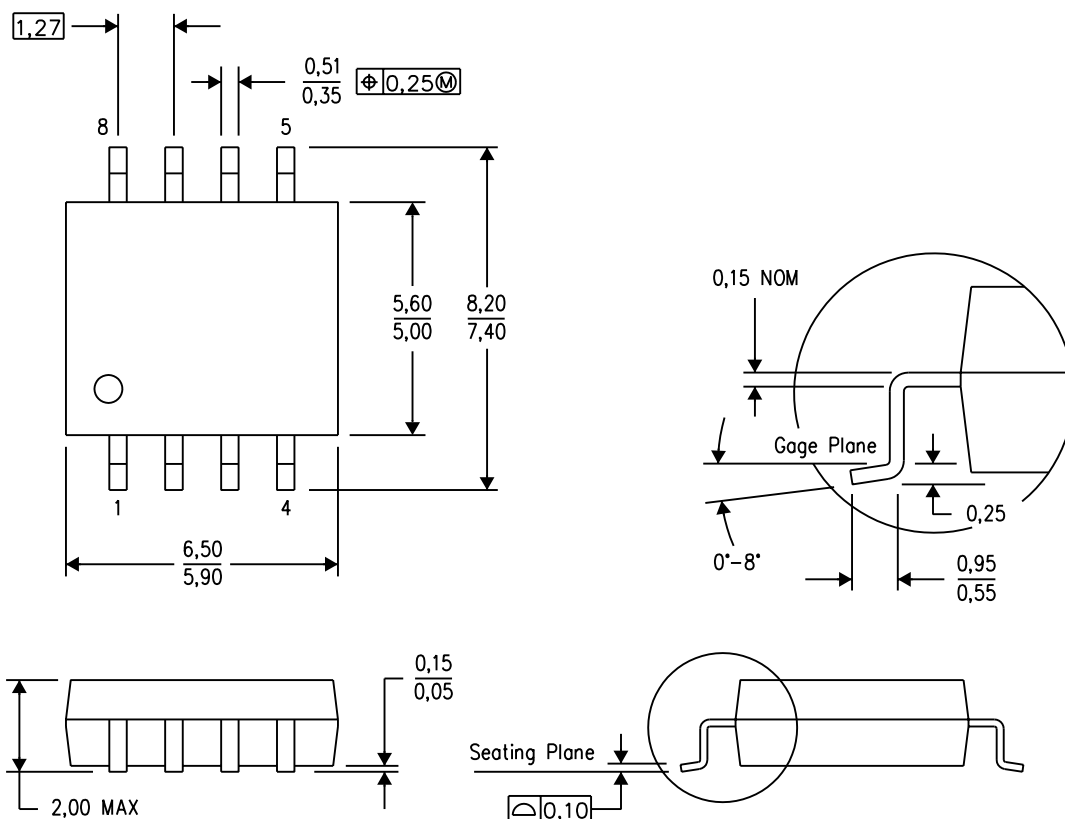
4211283-2/E 08/12

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

## MECHANICAL DATA

PS (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE

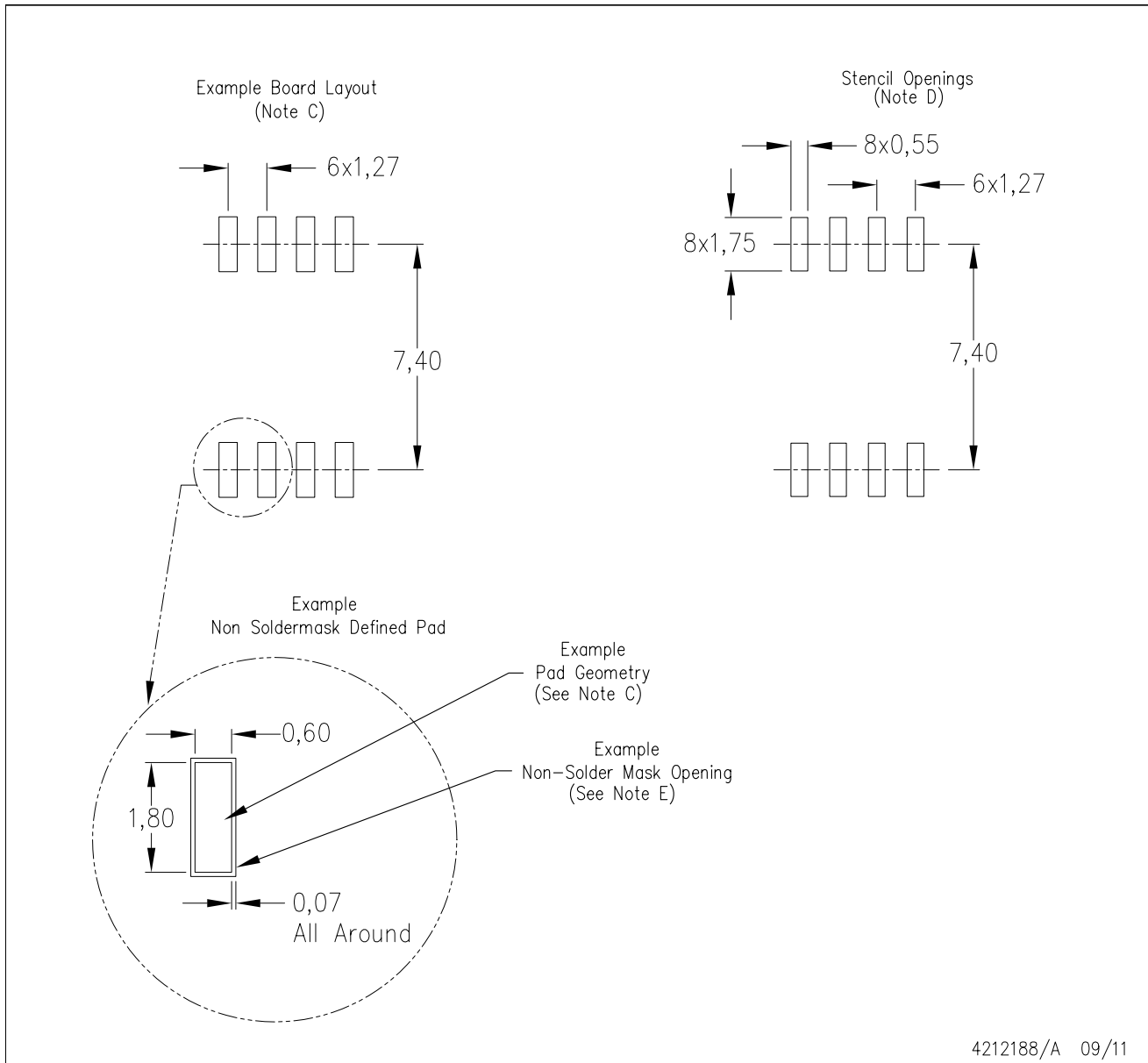


4040063/C 03/03

- 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.

## PS (R-PDSO-G8)

## PLASTIC SMALL OUTLINE



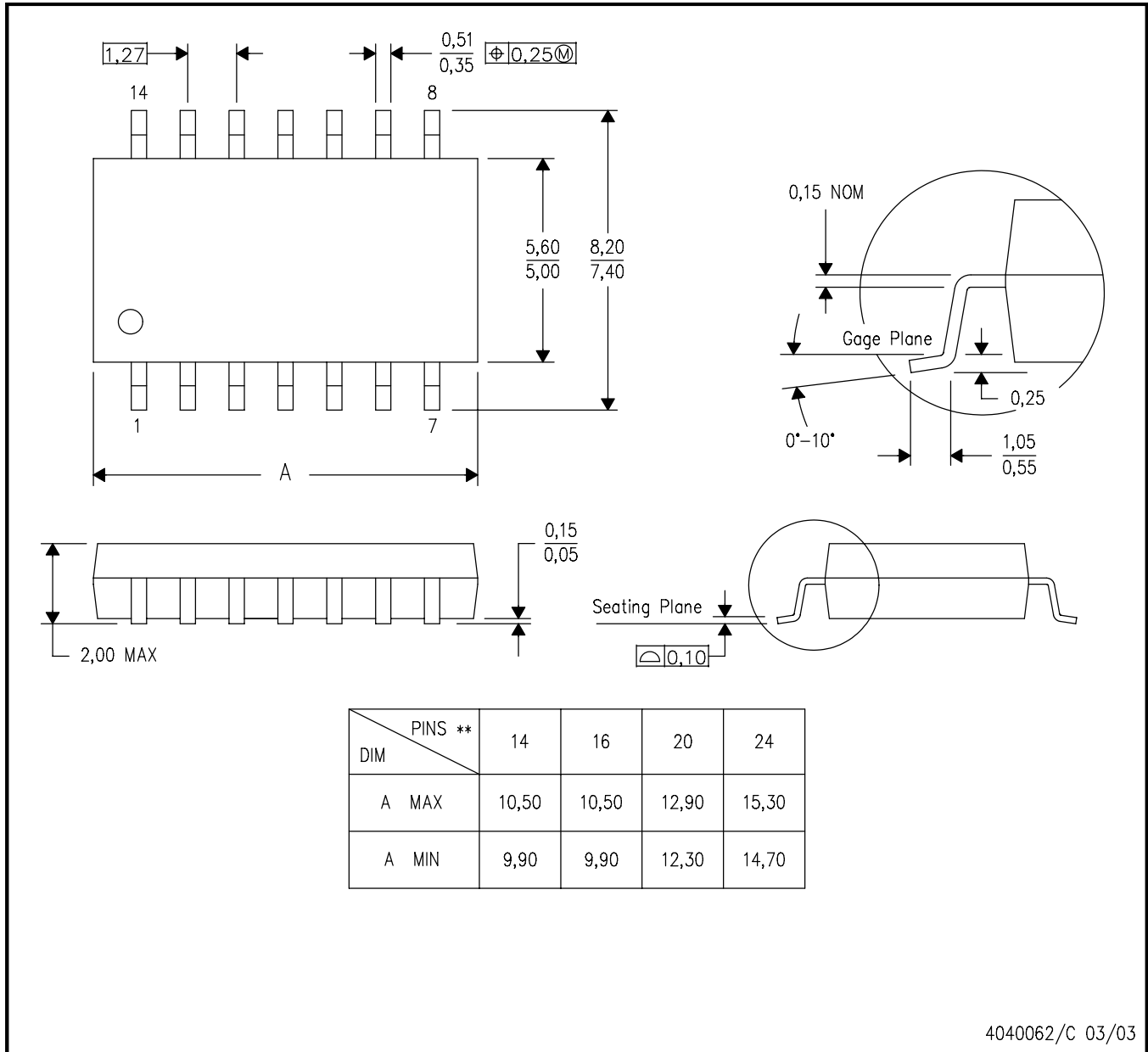
- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact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

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

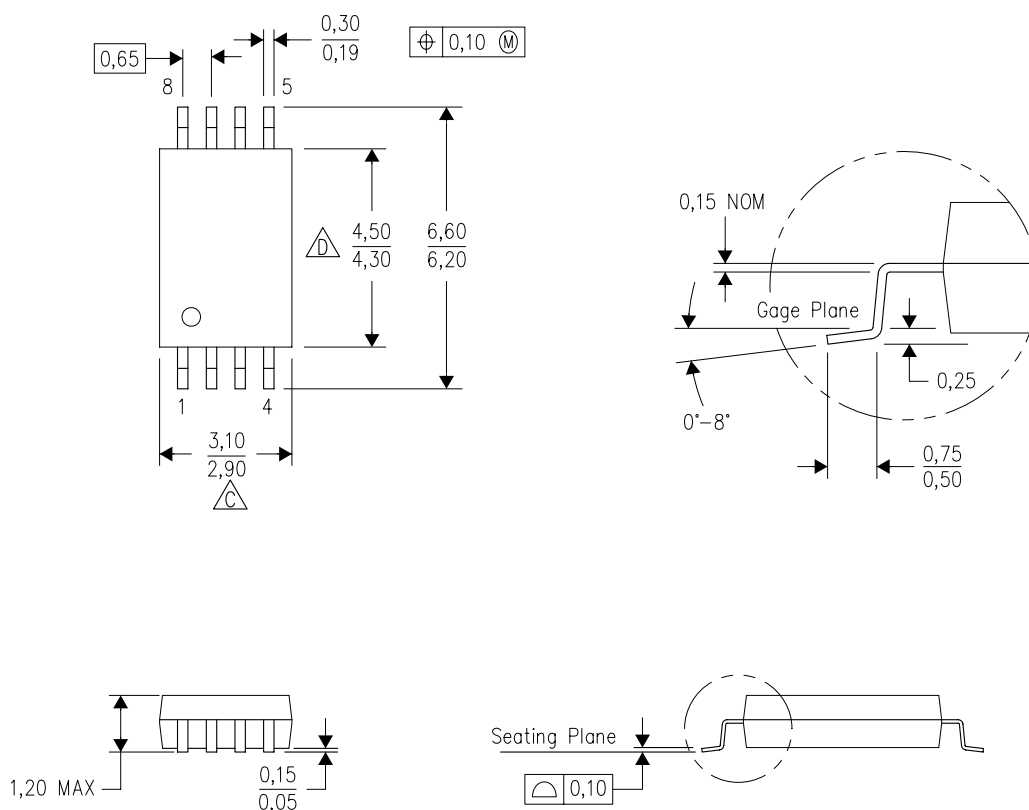
14-PINS SHOWN



- 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-G8)

PLASTIC SMALL OUTLINE



4040064-2/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - 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 0,15 each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

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