

## TL08xx FET 输入运算放大器

### 1 特性

- 高压摆率：20V/μs ( TL08xH, 典型值 )
- 低失调电压：1mV ( TL08xH, 典型值 )
- 低失调电压漂移：2 μV/°C
- 低功耗：940 μA/通道 ( TL08xH, 典型值 )
- 宽共模和差分电压范围
  - 共模输入电压范围包括  $V_{CC+}$
- 低输入偏置和失调电流
- 低噪声：
  - $f = 1\text{kHz}$  时,  $V_n = 18\text{nV}/\sqrt{\text{Hz}}$  ( 典型值 )
- 输出短路保护
- 低总计谐波失真：0.003% ( 典型值 )
- 宽电源电压：
  - $\pm 2.25\text{V}$  至  $\pm 20\text{V}$ , 4.5V 至 40V

### 2 应用

- 太阳能：串式和中央逆变器
- 电机驱动器：交流和伺服驱动控制及功率级模块
- 单相在线式 UPS
- 三相 UPS
- 专业音频混合器
- 电池测试设备

### 3 说明

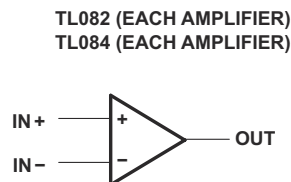
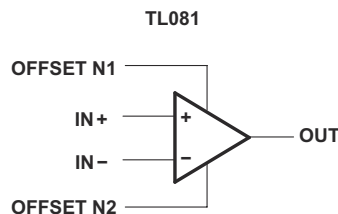
TL08xH ( TL081H、TL082H 和 TL084H ) 系列器件是业界通用的 TL08x ( TL081、TL082 和 TL084 ) 器件的下一代版本。这些器件为成本敏感型应用提供了卓越的价值，其特性包括低失调电压 ( 1mV, 典型值 )、高压摆率 (20V/μs) 和正电源的共模输入。得益于高 ESD ( 1.5kV, HBM )、集成 EMI 和射频滤波器以及 -40°C 至 125°C 的完整运行温度范围，TL08xH 器件可用于要求严苛的应用。

#### 器件信息

| 器件型号   | 封装 <sup>(1)</sup>  | 本体尺寸 ( 标称值 ) <sup>(2)</sup> |
|--------|--------------------|-----------------------------|
| TL081x | P ( PDIP, 8 )      | 9.59mm × 6.35mm             |
|        | DCK ( SC70, 5 )    | 2mm × 1.25mm                |
|        | PS ( SO, 8 )       | 6.2mm × 5.3mm               |
|        | D ( SOIC, 8 )      | 4.9mm × 3.9mm               |
|        | DBV ( SOT-23, 5 )  | 2.9mm × 1.6mm               |
| TL082x | P ( PDIP, 8 )      | 9.59mm × 6.35mm             |
|        | PS ( SO, 8 )       | 6.2mm × 5.3mm               |
|        | D ( SOIC, 8 )      | 4.9mm × 3.9mm               |
|        | DDF ( SOT-23, 8 )  | 2.9mm × 1.6mm               |
|        | PW ( TSSOP, 8 )    | 4.4mm × 3mm                 |
| TL082M | JG ( CDIP, 8 )     | 9.6mm × 6.67mm              |
|        | FK ( LCCC, 20 )    | 8.89mm × 8.89mm             |
| TL084x | N ( PDIP, 14 )     | 19.3mm × 6.35mm             |
|        | NS ( SO, 14 )      | 10.3mm × 5.3mm              |
|        | D ( SOIC, 14 )     | 8.65mm × 3.91mm             |
|        | DYY ( SOT-23, 14 ) | 4.2mm × 2mm                 |
|        | PW ( TSSOP, 14 )   | 5mm × 4.4mm                 |
| TL084M | J ( CDIP, 14 )     | 19.56mm × 6.67mm            |
|        | FK ( LCCC, 20 )    | 8.89mm × 8.89mm             |

(1) 有关更多信息，请参阅节 11。

(2) 本体尺寸 ( 长 × 宽 ) 为标称值，不包括引脚。



逻辑符号



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## 4 Pin Configuration and Functions

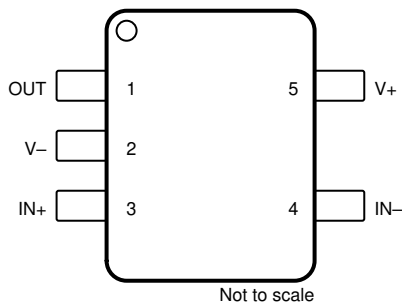


图 4-1. TL081H DBV Package,  
5-Pin SOT-23  
(Top View)

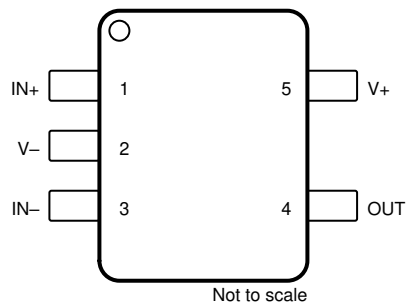
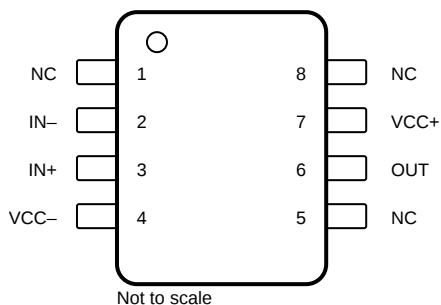


图 4-2. TL081H DCK Package,  
5-Pin SC70  
(Top View)



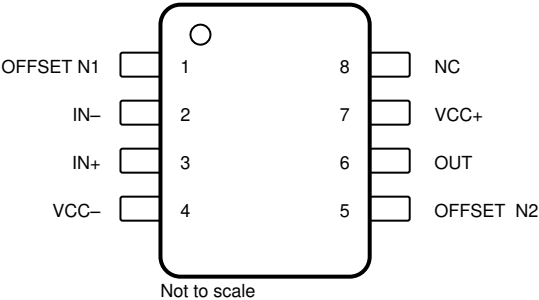
NC- no internal connection

图 4-3. TL081H D Package,  
8-Pin SOIC  
(Top View)

表 4-1. Pin Functions: TL081H

| NAME  | PIN |     |   | TYPE <sup>(1)</sup> | DESCRIPTION        |
|-------|-----|-----|---|---------------------|--------------------|
|       | DBV | DCK | D |                     |                    |
| IN -  | 4   | 3   | 2 | I                   | Inverting input    |
| IN+   | 3   | 1   | 3 | I                   | Noninverting input |
| NC    | —   | —   | 8 | —                   | Do not connect     |
| NC    | —   | —   | 1 | —                   | Do not connect     |
| NC    | —   | —   | 5 | —                   | Do not connect     |
| OUT   | 1   | 4   | 6 | O                   | Output             |
| VCC - | 2   | 2   | 4 | —                   | Power supply       |
| VCC+  | 5   | 5   | 7 | —                   | Power supply       |

(1) I = input, O = output



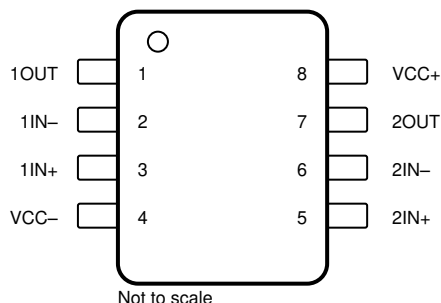
NC- no internal connection

图 4-4. TL081x D, P, and PS Package,  
8-Pin SOIC, PDIP, and SO  
(Top View)

表 4-2. Pin Functions: TL081x

| PIN       |     | TYPE <sup>(1)</sup> | DESCRIPTION             |
|-----------|-----|---------------------|-------------------------|
| NAME      | NO. |                     |                         |
| IN -      | 2   | I                   | Inverting input         |
| IN+       | 3   | I                   | Noninverting input      |
| NC        | 8   | —                   | Do not connect          |
| OFFSET N1 | 1   | —                   | Input offset adjustment |
| OFFSET N2 | 5   | —                   | Input offset adjustment |
| OUT       | 6   | O                   | Output                  |
| VCC -     | 4   | —                   | Power supply            |
| VCC+      | 7   | —                   | Power supply            |

(1) I = input, O = output



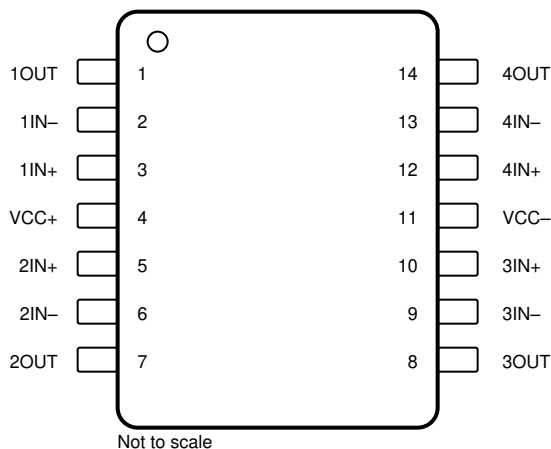
**图 4-5. TL082x D, DDF, DGK, JG, P, PS, and PW Package,  
 8-Pin SOIC, SOT-23 (8), VSSOP, CDIP, PDIP, SO, and TSSOP  
 (Top View)**

**表 4-3. Pin Functions: TL082x**

| PIN   |     | TYPE <sup>(1)</sup> | DESCRIPTION        |
|-------|-----|---------------------|--------------------|
| NAME  | NO. |                     |                    |
| 1IN – | 2   | I                   | Inverting input    |
| 1IN+  | 3   | I                   | Noninverting input |
| 1OUT  | 1   | O                   | Output             |
| 2IN – | 6   | I                   | Inverting input    |
| 2IN+  | 5   | I                   | Noninverting input |
| 2OUT  | 7   | O                   | Output             |
| VCC – | 4   | —                   | Power supply       |
| VCC+  | 8   | —                   | Power supply       |

(1) I = input, O = output



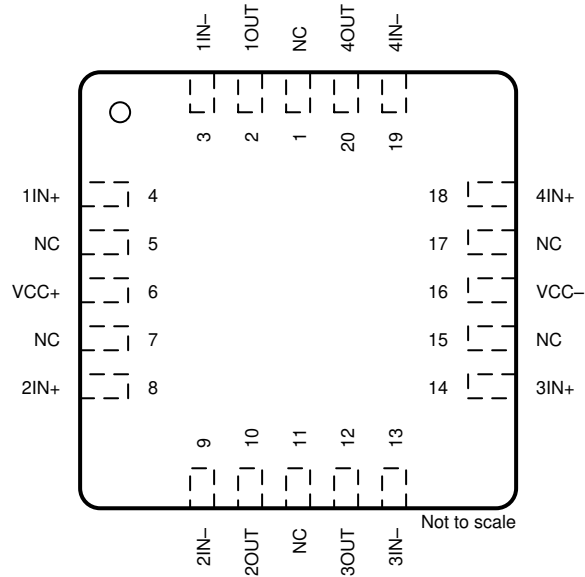


**图 4-7. TL084x D, N, NS, PW, J, and DYY Package,  
14-Pin SOIC, PDIP, SO, TSSOP, CDIP, and SOT-23 (14)  
(Top View)**

**表 4-5. Pin Functions: TL084x**

| PIN               |     | TYPE <sup>(1)</sup> | DESCRIPTION        |
|-------------------|-----|---------------------|--------------------|
| NAME              | NO. |                     |                    |
| 1IN -             | 2   | I                   | Inverting input    |
| 1IN+              | 3   | I                   | Noninverting input |
| 1OUT              | 1   | O                   | Output             |
| 2IN -             | 6   | I                   | Inverting input    |
| 2IN+              | 5   | I                   | Noninverting input |
| 2OUT              | 7   | O                   | Output             |
| 3IN -             | 9   | I                   | Inverting input    |
| 3IN+              | 10  | I                   | Noninverting input |
| 3OUT              | 8   | O                   | Output             |
| 4IN -             | 13  | I                   | Inverting input    |
| 4IN+              | 12  | I                   | Noninverting input |
| 4OUT              | 14  | O                   | Output             |
| V <sub>CC</sub> - | 11  | —                   | Power supply       |
| V <sub>CC</sub> + | 4   | —                   | Power supply       |

(1) I = input, O = output



NC- no internal connection

图 4-8. TL084 FK Package,  
20-Pin LCCC  
(Top View)

表 4-6. Pin Functions: TL084x

| PIN   |                     | TYPE <sup>(1)</sup> | DESCRIPTION        |
|-------|---------------------|---------------------|--------------------|
| NAME  | NO.                 |                     |                    |
| 1IN - | 3                   | I                   | Inverting input    |
| 1IN+  | 4                   | I                   | Noninverting input |
| 1OUT  | 2                   | O                   | Output             |
| 2IN - | 9                   | I                   | Inverting input    |
| 2IN+  | 8                   | I                   | Noninverting input |
| 2OUT  | 10                  | O                   | Output             |
| 3IN - | 13                  | I                   | Inverting input    |
| 3IN+  | 14                  | I                   | Noninverting input |
| 3OUT  | 12                  | O                   | Output             |
| 4IN - | 19                  | I                   | Inverting input    |
| 4IN+  | 18                  | I                   | Noninverting input |
| 4OUT  | 20                  | O                   | Output             |
| NC    | 1, 5, 7, 11, 15, 17 | —                   | Do not connect     |
| VCC - | 16                  | —                   | Power supply       |
| VCC+  | 6                   | —                   | Power supply       |

(1) I = input, O = output

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating ambient temperature range (unless otherwise noted) <sup>(1)</sup>

|                                                              |                                     |                                                           | MIN          | MAX          | UNIT |
|--------------------------------------------------------------|-------------------------------------|-----------------------------------------------------------|--------------|--------------|------|
| Supply voltage, $V_S = (V+) - (V-)$                          |                                     | All NS and PS packages; All TL08xM devices                | - 0.3        | 36           | V    |
|                                                              |                                     | All other devices                                         | 0            | 42           | V    |
| Signal input pins                                            | Common-mode voltage <sup>(3)</sup>  | All NS and PS packages; All TL08xM devices                | $(V-) - 0.3$ | $(V-) + 36$  | V    |
|                                                              |                                     | All other devices                                         | $(V-) - 0.5$ | $(V+) + 0.5$ | V    |
|                                                              | Differential voltage <sup>(3)</sup> | All NS and PS packages; All TL08xM devices <sup>(4)</sup> | $(V-) - 0.3$ | $(V-) + 36$  | V    |
|                                                              |                                     | All other devices                                         |              | $V_S + 0.2$  | V    |
|                                                              | Current <sup>(3)</sup>              | All NS and PS packages; All TL07xM devices                |              | 50           | mA   |
|                                                              |                                     | All other devices                                         | - 10         | 10           | mA   |
| Output short-circuit <sup>(2)</sup>                          |                                     |                                                           | Continuous   |              |      |
| Operating ambient temperature, $T_A$                         |                                     |                                                           | - 55         | 150          | °C   |
| Junction temperature, $T_J$                                  |                                     |                                                           |              | 150          | °C   |
| Case temperature for 60 seconds - FK package                 |                                     |                                                           |              | 260          | °C   |
| Lead temperature 1.8 mm (1/16 inch) from case for 10 seconds |                                     |                                                           |              | 300          | °C   |
| Storage temperature, $T_{stg}$                               |                                     |                                                           | - 65         | 150          | °C   |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) Short-circuit to ground, one amplifier per package.
- (3) Input pins are diode-clamped to the power-supply rails. Input signals that may swing more than 0.5V beyond the supply rails must be current limited to 10 mA or less.
- (4) Differential voltage only limited by input voltage.

### 5.2 ESD Ratings

|             |                         |                                                                                | VALUE | UNIT |
|-------------|-------------------------|--------------------------------------------------------------------------------|-------|------|
| $V_{(ESD)}$ | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | ±2000 | V    |
|             |                         | Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | ±1000 |      |

- (1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

### 5.3 Recommended Operating Conditions

over operating ambient temperature range (unless otherwise noted)

|       |                               |                                                           | MIN        | MAX          | UNIT |
|-------|-------------------------------|-----------------------------------------------------------|------------|--------------|------|
| $V_S$ | Supply voltage, $(V+) - (V-)$ | All NS and PS packages; All TL08xM devices <sup>(1)</sup> | 10         | 30           | V    |
|       |                               | All other devices                                         | 4.5        | 40           | V    |
| $V_I$ | Input voltage range           | All NS and PS packages; All TL08xM devices                | $(V-) + 2$ | $(V+) + 0.1$ | V    |
|       |                               | All other devices                                         | $(V-) + 4$ | $(V+) + 0.1$ | V    |
| $T_A$ | Specified temperature         | TL08xM                                                    | - 55       | 125          | °C   |
|       |                               | TL08xH                                                    | - 40       | 125          | °C   |
|       |                               | TL08xL                                                    | - 40       | 85           | °C   |
|       |                               | TL08xC                                                    | 0          | 70           | °C   |

- (1)  $V+$  and  $V-$  are not required to be of equal magnitude, provided that the total  $V_S$  ( $V+ - V-$ ) is between 10V and 30V.

## 5.4 Thermal Information for Single Channel

| THERMAL METRIC <sup>(1)</sup> |                                              | TL081xx     |               |                 |             |            | UNIT |
|-------------------------------|----------------------------------------------|-------------|---------------|-----------------|-------------|------------|------|
|                               |                                              | D<br>(SOIC) | DCK<br>(SC70) | DBV<br>(SOT-23) | P<br>(PDIP) | PS<br>(SO) |      |
|                               |                                              | 8 PINS      | 5 PINS        | 5 PINS          | 8 PINS      | 8 PINS     |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 158.8       | 217.5         | 212.2           | 85          | 95         | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 98.6        | 113.1         | 111.1           | –           | –          | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 102.3       | 63.8          | 79.4            | –           | –          | °C/W |
| ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 45.8        | 34.8          | 51.8            | –           | –          | °C/W |
| ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 101.5       | 63.5          | 79.0            | –           | –          | °C/W |
| R <sub>θJC(bot)</sub>         | Junction-to-case (bottom) thermal resistance | N/A         | N/A           | N/A             | N/A         | N/A        | °C/W |

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

## 5.5 Thermal Information for Dual Channel

| THERMAL METRIC <sup>(1)</sup> |                                              | TL082xx     |                 |              |              |             |            |               |            | UNIT |
|-------------------------------|----------------------------------------------|-------------|-----------------|--------------|--------------|-------------|------------|---------------|------------|------|
|                               |                                              | D<br>(SOIC) | DDF<br>(SOT-23) | FK<br>(LCCC) | JG<br>(CDIP) | P<br>(PDIP) | PS<br>(SO) | PW<br>(TSSOP) | U<br>(CFP) |      |
|                               |                                              | 8 PINS      | 8 PINS          | 20 PINS      | 8 PINS       | 8 PINS      | 8 PINS     | 8 PINS        | 10 PINS    |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 147.8       | 181.5           | –            | –            | 85          | 95         | 200.3         | 169.8      | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 88.2        | 112.5           | 5.61         | 15.05        | –           | –          | 89.4          | 62.1       | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 91.4        | 98.2            | –            | –            | –           | –          | 131.0         | 176.2      | °C/W |
| ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 36.8        | 17.2            | –            | –            | –           | –          | 22.2          | 48.4       | °C/W |
| ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 90.6        | 97.6            | –            | –            | –           | –          | 129.3         | 144.1      | °C/W |
| R <sub>θJC(bot)</sub>         | Junction-to-case (bottom) thermal resistance | N/A         | N/A             | –            | –            | –           | –          | N/A           | 5.4        | °C/W |

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

## 5.6 Thermal Information for Quad Channel

| THERMAL METRIC <sup>(1)</sup> |                                              | TL084xx     |                 |               |              |              |               |               |              | UNIT |
|-------------------------------|----------------------------------------------|-------------|-----------------|---------------|--------------|--------------|---------------|---------------|--------------|------|
|                               |                                              | D<br>(SOIC) | DYY<br>(SOT-23) | FK<br>(TSSOP) | J<br>(TSSOP) | N<br>(TSSOP) | NS<br>(TSSOP) | PW<br>(TSSOP) | W<br>(TSSOP) |      |
|                               |                                              | 14 PINS     | 14 PINS         | 20 PINS       | 14 PINS      | 14 PINS      | 14 PINS       | 14 PINS       | 14 PINS      |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance       | 114.2       | 153.2           | –             | –            | 80           | 76            | –             | 128.8        | °C/W |
| $R_{\theta JC(top)}$          | Junction-to-case (top) thermal resistance    | 70.3        | 88.7            | 5.61          | 14.5         | –            | –             | 14.5          | 56.1         | °C/W |
| $R_{\theta JB}$               | Junction-to-board thermal resistance         | 70.2        | 65.4            | –             | –            | –            | –             | –             | 127.6        | °C/W |
| $\psi_{JT}$                   | Junction-to-top characterization parameter   | 28.8        | 9.5             | –             | –            | –            | –             | –             | 29           | °C/W |
| $\psi_{JB}$                   | Junction-to-board characterization parameter | 69.8        | 65.0            | –             | –            | –            | –             | –             | 106.1        | °C/W |
| $R_{\theta JC(bot)}$          | Junction-to-case (bottom) thermal resistance | N/A         | N/A             | –             | –            | –            | –             | –             | 0.5          | °C/W |

- (1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

## 5.7 Electrical Characteristics: TL08xH

For  $V_S = (V_{CC+}) - (V_{CC-}) = 4.5V$  to  $40V$  ( $\pm 2.25V$  to  $\pm 20V$ ) at  $T_A = 25^\circ C$ ,  $R_L = 10k\Omega$  connected to  $V_S / 2$ ,  $V_{CM} = V_S / 2$ , and  $V_{OUT} = V_S / 2$ , unless otherwise noted.

| PARAMETER            |                                          | TEST CONDITIONS                                                                                                                                              |                                      | MIN                       | TYP      | MAX                 | UNIT              |
|----------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------|----------|---------------------|-------------------|
| OFFSET VOLTAGE       |                                          |                                                                                                                                                              |                                      |                           |          |                     |                   |
| V <sub>OS</sub>      | Input offset voltage                     |                                                                                                                                                              |                                      |                           | ±1       | ±4                  | mV                |
|                      |                                          |                                                                                                                                                              | T <sub>A</sub> = - 40°C to 125°C     |                           |          | ±5                  |                   |
| dV <sub>OS</sub> /dT | Input offset voltage drift               |                                                                                                                                                              | T <sub>A</sub> = - 40°C to 125°C     |                           | ±2       |                     | μV/°C             |
| PSRR                 | Input offset voltage versus power supply | V <sub>S</sub> = 5V to 40V, V <sub>CM</sub> = V <sub>S</sub> / 2                                                                                             | T <sub>A</sub> = - 40°C to 125°C     |                           | ±1       | ±10                 | μ V/V             |
|                      | Channel separation                       | f = 0Hz                                                                                                                                                      |                                      |                           | 10       |                     | μV/V              |
| INPUT BIAS CURRENT   |                                          |                                                                                                                                                              |                                      |                           |          |                     |                   |
| I <sub>B</sub>       | Input bias current                       |                                                                                                                                                              |                                      |                           | ±1       | ±120                | pA                |
|                      |                                          |                                                                                                                                                              | DCK and DBV packages                 |                           | ±1       | ±300                | pA                |
|                      |                                          |                                                                                                                                                              | T <sub>A</sub> = - 40°C to 125°C (1) |                           |          | ±5                  | nA                |
| I <sub>OS</sub>      | Input offset current                     |                                                                                                                                                              |                                      |                           | ±0.5     | ±120                | pA                |
|                      |                                          |                                                                                                                                                              | DCK and DBV packages                 |                           | ±0.5     | ±250                | pA                |
|                      |                                          |                                                                                                                                                              | T <sub>A</sub> = - 40°C to 125°C (1) |                           |          | ±5                  | nA                |
| NOISE                |                                          |                                                                                                                                                              |                                      |                           |          |                     |                   |
| E <sub>N</sub>       | Input voltage noise                      | f = 0.1Hz to 10Hz                                                                                                                                            |                                      |                           | 9.2      |                     | μ V <sub>PP</sub> |
|                      |                                          |                                                                                                                                                              |                                      |                           | 1.4      |                     | μV <sub>RMS</sub> |
| e <sub>N</sub>       | Input voltage noise density              | f = 1kHz                                                                                                                                                     |                                      |                           | 37       |                     | nV/ √ Hz          |
|                      |                                          | f = 10kHz                                                                                                                                                    |                                      |                           | 21       |                     |                   |
| i <sub>N</sub>       | Input current noise                      | f = 1kHz                                                                                                                                                     |                                      |                           | 80       |                     | fA/ √ Hz          |
| INPUT VOLTAGE RANGE  |                                          |                                                                                                                                                              |                                      |                           |          |                     |                   |
| V <sub>CM</sub>      | Common-mode voltage range                |                                                                                                                                                              |                                      | (V <sub>CC-</sub> ) + 1.5 |          | (V <sub>CC+</sub> ) | V                 |
| CMRR                 | Common-mode rejection ratio              | V <sub>S</sub> = 40V, (V <sub>CC-</sub> ) + 2.5V < V <sub>CM</sub> < (V <sub>CC+</sub> ) - 1.5V                                                              |                                      | 100                       | 105      |                     | dB                |
|                      |                                          |                                                                                                                                                              | T <sub>A</sub> = - 40°C to 125°C     | 95                        |          |                     | dB                |
|                      |                                          | V <sub>S</sub> = 40V, (V <sub>CC-</sub> ) + 2.5V < V <sub>CM</sub> < (V <sub>CC+</sub> )                                                                     |                                      | 90                        | 105      |                     | dB                |
|                      |                                          |                                                                                                                                                              | T <sub>A</sub> = - 40°C to 125°C     | 80                        |          |                     | dB                |
| INPUT CAPACITANCE    |                                          |                                                                                                                                                              |                                      |                           |          |                     |                   |
| Z <sub>ID</sub>      | Differential                             |                                                                                                                                                              |                                      |                           | 100    2 |                     | M Ω   pF          |
| Z <sub>ICM</sub>     | Common-mode                              |                                                                                                                                                              |                                      |                           | 6    1   |                     | T Ω   pF          |
| OPEN-LOOP GAIN       |                                          |                                                                                                                                                              |                                      |                           |          |                     |                   |
| A <sub>OL</sub>      | Open-loop voltage gain                   | V <sub>S</sub> = 40V, V <sub>CM</sub> = V <sub>S</sub> / 2, (V <sub>CC-</sub> ) + 0.3V < V <sub>O</sub> < (V <sub>CC+</sub> ) - 0.3V                         | T <sub>A</sub> = - 40°C to 125°C     | 118                       | 125      |                     | dB                |
| A <sub>OL</sub>      | Open-loop voltage gain                   | V <sub>S</sub> = 40V, V <sub>CM</sub> = V <sub>S</sub> / 2, R <sub>L</sub> = 2k Ω , (V <sub>CC-</sub> ) + 1.2V < V <sub>O</sub> < (V <sub>CC+</sub> ) - 1.2V | T <sub>A</sub> = - 40°C to 125°C     | 115                       | 120      |                     | dB                |
| FREQUENCY RESPONSE   |                                          |                                                                                                                                                              |                                      |                           |          |                     |                   |
| GBW                  | Gain-bandwidth product                   |                                                                                                                                                              |                                      |                           | 5.25     |                     | MHz               |
| SR                   | Slew rate                                | V <sub>S</sub> = 40V, G = +1, C <sub>L</sub> = 20pF                                                                                                          |                                      |                           | 20       |                     | V/ μ s            |
| t <sub>S</sub>       | Settling time                            | To 0.1%, V <sub>S</sub> = 40V, V <sub>STEP</sub> = 10V , G = +1, CL = 20pF                                                                                   |                                      |                           | 0.63     |                     | μ s               |
|                      |                                          | To 0.1%, V <sub>S</sub> = 40V, V <sub>STEP</sub> = 2V , G = +1, CL = 20pF                                                                                    |                                      |                           | 0.56     |                     |                   |
|                      |                                          | To 0.01%, V <sub>S</sub> = 40V, V <sub>STEP</sub> = 10V , G = +1, CL = 20pF                                                                                  |                                      |                           | 0.91     |                     |                   |
|                      |                                          | To 0.01%, V <sub>S</sub> = 40V, V <sub>STEP</sub> = 2V , G = +1, CL = 20pF                                                                                   |                                      |                           | 0.48     |                     |                   |
|                      | Phase margin                             | G = +1, R <sub>L</sub> = 10kΩ, C <sub>L</sub> = 20pF                                                                                                         |                                      |                           | 56       |                     | °                 |
|                      | Overload recovery time                   | V <sub>IN</sub> × gain > V <sub>S</sub>                                                                                                                      |                                      |                           | 300      |                     | ns                |
| THD+N                | Total harmonic distortion + noise        | V <sub>S</sub> = 40V, V <sub>O</sub> = 6V <sub>RMS</sub> , G = +1, f = 1kHz                                                                                  |                                      |                           | 0.00012  |                     | %                 |

## 5.7 Electrical Characteristics: TL08xH (续)

For  $V_S = (V_{CC+}) - (V_{CC-}) = 4.5V$  to  $40V$  ( $\pm 2.25V$  to  $\pm 20V$ ) at  $T_A = 25^\circ C$ ,  $R_L = 10k\Omega$  connected to  $V_S / 2$ ,  $V_{CM} = V_S / 2$ , and  $V_{O UT} = V_S / 2$ , unless otherwise noted.

| PARAMETER         |                                 | TEST CONDITIONS                                                                    |                                             | MIN   | TYP  | MAX | UNIT |
|-------------------|---------------------------------|------------------------------------------------------------------------------------|---------------------------------------------|-------|------|-----|------|
| EMIRR             | EMI rejection ratio             | f = 1GHz                                                                           |                                             | 53    |      |     | dB   |
| OUTPUT            |                                 |                                                                                    |                                             |       |      |     |      |
|                   | Voltage output swing from rail  | Positive rail headroom                                                             | V <sub>S</sub> = 40V, R <sub>L</sub> = 10kΩ | 115   | 210  | mV  |      |
|                   |                                 |                                                                                    | V <sub>S</sub> = 40V, R <sub>L</sub> = 2kΩ  | 520   | 965  |     |      |
|                   |                                 | Negative rail headroom                                                             | V <sub>S</sub> = 40V, R <sub>L</sub> = 10kΩ | 105   | 215  |     |      |
|                   |                                 |                                                                                    | V <sub>S</sub> = 40V, R <sub>L</sub> = 2kΩ  | 500   | 1030 |     |      |
| I <sub>SC</sub>   | Short-circuit current           |                                                                                    |                                             | ±26   |      |     | mA   |
| C <sub>LOAD</sub> | Capacitive load drive           |                                                                                    |                                             | 300   |      |     | pF   |
| Z <sub>O</sub>    | Open-loop output impedance      | f = 1MHz, I <sub>O</sub> = 0 A                                                     |                                             | 125   |      |     | Ω    |
| POWER SUPPLY      |                                 |                                                                                    |                                             |       |      |     |      |
| I <sub>Q</sub>    | Quiescent current per amplifier | I <sub>O</sub> = 0 A                                                               | T <sub>A</sub> = - 40°C to 125°C            | 937.5 | 1125 | μA  |      |
|                   |                                 | I <sub>O</sub> = 0 A, (TL081H)                                                     |                                             | 960   | 1156 |     |      |
|                   |                                 | I <sub>O</sub> = 0 A                                                               |                                             |       | 1130 |     |      |
|                   |                                 | I <sub>O</sub> = 0 A, (TL082H)                                                     |                                             |       | 1143 |     |      |
|                   |                                 | I <sub>O</sub> = 0 A, (TL071H)                                                     |                                             |       | 1160 |     |      |
|                   | Turn-On Time                    | At T <sub>A</sub> = 25°C, V <sub>S</sub> = 40V, V <sub>S</sub> ramp rate > 0.3V/μs |                                             | 60    |      |     | μ s  |

(1) Max  $I_B$  and  $I_{OS}$  data is specified based on characterization results.

## 5.8 Electrical Characteristics (DC): TL08xC, TL08xAC, TL08xBC, TL08xI, TL08xM

For  $V_S = (V_{CC+}) - (V_{CC-}) = \pm 15V$  at  $T_A = 25^\circ C$ , unless otherwise noted

| PARAMETER                   |                                          | TEST CONDITIONS <sup>(1) (2)</sup>                                                      |                                  |                             | MIN            | TYP   | MAX  | UNIT  |
|-----------------------------|------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------------|-----------------------------|----------------|-------|------|-------|
|                             |                                          |                                                                                         |                                  |                             |                |       |      |       |
| V <sub>OS</sub>             | Input offset voltage                     | V <sub>O</sub> = 0V<br>R <sub>S</sub> = 50 Ω                                            | TL08xC                           |                             | 3              | 10    | mV   |       |
|                             |                                          |                                                                                         |                                  | T <sub>A</sub> = Full range | 13             |       |      |       |
|                             |                                          |                                                                                         | TL08xAC                          |                             | 3              | 6     |      |       |
|                             |                                          |                                                                                         |                                  | T <sub>A</sub> = Full range | 7.5            |       |      |       |
|                             |                                          |                                                                                         | TL08xBC                          |                             | 2              | 3     |      |       |
|                             |                                          |                                                                                         |                                  | T <sub>A</sub> = Full range | 5              |       |      |       |
|                             |                                          |                                                                                         | TL08xI                           |                             | 3              | 6     |      |       |
|                             |                                          |                                                                                         |                                  | T <sub>A</sub> = Full range | 8              |       |      |       |
|                             |                                          |                                                                                         | TL081M, TL082M                   |                             | 3              | 6     |      |       |
| T <sub>A</sub> = Full range | 9                                        |                                                                                         |                                  |                             |                |       |      |       |
| TL084M                      |                                          | 3                                                                                       | 9                                |                             |                |       |      |       |
|                             | T <sub>A</sub> = Full range              | 15                                                                                      |                                  |                             |                |       |      |       |
| dV <sub>OS</sub> /dT        | Input offset voltage drift               | V <sub>O</sub> = 0V, R <sub>S</sub> = 50 Ω                                              | T <sub>A</sub> = Full range      |                             | ±18            |       |      | μV/°C |
| I <sub>OS</sub>             | Input offset current                     | V <sub>O</sub> = 0V                                                                     | TL08xC                           |                             | 5              | 100   | pA   |       |
|                             |                                          |                                                                                         |                                  | T <sub>A</sub> = Full range | 10             | nA    |      |       |
|                             |                                          |                                                                                         | TL08xAC, TL08xBC, TL08xI         |                             | 5              | 100   | pA   |       |
|                             |                                          |                                                                                         |                                  | T <sub>A</sub> = Full range | 2              | nA    |      |       |
|                             |                                          |                                                                                         | TL08xM                           |                             | 5              | 100   | pA   |       |
| T <sub>A</sub> = Full range | 20                                       | nA                                                                                      |                                  |                             |                |       |      |       |
| I <sub>B</sub>              | Input bias current                       | V <sub>O</sub> = 0V                                                                     | TL08xC, TL08xAC, TL08xBC, TL08xI |                             | 65             | 200   | pA   |       |
|                             |                                          |                                                                                         |                                  | T <sub>A</sub> = Full range | 7              | nA    |      |       |
|                             |                                          |                                                                                         | TL081M, TL082M                   |                             | 65             | 200   | pA   |       |
|                             |                                          |                                                                                         |                                  | T <sub>A</sub> = Full range | 50             | nA    |      |       |
|                             |                                          |                                                                                         | TL084M                           |                             | 65             | 200   | pA   |       |
| T <sub>A</sub> = Full range | 20                                       | nA                                                                                      |                                  |                             |                |       |      |       |
| V <sub>CM</sub>             | Common-mode voltage range                |                                                                                         |                                  |                             | ±11 – 12 to 15 |       |      | V     |
| V <sub>OM</sub>             | Maximum peak output voltage swing        | R <sub>L</sub> = 10k Ω                                                                  | T <sub>A</sub> = Full range      |                             | ±12            | ±13.5 | V    |       |
|                             |                                          | R <sub>L</sub> ≥ 10k Ω                                                                  |                                  |                             | ±12            |       |      |       |
|                             |                                          | R <sub>L</sub> ≥ 2k Ω                                                                   |                                  |                             | ±10            |       |      |       |
| A <sub>OL</sub>             | Open-loop voltage gain                   | V <sub>O</sub> = 0V                                                                     | TL08xC                           |                             | 25             | 200   | V/mV |       |
|                             |                                          |                                                                                         |                                  | T <sub>A</sub> = Full range | 15             |       |      |       |
|                             |                                          |                                                                                         | TL08xAC, TL08xBC, TL08xI         |                             | 50             | 200   |      |       |
|                             |                                          |                                                                                         |                                  | T <sub>A</sub> = Full range | 25             |       |      |       |
|                             |                                          |                                                                                         | TL08xM                           |                             | 35             | 200   |      |       |
| T <sub>A</sub> = Full range | 15                                       |                                                                                         |                                  |                             |                |       |      |       |
| GBW                         | Gain-bandwidth product                   | All NS and PS packages; All TL08xM devices                                              |                                  |                             | 3              |       | MHz  |       |
|                             |                                          | All other devices                                                                       |                                  |                             | 5.25           |       |      |       |
| R <sub>ID</sub>             | Common-mode input resistance             |                                                                                         |                                  |                             | 1              |       | T Ω  |       |
| CMRR                        | Common-mode rejection ratio              | V <sub>IC</sub> = V <sub>ICR(min)</sub><br>V <sub>O</sub> = 0V<br>R <sub>S</sub> = 50 Ω | TL08xC                           | 70                          |                | 100   | dB   |       |
|                             |                                          |                                                                                         | TL08xAC, TL08xBC, TL08xI         | 75                          |                | 100   |      |       |
|                             |                                          |                                                                                         | TL08xM                           | 80                          |                | 86    |      |       |
| PSRR                        | Input offset voltage versus power supply | V <sub>S</sub> = ±9V to ± 18V<br>V <sub>O</sub> = 0V<br>R <sub>S</sub> = 50 Ω           | TL08xC                           | 70                          |                | 100   | dB   |       |
|                             |                                          |                                                                                         | TL08xAC, TL08xBC, TL08xI         | 80                          |                | 100   |      |       |
|                             |                                          |                                                                                         | TL08xM                           | 80                          |                | 86    |      |       |

## 5.8 Electrical Characteristics (DC): TL08xC, TL08xAC, TL08xBC, TL08xI, TL08xM ( 续 )

For  $V_S = (V_{CC+}) - (V_{CC-}) = \pm 15V$  at  $T_A = 25^\circ C$ , unless otherwise noted

| PARAMETER |                                 | TEST CONDITIONS <sup>(1)</sup> <sup>(2)</sup> | MIN | TYP | MAX | UNIT      |
|-----------|---------------------------------|-----------------------------------------------|-----|-----|-----|-----------|
| $I_Q$     | Quiescent current per amplifier | $V_O = 0V$ ; no load                          |     | 1.4 | 2.5 | mA        |
|           | Channel separation              | $f = 0Hz$                                     |     | 1   |     | $\mu V/V$ |

- (1) All characteristics are measured under open-loop conditions with zero common-mode voltage, unless otherwise specified.
- (2) Full range is  $T_A = 0^\circ C$  to  $70^\circ C$  for the TL07xC, TL07xAC, and TL07xBC;  $T_A = -40^\circ C$  to  $85^\circ C$  for the TL07xI; and  $T_A = -55^\circ C$  to  $125^\circ C$  for the TL07xM.

## 5.9 Electrical Characteristics (AC): TL08xC, TL08xAC, TL08xBC, TL08xI, TL08xM

For  $V_S = (V_{CC+}) - (V_{CC-}) = \pm 15V$  at  $T_A = 25^\circ C$ , unless otherwise noted.

| PARAMETER |                                   | TEST CONDITIONS                            |                                                                          | MIN | TYP     | MAX | UNIT            |
|-----------|-----------------------------------|--------------------------------------------|--------------------------------------------------------------------------|-----|---------|-----|-----------------|
| SR        | Slew rate                         | $V_I = 10V, C_L = 100pF, R_L = 2k\Omega$   | TL08xM                                                                   | 5   | 20      |     | V/ $\mu s$      |
|           |                                   |                                            | TL08xC, TL08xAC, TL08xBC, TL08xI                                         | 8   | 20      |     | V/ $\mu s$      |
| $t_S$     | Settling time                     | $V_I = 20V, C_L = 100pF, R_L = 2k\Omega$   |                                                                          |     | 0.1     |     | $\mu s$         |
|           |                                   |                                            |                                                                          |     | 20%     |     |                 |
| $e_N$     | Input voltage noise density       | All PS and NS packages; All TL08xM devices | $R_S = 20\Omega, f = 1kHz$                                               |     | 18      |     | nV/ $\sqrt{Hz}$ |
|           |                                   | All other devices                          | $f = 1kHz$                                                               |     | 37      |     | nV/ $\sqrt{Hz}$ |
|           |                                   |                                            | $f = 10kHz$                                                              |     | 21      |     |                 |
| $E_N$     | Input voltage noise               | All PS and NS packages; All TL08xM devices | $R_S = 20\Omega, f = 10Hz$ to 10kHz                                      |     | 4       |     | $\mu V_{RMS}$   |
|           |                                   | All other devices                          | $f = 0.1Hz$ to 10Hz                                                      |     | 1.4     |     | $\mu V_{RMS}$   |
| $i_N$     | Input current noise               | $R_S = 20\Omega, f = 1kHz$                 |                                                                          |     | 10      |     | fA/ $\sqrt{Hz}$ |
|           | Phase margin                      | TL08xC, TL08xAC, TL08xBC, TL08xI           | $G = +1, R_L = 10k\Omega, C_L = 20pF$                                    |     | 56      |     | °               |
|           | Overload recovery time            | $V_{IN} \times \text{gain} > V_S$          |                                                                          |     | 300     |     | ns              |
| THD+N     | Total harmonic distortion + noise | All PS and NS packages; All TL08xM devices | $V_O = 6V_{RMS}, R_L \geq 2k\Omega, f = 1kHz, G = +1, R_S \leq 1k\Omega$ |     | 0.003   |     | %               |
|           |                                   | All other devices                          | $V_S = 40V, V_O = 6V_{RMS}, G = +1, f = 1kHz$                            |     | 0.00012 |     | %               |
| EMIRR     | EMI rejection ratio               | TL08xC, TL08xAC, TL08xBC, TL08xI           | $f = 1GHz$                                                               |     | 53      |     | dB              |
| $Z_O$     | Open-loop output impedance        | TL07xC, TL07xAC, TL07xBC, TL07xI           | $f = 1MHz, I_O = 0A$                                                     |     | 125     |     | $\Omega$        |

## 5.10 Typical Characteristics: TL08xH

at  $T_A = 25^\circ\text{C}$ ,  $V_S = 40\text{V}$  ( $\pm 20\text{V}$ ),  $V_{CM} = V_S / 2$ ,  $R_{LOAD} = 10\text{k}\Omega$  connected to  $V_S / 2$ , and  $C_L = 20\text{pF}$  (unless otherwise noted)

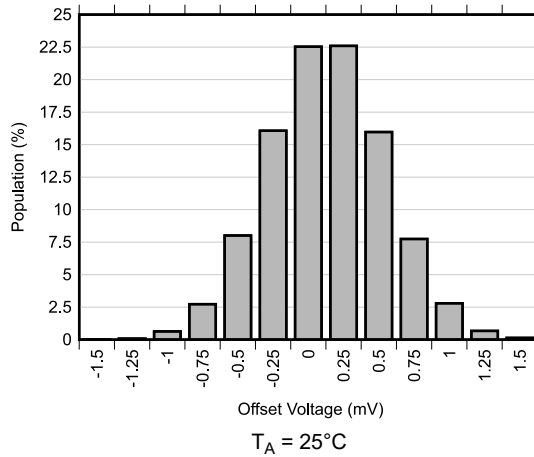


图 5-1. Offset Voltage Production Distribution

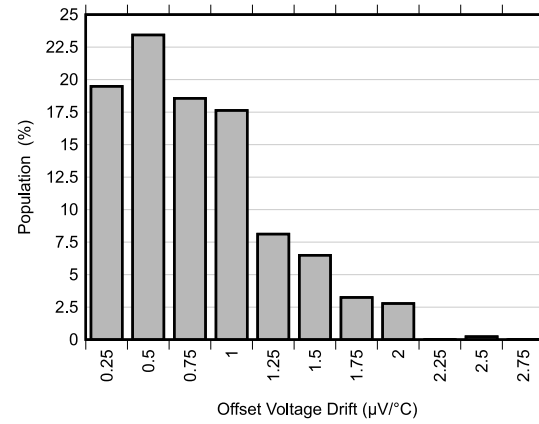


图 5-2. Offset Voltage Drift Distribution

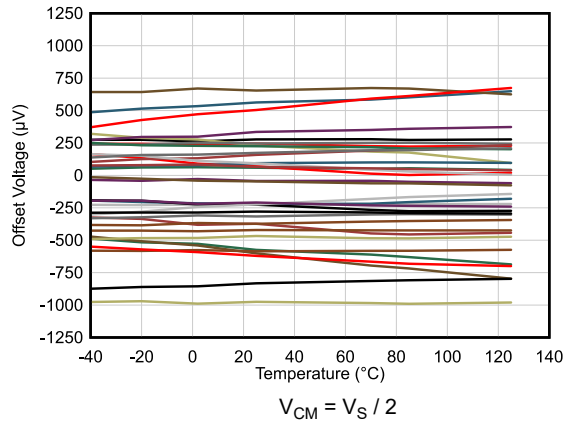


图 5-3. Offset Voltage vs Temperature

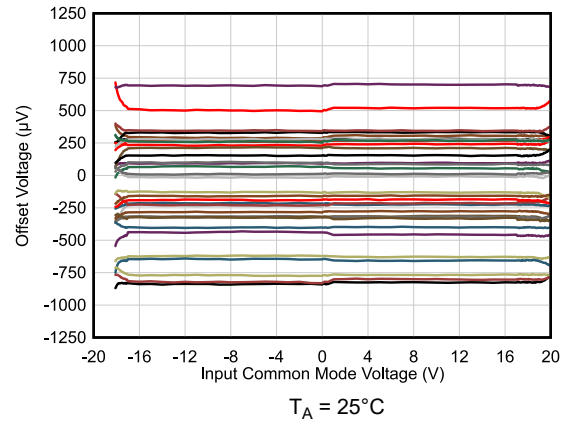


图 5-4. Offset Voltage vs Common-Mode Voltage

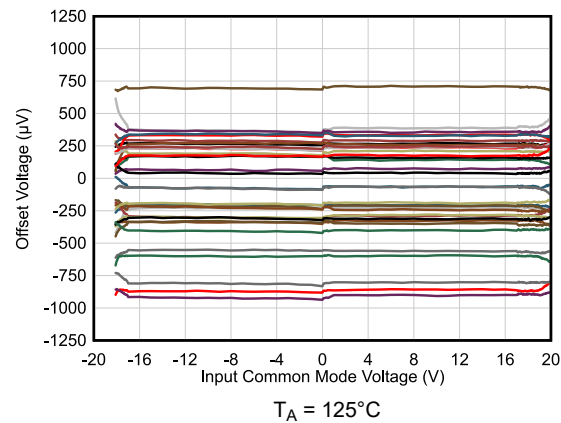


图 5-5. Offset Voltage vs Common-Mode Voltage

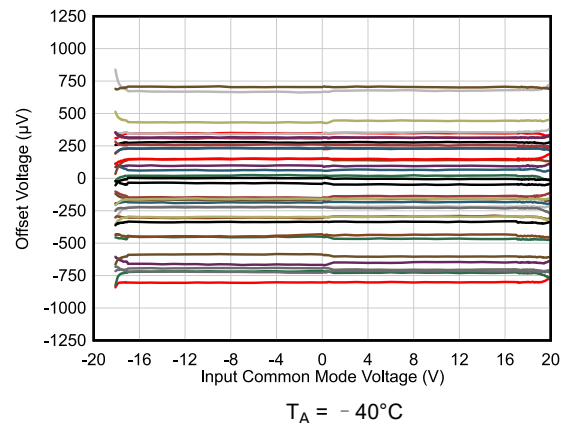


图 5-6. Offset Voltage vs Common-Mode Voltage

## 5.10 Typical Characteristics: TL08xH (continued)

at  $T_A = 25^\circ\text{C}$ ,  $V_S = 40\text{V}$  ( $\pm 20\text{V}$ ),  $V_{CM} = V_S / 2$ ,  $R_{LOAD} = 10\text{k}\Omega$  connected to  $V_S / 2$ , and  $C_L = 20\text{pF}$  (unless otherwise noted)

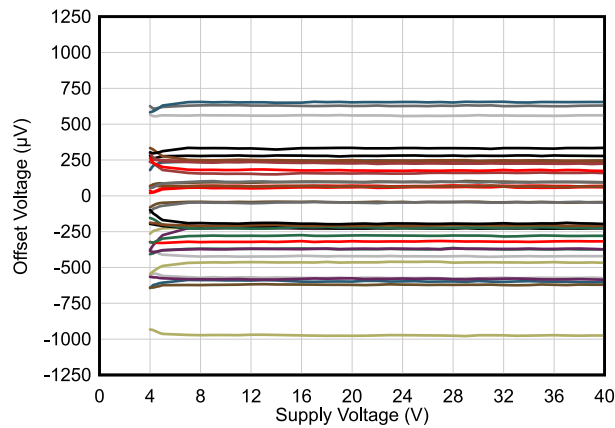


图 5-7. Offset Voltage vs Power Supply

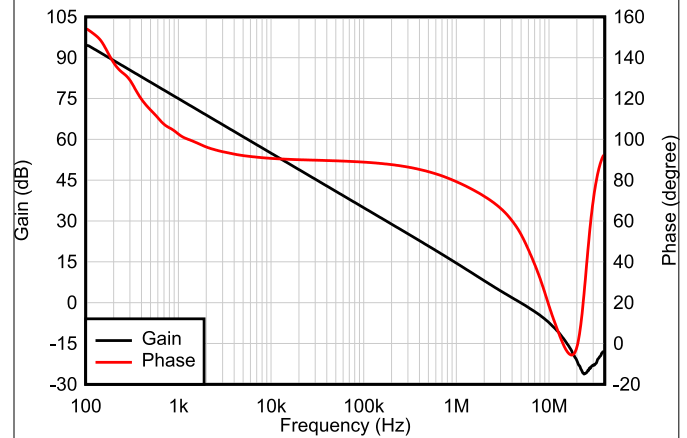


图 5-8. Open-Loop Gain and Phase vs Frequency

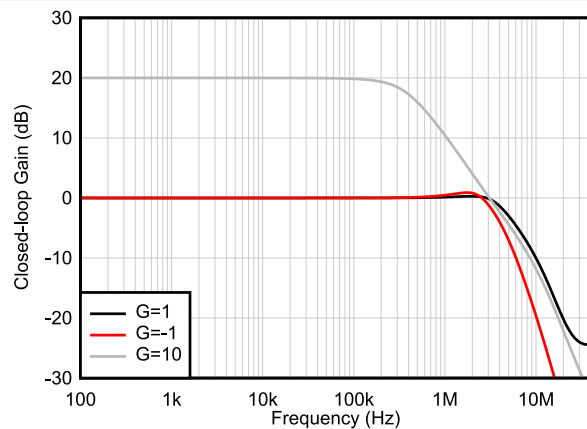


图 5-9. Closed-Loop Gain vs Frequency

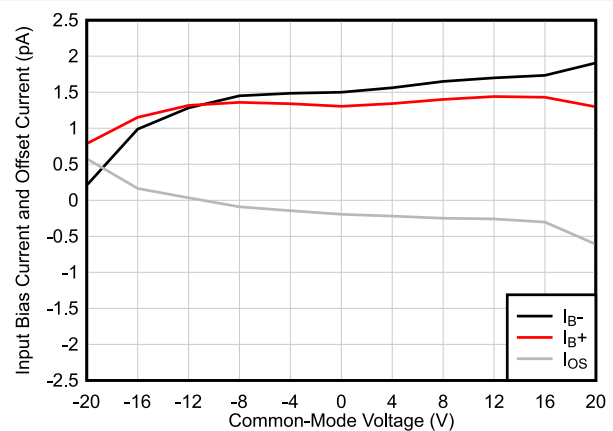


图 5-10. Input Bias Current vs Common-Mode Voltage

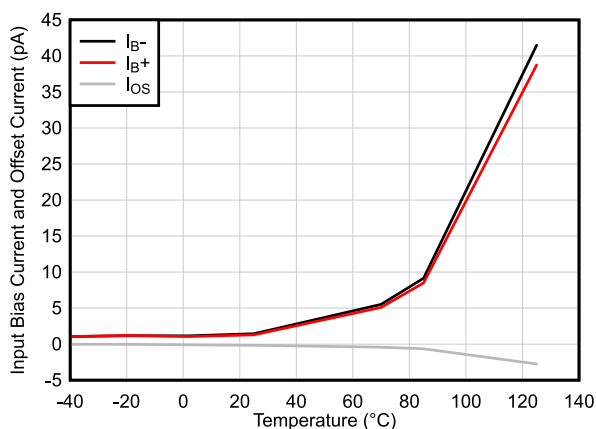


图 5-11. Input Bias Current vs Temperature

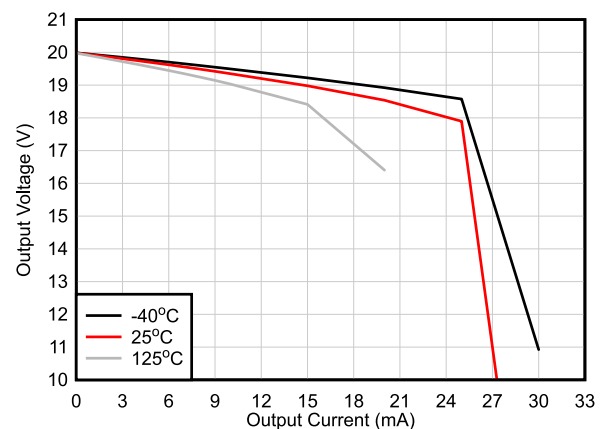


图 5-12. Output Voltage Swing vs Output Current (Sourcing)

## 5.10 Typical Characteristics: TL08xH (continued)

at  $T_A = 25^\circ\text{C}$ ,  $V_S = 40\text{V}$  ( $\pm 20\text{V}$ ),  $V_{CM} = V_S / 2$ ,  $R_{LOAD} = 10\text{k}\Omega$  connected to  $V_S / 2$ , and  $C_L = 20\text{pF}$  (unless otherwise noted)

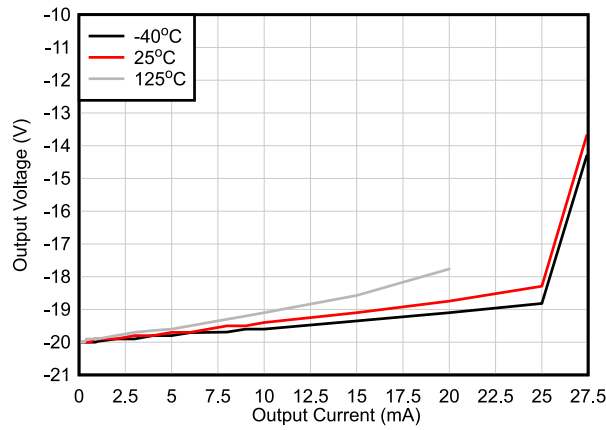


图 5-13. Output Voltage Swing vs Output Current (Sinking)

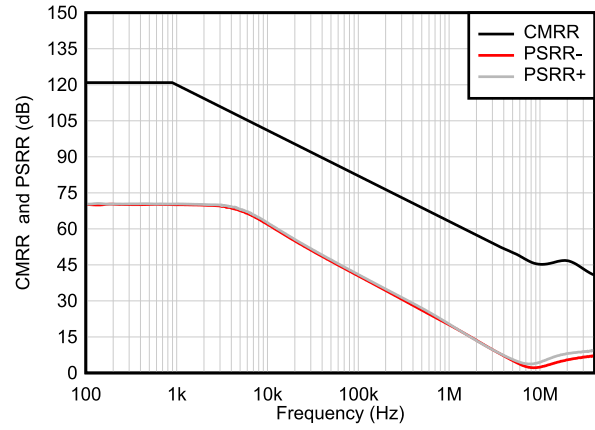


图 5-14. CMRR and PSRR vs Frequency

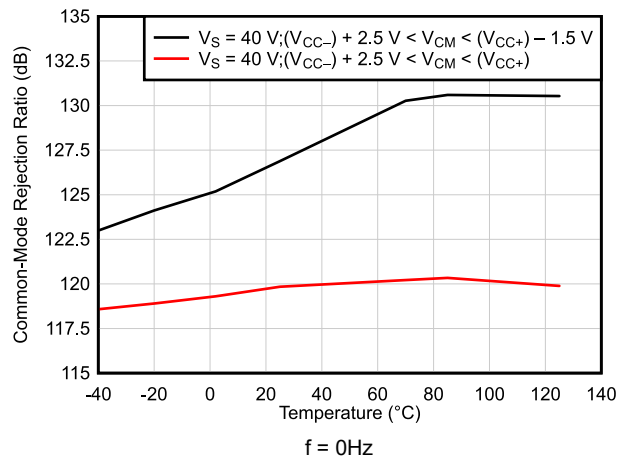


图 5-15. CMRR vs Temperature (dB)

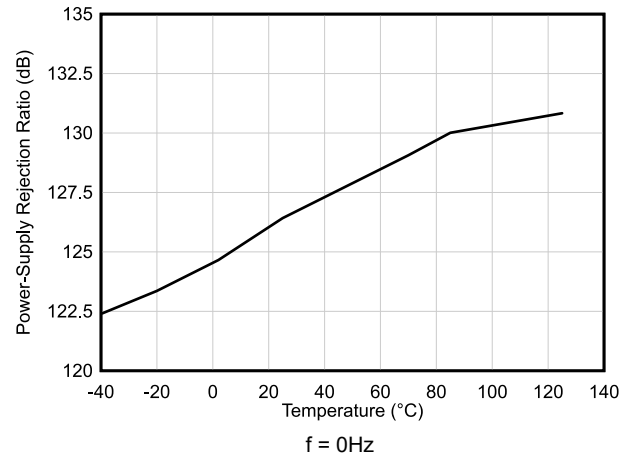


图 5-16. PSRR vs Temperature (dB)

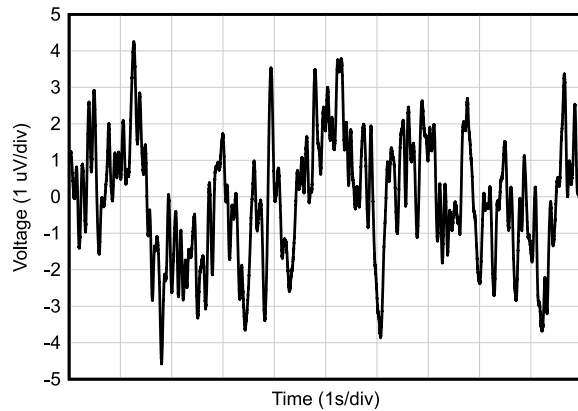


图 5-17. 0.1-Hz to 10-Hz Noise

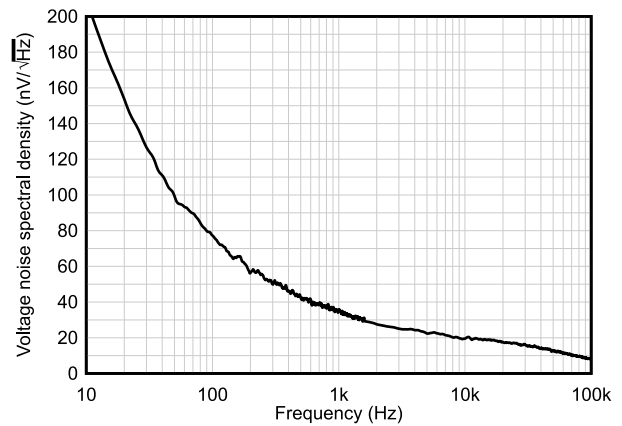


图 5-18. Input Voltage Noise Spectral Density vs Frequency

## 5.10 Typical Characteristics: TL08xH (continued)

at  $T_A = 25^\circ\text{C}$ ,  $V_S = 40\text{V}$  ( $\pm 20\text{V}$ ),  $V_{CM} = V_S / 2$ ,  $R_{LOAD} = 10\text{k}\Omega$  connected to  $V_S / 2$ , and  $C_L = 20\text{pF}$  (unless otherwise noted)

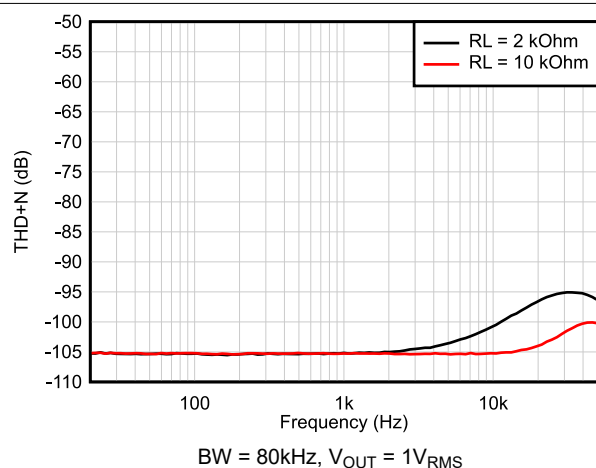


图 5-19. THD+N Ratio vs Frequency

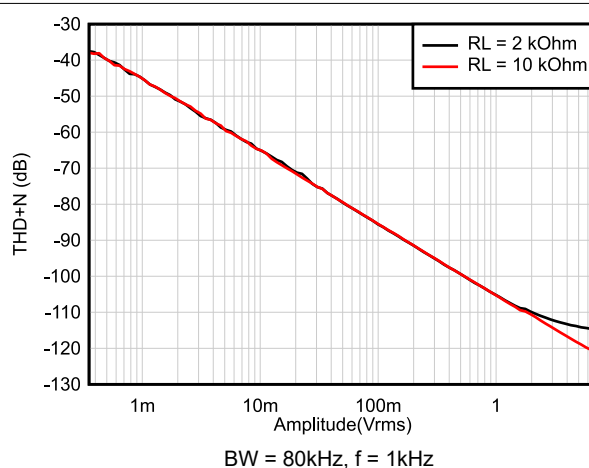


图 5-20. THD+N vs Output Amplitude

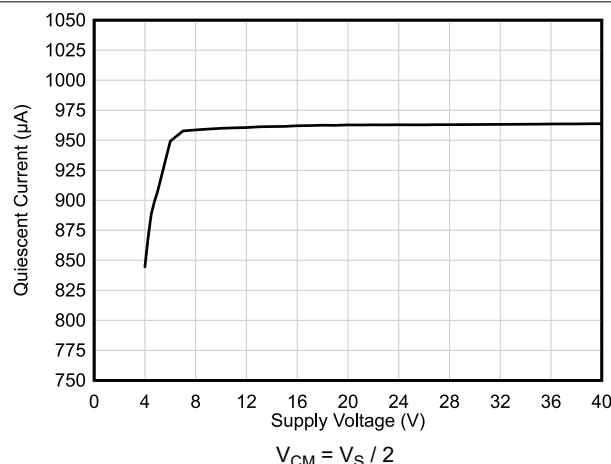


图 5-21. Quiescent Current vs Supply Voltage

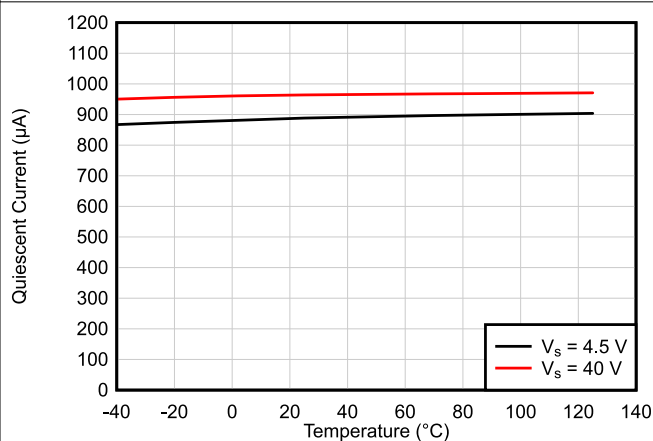


图 5-22. Quiescent Current vs Temperature

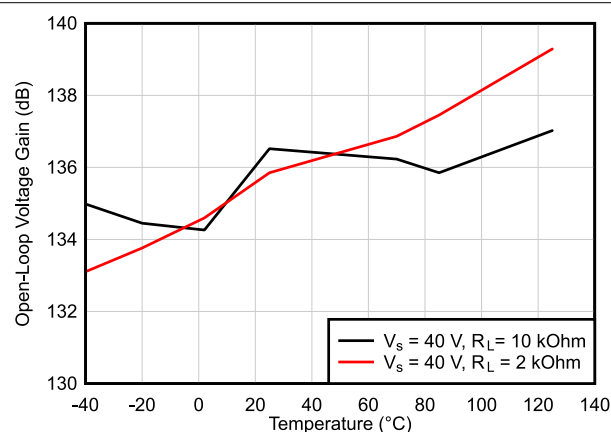


图 5-23. Open-Loop Voltage Gain vs Temperature (dB)

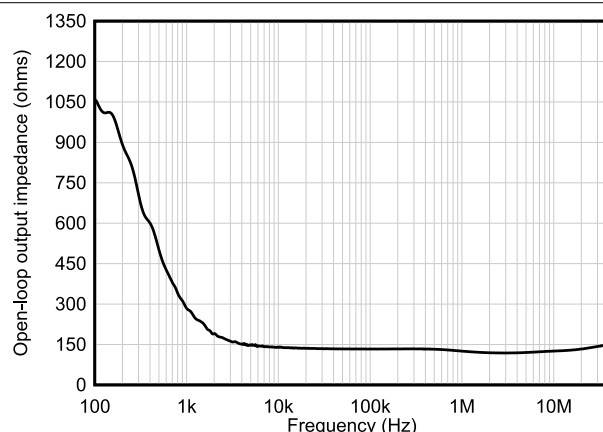
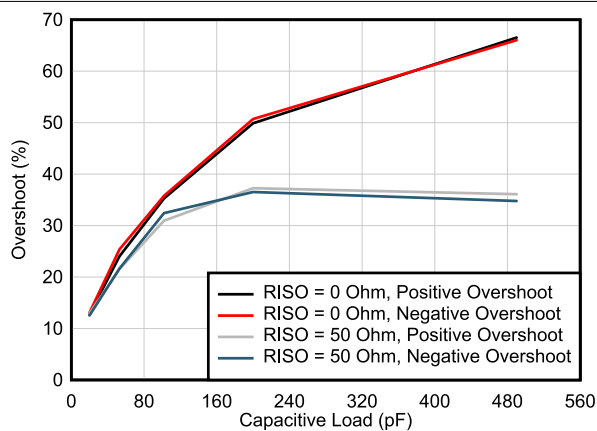


图 5-24. Open-Loop Output Impedance vs Frequency

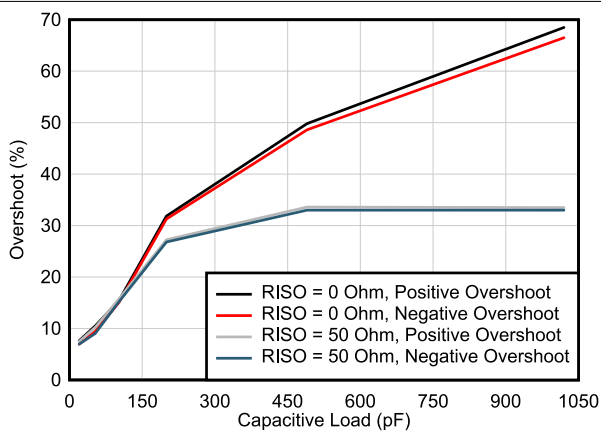
## 5.10 Typical Characteristics: TL08xH (continued)

at  $T_A = 25^\circ\text{C}$ ,  $V_S = 40\text{V}$  ( $\pm 20\text{V}$ ),  $V_{CM} = V_S / 2$ ,  $R_{LOAD} = 10\text{k}\Omega$  connected to  $V_S / 2$ , and  $C_L = 20\text{pF}$  (unless otherwise noted)



$G = -1$ , 25-mV output step

图 5-25. Small-Signal Overshoot vs Capacitive Load



$G = 1$ , 10-mV output step

图 5-26. Small-Signal Overshoot vs Capacitive Load

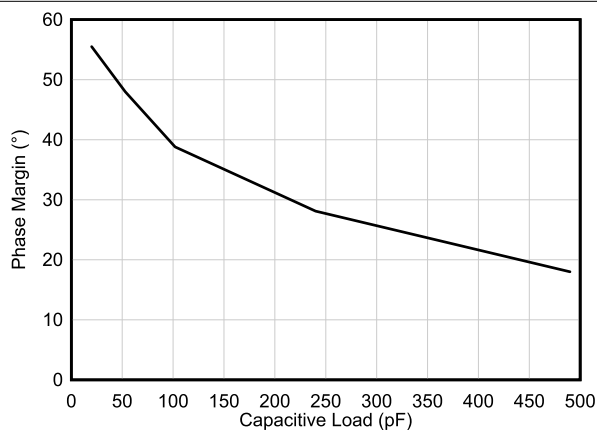
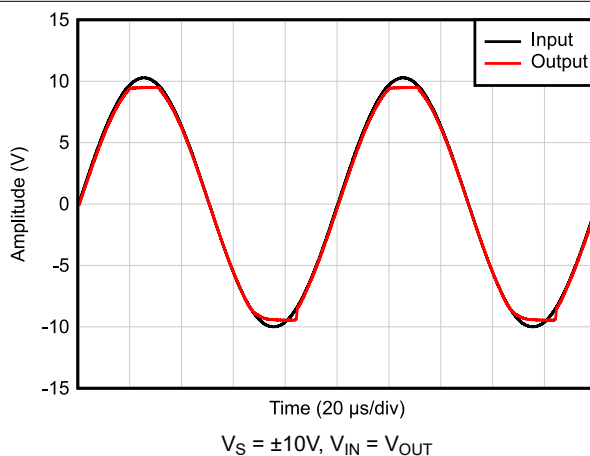
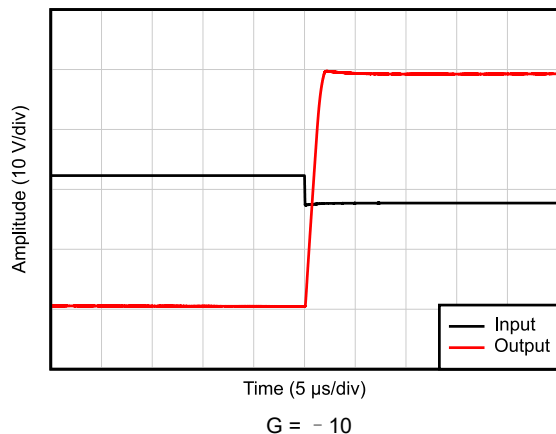


图 5-27. Phase Margin vs Capacitive Load



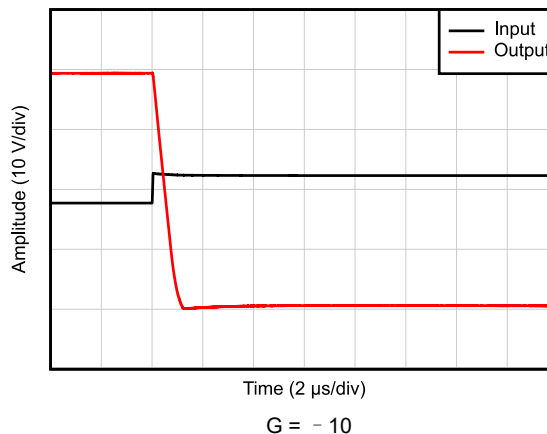
$V_S = \pm 10\text{V}$ ,  $V_{IN} = V_{OUT}$

图 5-28. No Phase Reversal



$G = -10$

图 5-29. Positive Overload Recovery

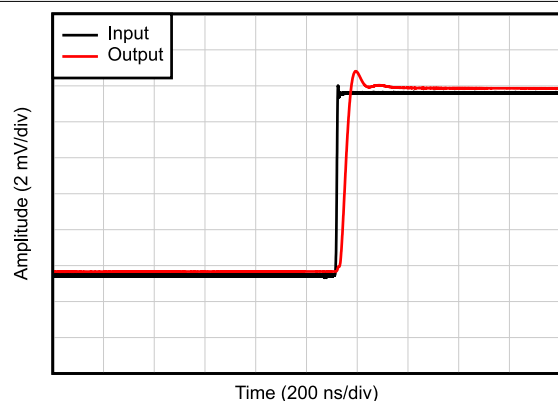


$G = -10$

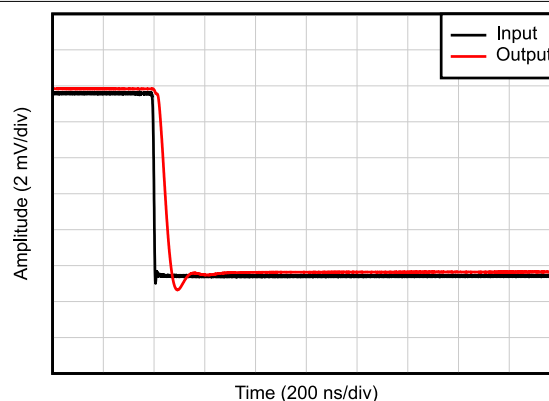
图 5-30. Negative Overload Recovery

## 5.10 Typical Characteristics: TL08xH (continued)

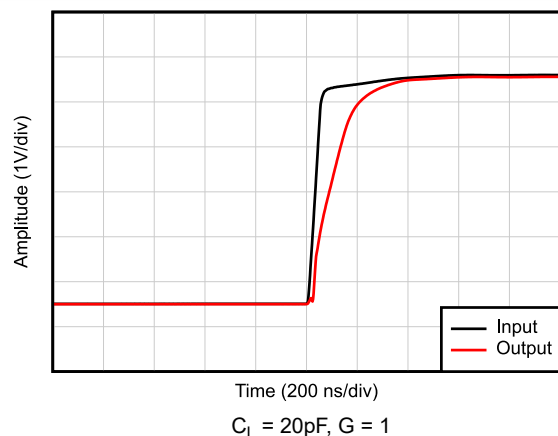
at  $T_A = 25^\circ\text{C}$ ,  $V_S = 40\text{V}$  ( $\pm 20\text{V}$ ),  $V_{CM} = V_S / 2$ ,  $R_{LOAD} = 10\text{k}\Omega$  connected to  $V_S / 2$ , and  $C_L = 20\text{pF}$  (unless otherwise noted)



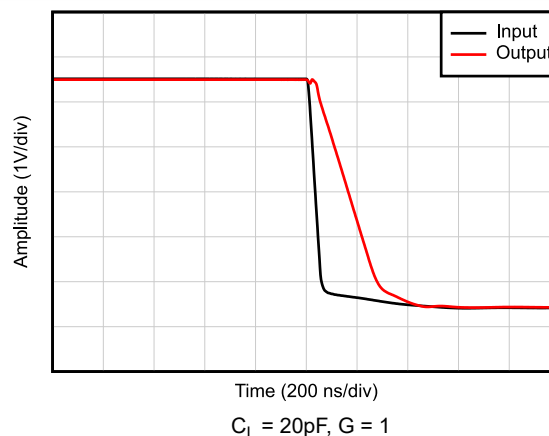
$C_L = 20\text{pF}$ ,  $G = 1$ , 10-mV step response  
 图 5-31. Small-Signal Step Response, Rising



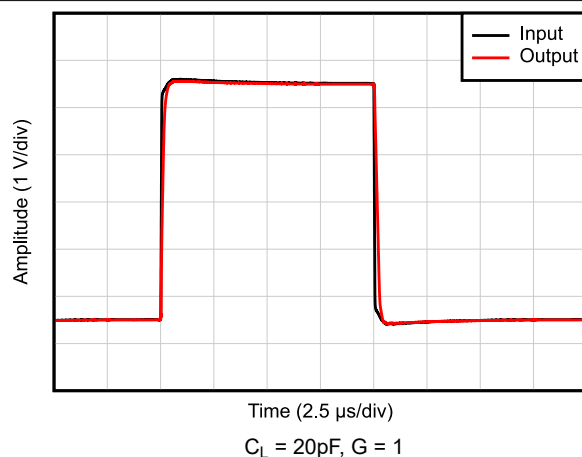
$C_L = 20\text{pF}$ ,  $G = 1$ , 10-mV step response  
 图 5-32. Small-Signal Step Response, Falling



$C_L = 20\text{pF}$ ,  $G = 1$   
 图 5-33. Large-Signal Step Response (Rising)



$C_L = 20\text{pF}$ ,  $G = 1$   
 图 5-34. Large-Signal Step Response (Falling)



$C_L = 20\text{pF}$ ,  $G = 1$   
 图 5-35. Large-Signal Step Response

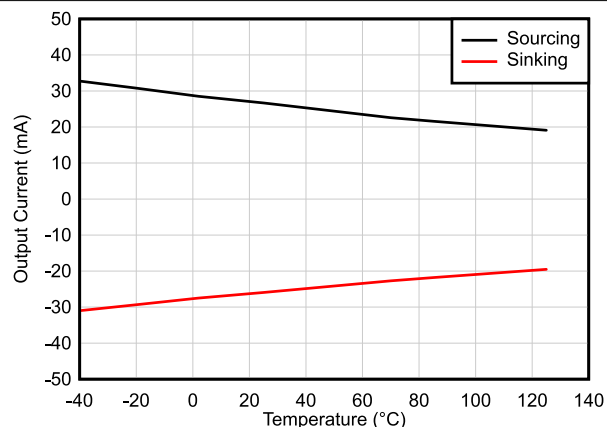


图 5-36. Short-Circuit Current vs Temperature

## 5.10 Typical Characteristics: TL08xH (continued)

at  $T_A = 25^\circ\text{C}$ ,  $V_S = 40\text{V}$  ( $\pm 20\text{V}$ ),  $V_{CM} = V_S / 2$ ,  $R_{LOAD} = 10\text{k}\Omega$  connected to  $V_S / 2$ , and  $C_L = 20\text{pF}$  (unless otherwise noted)

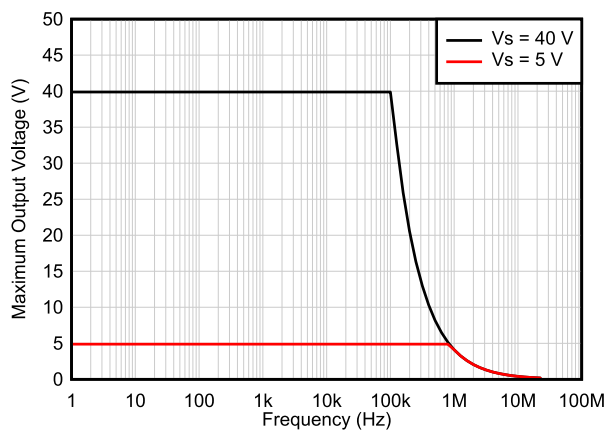


图 5-37. Maximum Output Voltage vs Frequency

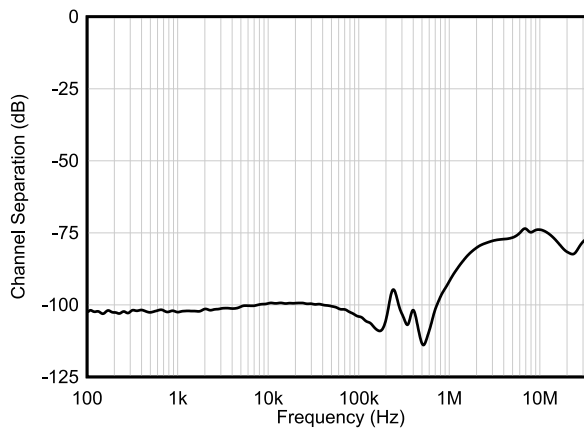


图 5-38. Channel Separation vs Frequency

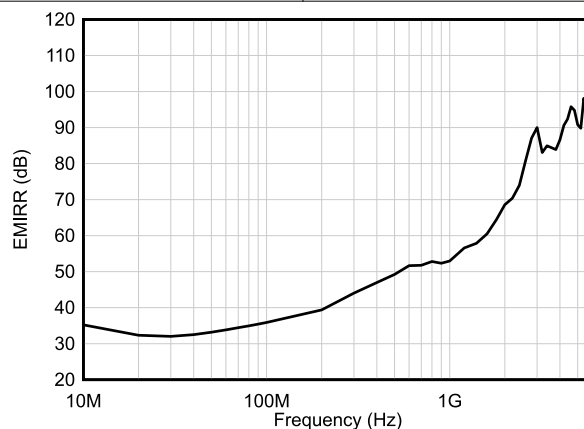


图 5-39. EMIRR (Electromagnetic Interference Rejection Ratio) vs Frequency

## 6 Parameter Measurement Information

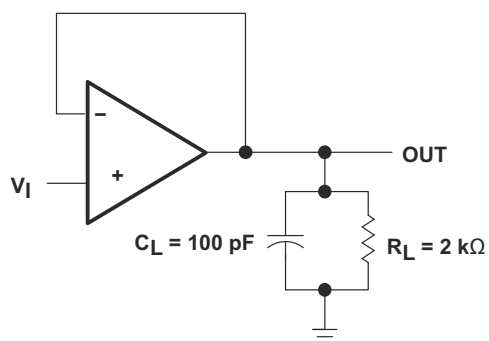


图 6-1. Test Figure 1

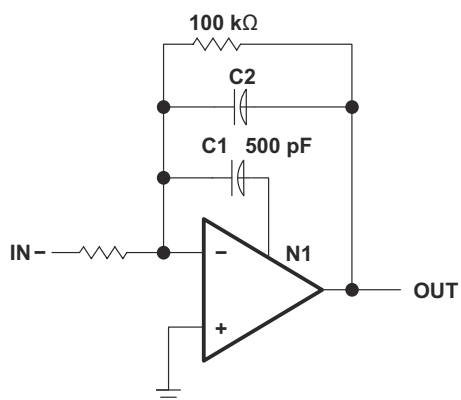


图 6-3. Test Figure 3

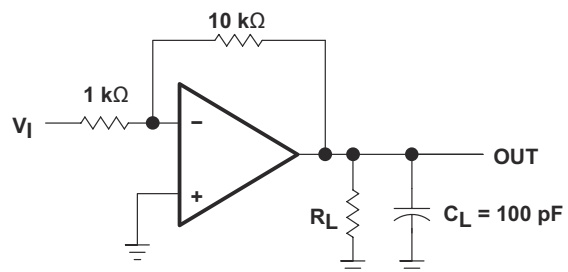


图 6-2. Test Figure 2

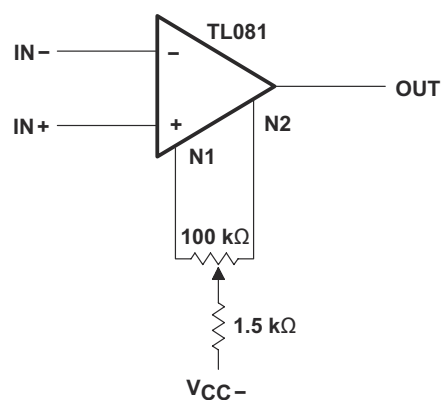


图 6-4. Test Figure 4

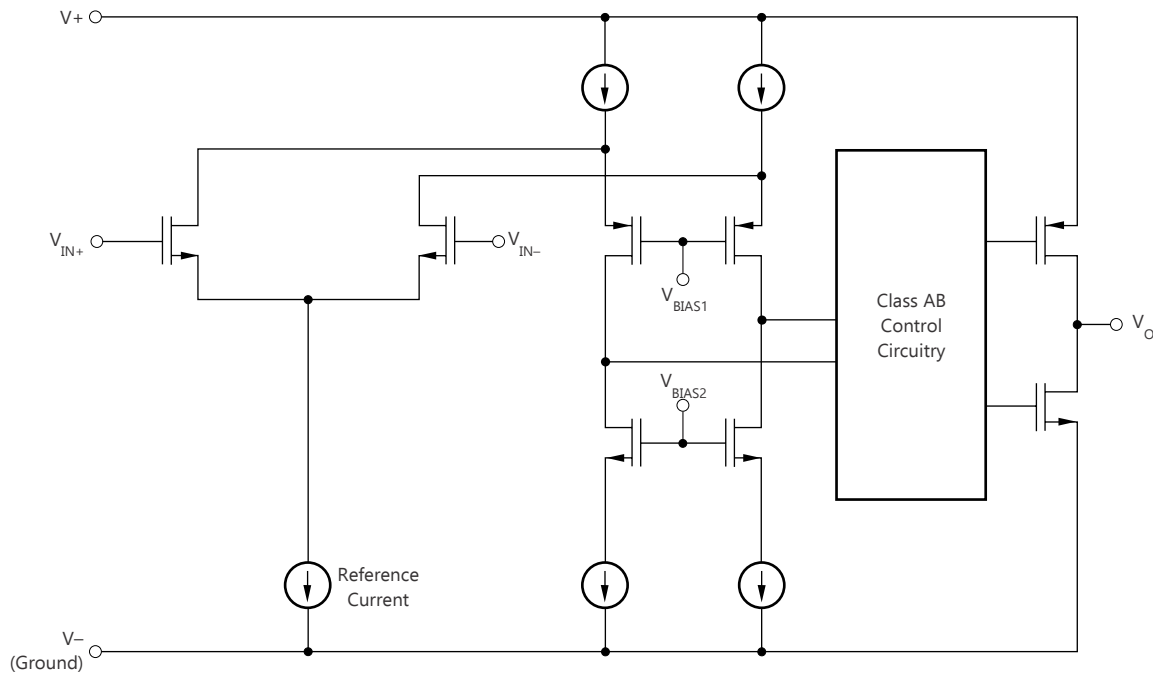
## 7 Detailed Description

### 7.1 Overview

The TL08xH family (TL081H, TL082H, and TL084H) is the next-generation family of the industry standard TL08x (TL081, TL082, and TL084) high-voltage general purpose amplifiers. These devices provide outstanding value for cost-sensitive applications requiring high slew rate with high voltage signals, such as motor drive and inverter systems.

A robust MUX-friendly input stage enhances flexibility in design, with common-mode voltage range extending to the positive rail as well as improved settling time in multi-channel applications. Low offset voltage (1mV, typ) and low offset voltage drift (2 $\mu$ V/°C) allows the TL08xH family to be used in rugged applications requiring precision current and voltage sensing. High voltage operation (up to 40V) and high slew rate (20V/ $\mu$ s) make the TL08xH family a premier choice for high-voltage applications with fast transients.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

#### 7.3.1 Total Harmonic Distortion

Harmonic distortions to an audio signal are created by electronic components in a circuit. Total harmonic distortion (THD) is a measure of harmonic distortions accumulated by a signal in an audio system. These devices have a very low THD of 0.003% meaning that the TL08x devices will add little harmonic distortion when used in audio signal applications.

#### 7.3.2 Slew Rate

The slew rate is the rate at which an operational amplifier can change its output when there is a change on the input. These devices have a 20V/ $\mu$ s slew rate.

### 7.4 Device Functional Modes

These devices are powered on when the supply is connected. This device can be operated as a single-supply operational amplifier or dual-supply amplifier depending on the application.

## 8 Applications and Implementation

### 备注

以下应用部分中的信息不属于 TI 器件规格的范围，TI 不担保其准确性和完整性。TI 的客户应负责确定器件是否适用于其应用。客户应验证并测试其设计，以确保系统功能。

### 8.1 Application Information

The TL08x series of operational amplifiers can be used in countless applications. The few applications in this section show principles used in all applications of these parts.

### 8.2 Typical Applications

#### 8.2.1 Inverting Amplifier Application

A typical application for an operational amplifier in an inverting amplifier. This amplifier takes a positive voltage on the input, and makes it a negative voltage of the same magnitude. In the same manner, it also makes negative voltages positive.

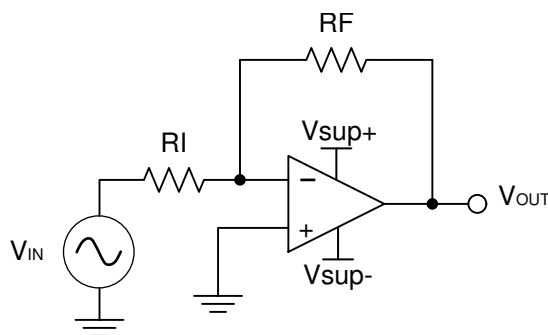


图 8-1. Schematic for Inverting Amplifier Application

##### 8.2.1.1 Design Requirements

The supply voltage must be chosen such that it is larger than the input voltage range and output range. For instance, this application will scale a signal of  $\pm 0.5V$  to  $\pm 1.8V$ . Setting the supply at  $\pm 12V$  is sufficient to accommodate this application.

##### 8.2.1.2 Detailed Design Procedure

Determine the gain required by the inverting amplifier:

$$A_V = \frac{V_{OUT}}{V_{IN}} \quad (1)$$

$$A_V = \frac{1.8}{-0.5} = -3.6 \quad (2)$$

Once the desired gain is determined, choose a value for  $R_I$  or  $R_F$ . Choosing a value in the  $k\Omega$  range is desirable because the amplifier circuit will use currents in the milliamp range. This causes the part will not draw too much current. This example will choose  $10k\Omega$  for  $R_I$  which means  $36k\Omega$  will be used for  $R_F$ . This was determined by Equation 3.

$$A_V = -\frac{R_F}{R_I} \quad (3)$$

### 8.2.1.3 Application Curve

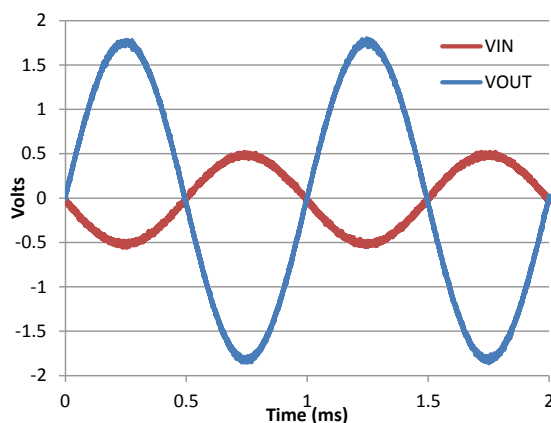


图 8-2. Input and Output Voltages of the Inverting Amplifier

## 8.3 System Examples

### 8.3.1 General Applications

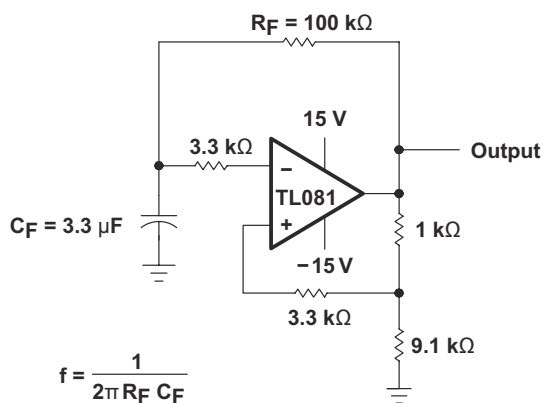


图 8-3. 0.5-Hz Square-Wave Oscillator

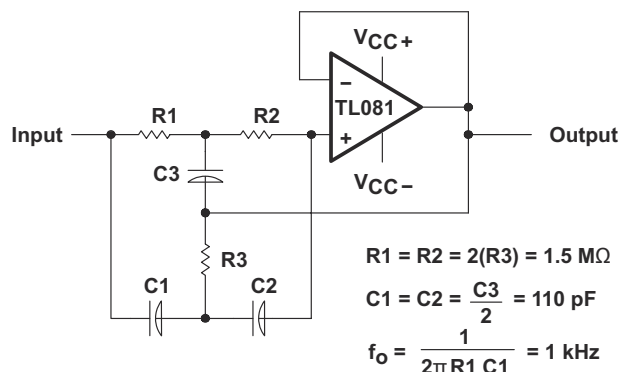


图 8-4. High-Q Notch Filter

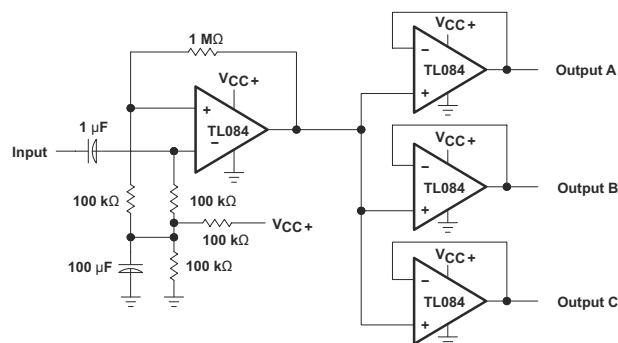


图 8-5. Audio-Distribution Amplifier

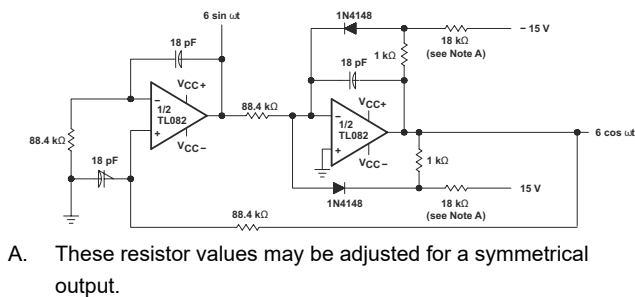


图 8-6. 100-kHz Quadrature Oscillator

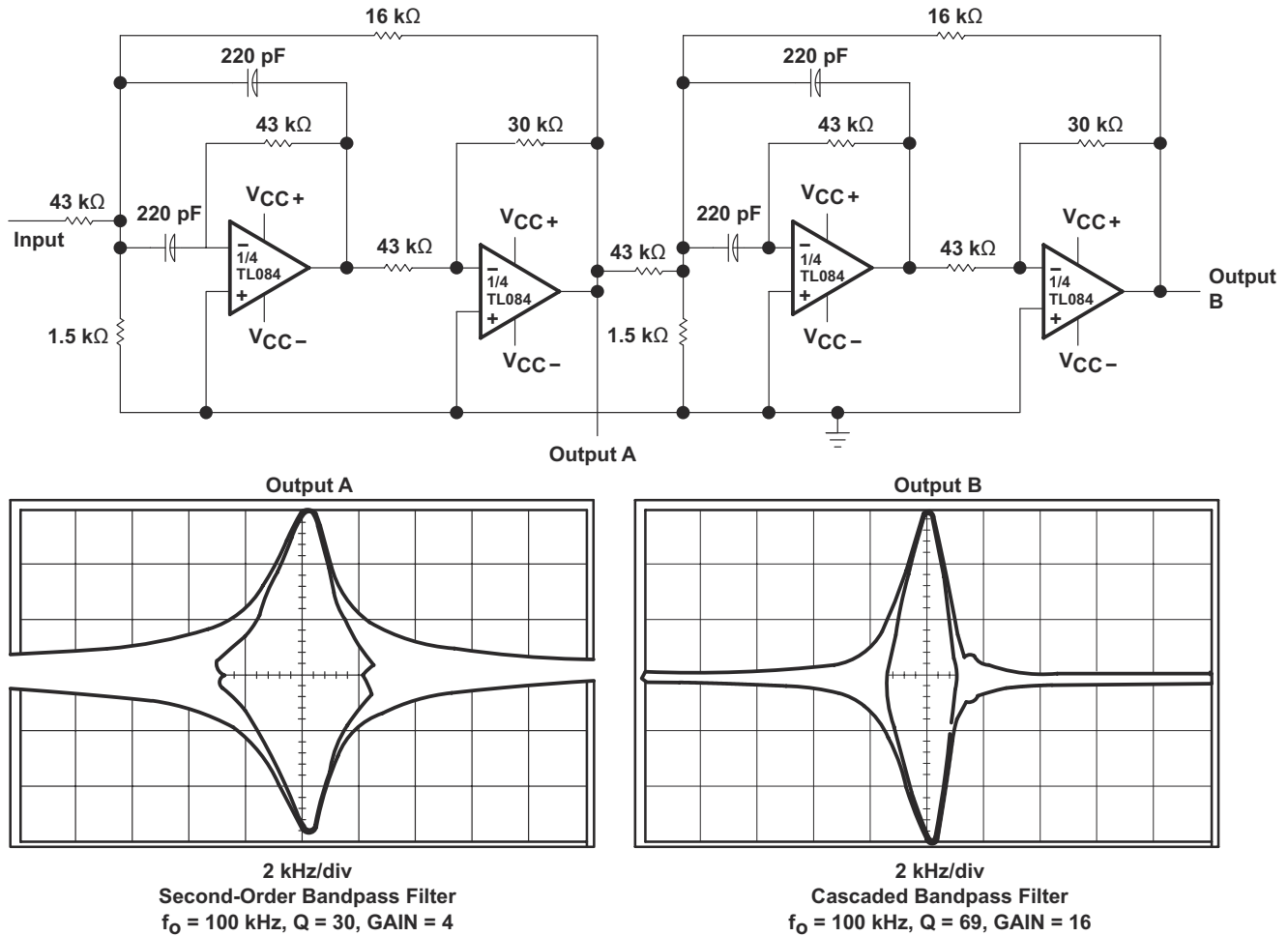


图 8-7. Positive-Feedback Bandpass Filter

## 8.4 Power Supply Recommendations

### 小心

Supply voltages larger than 36V for a single-supply or outside the range of  $\pm 18\text{V}$  for a dual-supply can permanently damage the device (see 节 5.1).

Place  $0.1 \mu\text{F}$  bypass capacitors close to the power-supply pins to reduce errors coupling in from noisy or high impedance power supplies. For more detailed information on bypass capacitor placement, refer to 节 8.5.

## 8.5 Layout

### 8.5.1 Layout Guidelines

For best operational performance of the device, use good PCB layout practices, including:

- Noise can propagate into analog circuitry through the power pins of the circuit as a whole, as well as the operational amplifier. Bypass capacitors are used to reduce the coupled noise by providing low impedance power sources local to the analog circuitry.
  - Connect low-ESR,  $0.1 \mu\text{F}$  ceramic bypass capacitors between each supply pin and ground, placed as close to the device as possible. A single bypass capacitor from  $V+$  to ground is applicable for single-supply applications.

- Separate grounding for analog and digital portions of circuitry is one of the simplest and most-effective methods of noise suppression. One or more layers on multilayer PCBs are usually devoted to ground planes. A ground plane helps distribute heat and reduces EMI noise pickup. Ensure to physically separate digital and analog grounds, paying attention to the flow of the ground current.
- To reduce parasitic coupling, run the input traces as far away from the supply or output traces as possible. If it is not possible to keep them separate, it is much better to cross the sensitive trace perpendicular as opposed to in parallel with the noisy trace.
- Place the external components as close to the device as possible. Keeping RF and RG close to the inverting input minimizes parasitic capacitance, as shown in 节 8.5.2.
- Keep the length of input traces as short as possible. Always remember that the input traces are the most sensitive part of the circuit.
- Consider a driven, low-impedance guard ring around the critical traces. A guard ring can significantly reduce leakage currents from nearby traces that are at different potentials.

### 8.5.2 Layout Examples

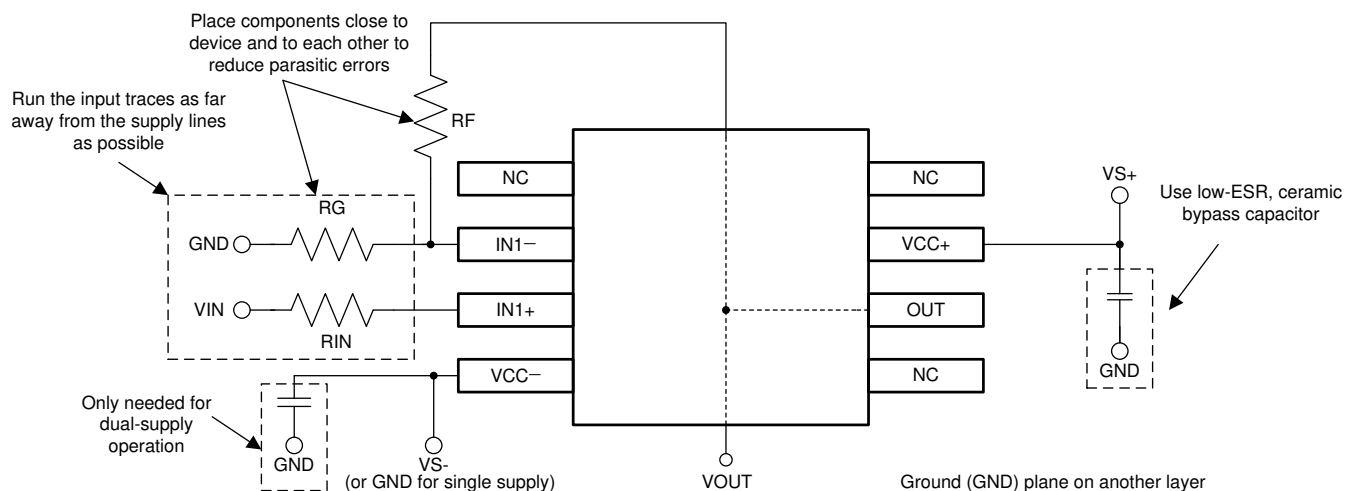


图 8-8. Operational Amplifier Board Layout for Noninverting Configuration

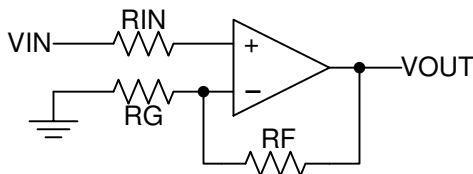


图 8-9. Operational Amplifier Schematic for Noninverting Configuration

## 9 Device and Documentation Support

### 9.1 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](https://www.ti.com) 上的器件产品文件夹。点击 [通知](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

### 9.2 支持资源

[TI E2E™ 中文支持论坛](#) 是工程师的重要参考资料，可直接从专家处获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题，获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 [使用条款](#)。

### 9.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.  
所有商标均为其各自所有者的财产。

### 9.4 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

### 9.5 术语表

[TI 术语表](#) 本术语表列出并解释了术语、首字母缩略词和定义。

## 10 Revision History

注：以前版本的页码可能与当前版本的页码不同

| Changes from Revision M (December 2021) to Revision N (June 2024)                                                                                                    | Page |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| • Changed Absolute Maximum Ratings, ESD Ratings, Recommended Operating Conditions, and Thermal Information sections by merging TL08xH and TL08xx specifications..... | 9    |
| • Changed Electrical Characteristics tables by merging TL08xC, TL08xAC, TL08xBC, TL08xI, and TL08xM specifications.....                                              | 14   |
| • Increased gain bandwidth of all non-NS/non-PS packages and non-TL08xM devices from 3MHz to 5.25MHz.....                                                            | 14   |
| • Merged TL08xC, TL08xAC, TL08xBC, TL08xI, and TL08xM Switching Characteristics tables and renamed to Electrical Characteristics (AC).....                           | 16   |
| • Changed input voltage noise density at 1kHz for all non-PS/non-NS packages and all non-TL08xM devices to 37nV/√Hz.....                                             | 16   |
| • Changed THD+N for all non-PS/non-NS packages and all non-TL08xM devices to 0.00012%.....                                                                           | 16   |
| • Updated <i>Functional Block Diagram</i> and <i>Feature Description</i> sections.....                                                                               | 25   |

| Changes from Revision L (July 2021) to Revision M (December 2021)                                | Page |
|--------------------------------------------------------------------------------------------------|------|
| • Corrected DCK pinout diagram and table in <i>Pin Configurations and Functions</i> section..... | 3    |

## 11 Mechanical, Packaging, and Orderable Information

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

## PACKAGING INFORMATION

| Orderable part number           | Status<br>(1) | Material type<br>(2) | Package   Pins   | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)                  |
|---------------------------------|---------------|----------------------|------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|--------------------------------------|
| <a href="#">5962-9851501Q2A</a> | Active        | Production           | LCCC (FK)   20   | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-<br>9851501Q2A<br>TL082MFKB     |
| <a href="#">5962-9851501QPA</a> | Active        | Production           | CDIP (JG)   8    | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 9851501QPA<br>TL082M                 |
| <a href="#">5962-9851503Q2A</a> | Active        | Production           | LCCC (FK)   20   | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-<br>9851503Q2A<br>TL084<br>MFKB |
| <a href="#">5962-9851503QCA</a> | Active        | Production           | CDIP (J)   14    | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9851503QC<br>A<br>TL084MJB      |
| <a href="#">TL081ACD</a>        | Obsolete      | Production           | SOIC (D)   8     | -                     | -           | Call TI                              | Call TI                           | 0 to 70      | 081AC                                |
| <a href="#">TL081ACDR</a>       | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 081AC                                |
| TL081ACDR.A                     | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 081AC                                |
| <a href="#">TL081ACP</a>        | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL081ACP                             |
| TL081ACP.A                      | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL081ACP                             |
| <a href="#">TL081BCD</a>        | Obsolete      | Production           | SOIC (D)   8     | -                     | -           | Call TI                              | Call TI                           | 0 to 70      | 081BC                                |
| <a href="#">TL081BCDR</a>       | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 081BC                                |
| TL081BCDR.A                     | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 081BC                                |
| <a href="#">TL081BCP</a>        | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL081BCP                             |
| TL081BCP.A                      | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL081BCP                             |
| <a href="#">TL081CD</a>         | Obsolete      | Production           | SOIC (D)   8     | -                     | -           | Call TI                              | Call TI                           | 0 to 70      | TL081C                               |
| <a href="#">TL081CDR</a>        | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL081C                               |
| TL081CDR.A                      | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL081C                               |
| <a href="#">TL081CP</a>         | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL081CP                              |
| TL081CP.A                       | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL081CP                              |
| TL081CPE4                       | Active        | Production           | PDIP (P)   8     | 50   TUBE             | -           | Call TI                              | Call TI                           | 0 to 70      |                                      |
| <a href="#">TL081CPSR</a>       | Active        | Production           | SO (PS)   8      | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T081                                 |
| TL081CPSR.A                     | Active        | Production           | SO (PS)   8      | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T081                                 |
| <a href="#">TL081HIDBVR</a>     | Active        | Production           | SOT-23 (DBV)   5 | 3000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 125   | T81V                                 |

| Orderable part number       | Status<br>(1) | Material type<br>(2) | Package   Pins   | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-----------------------------|---------------|----------------------|------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| TL081HIDBVR.A               | Active        | Production           | SOT-23 (DBV)   5 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | T81V                |
| TL081HIDBVR.B               | Active        | Production           | SOT-23 (DBV)   5 | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | T81V                |
| <a href="#">TL081HIDCKR</a> | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 1IP                 |
| TL081HIDCKR.A               | Active        | Production           | SC70 (DCK)   5   | 3000   LARGE T&R      | Yes         | SN                                   | Level-1-260C-UNLIM                | -40 to 125   | 1IP                 |
| <a href="#">TL081HIDR</a>   | Active        | Production           | SOIC (D)   8     | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL081D              |
| TL081HIDR.A                 | Active        | Production           | SOIC (D)   8     | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL081D              |
| TL081HIDR.B                 | Active        | Production           | SOIC (D)   8     | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL081D              |
| <a href="#">TL081ID</a>     | Obsolete      | Production           | SOIC (D)   8     | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | TL081I              |
| <a href="#">TL081IDR</a>    | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TL081I              |
| TL081IDR.A                  | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TL081I              |
| <a href="#">TL081IP</a>     | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 85    | TL081IP             |
| TL081IP.A                   | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 85    | TL081IP             |
| <a href="#">TL082ACD</a>    | Obsolete      | Production           | SOIC (D)   8     | -                     | -           | Call TI                              | Call TI                           | 0 to 70      | 082AC               |
| <a href="#">TL082ACDR</a>   | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 082AC               |
| TL082ACDR.A                 | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 082AC               |
| TL082ACDRE4                 | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | -           | Call TI                              | Call TI                           | 0 to 70      |                     |
| <a href="#">TL082ACP</a>    | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL082ACP            |
| TL082ACP.A                  | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL082ACP            |
| <a href="#">TL082ACPSR</a>  | Active        | Production           | SO (PS)   8      | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T082A               |
| TL082ACPSR.A                | Active        | Production           | SO (PS)   8      | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T082A               |
| <a href="#">TL082BCD</a>    | Obsolete      | Production           | SOIC (D)   8     | -                     | -           | Call TI                              | Call TI                           | 0 to 70      | 082BC               |
| <a href="#">TL082BCDR</a>   | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 082BC               |
| TL082BCDR.A                 | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 082BC               |
| TL082BCDRG4                 | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 082BC               |
| TL082BCDRG4.A               | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | 082BC               |
| <a href="#">TL082BCP</a>    | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL082BCP            |
| TL082BCP.A                  | Active        | Production           | PDIP (P)   8     | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL082BCP            |
| TL082BCPE4                  | Active        | Production           | PDIP (P)   8     | 50   TUBE             | -           | Call TI                              | Call TI                           | 0 to 70      |                     |
| <a href="#">TL082CDR</a>    | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL082C              |
| TL082CDR.A                  | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL082C              |
| TL082CDRE4                  | Active        | Production           | SOIC (D)   8     | 2500   LARGE T&R      | -           | Call TI                              | Call TI                           | 0 to 70      |                     |

| Orderable part number       | Status<br>(1) | Material type<br>(2) | Package   Pins        | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)              |
|-----------------------------|---------------|----------------------|-----------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|----------------------------------|
| TL082CDRG4                  | Active        | Production           | SOIC (D)   8          | 2500   LARGE T&R      | -           | Call TI                              | Call TI                           | 0 to 70      |                                  |
| <a href="#">TL082CP</a>     | Active        | Production           | PDIP (P)   8          | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL082CP                          |
| TL082CP.A                   | Active        | Production           | PDIP (P)   8          | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL082CP                          |
| <a href="#">TL082CPSR</a>   | Active        | Production           | SO (PS)   8           | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T082                             |
| TL082CPSR.A                 | Active        | Production           | SO (PS)   8           | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T082                             |
| TL082CPSRG4                 | Active        | Production           | SO (PS)   8           | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T082                             |
| <a href="#">TL082CPWR</a>   | Active        | Production           | TSSOP (PW)   8        | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T082                             |
| TL082CPWR.A                 | Active        | Production           | TSSOP (PW)   8        | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T082                             |
| TL082CPWRG4                 | Active        | Production           | TSSOP (PW)   8        | 2000   LARGE T&R      | -           | Call TI                              | Call TI                           | 0 to 70      |                                  |
| <a href="#">TL082HIDDFR</a> | Active        | Production           | SOT-23-THIN (DDF)   8 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | 082F                             |
| TL082HIDDFR.A               | Active        | Production           | SOT-23-THIN (DDF)   8 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | 082F                             |
| TL082HIDDFR.B               | Active        | Production           | SOT-23-THIN (DDF)   8 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | 082F                             |
| <a href="#">TL082HIDR</a>   | Active        | Production           | SOIC (D)   8          | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL082D                           |
| TL082HIDR.A                 | Active        | Production           | SOIC (D)   8          | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL082D                           |
| <a href="#">TL082HIPWR</a>  | Active        | Production           | TSSOP (PW)   8        | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | 082HPW                           |
| TL082HIPWR.A                | Active        | Production           | TSSOP (PW)   8        | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | 082HPW                           |
| <a href="#">TL082IDR</a>    | Active        | Production           | SOIC (D)   8          | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TL082I                           |
| TL082IDR.A                  | Active        | Production           | SOIC (D)   8          | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TL082I                           |
| TL082IDRE4                  | Active        | Production           | SOIC (D)   8          | 2500   LARGE T&R      | -           | Call TI                              | Call TI                           | -40 to 85    |                                  |
| <a href="#">TL082IP</a>     | Active        | Production           | PDIP (P)   8          | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 85    | TL082IP                          |
| TL082IP.A                   | Active        | Production           | PDIP (P)   8          | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 85    | TL082IP                          |
| TL082IPE4                   | Active        | Production           | PDIP (P)   8          | 50   TUBE             | -           | Call TI                              | Call TI                           | -40 to 85    |                                  |
| <a href="#">TL082IPWR</a>   | Active        | Production           | TSSOP (PW)   8        | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | Z082                             |
| TL082IPWR.A                 | Active        | Production           | TSSOP (PW)   8        | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | Z082                             |
| <a href="#">TL082MFKB</a>   | Active        | Production           | LCCC (FK)   20        | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-<br>9851501Q2A<br>TL082MFKB |
| TL082MFKB.A                 | Active        | Production           | LCCC (FK)   20        | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-<br>9851501Q2A<br>TL082MFKB |
| <a href="#">TL082MJG</a>    | Active        | Production           | CDIP (JG)   8         | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | TL082MJG                         |
| TL082MJG.A                  | Active        | Production           | CDIP (JG)   8         | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | TL082MJG                         |

| Orderable part number       | Status<br>(1) | Material type<br>(2) | Package   Pins  | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)  |
|-----------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|----------------------|
| <a href="#">TL082MJGB</a>   | Active        | Production           | CDIP (JG)   8   | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 9851501QPA<br>TL082M |
| TL082MJGB.A                 | Active        | Production           | CDIP (JG)   8   | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 9851501QPA<br>TL082M |
| <a href="#">TL084ACDR</a>   | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | 0 to 70      | TL084AC              |
| TL084ACDR.A                 | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084AC              |
| <a href="#">TL084ACN</a>    | Active        | Production           | PDIP (N)   14   | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL084ACN             |
| TL084ACN.A                  | Active        | Production           | PDIP (N)   14   | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL084ACN             |
| <a href="#">TL084ACNSR</a>  | Active        | Production           | SOP (NS)   14   | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084A               |
| TL084ACNSR.A                | Active        | Production           | SOP (NS)   14   | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084A               |
| <a href="#">TL084BCDR</a>   | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084BC              |
| TL084BCDR.A                 | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084BC              |
| TL084BCDR.B                 | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084BC              |
| TL084BCDR1G4                | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084BC              |
| TL084BCDR1G4.A              | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084BC              |
| TL084BCDRG4                 | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | -           | Call TI                              | Call TI                           | 0 to 70      |                      |
| <a href="#">TL084BCN</a>    | Active        | Production           | PDIP (N)   14   | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL084BCN             |
| TL084BCN.A                  | Active        | Production           | PDIP (N)   14   | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL084BCN             |
| TL084BCNE4                  | Active        | Production           | PDIP (N)   14   | 25   TUBE             | -           | Call TI                              | Call TI                           | 0 to 70      |                      |
| <a href="#">TL084CDR</a>    | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU   NIPDAU                      | Level-1-260C-UNLIM                | 0 to 70      | TL084C               |
| TL084CDR.A                  | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084C               |
| <a href="#">TL084CDRG4</a>  | Obsolete      | Production           | SOIC (D)   14   | -                     | -           | Call TI                              | Call TI                           | 0 to 70      | TL084C               |
| <a href="#">TL084CN</a>     | Active        | Production           | PDIP (N)   14   | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL084CN              |
| TL084CN.A                   | Active        | Production           | PDIP (N)   14   | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | TL084CN              |
| <a href="#">TL084CNSR</a>   | Active        | Production           | SOP (NS)   14   | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084                |
| TL084CNSR.A                 | Active        | Production           | SOP (NS)   14   | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | TL084                |
| <a href="#">TL084CPWR</a>   | Active        | Production           | TSSOP (PW)   14 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T084                 |
| TL084CPWR.A                 | Active        | Production           | TSSOP (PW)   14 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T084                 |
| <a href="#">TL084CPWRG4</a> | Active        | Production           | TSSOP (PW)   14 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | T084                 |
| <a href="#">TL084HIDR</a>   | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL084HID             |
| TL084HIDR.A                 | Active        | Production           | SOIC (D)   14   | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL084HID             |

| Orderable part number       | Status<br>(1) | Material type<br>(2) | Package   Pins            | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)                  |
|-----------------------------|---------------|----------------------|---------------------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|--------------------------------------|
| <a href="#">TL084HIDYYR</a> | Active        | Production           | SOT-23-THIN<br>(DYY)   14 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | T084HDYY                             |
| TL084HIDYYR.A               | Active        | Production           | SOT-23-THIN<br>(DYY)   14 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | T084HDYY                             |
| TL084HIDYYR.B               | Active        | Production           | SOT-23-THIN<br>(DYY)   14 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | T084HDYY                             |
| TL084HIDYYRG4               | Active        | Production           | SOT-23-THIN<br>(DYY)   14 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | T084HDYY                             |
| TL084HIDYYRG4.A             | Active        | Production           | SOT-23-THIN<br>(DYY)   14 | 3000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | T084HDYY                             |
| <a href="#">TL084HIPWR</a>  | Active        | Production           | TSSOP (PW)   14           | 2000   LARGE T&R      | Yes         | NIPDAU   SN                          | Level-1-260C-UNLIM                | -40 to 125   | TL084PW                              |
| TL084HIPWR.A                | Active        | Production           | TSSOP (PW)   14           | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL084PW                              |
| <a href="#">TL084ID</a>     | Obsolete      | Production           | SOIC (D)   14             | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | TL084I                               |
| <a href="#">TL084IDR</a>    | Active        | Production           | SOIC (D)   14             | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TL084I                               |
| TL084IDR.A                  | Active        | Production           | SOIC (D)   14             | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | TL084I                               |
| TL084IDR.B                  | Active        | Production           | SOIC (D)   14             | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL084I                               |
| TL084IDR1G4                 | Active        | Production           | SOIC (D)   14             | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL084I                               |
| TL084IDR1G4.A               | Active        | Production           | SOIC (D)   14             | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL084I                               |
| TL084IDRE4                  | Active        | Production           | SOIC (D)   14             | 2500   LARGE T&R      | -           | Call TI                              | Call TI                           | -40 to 85    |                                      |
| TL084IDRG4                  | Active        | Production           | SOIC (D)   14             | 2500   LARGE T&R      | -           | Call TI                              | Call TI                           | -40 to 85    |                                      |
| <a href="#">TL084IN</a>     | Active        | Production           | PDIP (N)   14             | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 85    | TL084IN                              |
| TL084IN.A                   | Active        | Production           | PDIP (N)   14             | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 85    | TL084IN                              |
| TL084ING4                   | Active        | Production           | PDIP (N)   14             | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 125   | TL084IN                              |
| TL084ING4.A                 | Active        | Production           | PDIP (N)   14             | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 125   | TL084IN                              |
| <a href="#">TL084MFK</a>    | Active        | Production           | LCCC (FK)   20            | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | TL084MFK                             |
| TL084MFK.A                  | Active        | Production           | LCCC (FK)   20            | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | TL084MFK                             |
| <a href="#">TL084MFKB</a>   | Active        | Production           | LCCC (FK)   20            | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-<br>9851503Q2A<br>TL084<br>MFKB |
| TL084MFKB.A                 | Active        | Production           | LCCC (FK)   20            | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-<br>9851503Q2A<br>TL084<br>MFKB |

| Orderable part number      | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)             |
|----------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------------------|
| <a href="#">TL084MJ</a>    | Active        | Production           | CDIP (J)   14  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | TL084MJ                         |
| TL084MJ.A                  | Active        | Production           | CDIP (J)   14  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | TL084MJ                         |
| <a href="#">TL084MJB</a>   | Active        | Production           | CDIP (J)   14  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9851503QC<br>A<br>TL084MJB |
| TL084MJB.A                 | Active        | Production           | CDIP (J)   14  | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-9851503QC<br>A<br>TL084MJB |
| <a href="#">TL084QDR</a>   | Active        | Production           | SOIC (D)   14  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL084Q                          |
| TL084QDR.A                 | Active        | Production           | SOIC (D)   14  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL084Q                          |
| <a href="#">TL084QDRG4</a> | Active        | Production           | SOIC (D)   14  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL084Q                          |
| TL084QDRG4.A               | Active        | Production           | SOIC (D)   14  | 2500   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 125   | TL084Q                          |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

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

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

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

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

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

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

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative

and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

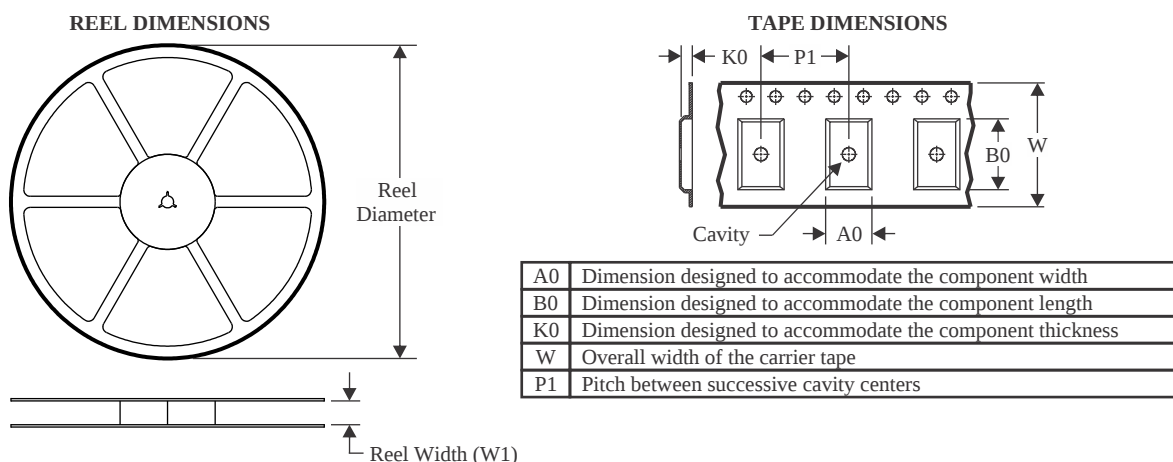
**OTHER QUALIFIED VERSIONS OF TL082, TL082M, TL084, TL084M :**

- Catalog : [TL082](#), [TL084](#)
- Automotive : [TL082-Q1](#), [TL082-Q1](#)
- Military : [TL082M](#), [TL084M](#)

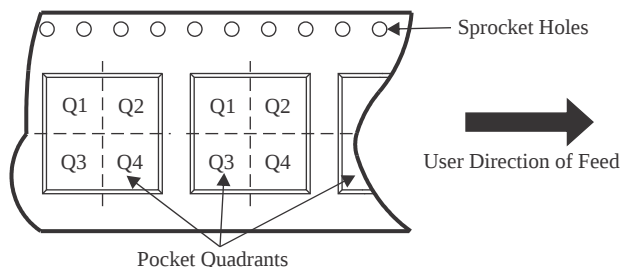
**NOTE: Qualified Version Definitions:**

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

## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

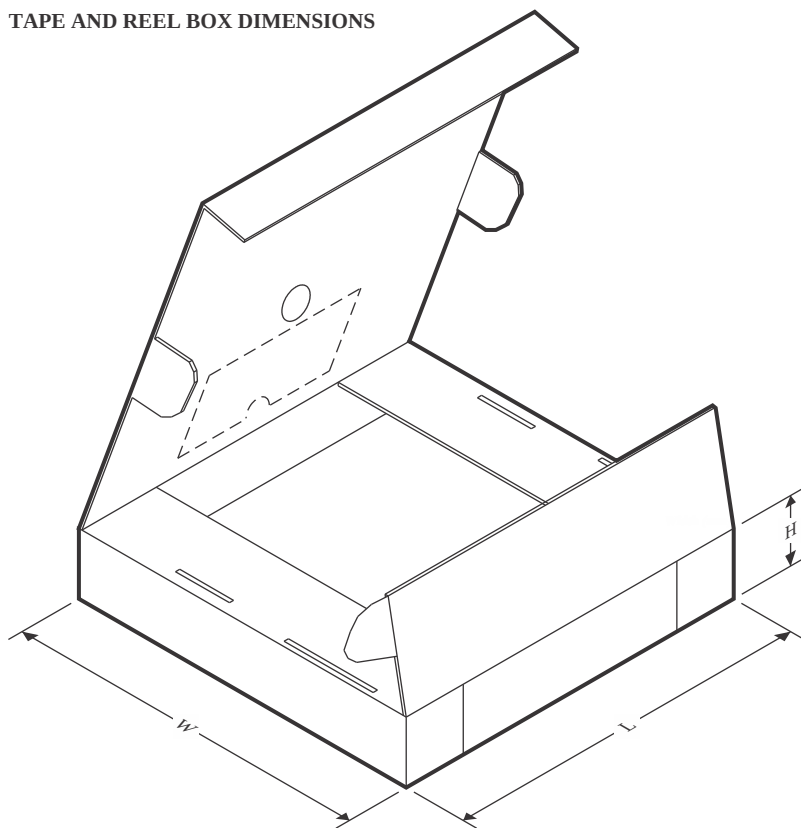


\*All dimensions are nominal

| 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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TL081ACDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL081ACDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL081BCDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL081CDR    | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL081CPSR   | SO           | PS              | 8    | 2000 | 330.0              | 16.4               | 8.35    | 6.6     | 2.4     | 12.0    | 16.0   | Q1            |
| TL081HIDBVR | SOT-23       | DBV             | 5    | 3000 | 178.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TL081HIDBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TL081HIDCKR | SC70         | DCK             | 5    | 3000 | 178.0              | 9.0                | 2.4     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| TL081HIDR   | SOIC         | D               | 8    | 3000 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL081IDR    | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL081IDR    | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL082ACDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL082ACPSR  | SO           | PS              | 8    | 2000 | 330.0              | 16.4               | 8.35    | 6.6     | 2.4     | 12.0    | 16.0   | Q1            |
| TL082BCDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL082BCDRG4 | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL082CDR    | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TL082CPSR     | SO           | PS              | 8    | 2000 | 330.0              | 16.4               | 8.35    | 6.6     | 2.4     | 12.0    | 16.0   | Q1            |
| TL082CPWR     | TSSOP        | PW              | 8    | 2000 | 330.0              | 12.4               | 7.0     | 3.6     | 1.6     | 8.0     | 12.0   | Q1            |
| TL082HIDDFR   | SOT-23-THIN  | DDF             | 8    | 3000 | 180.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TL082HIDR     | SOIC         | D               | 8    | 3000 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL082HIPWR    | TSSOP        | PW              | 8    | 3000 | 330.0              | 12.4               | 7.0     | 3.6     | 1.6     | 8.0     | 12.0   | Q1            |
| TL082IDR      | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TL082IPWR     | TSSOP        | PW              | 8    | 2000 | 330.0              | 12.4               | 7.0     | 3.6     | 1.6     | 8.0     | 12.0   | Q1            |
| TL084ACDR     | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL084ACNSR    | SOP          | NS              | 14   | 2000 | 330.0              | 16.4               | 8.45    | 10.55   | 2.5     | 12.0    | 16.2   | Q1            |
| TL084BCDR     | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL084BCDR1G4  | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL084CDR      | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL084CNSR     | SOP          | NS              | 14   | 2000 | 330.0              | 16.4               | 8.45    | 10.55   | 2.5     | 12.0    | 16.2   | Q1            |
| TL084CPWR     | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| TL084CPWR     | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| TL084CPWRG4   | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| TL084CPWRG4   | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| TL084HIDR     | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL084HIDYYR   | SOT-23-THIN  | DYY             | 14   | 3000 | 330.0              | 12.4               | 4.8     | 3.6     | 1.6     | 8.0     | 12.0   | Q3            |
| TL084HIDYYRG4 | SOT-23-THIN  | DYY             | 14   | 3000 | 330.0              | 12.4               | 4.8     | 3.6     | 1.6     | 8.0     | 12.0   | Q3            |
| TL084HIPWR    | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| TL084IDR      | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL084IDR1G4   | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL084QDR      | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TL084QDRG4    | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |

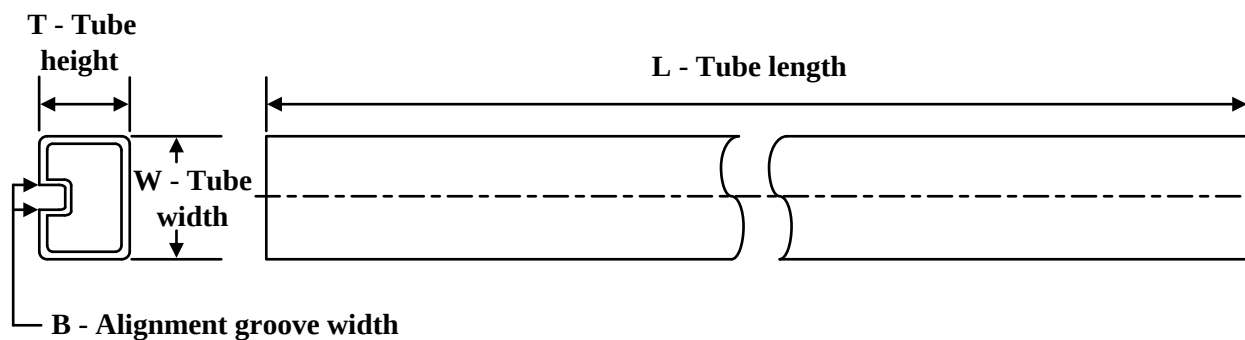
## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device      | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TL081ACDR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| TL081ACDR   | SOIC         | D               | 8    | 2500 | 353.0       | 353.0      | 32.0        |
| TL081BCDR   | SOIC         | D               | 8    | 2500 | 353.0       | 353.0      | 32.0        |
| TL081CDR    | SOIC         | D               | 8    | 2500 | 353.0       | 353.0      | 32.0        |
| TL081CPSR   | SO           | PS              | 8    | 2000 | 353.0       | 353.0      | 32.0        |
| TL081HIDBVR | SOT-23       | DBV             | 5    | 3000 | 208.0       | 191.0      | 35.0        |
| TL081HIDBVR | SOT-23       | DBV             | 5    | 3000 | 210.0       | 185.0      | 35.0        |
| TL081HIDCKR | SC70         | DCK             | 5    | 3000 | 190.0       | 190.0      | 30.0        |
| TL081HIDR   | SOIC         | D               | 8    | 3000 | 353.0       | 353.0      | 32.0        |
| TL081IDR    | SOIC         | D               | 8    | 2500 | 353.0       | 353.0      | 32.0        |
| TL081IDR    | SOIC         | D               | 8    | 2500 | 353.0       | 353.0      | 32.0        |
| TL082ACDR   | SOIC         | D               | 8    | 2500 | 353.0       | 353.0      | 32.0        |
| TL082ACPSR  | SO           | PS              | 8    | 2000 | 353.0       | 353.0      | 32.0        |
| TL082BCDR   | SOIC         | D               | 8    | 2500 | 353.0       | 353.0      | 32.0        |
| TL082BCDRG4 | SOIC         | D               | 8    | 2500 | 353.0       | 353.0      | 32.0        |
| TL082CDR    | SOIC         | D               | 8    | 2500 | 353.0       | 353.0      | 32.0        |
| TL082CPSR   | SO           | PS              | 8    | 2000 | 353.0       | 353.0      | 32.0        |
| TL082CPWR   | TSSOP        | PW              | 8    | 2000 | 353.0       | 353.0      | 32.0        |

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TL082HIDDFR   | SOT-23-THIN  | DDF             | 8    | 3000 | 210.0       | 185.0      | 35.0        |
| TL082HIDR     | SOIC         | D               | 8    | 3000 | 353.0       | 353.0      | 32.0        |
| TL082HIPWR    | TSSOP        | PW              | 8    | 3000 | 353.0       | 353.0      | 32.0        |
| TL082IDR      | SOIC         | D               | 8    | 2500 | 353.0       | 353.0      | 32.0        |
| TL082IPWR     | TSSOP        | PW              | 8    | 2000 | 353.0       | 353.0      | 32.0        |
| TL084ACDR     | SOIC         | D               | 14   | 2500 | 353.0       | 353.0      | 32.0        |
| TL084ACNSR    | SOP          | NS              | 14   | 2000 | 353.0       | 353.0      | 32.0        |
| TL084BCDR     | SOIC         | D               | 14   | 2500 | 353.0       | 353.0      | 32.0        |
| TL084BCDR1G4  | SOIC         | D               | 14   | 2500 | 353.0       | 353.0      | 32.0        |
| TL084CDR      | SOIC         | D               | 14   | 2500 | 353.0       | 353.0      | 32.0        |
| TL084CNSR     | SOP          | NS              | 14   | 2000 | 353.0       | 353.0      | 32.0        |
| TL084CPWR     | TSSOP        | PW              | 14   | 2000 | 353.0       | 353.0      | 32.0        |
| TL084CPWR     | TSSOP        | PW              | 14   | 2000 | 353.0       | 353.0      | 32.0        |
| TL084CPWRG4   | TSSOP        | PW              | 14   | 2000 | 353.0       | 353.0      | 32.0        |
| TL084CPWRG4   | TSSOP        | PW              | 14   | 2000 | 356.0       | 356.0      | 35.0        |
| TL084HIDR     | SOIC         | D               | 14   | 2500 | 353.0       | 353.0      | 32.0        |
| TL084HIDYYR   | SOT-23-THIN  | DYY             | 14   | 3000 | 336.6       | 336.6      | 31.8        |
| TL084HIDYYRG4 | SOT-23-THIN  | DYY             | 14   | 3000 | 336.6       | 336.6      | 31.8        |
| TL084HIPWR    | TSSOP        | PW              | 14   | 2000 | 353.0       | 353.0      | 32.0        |
| TL084IDR      | SOIC         | D               | 14   | 2500 | 353.0       | 353.0      | 32.0        |
| TL084IDR1G4   | SOIC         | D               | 14   | 2500 | 353.0       | 353.0      | 32.0        |
| TL084QDR      | SOIC         | D               | 14   | 2500 | 353.0       | 353.0      | 32.0        |
| TL084QDRG4    | SOIC         | D               | 14   | 2500 | 353.0       | 353.0      | 32.0        |

**TUBE**


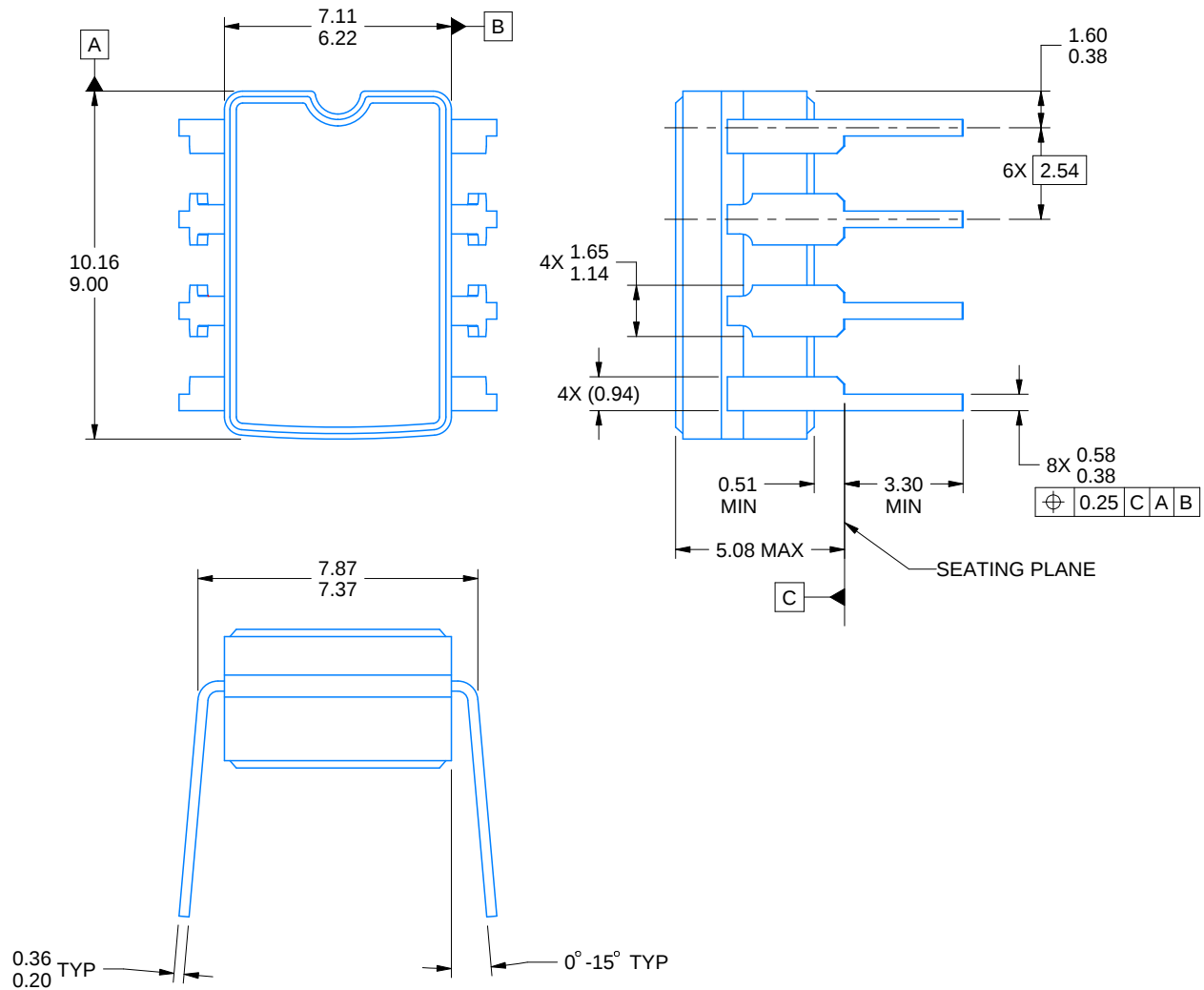
\*All dimensions are nominal

| Device          | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-----------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-9851501Q2A | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| 5962-9851503Q2A | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| TL081ACP        | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL081ACP.A      | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL081BCP        | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL081BCP.A      | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL081CP         | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL081CP.A       | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL081IP         | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL081IP.A       | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082ACP        | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082ACP.A      | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082BCP        | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082BCP.A      | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082CP         | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082CP.A       | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082IP         | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082IP         | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082IP.A       | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082IP.A       | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| TL082MFKB       | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| TL082MFKB.A     | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| TL084ACN        | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084ACN        | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084ACN.A      | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084ACN.A      | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084BCN        | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084BCN        | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084BCN.A      | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |

| Device      | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| TL084BCN.A  | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084CN     | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084CN.A   | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084IN     | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084IN.A   | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084ING4   | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084ING4.A | N            | PDIP         | 14   | 25  | 506    | 13.97  | 11230  | 4.32   |
| TL084MFK    | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| TL084MFK.A  | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| TL084MFKB   | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |
| TL084MFKB.A | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030   | NA     |

**JG0008A****PACKAGE OUTLINE****CDIP - 5.08 mm max height**

CERAMIC DUAL IN-LINE PACKAGE



4230036/A 09/2023

**NOTES:**

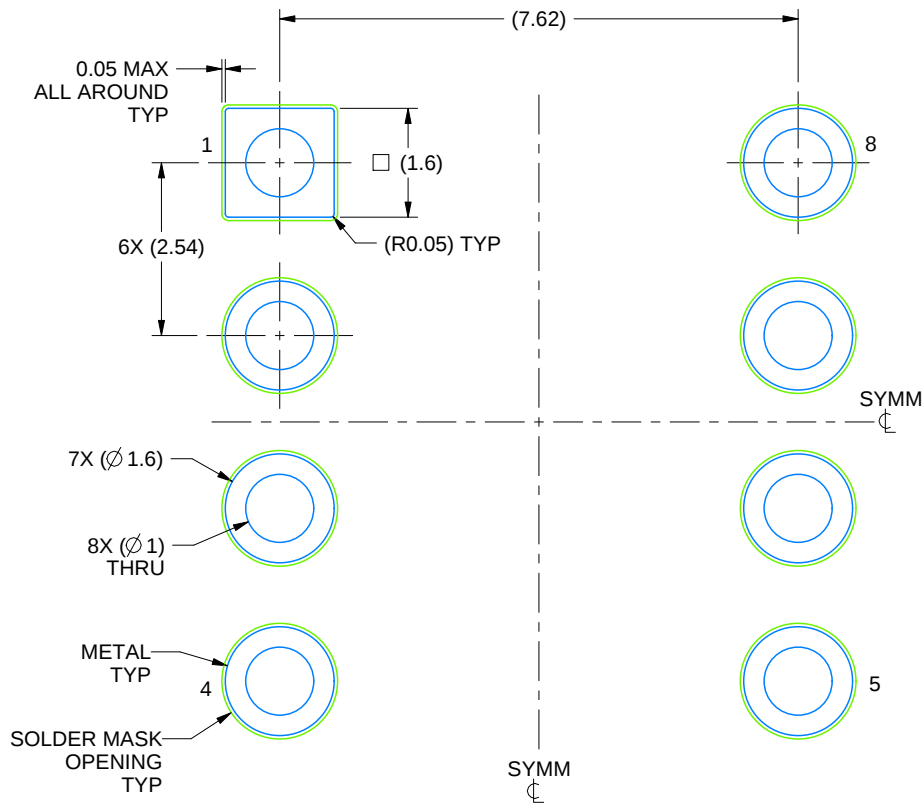
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package can be hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided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

# EXAMPLE BOARD LAYOUT

JG0008A

CDIP - 5.08 mm max height

CERAMIC DUAL IN-LINE PACKAGE





## SOT-23 - 1.45 mm max height

## SMALL OUTLINE TRANSISTOR

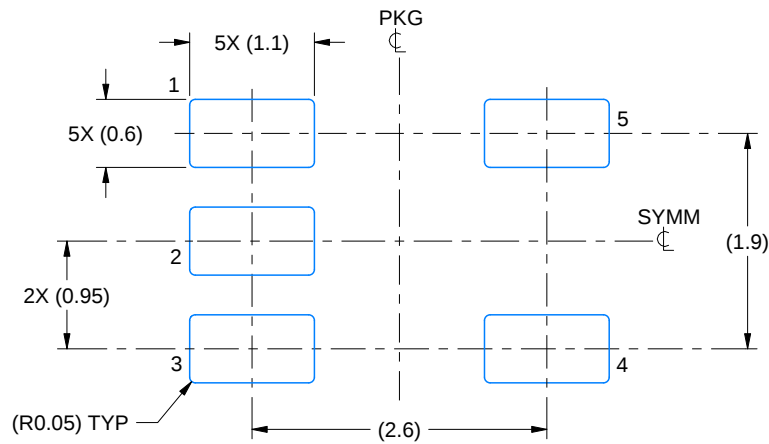


1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25 mm per side.
5. Support pin may differ or may not be present.

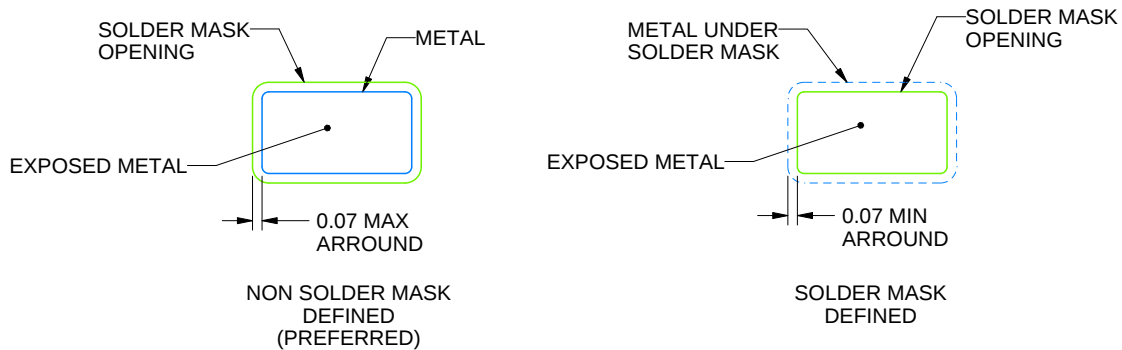
**DBV0005A**

**SOT-23 - 1.45 mm max height**

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



## SOLDER MASK DETAILS

4214839/K 08/2024

NOTES: (continued)

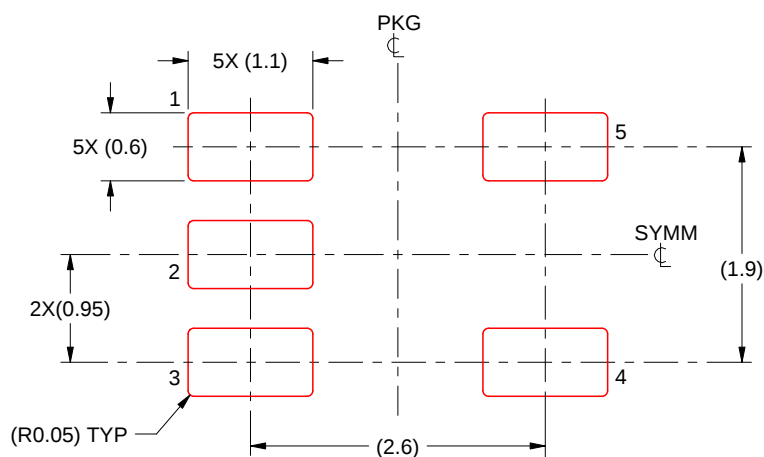
6. Publication IPC-7351 may have alternate designs.  
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR

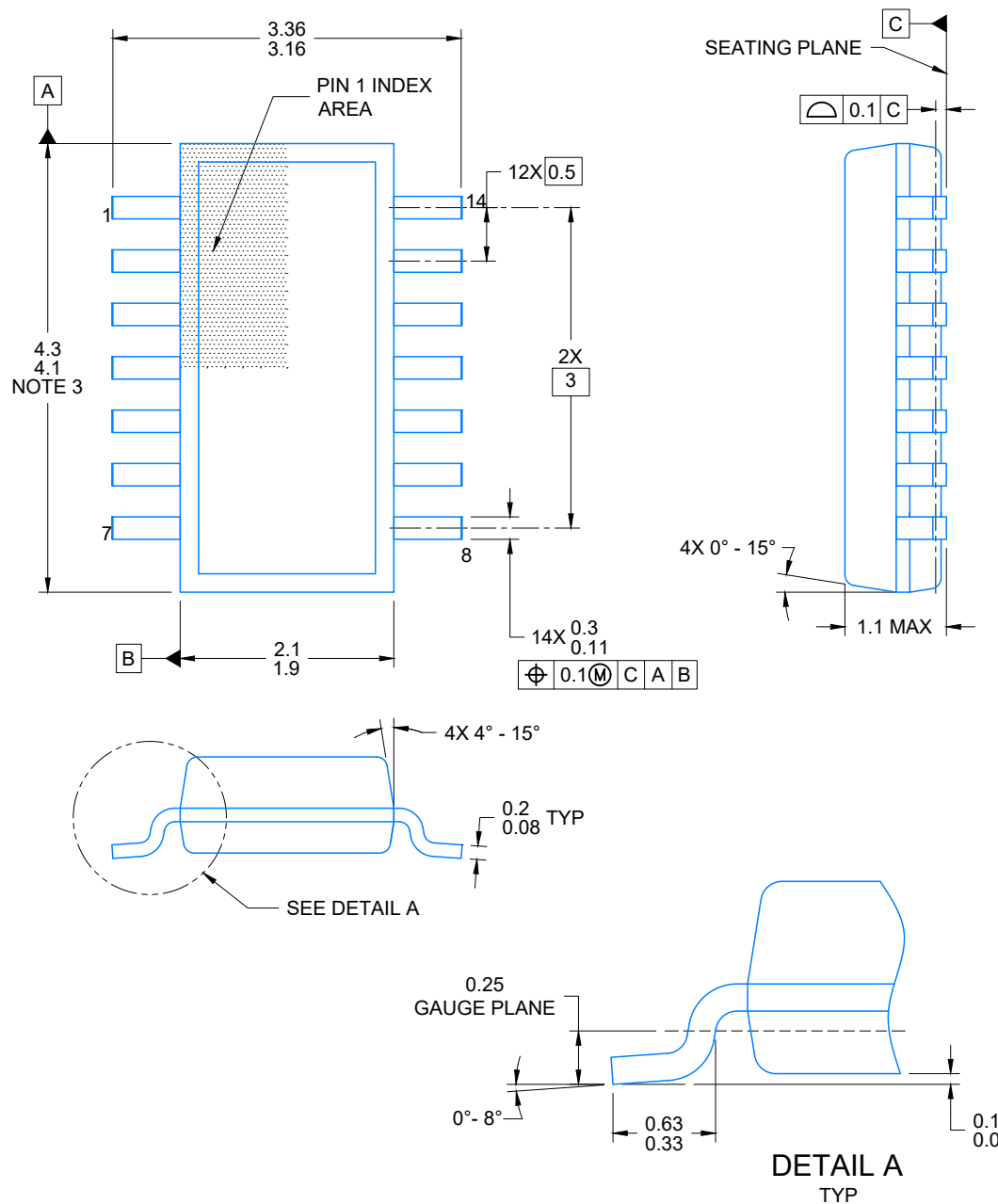


SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:15X

4214839/K 08/2024

NOTES: (continued)

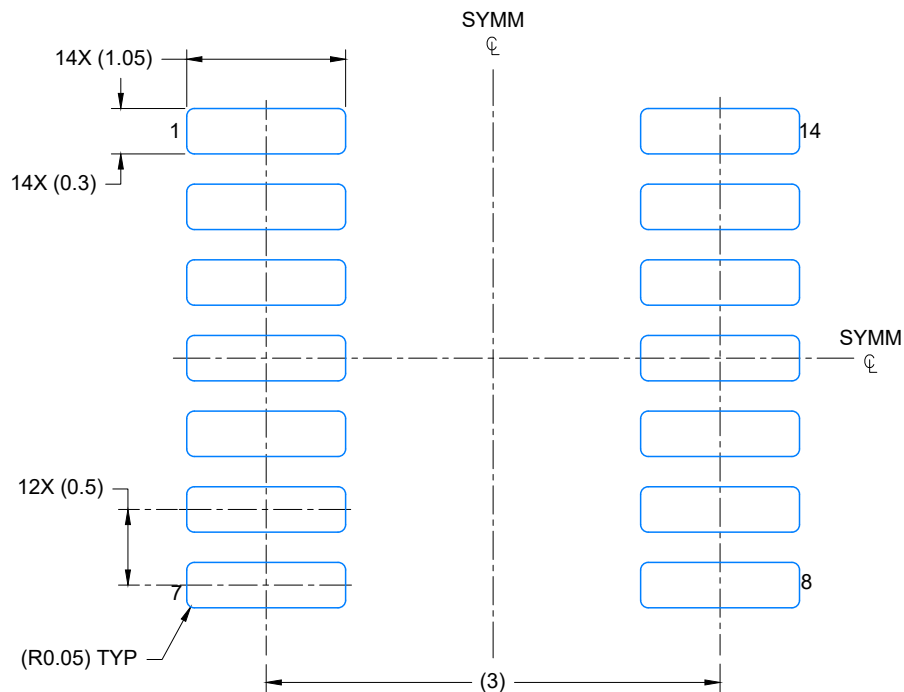
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.



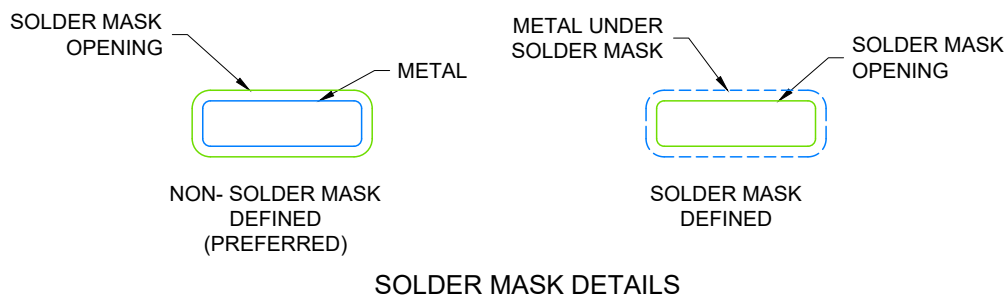
4224643/D 07/2024

## NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
5. Reference JEDEC Registration MO-345, Variation AB



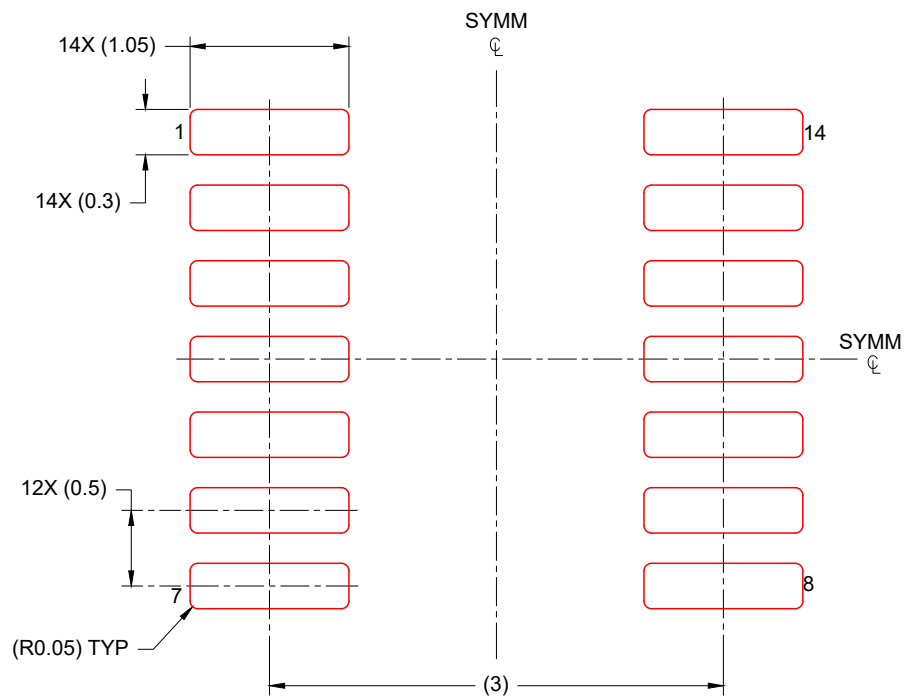
LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 20X



4224643/D 07/2024

## NOTES: (continued)

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

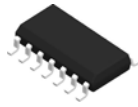


SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 20X

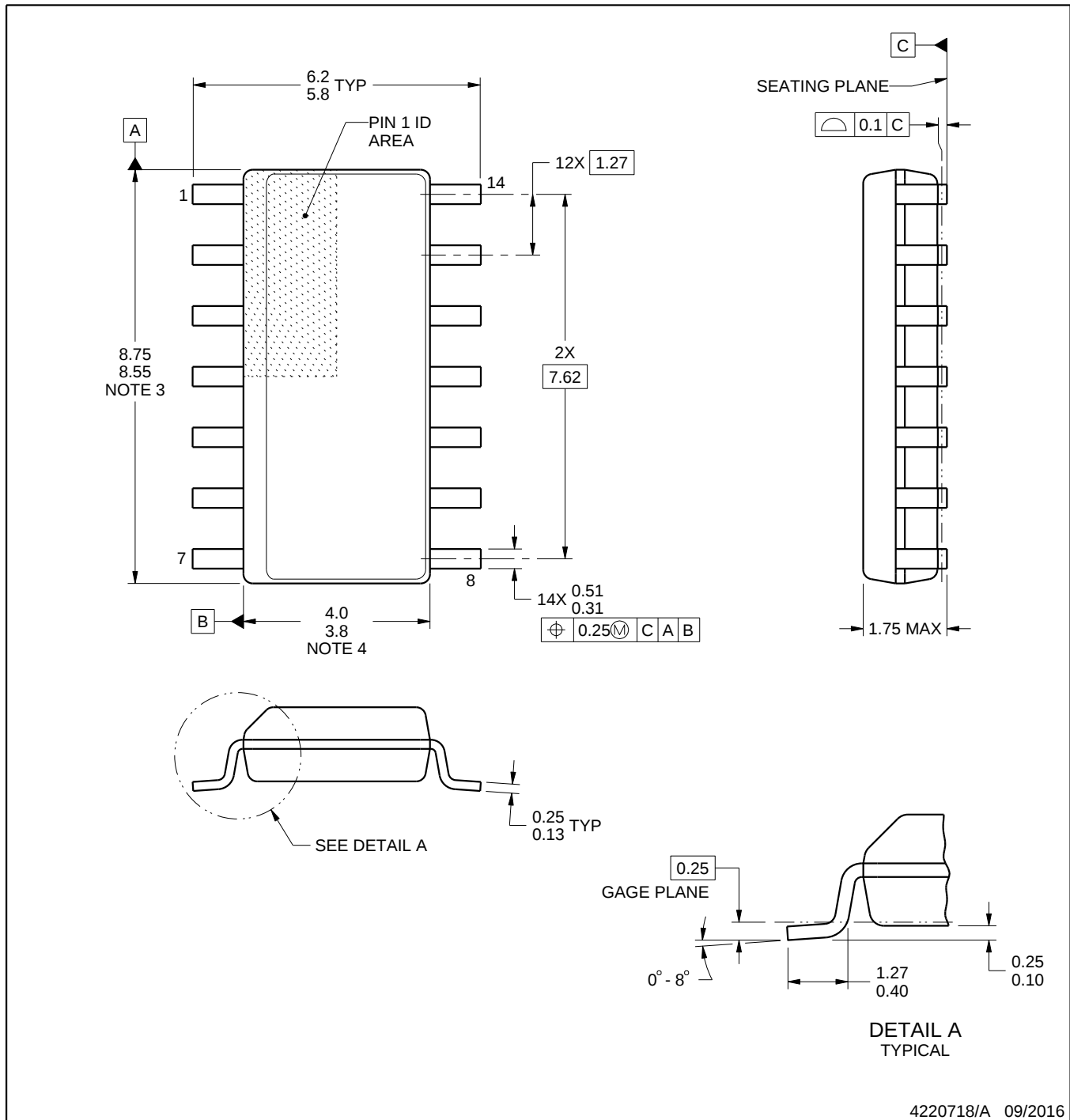
4224643/D 07/2024

## NOTES: (continued)

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

**D0014A****PACKAGE OUTLINE****SOIC - 1.75 mm max height**

SMALL OUTLINE INTEGRATED CIRCUIT



4220718/A 09/2016

**NOTES:**

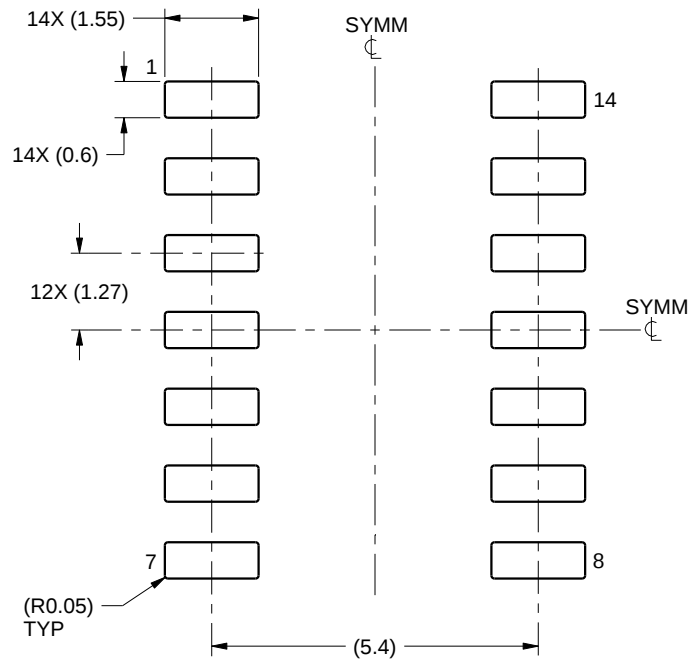
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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

# EXAMPLE BOARD LAYOUT

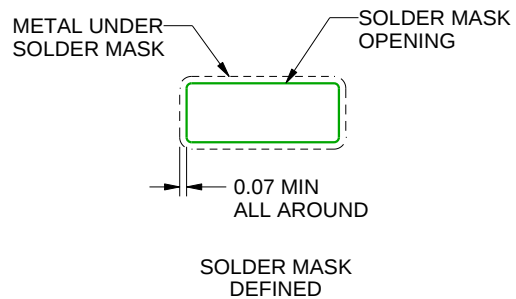
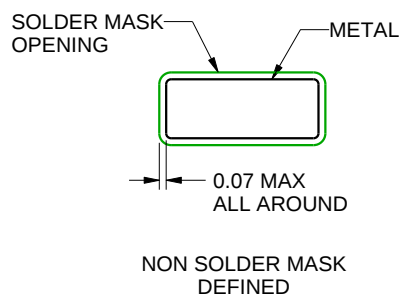
D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
SCALE:8X



SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

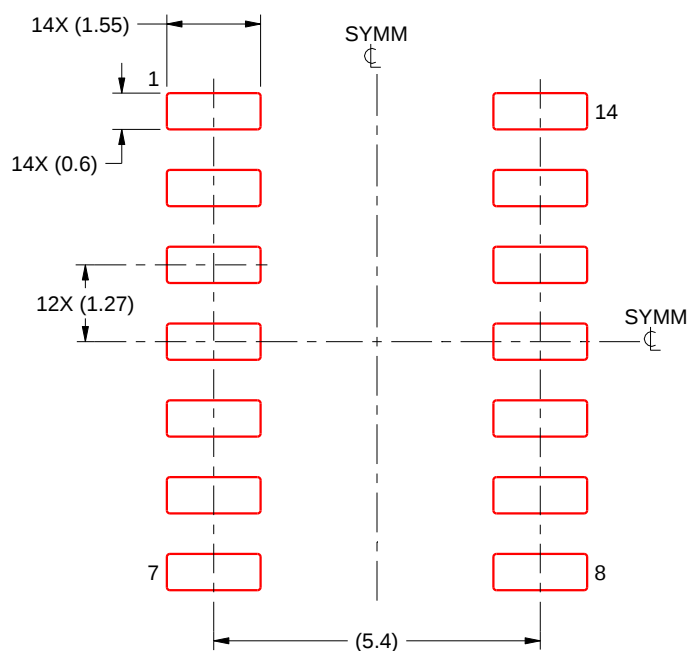
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



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

4220718/A 09/2016

NOTES: (continued)

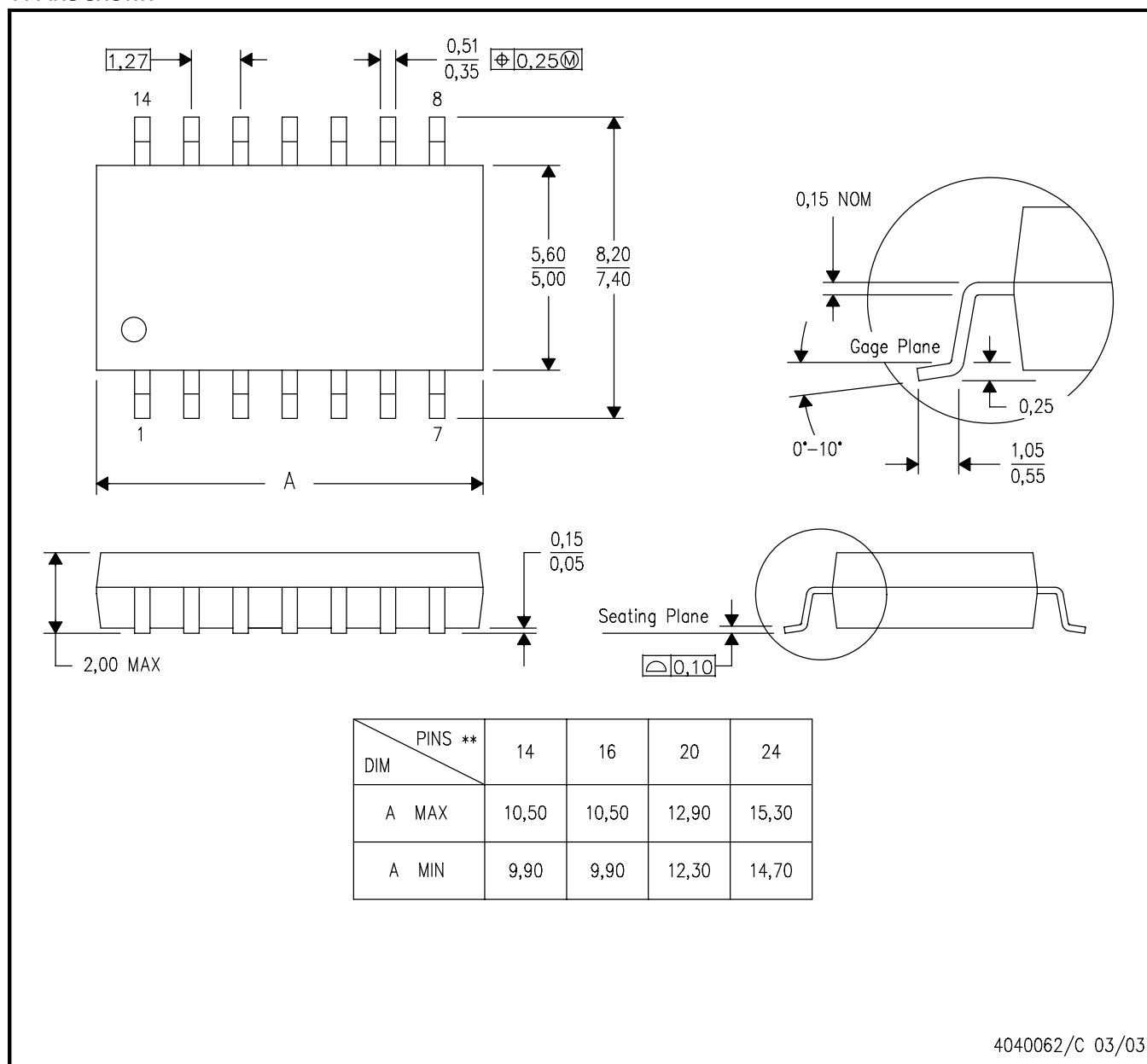
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

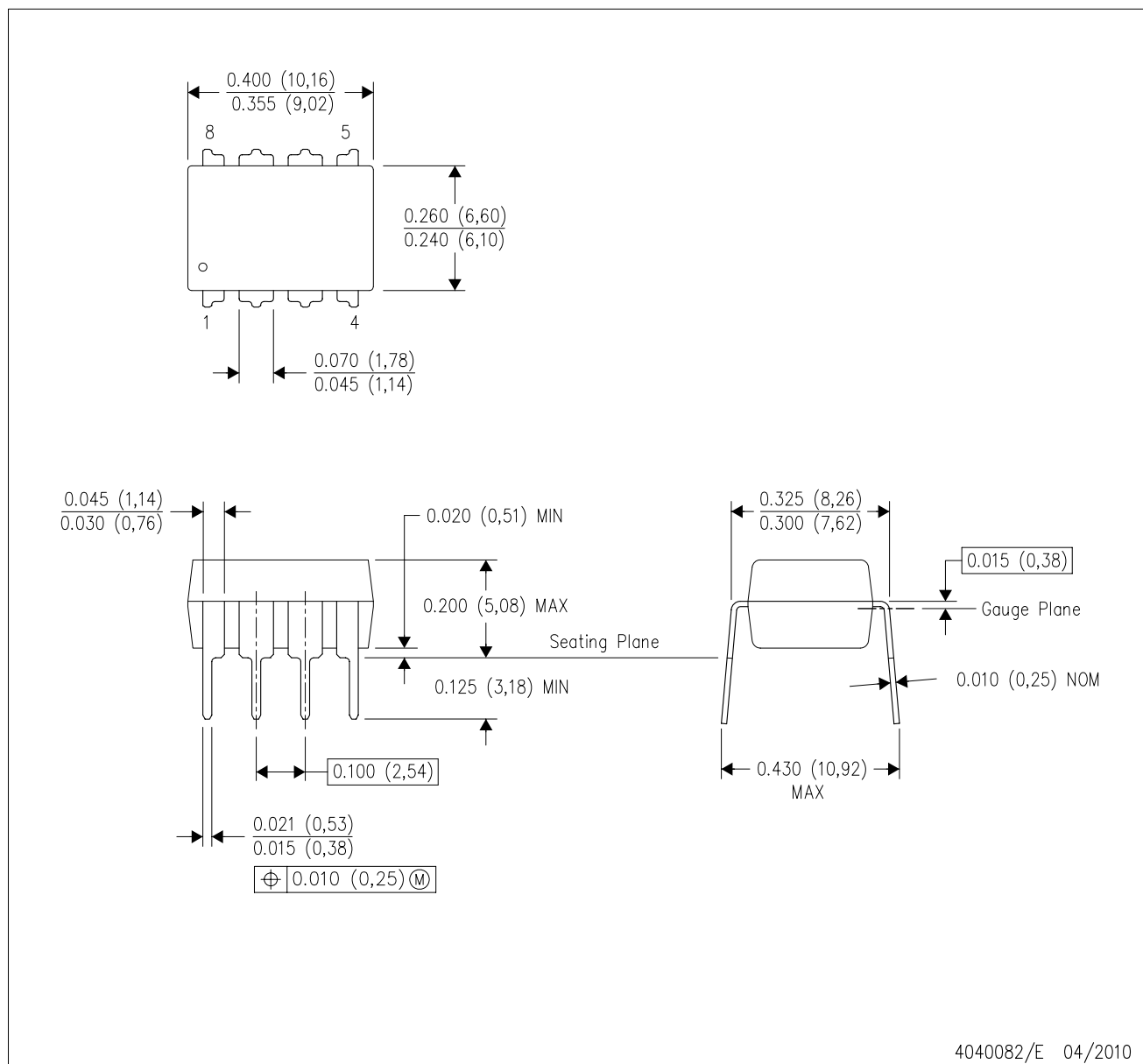
14-PINS SHOWN



- 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.

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE

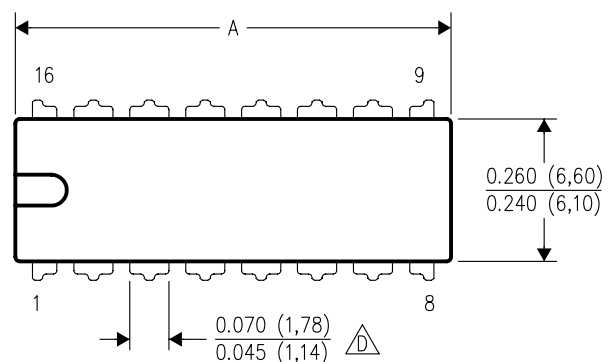


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MS-001 variation BA.

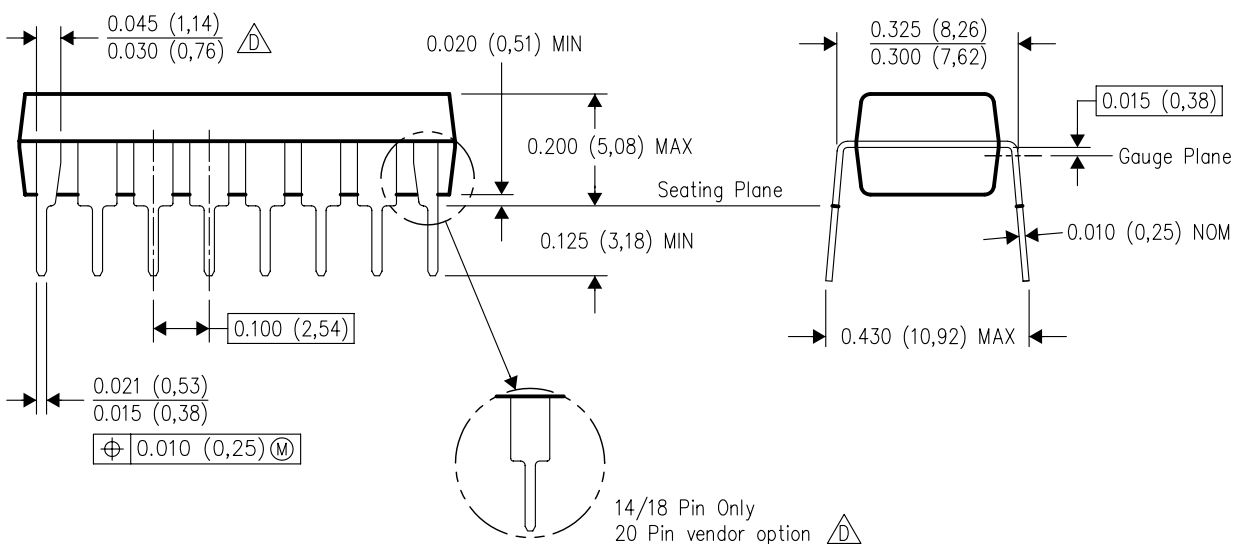
N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



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



4040049/E 12/2002

NOTES:

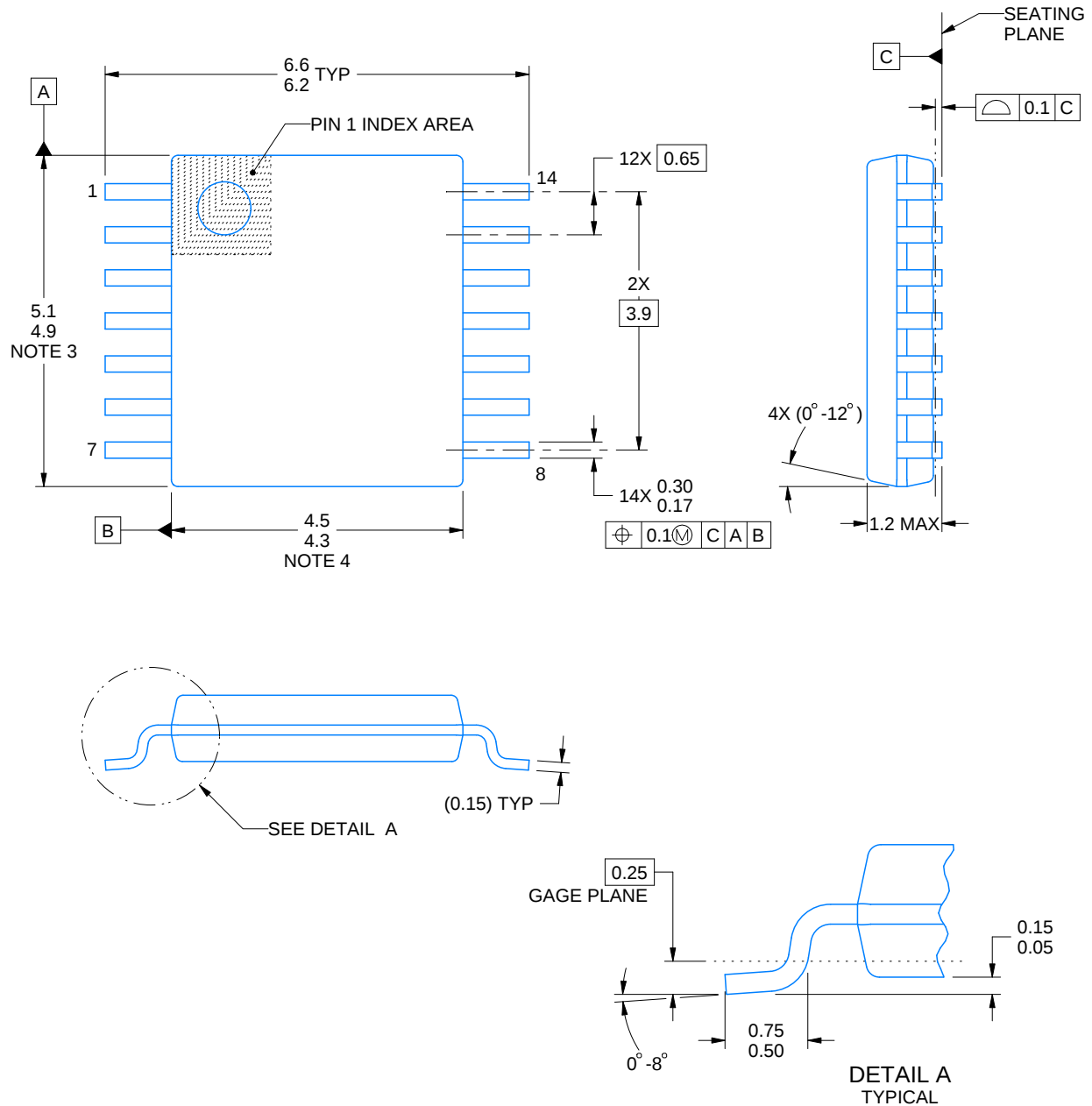
- A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

**PW0014A**

## PACKAGE OUTLINE

**TSSOP - 1.2 mm max height**

SMALL OUTLINE PACKAGE



4220202/B 12/2023

NOTES:

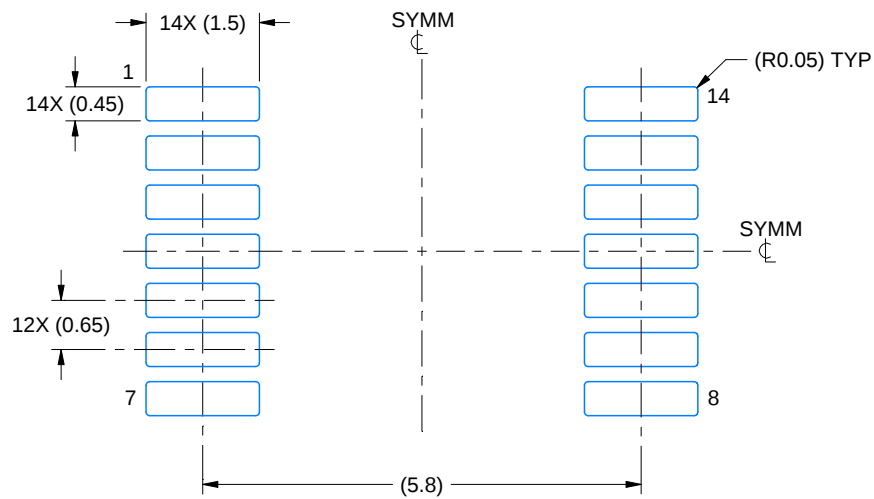
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

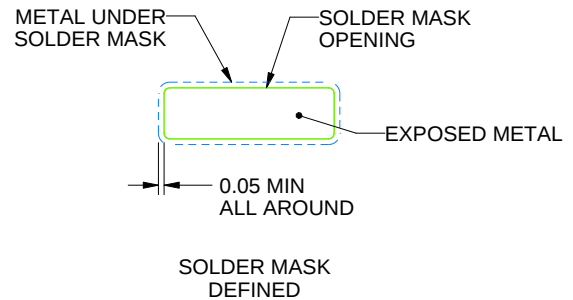
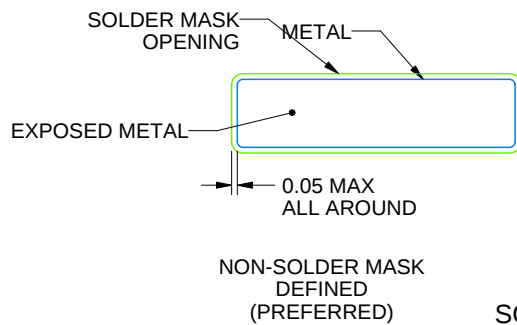
PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220202/B 12/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

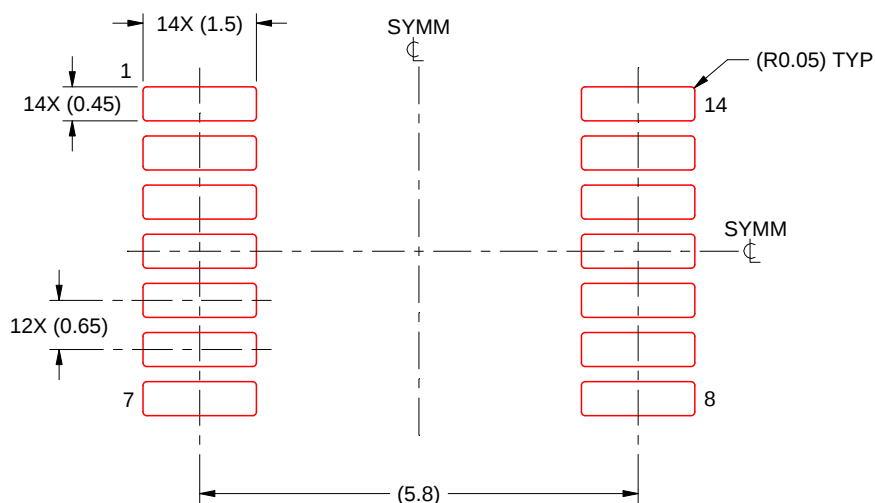
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220202/B 12/2023

NOTES: (continued)

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

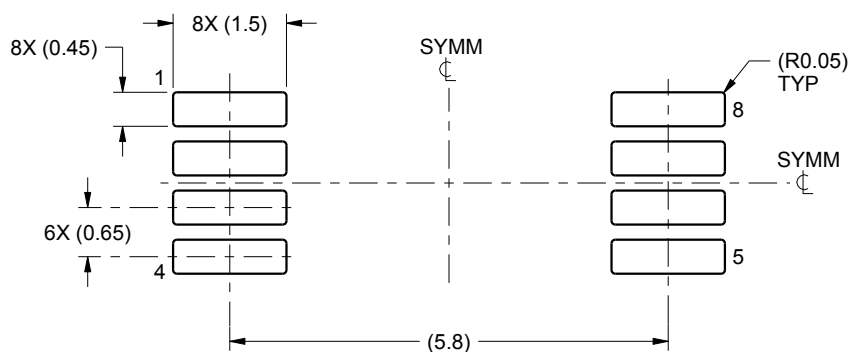


# EXAMPLE BOARD LAYOUT

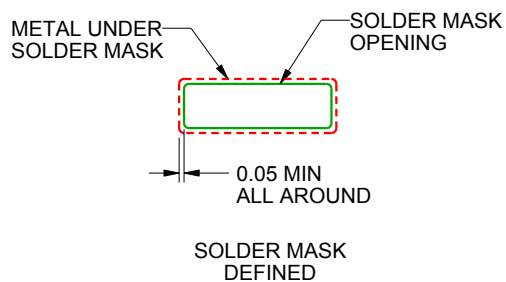
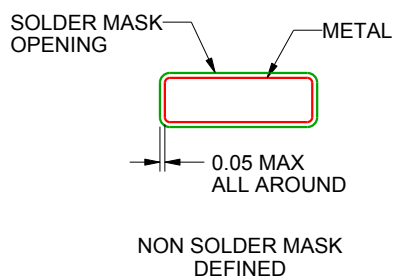
PW0008A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
SCALE:10X



SOLDER MASK DETAILS  
NOT TO SCALE

4221848/A 02/2015

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

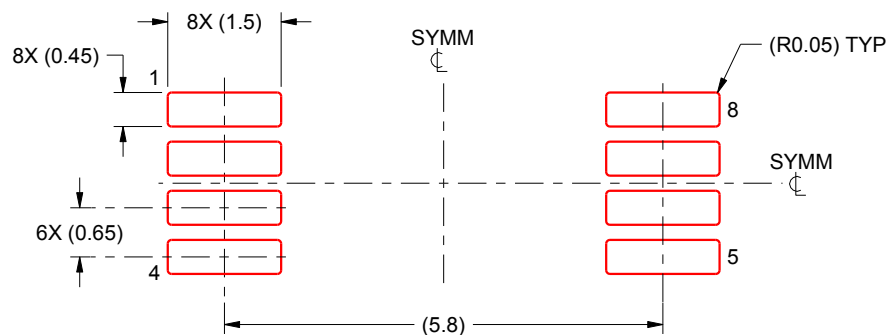
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

PW0008A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:10X

4221848/A 02/2015

NOTES: (continued)

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

## GENERIC PACKAGE VIEW

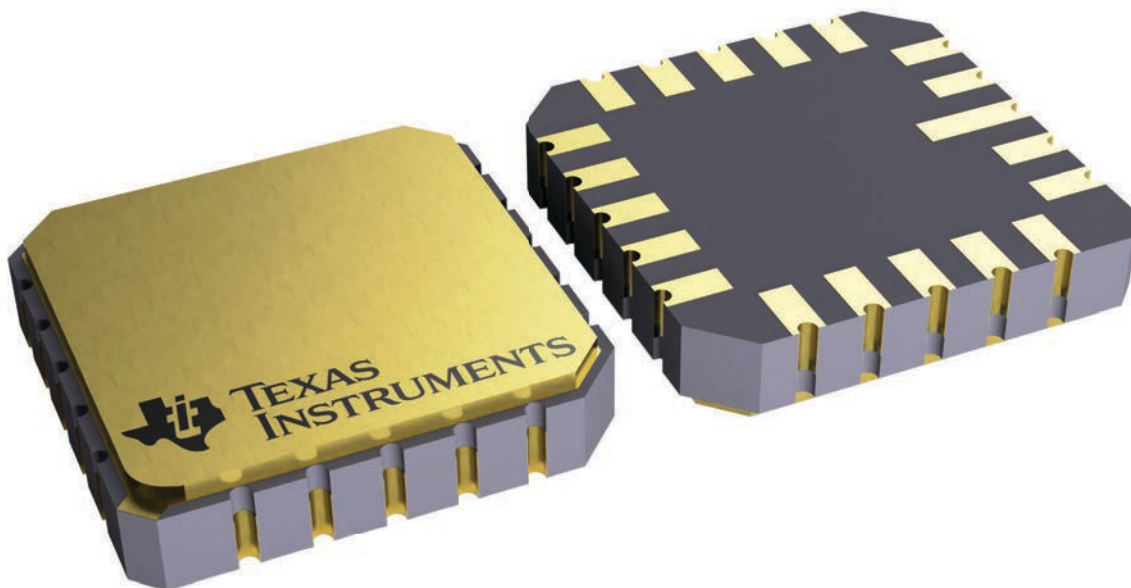
**FK 20**

**LCCC - 2.03 mm max height**

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

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



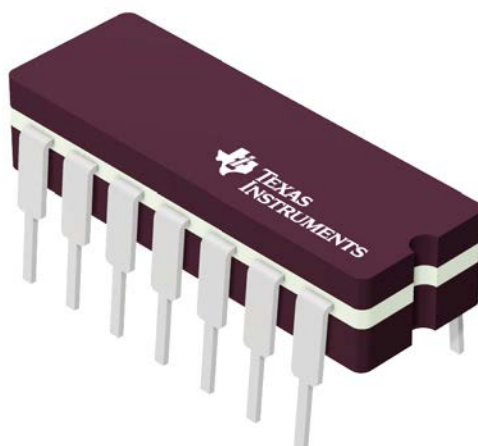
4229370VA\

**J 14**

## GENERIC PACKAGE VIEW

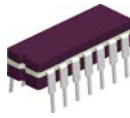
**CDIP - 5.08 mm max height**

CERAMIC DUAL IN LINE PACKAGE

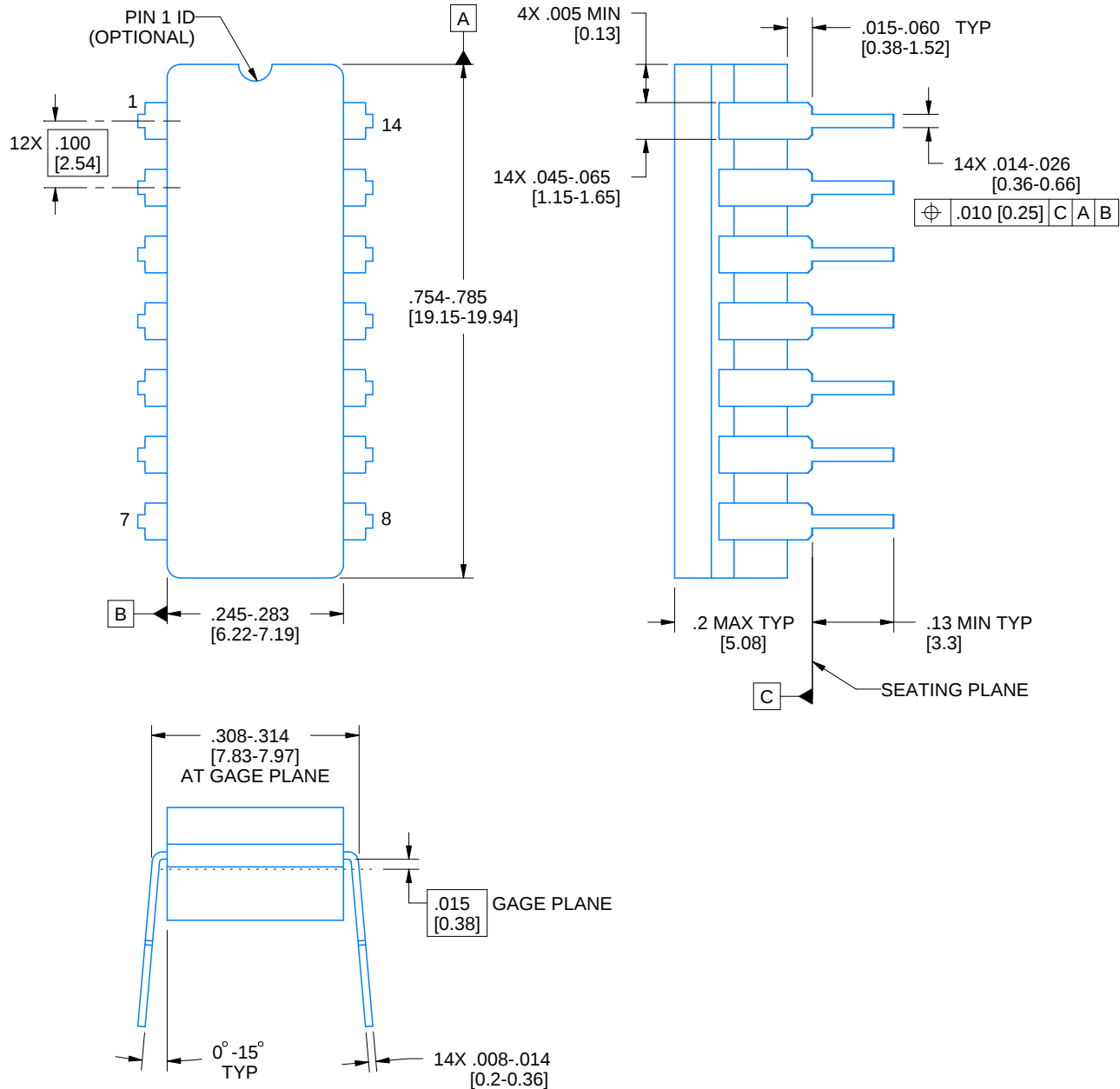


Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4040083-5/G

**J0014A****PACKAGE OUTLINE****CDIP - 5.08 mm max height**

CERAMIC DUAL IN LINE PACKAGE

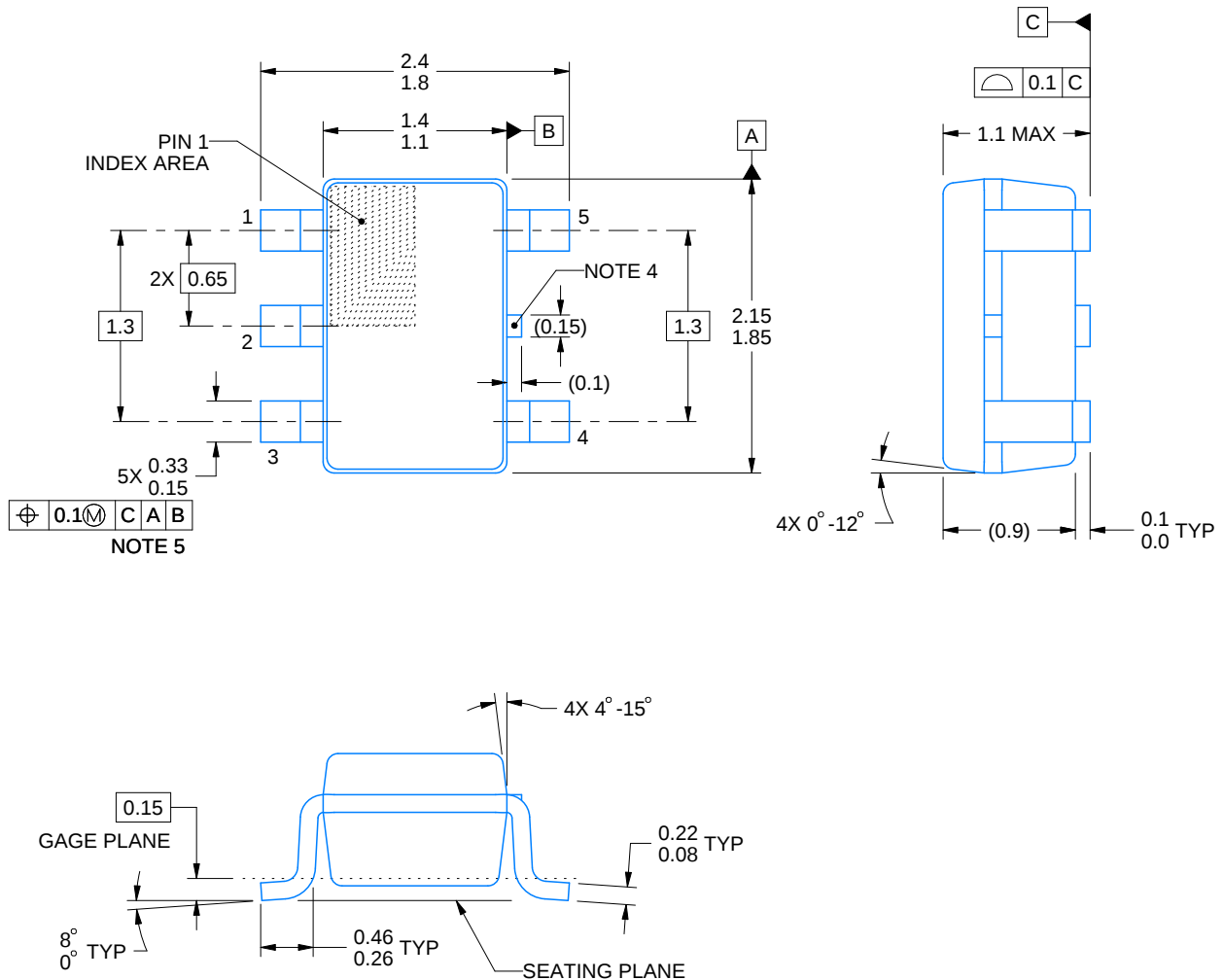


4214771/A 05/2017

**NOTES:**

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

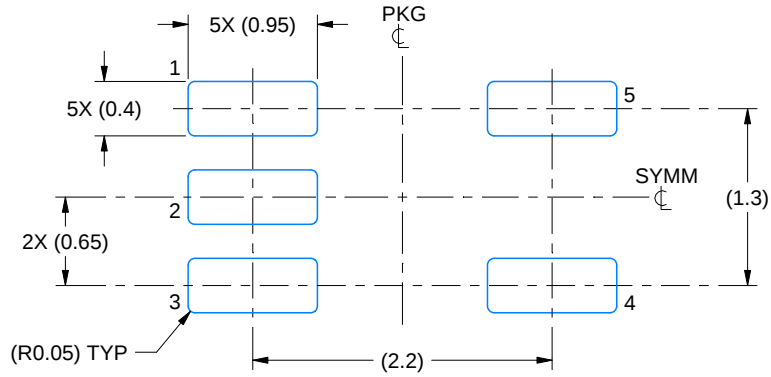




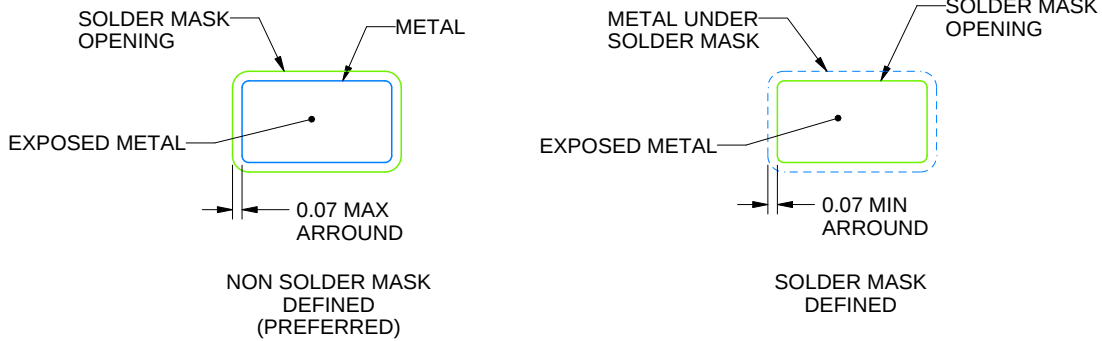
4214834/G 11/2024

## NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC MO-203.
4. Support pin may differ or may not be present.
5. Lead width does not comply with JEDEC.
6. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:18X



SOLDER MASK DETAILS

4214834/G 11/2024

NOTES: (continued)

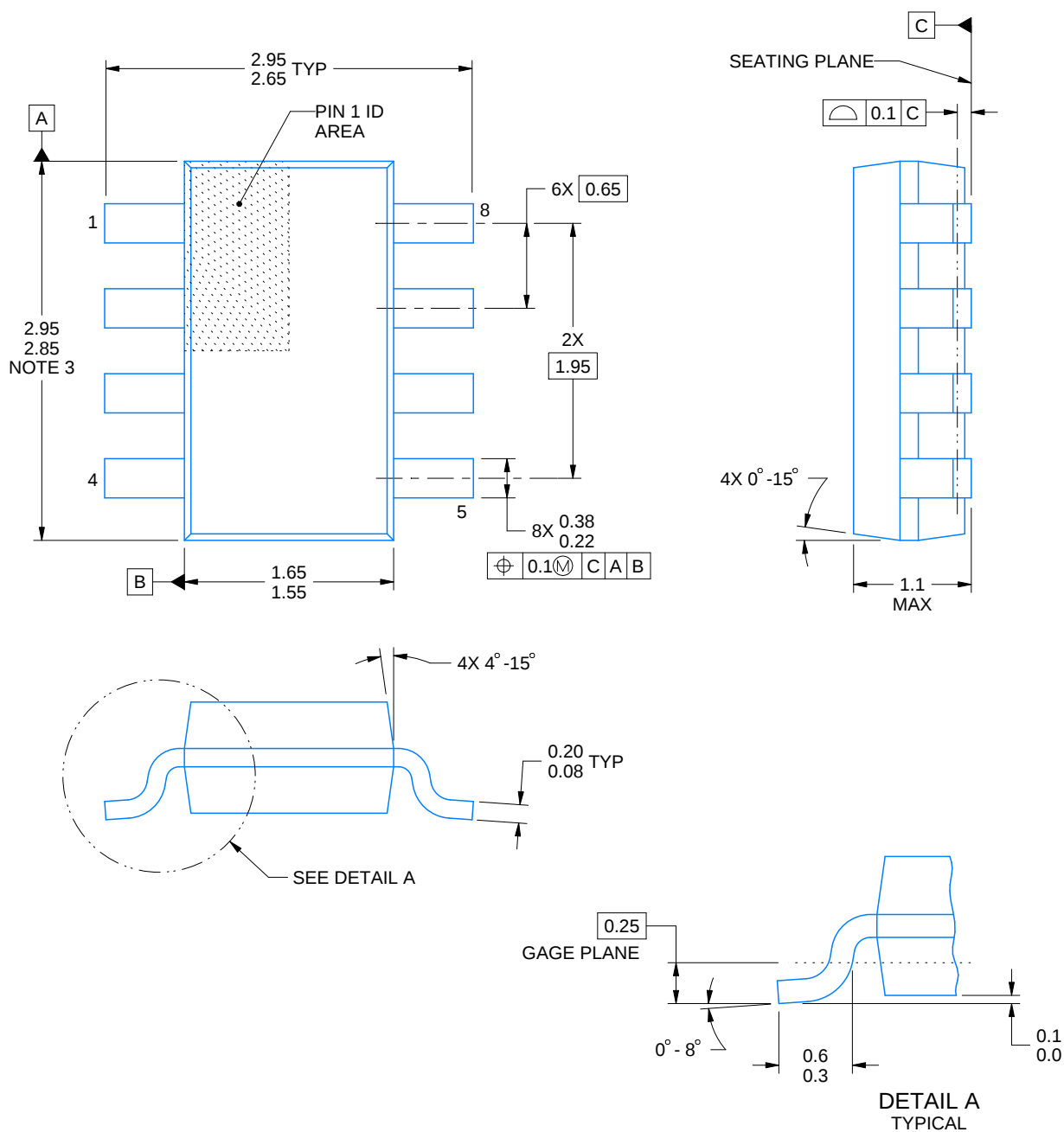
7. Publication IPC-7351 may have alternate designs.
8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.





## SOT-23-THIN - 1.1 mm max height

## PLASTIC SMALL OUTLINE



4222047/E 07/2024

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.

2. This drawing is subject to change without notice.

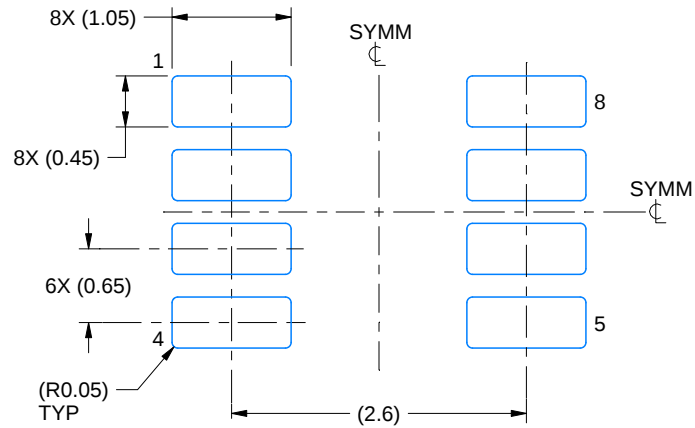
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.

# EXAMPLE BOARD LAYOUT

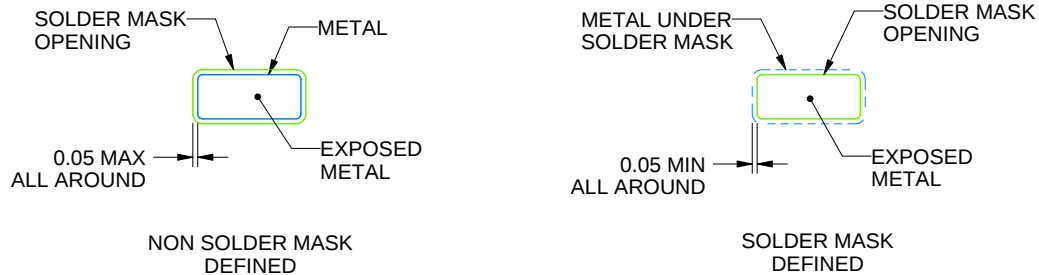
DDF0008A

SOT-23-THIN - 1.1 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4222047/E 07/2024

NOTES: (continued)

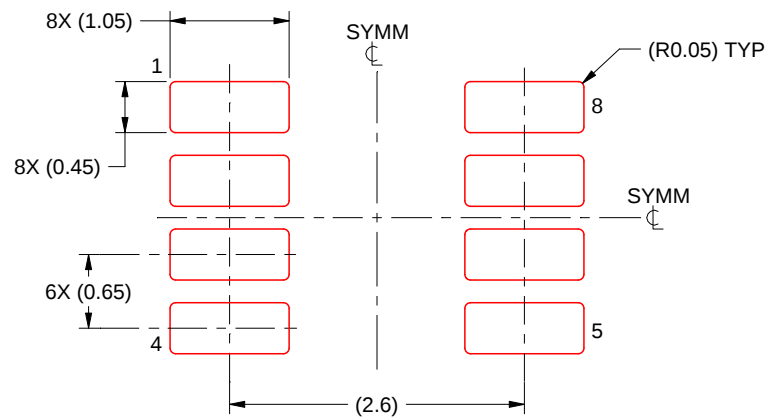
4. Publication IPC-7351 may have alternate designs.
5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DDF0008A

SOT-23-THIN - 1.1 mm max height

PLASTIC SMALL OUTLINE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:15X

4222047/E 07/2024

NOTES: (continued)

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



## PACKAGE OUTLINE

**SOIC - 1.75 mm max height**

SMALL OUTLINE INTEGRATED CIRCUIT

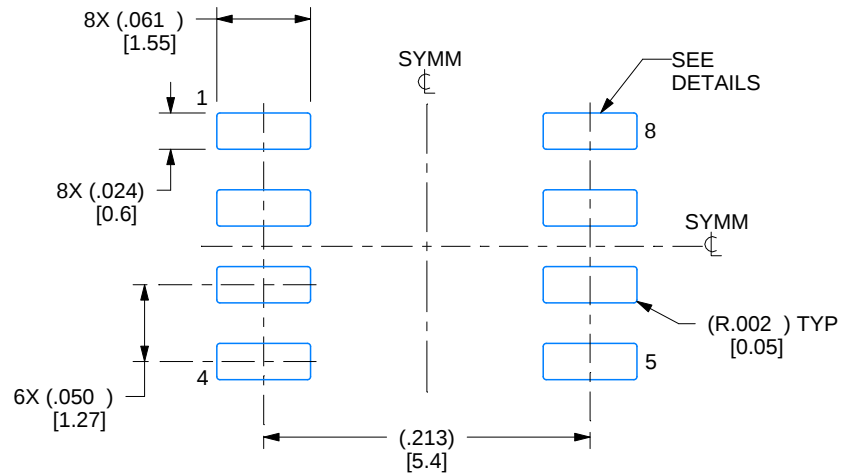


1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate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

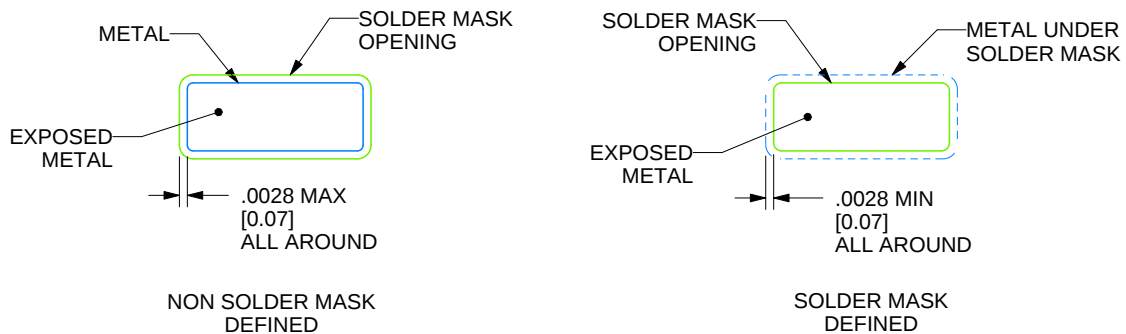
**D0008A**

**SOIC - 1.75 mm max height**

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:8X



## SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

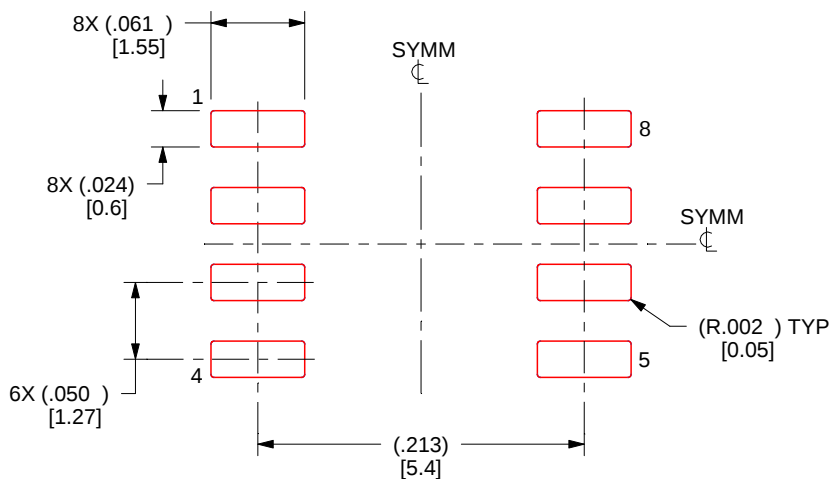
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



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

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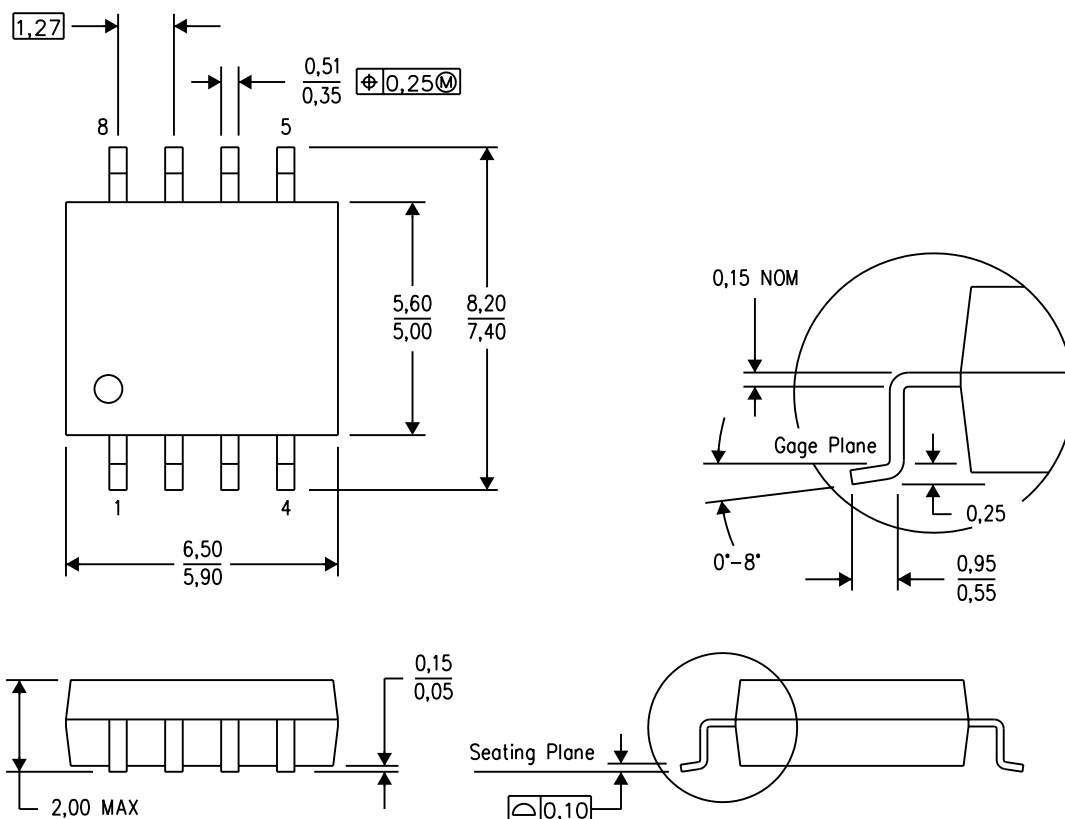
NOTES: (continued)

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

## 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.



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