

TL08xx FET-Input Operational Amplifiers

1 Features

- High slew rate: 20V/μs (TL08xH, typ)
- Low offset voltage: 1mV (TL08xH, typ)
- Low offset voltage drift: 2 μV/°C
- Low power consumption: 940μA/ch (TL08xH, typ)
- Wide common-mode and differential voltage ranges
 - Common-mode input voltage range includes V_{CC+}
- Low input bias and offset currents
- Low noise: V_n = 18nV/√Hz (typ) at f = 1kHz
- Output short-circuit protection
- Low total harmonic distortion: 0.003% (typ)
- Wide supply voltage: ±2.25V to ±20V, 4.5V to 40V

2 Applications

- [Solar energy: string and central inverter](#)
- [Motor drives: AC and servo drive control and power stage modules](#)
- [Single phase online UPS](#)
- [Three phase UPS](#)
- [Pro audio mixers](#)
- [Battery test equipment](#)

3 Description

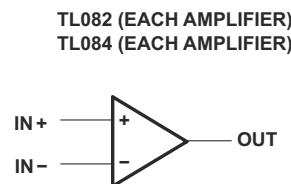
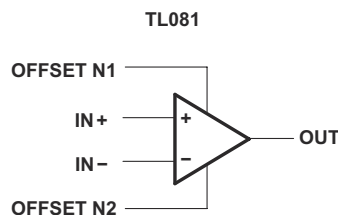
The TL08xH (TL081H, TL082H, and TL084H) family of devices are the next-generation versions of the industry-standard TL08x (TL081, TL082, and TL084) devices. These devices provide outstanding value for cost-sensitive applications, with features including low offset (1mV, typical), high slew rate (20V/μs), and common-mode input to the positive supply. High ESD (1.5kV, HBM), integrated EMI and RF filters, and operation across the full –40°C to 125°C enable the TL08xH devices to be used in the most rugged and demanding applications.

Device Information

| PART NUMBER | PACKAGE ⁽¹⁾ | BODY SIZE (NOM) ⁽²⁾ |
|-------------|------------------------|--------------------------------|
| 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) For more information, see [Section 11](#).

(2) The body size (length × width) is a nominal value and does not include pins.



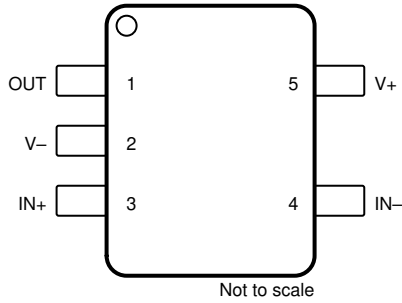
Logic Symbols



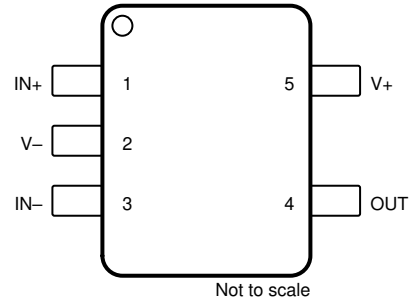
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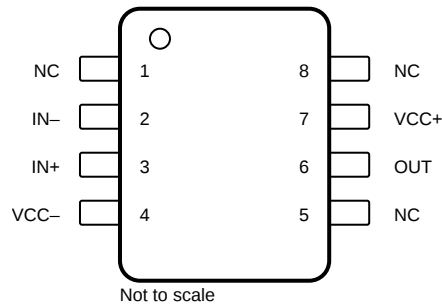
4 Pin Configuration and Functions



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



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



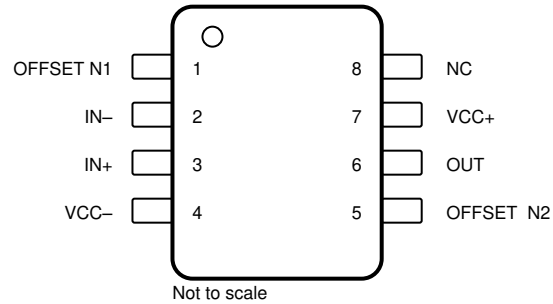
NC- no internal connection

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

Table 4-1. Pin Functions: TL081H

| NAME | PIN | | | TYPE ⁽¹⁾ | 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



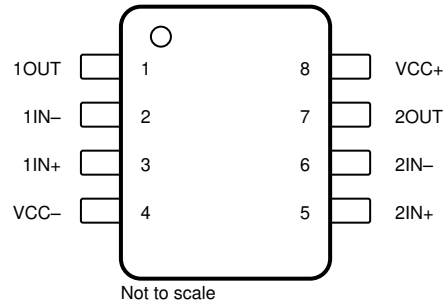
NC- no internal connection

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

Table 4-2. Pin Functions: TL081x

| PIN | | TYPE ⁽¹⁾ | 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

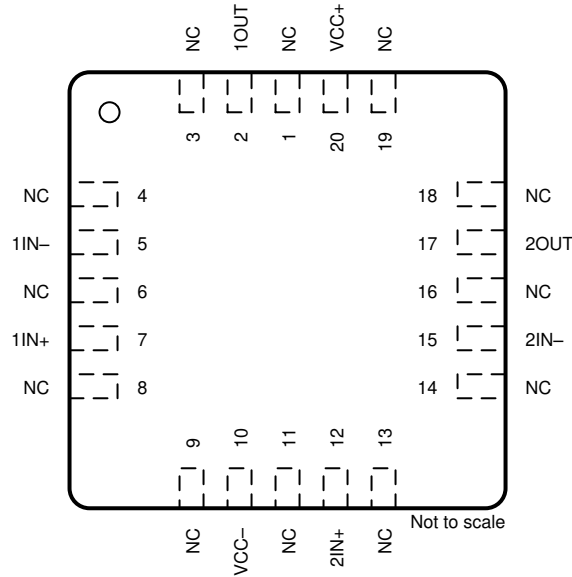


**Figure 4-5. TL082x D, DDF, DGK, JG, P, PS, and PW Package,
8-Pin SOIC, SOT-23 (8), VSSOP, CDIP, PDIP, SO, and TSSOP
(Top View)**

Table 4-3. Pin Functions: TL082x

| PIN | | TYPE ⁽¹⁾ | 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



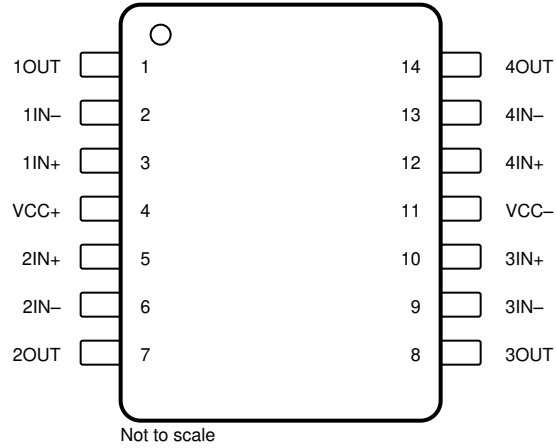
NC- no internal connection

**Figure 4-6. TL082 FK Package,
20-Pin LCCC
(Top View)**

Table 4-4. Pin Functions: TL082x

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

(1) I = input, O = output



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

Table 4-5. Pin Functions: TL084x

| PIN | | TYPE ⁽¹⁾ | 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 _{CC-} | 11 | — | Power supply |
| V _{CC+} | 4 | — | Power supply |

(1) I = input, O = output

5 Specifications

5.1 Absolute Maximum Ratings

over operating ambient temperature range (unless otherwise noted) ⁽¹⁾

| | | | 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 ⁽³⁾ | 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 ⁽³⁾ | All NS and PS packages; All TL08xM devices ⁽⁴⁾ | $(V-) - 0.3$ | $(V-) + 36$ | V |
| | | All other devices | | $V_S + 0.2$ | V |
| | Current ⁽³⁾ | All NS and PS packages; All TL07xM devices | | 50 | mA |
| | | All other devices | -10 | 10 | mA |
| Output short-circuit ⁽²⁾ | | | 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 ⁽¹⁾ | ±2000 | V |
| | | Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾ | ±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 ⁽¹⁾ | 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 |
| | | TL08xI | -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 ⁽¹⁾ | | TL081xx | | | | | UNIT |
|-------------------------------|--|----------|------------|--------------|----------|---------|------|
| | | D (SOIC) | DCK (SC70) | DBV (SOT-23) | P (PDIP) | PS (SO) | |
| | | 8 PINS | 5 PINS | 5 PINS | 8 PINS | 8 PINS | |
| R _{θJA} | Junction-to-ambient thermal resistance | 158.8 | 217.5 | 212.2 | 85 | 95 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 98.6 | 113.1 | 111.1 | – | – | °C/W |
| R _{θJB} | Junction-to-board thermal resistance | 102.3 | 63.8 | 79.4 | – | – | °C/W |
| ψ _{JT} | Junction-to-top characterization parameter | 45.8 | 34.8 | 51.8 | – | – | °C/W |
| ψ _{JB} | Junction-to-board characterization parameter | 101.5 | 63.5 | 79.0 | – | – | °C/W |
| R _{θJC(bot)} | 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 ⁽¹⁾ | | TL082xx | | | | | | | | UNIT |
|-------------------------------|--|----------|--------------|-----------|-----------|----------|---------|------------|---------|------|
| | | D (SOIC) | DDF (SOT-23) | FK (LCCC) | JG (CDIP) | P (PDIP) | PS (SO) | PW (TSSOP) | U (CFP) | |
| | | 8 PINS | 8 PINS | 20 PINS | 8 PINS | 8 PINS | 8 PINS | 8 PINS | 10 PINS | |
| R _{θJA} | Junction-to-ambient thermal resistance | 147.8 | 181.5 | – | – | 85 | 95 | 200.3 | 169.8 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 88.2 | 112.5 | 5.61 | 15.05 | – | – | 89.4 | 62.1 | °C/W |
| R _{θJB} | Junction-to-board thermal resistance | 91.4 | 98.2 | – | – | – | – | 131.0 | 176.2 | °C/W |
| ψ _{JT} | Junction-to-top characterization parameter | 36.8 | 17.2 | – | – | – | – | 22.2 | 48.4 | °C/W |
| ψ _{JB} | Junction-to-board characterization parameter | 90.6 | 97.6 | – | – | – | – | 129.3 | 144.1 | °C/W |
| R _{θJC(bot)} | 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 ⁽¹⁾ | | TL084xx | | | | | | | | UNIT |
|-------------------------------|--|-------------|-----------------|---------------|--------------|--------------|---------------|---------------|--------------|------|
| | | D (SOIC) | DYY (SOT-23) | FK (TSSOP) | J (TSSOP) | N (TSSOP) | NS (TSSOP) | PW (TSSOP) | W (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 |
| Ψ_{JT} | Junction-to-top characterization parameter | 28.8 | 9.5 | – | – | – | – | – | 29 | °C/W |
| Ψ_{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 $V_{O UT} = V_S / 2$, unless otherwise noted.

| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT | |
|----------------------------|--|---|--|----------------------|-------------------|-------------|-------------------------|-----------|
| OFFSET VOLTAGE | | | | | | | | |
| V_{OS} | Input offset voltage | | $T_A = -40^\circ C$ to $125^\circ C$ | | ± 1 | ± 4 | mV | |
| | | | | | | ± 5 | | |
| dV_{OS}/dT | Input offset voltage drift | | $T_A = -40^\circ C$ to $125^\circ C$ | | ± 2 | | $\mu V/^\circ C$ | |
| PSRR | Input offset voltage versus power supply | $V_S = 5V$ to $40V$, $V_{CM} = V_S / 2$ | $T_A = -40^\circ C$ to $125^\circ C$ | | ± 1 | ± 10 | $\mu V/V$ | |
| | Channel separation | | | $f = 0Hz$ | | 10 | | $\mu V/V$ |
| INPUT BIAS CURRENT | | | | | | | | |
| I_B | Input bias current | | $T_A = -40^\circ C$ to $125^\circ C$ (1) | | ± 1 | ± 120 | pA | |
| | | | | DCK and DBV packages | | ± 1 | ± 300 | pA |
| | | | | | | | ± 5 | nA |
| I_{OS} | Input offset current | | $T_A = -40^\circ C$ to $125^\circ C$ (1) | | ± 0.5 | ± 120 | pA | |
| | | | | DCK and DBV packages | | ± 0.5 | ± 250 | pA |
| | | | | | | | ± 5 | nA |
| NOISE | | | | | | | | |
| E_N | Input voltage noise | $f = 0.1Hz$ to $10Hz$ | | | 9.2 | | μV_{PP} | |
| | | | | | 1.4 | | μV_{RMS} | |
| e_N | Input voltage noise density | $f = 1kHz$ | | | 37 | | nV/ \sqrt{Hz} | |
| | | $f = 10kHz$ | | | 21 | | | |
| i_N | Input current noise | $f = 1kHz$ | | | 80 | | fA/ \sqrt{Hz} | |
| INPUT VOLTAGE RANGE | | | | | | | | |
| V_{CM} | Common-mode voltage range | | | $(V_{CC-}) + 1.5$ | | (V_{CC+}) | V | |
| CMRR | Common-mode rejection ratio | $V_S = 40V$, $(V_{CC-}) + 2.5V < V_{CM} < (V_{CC+}) - 1.5V$ | $T_A = -40^\circ C$ to $125^\circ C$ | 100 | 105 | | dB | |
| | | | | 95 | | | dB | |
| | | $V_S = 40V$, $(V_{CC-}) + 2.5V < V_{CM} < (V_{CC+})$ | $T_A = -40^\circ C$ to $125^\circ C$ | 90 | 105 | | dB | |
| | | | | 80 | | | dB | |
| INPUT CAPACITANCE | | | | | | | | |
| Z_{ID} | Differential | | | | $100 \parallel 2$ | | M $\Omega \parallel pF$ | |
| Z_{ICM} | Common-mode | | | | $6 \parallel 1$ | | T $\Omega \parallel pF$ | |
| OPEN-LOOP GAIN | | | | | | | | |
| A_{OL} | Open-loop voltage gain | $V_S = 40V$, $V_{CM} = V_S / 2$, $(V_{CC-}) + 0.3V < V_O < (V_{CC+}) - 0.3V$ | $T_A = -40^\circ C$ to $125^\circ C$ | 118 | 125 | | dB | |
| A_{OL} | Open-loop voltage gain | $V_S = 40V$, $V_{CM} = V_S / 2$, $R_L = 2k\Omega$, $(V_{CC-}) + 1.2V < V_O < (V_{CC+}) - 1.2V$ | $T_A = -40^\circ C$ to $125^\circ C$ | 115 | 120 | | dB | |
| FREQUENCY RESPONSE | | | | | | | | |
| GBW | Gain-bandwidth product | | | | 5.25 | | MHz | |
| SR | Slew rate | $V_S = 40V$, $G = +1$, $C_L = 20pF$ | | | 20 | | V/ μs | |
| t_s | Settling time | T_O 0.1%, $V_S = 40V$, $V_{STEP} = 10V$, $G = +1$, $C_L = 20pF$ | | | 0.63 | | μs | |
| | | T_O 0.1%, $V_S = 40V$, $V_{STEP} = 2V$, $G = +1$, $C_L = 20pF$ | | | 0.56 | | | |
| | | T_O 0.01%, $V_S = 40V$, $V_{STEP} = 10V$, $G = +1$, $C_L = 20pF$ | | | 0.91 | | | |
| | | T_O 0.01%, $V_S = 40V$, $V_{STEP} = 2V$, $G = +1$, $C_L = 20pF$ | | | 0.48 | | | |
| | Phase margin | $G = +1$, $R_L = 10k\Omega$, $C_L = 20pF$ | | | 56 | | $^\circ$ | |
| | Overload recovery time | $V_{IN} \times \text{gain} > V_S$ | | | 300 | | ns | |
| THD+N | Total harmonic distortion + noise | $V_S = 40V$, $V_O = 6V_{RMS}$, $G = +1$, $f = 1kHz$ | | | 0.00012 | | % | |
| EMIRR | EMI rejection ratio | $f = 1GHz$ | | | 53 | | dB | |
| OUTPUT | | | | | | | | |

5.7 Electrical Characteristics: TL08xH (continued)

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 |
|--------------------------------|---------------------------------|--|--------------------------------------|----------|------|----------|
| Voltage output swing from rail | Positive rail headroom | $V_S = 40V, R_L = 10k\Omega$ | | 115 | 210 | mV |
| | | $V_S = 40V, R_L = 2k\Omega$ | | 520 | 965 | |
| | Negative rail headroom | $V_S = 40V, R_L = 10k\Omega$ | | 105 | 215 | |
| | | $V_S = 40V, R_L = 2k\Omega$ | | 500 | 1030 | |
| I_{SC} | Short-circuit current | | | ± 26 | | mA |
| C_{LOAD} | Capacitive load drive | | | 300 | | pF |
| Z_O | Open-loop output impedance | $f = 1MHz, I_O = 0 A$ | | 125 | | Ω |
| POWER SUPPLY | | | | | | |
| I_Q | Quiescent current per amplifier | $I_O = 0 A$ | $T_A = -40^\circ C$ to $125^\circ C$ | 937.5 | 1125 | μA |
| | | $I_O = 0 A, (TL081H)$ | | 960 | 1156 | |
| | | $I_O = 0 A$ | | | 1130 | |
| | | $I_O = 0 A, (TL082H)$ | | | 1143 | |
| | | $I_O = 0 A, (TL071H)$ | | | 1160 | |
| | Turn-On Time | At $T_A = 25^\circ C, V_S = 40V, V_S$ ramp rate $> 0.3V/\mu s$ | | 60 | | μs |

(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 ^{(1) (2)} | | MIN | TYP | MAX | UNIT | |
|----------------|--|--|----------------------------------|---------------------------|------------|------------------|------|
| V_{OS} | Input offset voltage | $V_O = 0V$ $R_S = 50 \Omega$ | TL08xC | | 3 | 10 | mV |
| | | | | $T_A = \text{Full range}$ | | | |
| | | | TL08xAC | | 3 | 6 | |
| | | | | $T_A = \text{Full range}$ | | | |
| | | | TL08xBC | | 2 | 3 | |
| | | | | $T_A = \text{Full range}$ | | | |
| | | | TL08xI | | 3 | 6 | |
| | | | | $T_A = \text{Full range}$ | | | |
| TL081M, TL082M | | 3 | 6 | | | | |
| | $T_A = \text{Full range}$ | | | 9 | | | |
| TL084M | | 3 | 9 | | | | |
| | $T_A = \text{Full range}$ | | | 15 | | | |
| dV_{OS}/dT | Input offset voltage drift | $V_O = 0V, R_S = 50 \Omega$ | $T_A = \text{Full range}$ | | ± 18 | $\mu V/^\circ C$ | |
| I_{OS} | Input offset current | $V_O = 0V$ | TL08xC | | 5 | 100 | pA |
| | | | | $T_A = \text{Full range}$ | | | 10 |
| | | | TL08xAC, TL08xBC, TL08xI | | 5 | 100 | pA |
| | | | | $T_A = \text{Full range}$ | | | 2 |
| TL08xM | | 5 | 100 | pA | | | |
| | $T_A = \text{Full range}$ | | | 20 | nA | | |
| I_B | Input bias current | $V_O = 0V$ | TL08xC, TL08xAC, TL08xBC, TL08xI | | 65 | 200 | pA |
| | | | | $T_A = \text{Full range}$ | | | 7 |
| | | | TL081M, TL082M | | 65 | 200 | pA |
| | | | | $T_A = \text{Full range}$ | | | 50 |
| TL084M | | 65 | 200 | pA | | | |
| | $T_A = \text{Full range}$ | | | 20 | nA | | |
| V_{CM} | Common-mode voltage range | | ± 11 | -12 to 15 | | V | |
| VOM | Maximum peak output voltage swing | $R_L = 10k\Omega$ | $T_A = \text{Full range}$ | ± 12 | ± 13.5 | V | |
| | | $R_L \geq 10k\Omega$ | | ± 12 | | | |
| | | $R_L \geq 2k\Omega$ | | ± 10 | | | |
| A_{OL} | Open-loop voltage gain | $V_O = 0V$ | TL08xC | | 25 | 200 | V/mV |
| | | | | $T_A = \text{Full range}$ | | | |
| | | | TL08xAC, TL08xBC, TL08xI | | 50 | 200 | |
| | | | | $T_A = \text{Full range}$ | | | |
| TL08xM | | 35 | 200 | | | | |
| | $T_A = \text{Full range}$ | | | 15 | | | |
| GBW | Gain-bandwidth product | All NS and PS packages; All TL08xM devices | | 3 | | MHz | |
| | | All other devices | | 5.25 | | | |
| R_{ID} | Common-mode input resistance | | | 1 | | T Ω | |
| CMRR | Common-mode rejection ratio | $V_{IC} = V_{ICR(min)}$ $V_O = 0V$ $R_S = 50 \Omega$ | TL08xC | 70 | 100 | dB | |
| | | | TL08xAC, TL08xBC, TL08xI | 75 | 100 | | |
| | | | TL08xM | 80 | 86 | | |
| PSRR | Input offset voltage versus power supply | $V_S = \pm 9V$ to $\pm 18V$ $V_O = 0V$ $R_S = 50 \Omega$ | TL08xC | 70 | 100 | dB | |
| | | | TL08xAC, TL08xBC, TL08xI | 80 | 100 | | |
| | | | TL08xM | 80 | 86 | | |

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

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

| PARAMETER | | TEST CONDITIONS ^{(1) (2)} | 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/ μs |
| | | | TL08xC, TL08xAC, TL08xBC, TL08xI | 8 | 20 | | V/ μs |
| t_s | Settling time | $V_I = 20V, C_L = 100pF, R_L = 2k\Omega$ | | | 0.1 | | μs |
| | | | | | 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} |
| | | | $f = 1kHz$ | | 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 | | μV_{RMS} |
| | | | All other devices | $f = 0.1Hz$ to 10Hz | | 1.4 | |
| 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 | | $V_{IN} \times gain > V_S$ | | 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 | | Ω |

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)

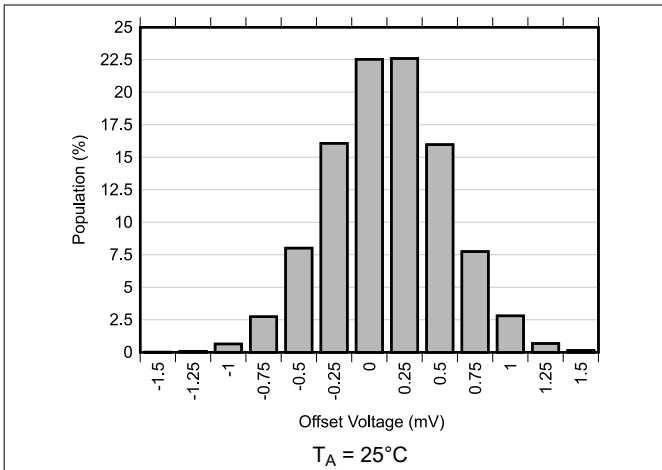


Figure 5-1. Offset Voltage Production Distribution

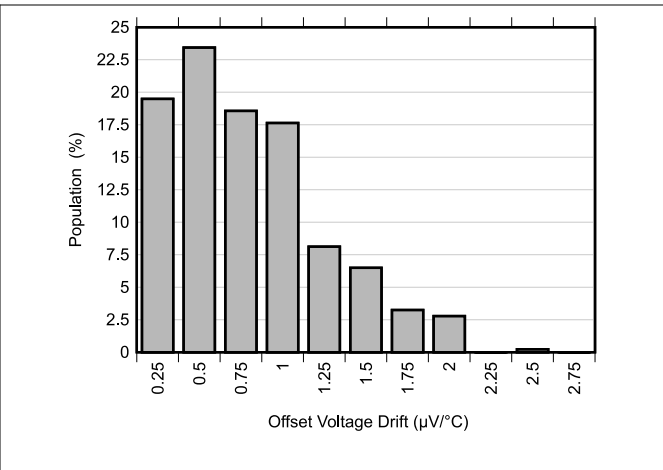


Figure 5-2. Offset Voltage Drift Distribution

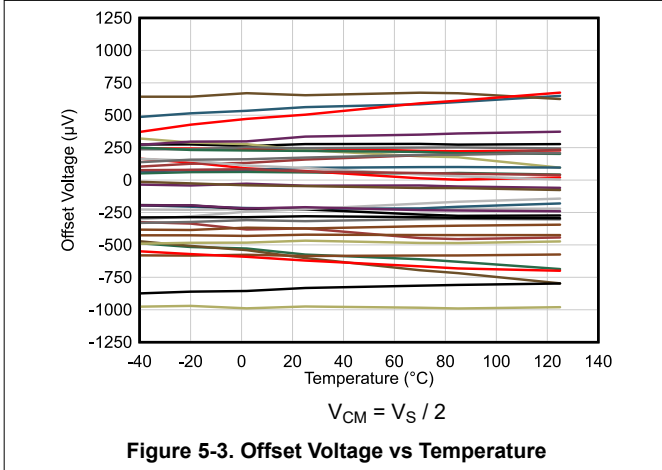


Figure 5-3. Offset Voltage vs Temperature

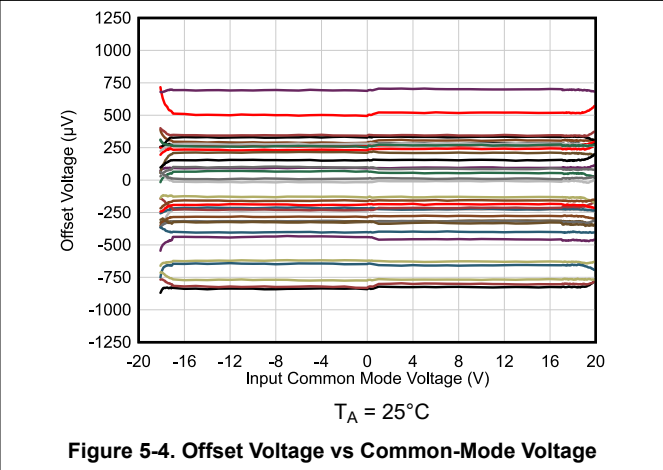


Figure 5-4. Offset Voltage vs Common-Mode Voltage

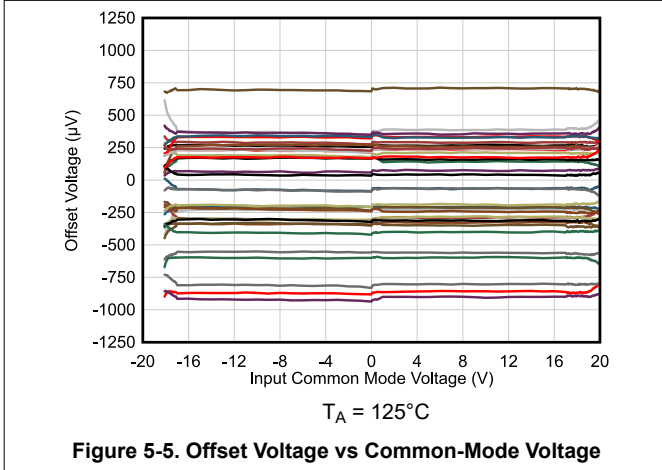


Figure 5-5. Offset Voltage vs Common-Mode Voltage

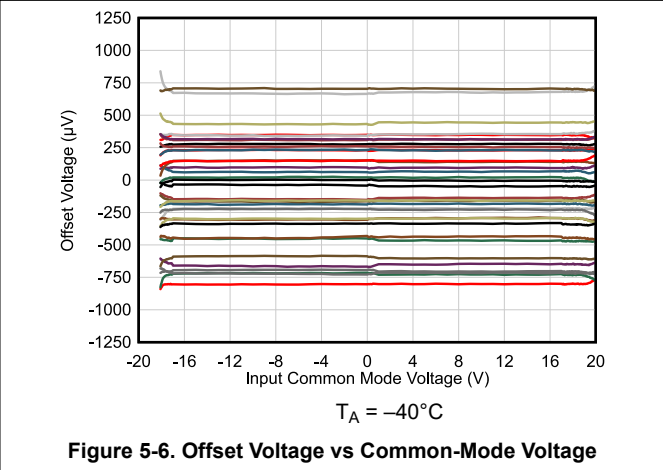


Figure 5-6. Offset Voltage vs Common-Mode Voltage

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)

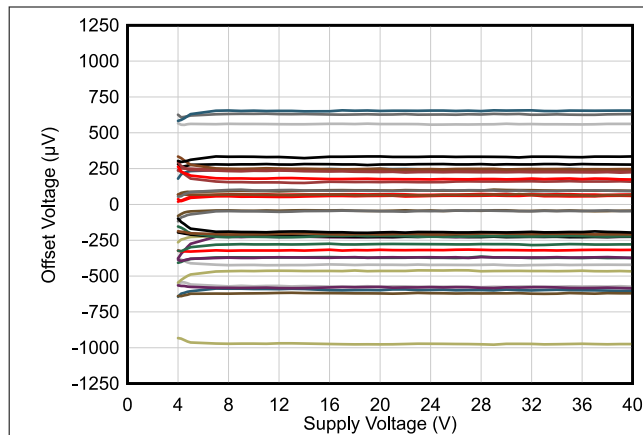


Figure 5-7. Offset Voltage vs Power Supply

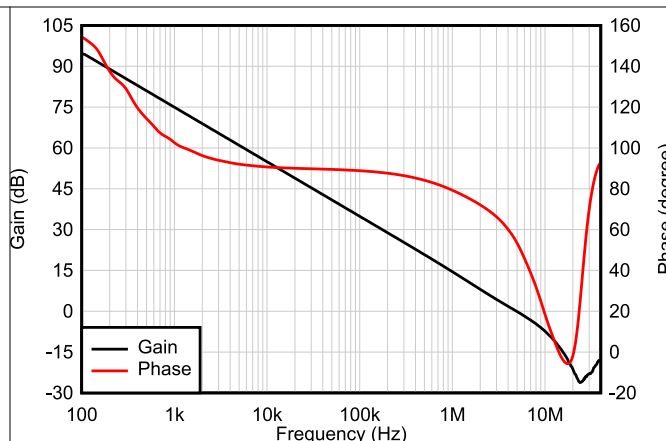


Figure 5-8. Open-Loop Gain and Phase vs Frequency

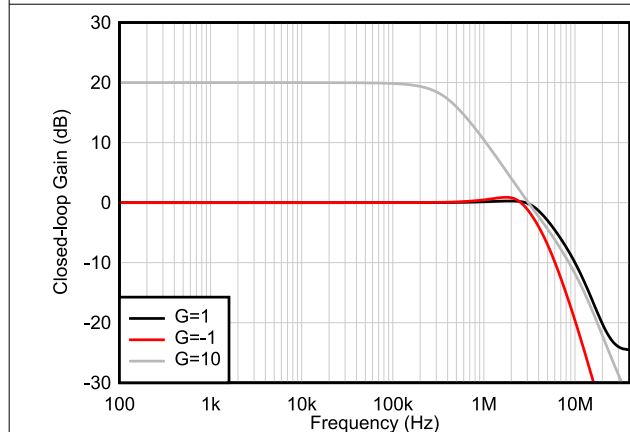


Figure 5-9. Closed-Loop Gain vs Frequency

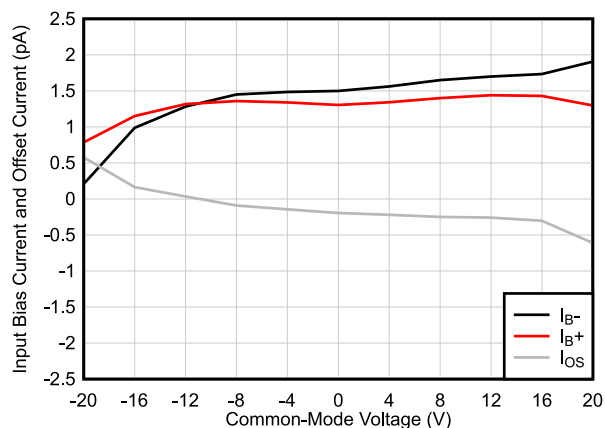


Figure 5-10. Input Bias Current vs Common-Mode Voltage

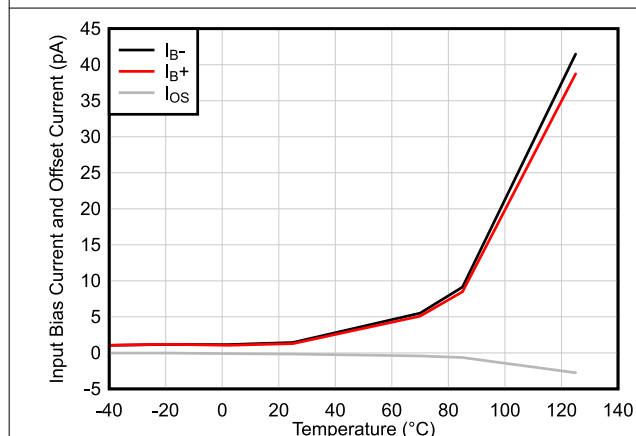


Figure 5-11. Input Bias Current vs Temperature

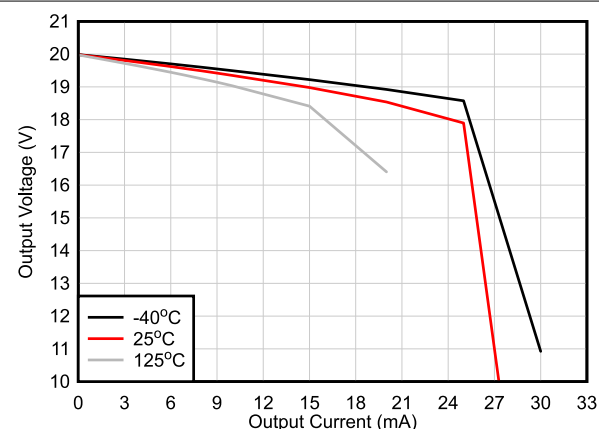


Figure 5-12. Output Voltage Swing vs Output Current (Sourcing)

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)

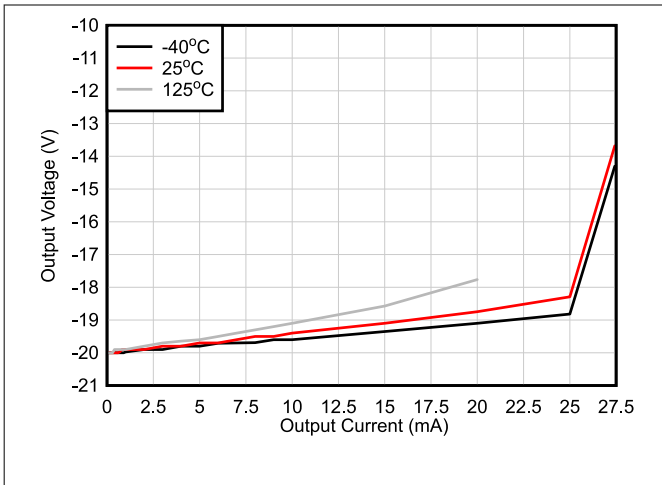


Figure 5-13. Output Voltage Swing vs Output Current (Sinking)

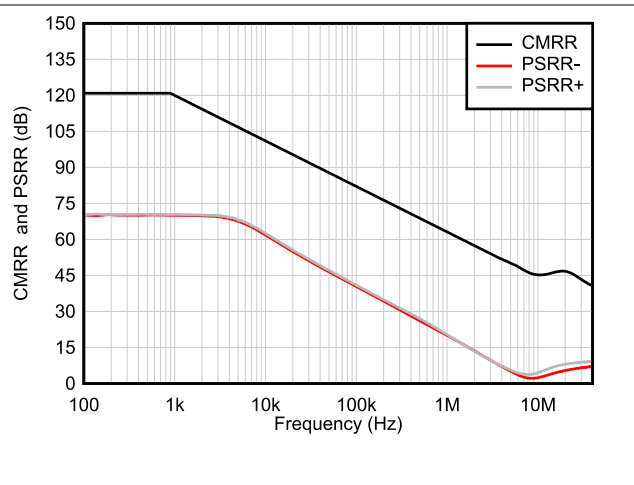


Figure 5-14. CMRR and PSRR vs Frequency

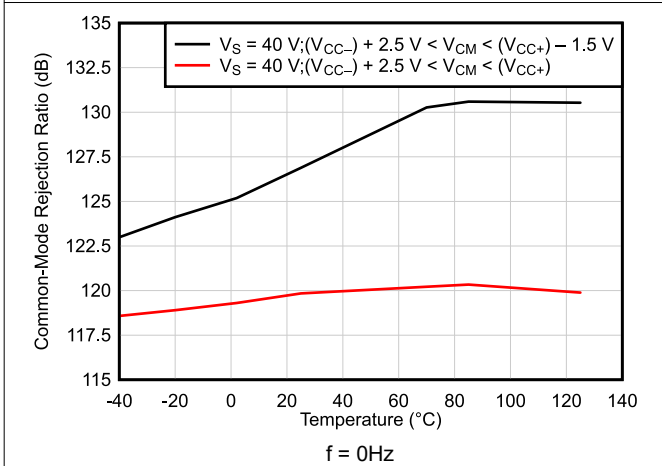


Figure 5-15. CMRR vs Temperature (dB)

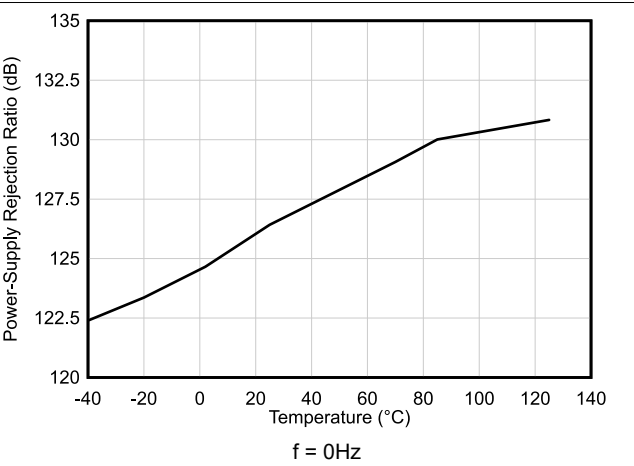


Figure 5-16. PSRR vs Temperature (dB)

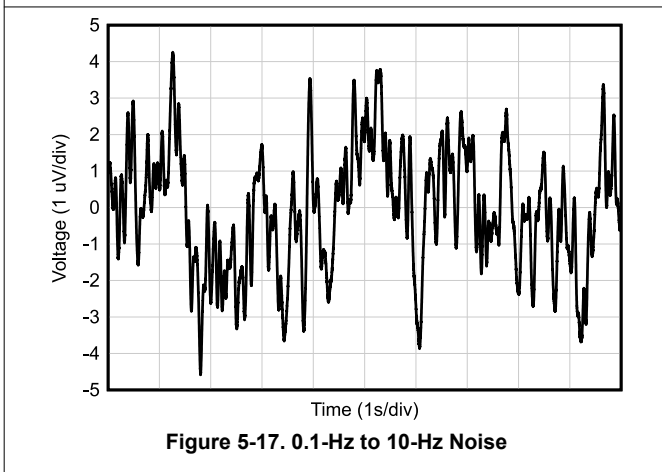


Figure 5-17. 0.1-Hz to 10-Hz Noise

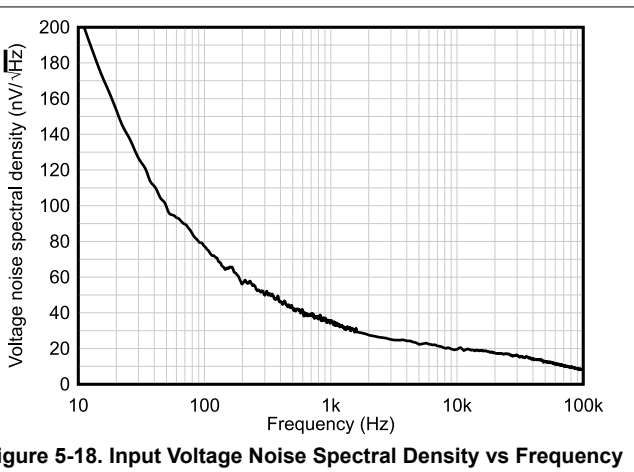


Figure 5-18. Input Voltage Noise Spectral Density vs Frequency

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)

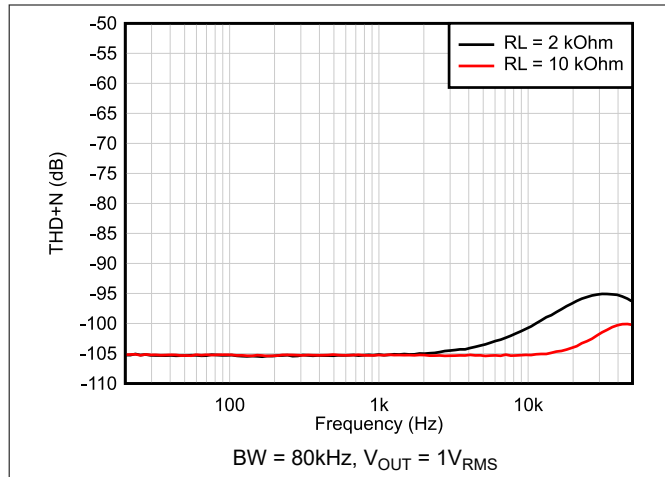


Figure 5-19. THD+N Ratio vs Frequency

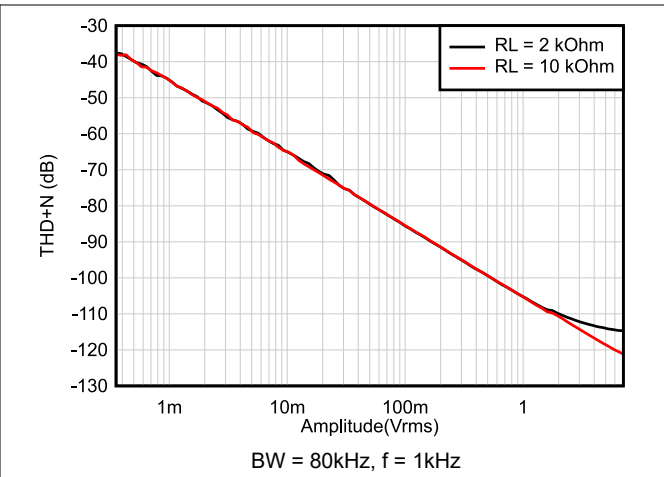


Figure 5-20. THD+N vs Output Amplitude

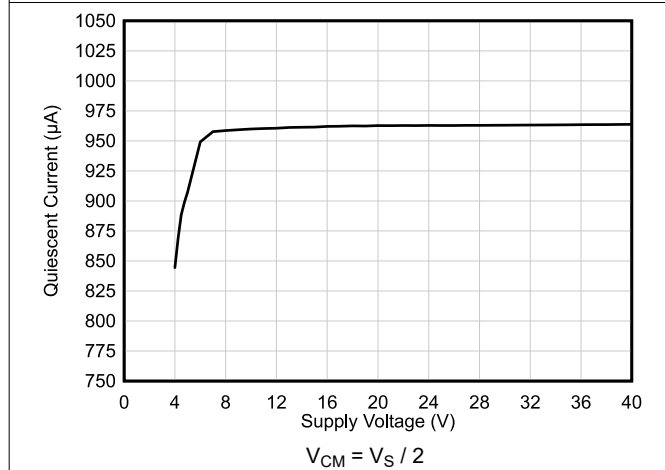


Figure 5-21. Quiescent Current vs Supply Voltage

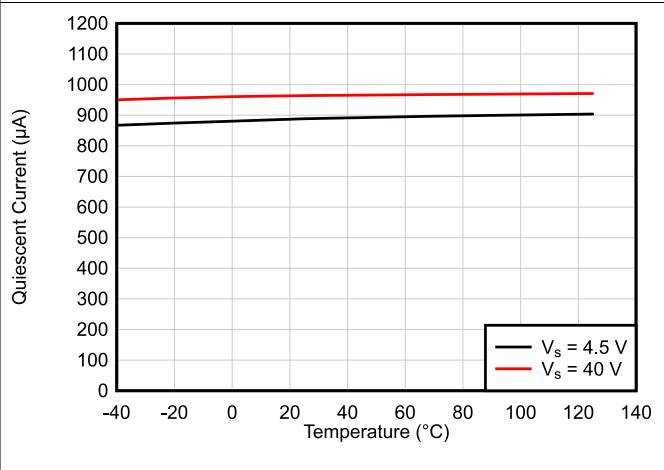


Figure 5-22. Quiescent Current vs Temperature

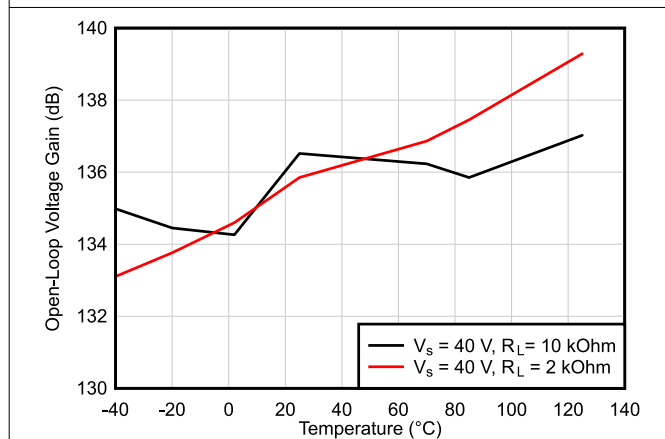


Figure 5-23. Open-Loop Voltage Gain vs Temperature (dB)

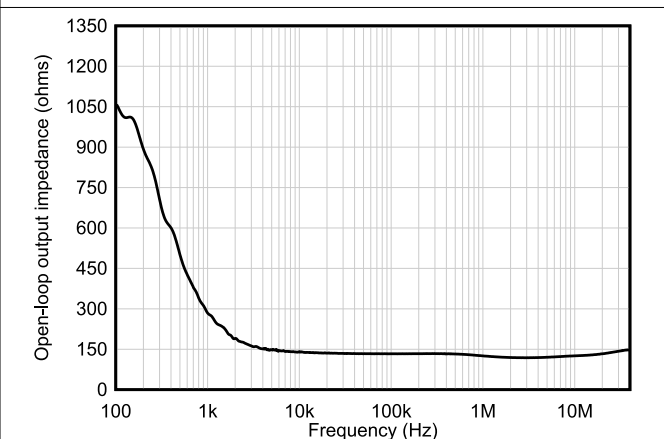


Figure 5-24. Open-Loop Output Impedance vs Frequency

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)

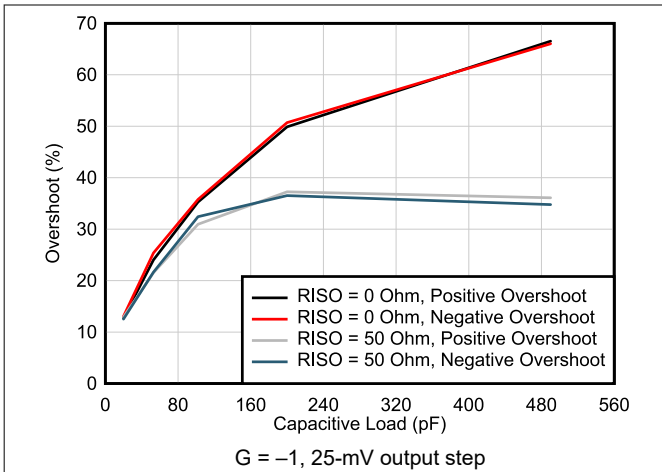


Figure 5-25. Small-Signal Overshoot vs Capacitive Load

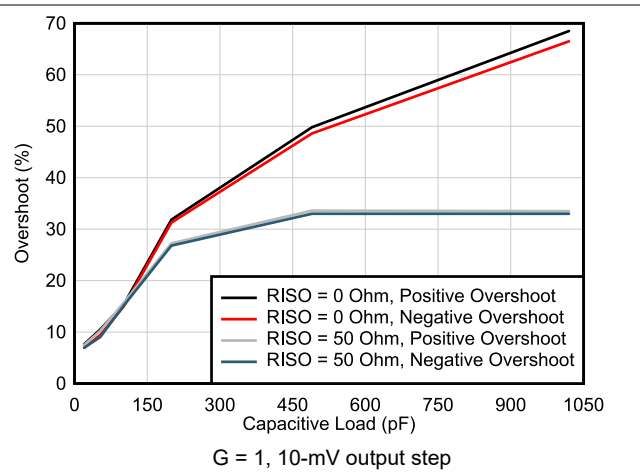


Figure 5-26. Small-Signal Overshoot vs Capacitive Load

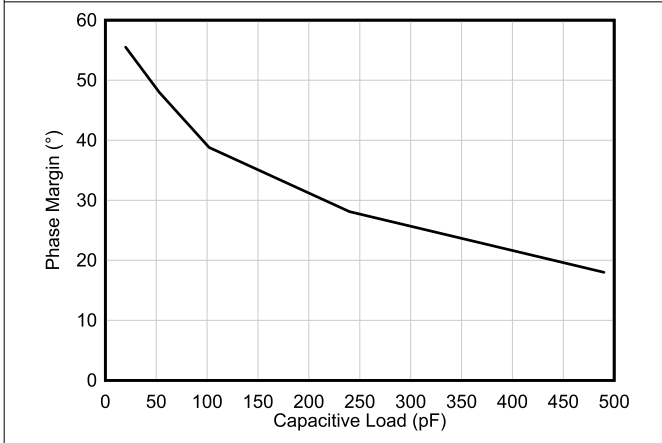


Figure 5-27. Phase Margin vs Capacitive Load

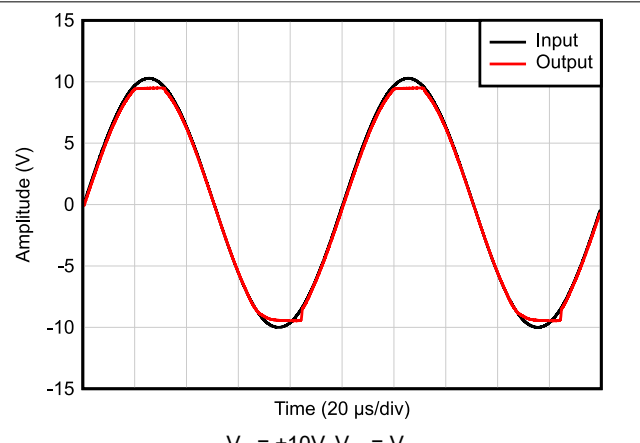


Figure 5-28. No Phase Reversal

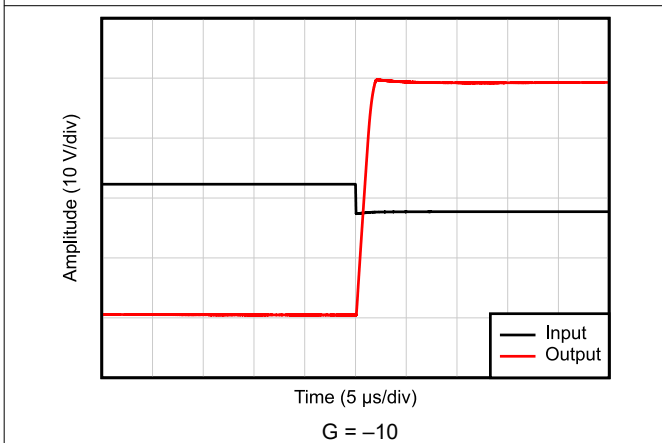


Figure 5-29. Positive Overload Recovery

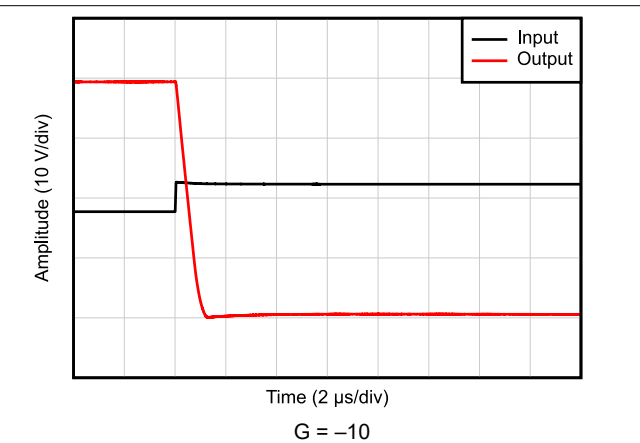
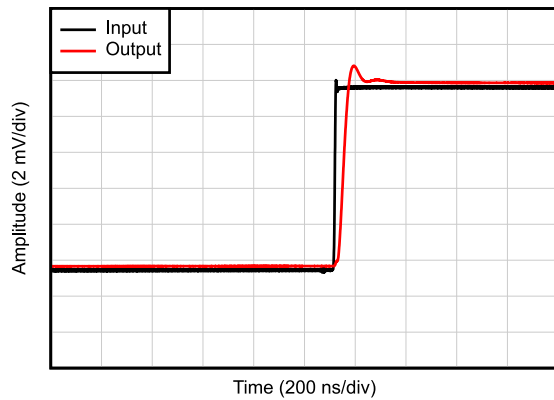


Figure 5-30. Negative Overload Recovery

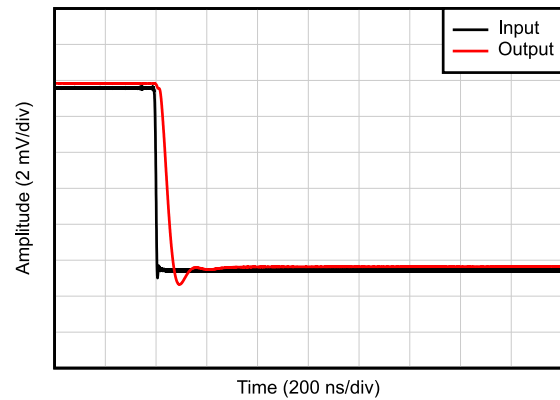
5.10 Typical Characteristics: TL08xH (continued)

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)



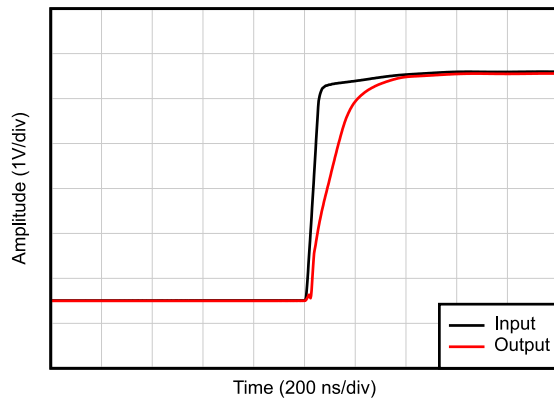
$C_L = 20\text{pF}$, $G = 1$, 10-mV step response

Figure 5-31. Small-Signal Step Response, Rising



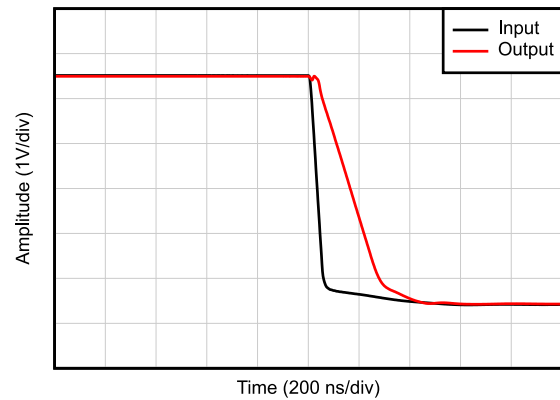
$C_L = 20\text{pF}$, $G = 1$, 10-mV step response

Figure 5-32. Small-Signal Step Response, Falling



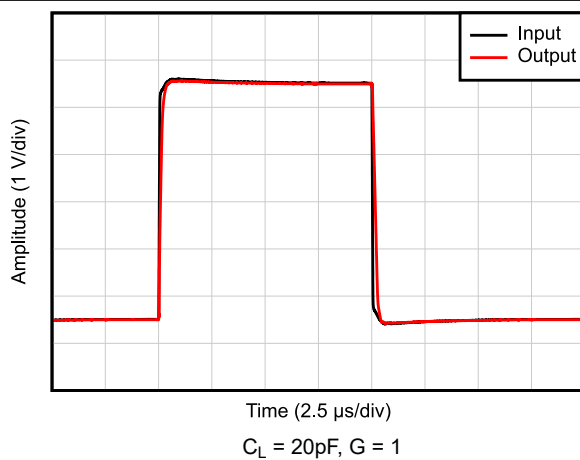
$C_L = 20\text{pF}$, $G = 1$

Figure 5-33. Large-Signal Step Response (Rising)



$C_L = 20\text{pF}$, $G = 1$

Figure 5-34. Large-Signal Step Response (Falling)



$C_L = 20\text{pF}$, $G = 1$

Figure 5-35. Large-Signal Step Response

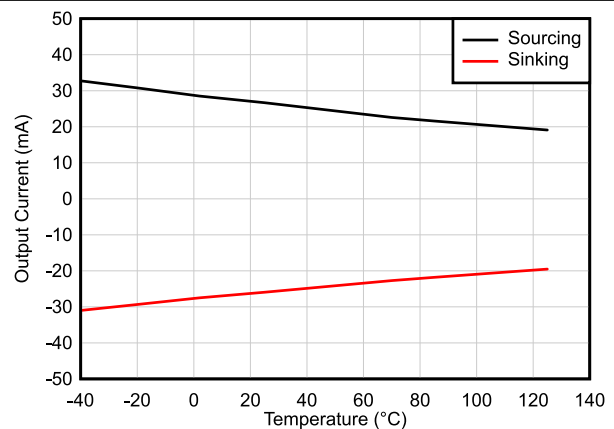


Figure 5-36. Short-Circuit Current vs Temperature

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)

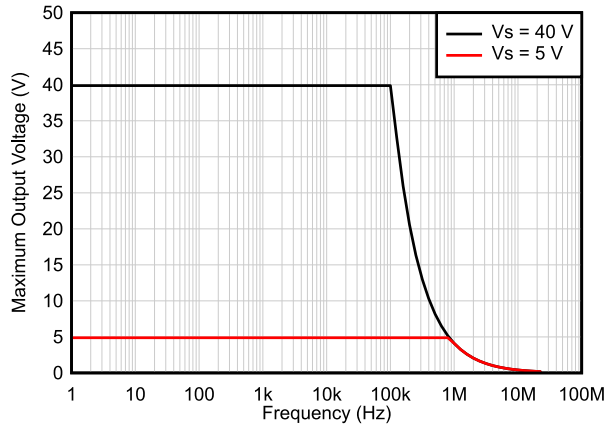


Figure 5-37. Maximum Output Voltage vs Frequency

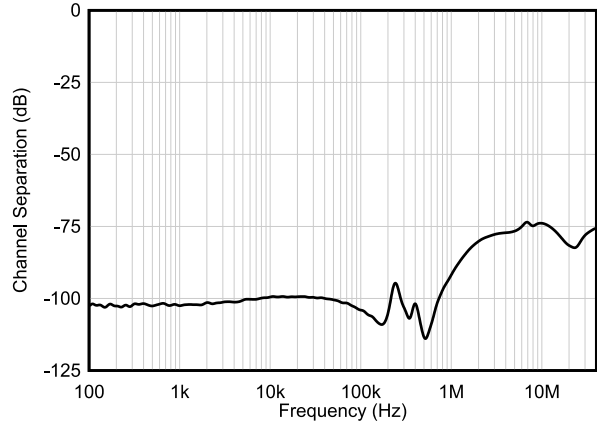


Figure 5-38. Channel Separation vs Frequency

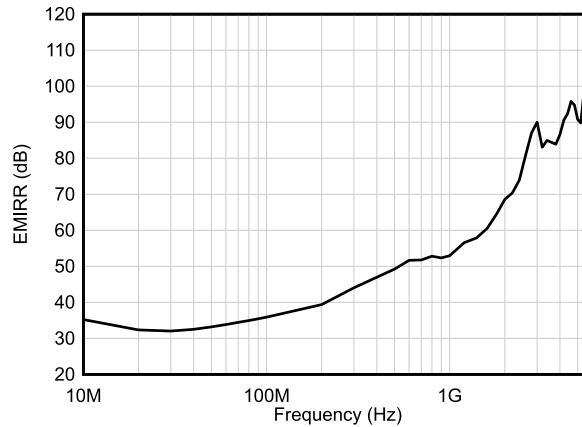


Figure 5-39. EMIRR (Electromagnetic Interference Rejection Ratio) vs Frequency

6 Parameter Measurement Information

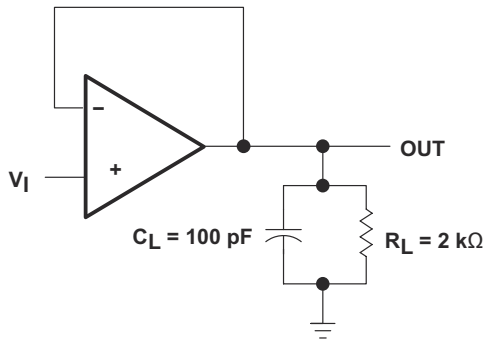


Figure 6-1. Test Figure 1

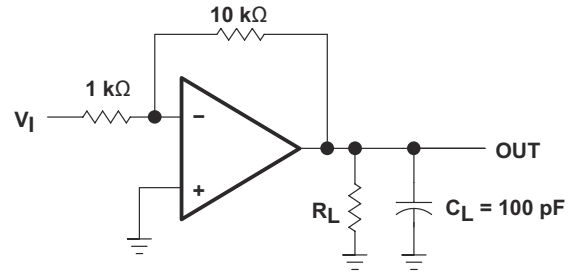


Figure 6-2. Test Figure 2

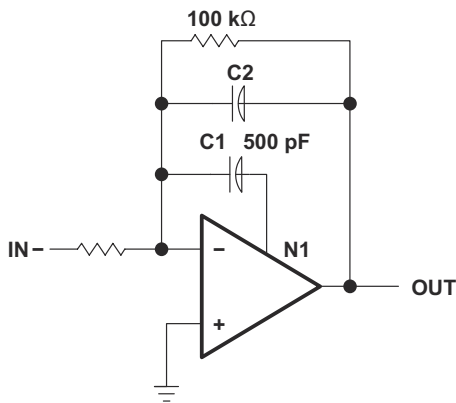


Figure 6-3. Test Figure 3

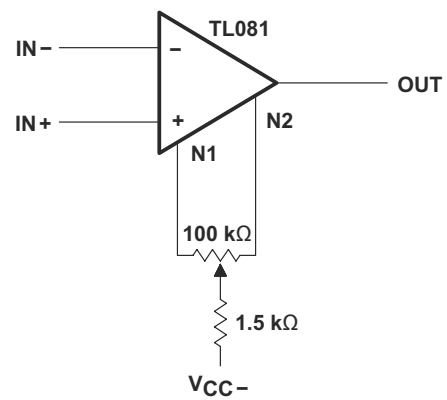


Figure 6-4. Test Figure 4

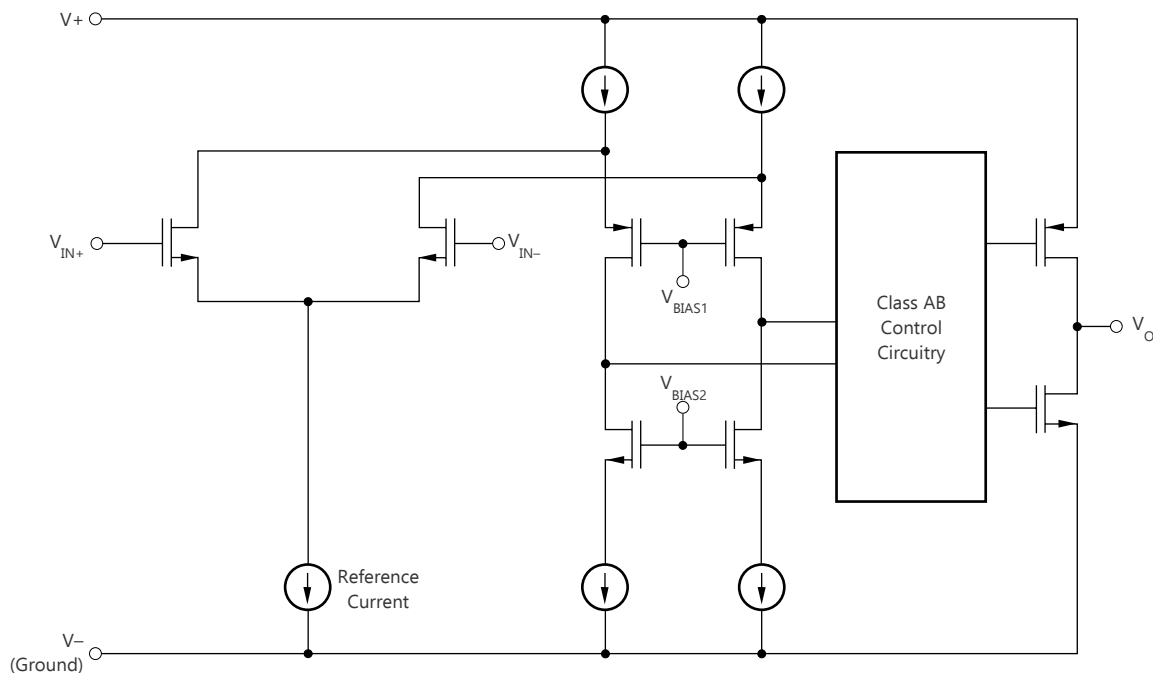
7 Detailed Description

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 ($2\mu\text{V}/^\circ\text{C}$) 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 ($20\text{V}/\mu\text{s}$) 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 $20\text{V}/\mu\text{s}$ 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

Note

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

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 is 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.

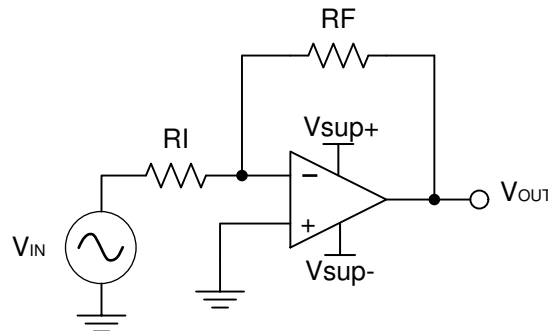


Figure 8-1. Schematic for Inverting Amplifier Application

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 $\pm 0.5\text{V}$ to $\pm 1.8\text{V}$. Setting the supply at $\pm 12\text{V}$ 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 $\text{k}\Omega$ 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 $10\text{k}\Omega$ for R_I which means $36\text{k}\Omega$ 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

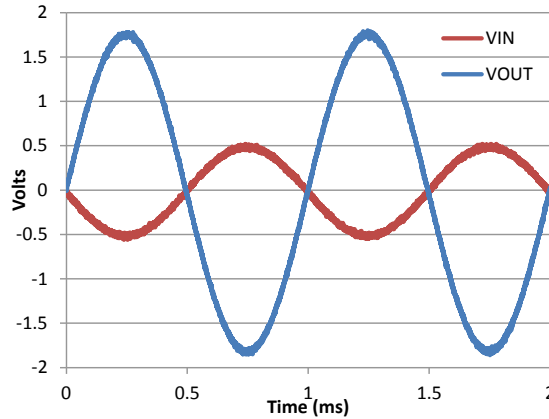


Figure 8-2. Input and Output Voltages of the Inverting Amplifier

8.3 System Examples

8.3.1 General Applications

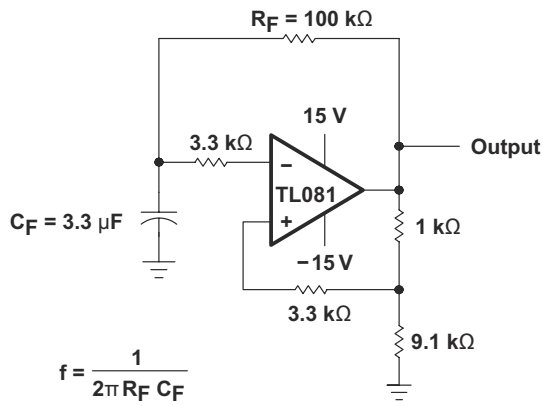


Figure 8-3. 0.5-Hz Square-Wave Oscillator

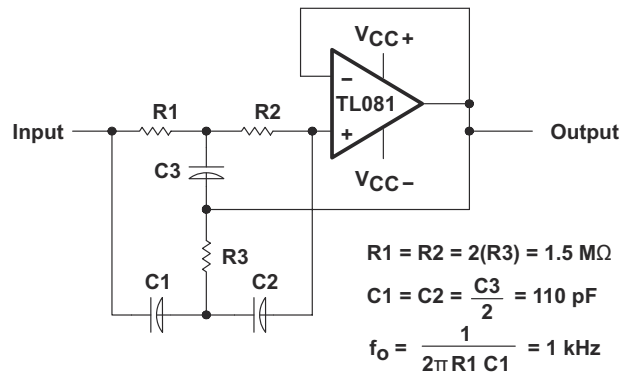


Figure 8-4. High-Q Notch Filter

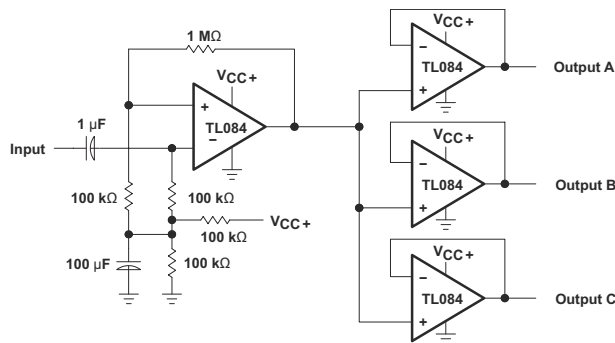
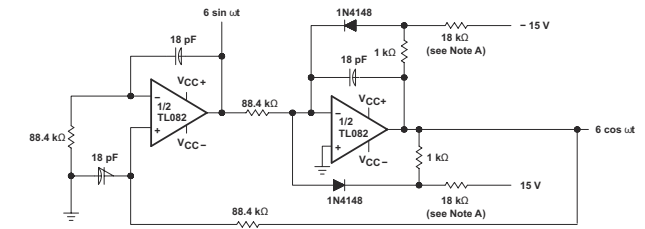


Figure 8-5. Audio-Distribution Amplifier



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

Figure 8-6. 100-kHz Quadrature Oscillator

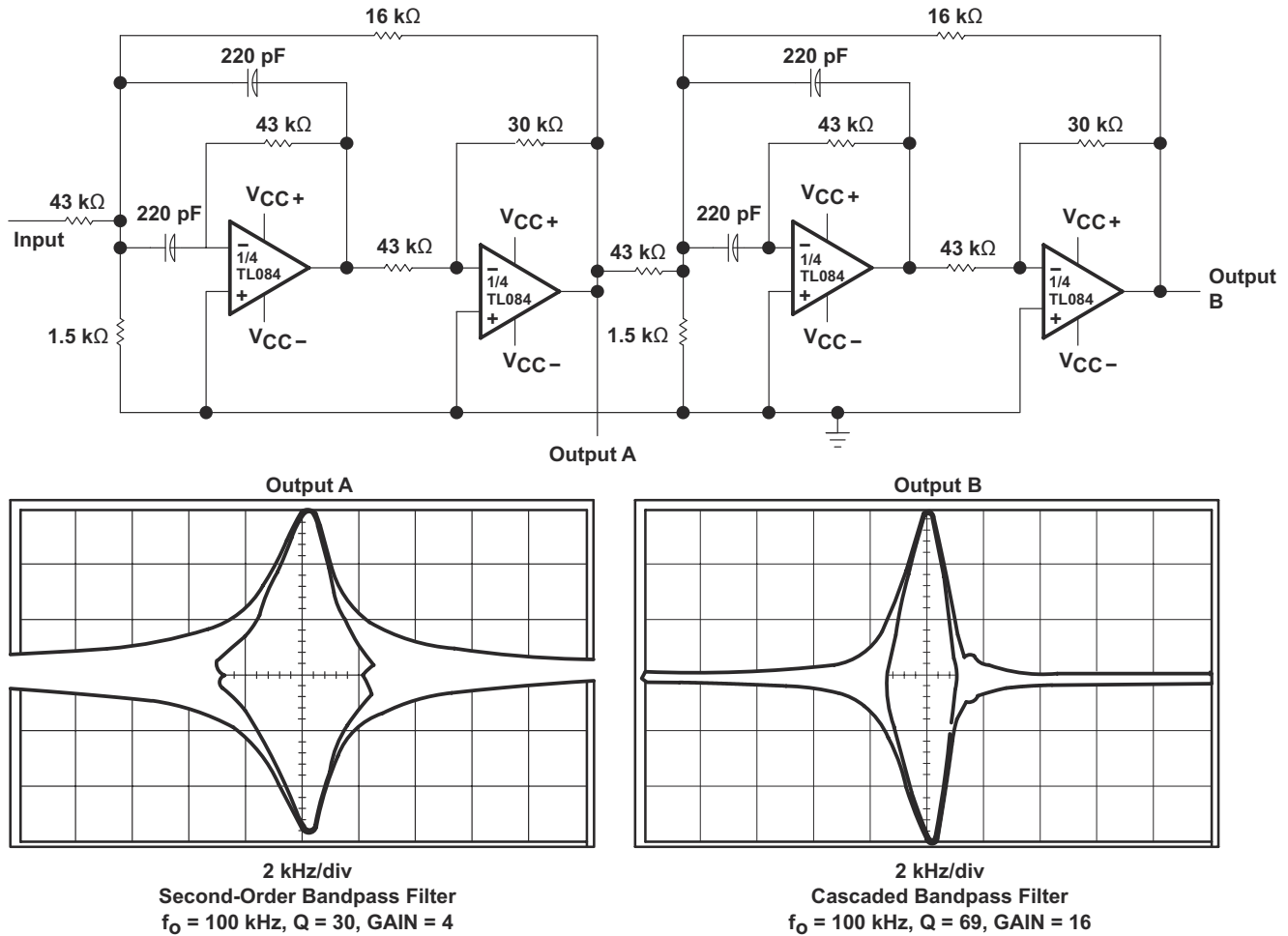


Figure 8-7. Positive-Feedback Bandpass Filter

8.4 Power Supply Recommendations

CAUTION

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 [Section 5.1](#)).

Place 0.1 μF 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 [Section 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 μF 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 Section 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

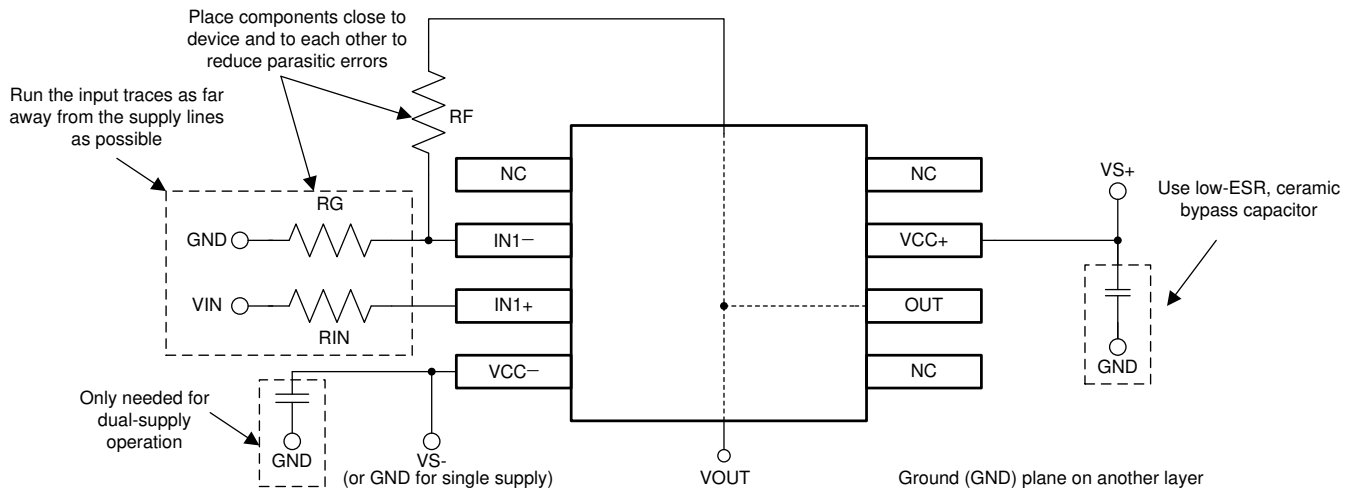


Figure 8-8. Operational Amplifier Board Layout for Noninverting Configuration

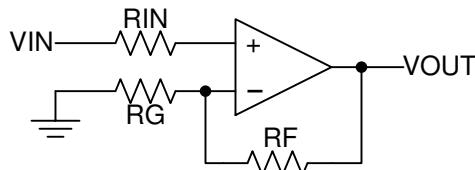


Figure 8-9. Operational Amplifier Schematic for Noninverting Configuration

9 Device and Documentation Support

9.1 Receiving Notification of Documentation Updates

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

9.2 Support Resources

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

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

9.3 Trademarks

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

9.4 Electrostatic Discharge Caution



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

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

9.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

10 Revision History

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

| 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 Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|----------------------------------|-------------------------|
| 5962-9851501Q2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9851501Q2A TL082MFKB | Samples |
| 5962-9851501QPA | ACTIVE | CDIP | JG | 8 | 50 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 9851501QPA TL082M | Samples |
| 5962-9851503Q2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9851503Q2A TL084 MFKB | Samples |
| 5962-9851503QCA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9851503QC A TL084MJB | Samples |
| TL081ACDR | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 081AC | Samples |
| TL081ACP | ACTIVE | PDIP | P | 8 | 50 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | TL081ACP | Samples |
| TL081BCDR | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 081BC | Samples |
| TL081BCP | ACTIVE | PDIP | P | 8 | 50 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | TL081BCP | Samples |
| TL081CDR | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | TL081C | Samples |
| TL081CP | ACTIVE | PDIP | P | 8 | 50 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | TL081CP | Samples |
| TL081CPE4 | ACTIVE | PDIP | P | 8 | 50 | TBD | Call TI | Call TI | 0 to 70 | | Samples |
| TL081CPSR | ACTIVE | SO | PS | 8 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | T081 | Samples |
| TL081HIDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | T81V | Samples |
| TL081HIDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | RoHS & Green | SN | Level-1-260C-UNLIM | -40 to 125 | 1IP | Samples |
| TL081HIDR | ACTIVE | SOIC | D | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TL081D | Samples |
| TL081IDR | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TL081I | Samples |
| TL081IP | ACTIVE | PDIP | P | 8 | 50 | RoHS & Green | NIPDAU | N / A for Pkg Type | -40 to 85 | TL081IP | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| TL082ACDR | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 082AC | Samples |
| TL082ACDRE4 | ACTIVE | SOIC | D | 8 | 2500 | TBD | Call TI | Call TI | 0 to 70 | | Samples |
| TL082ACP | ACTIVE | PDIP | P | 8 | 50 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | TL082ACP | Samples |
| TL082ACPSR | ACTIVE | SO | PS | 8 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | T082A | Samples |
| TL082BCDR | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 082BC | Samples |
| TL082BCP | ACTIVE | PDIP | P | 8 | 50 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | TL082BCP | Samples |
| TL082BCPE4 | ACTIVE | PDIP | P | 8 | 50 | TBD | Call TI | Call TI | 0 to 70 | | Samples |
| TL082CDR | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | TL082C | Samples |
| TL082CDRE4 | ACTIVE | SOIC | D | 8 | 2500 | TBD | Call TI | Call TI | 0 to 70 | | Samples |
| TL082CDRG4 | ACTIVE | SOIC | D | 8 | 2500 | TBD | Call TI | Call TI | 0 to 70 | | Samples |
| TL082CP | ACTIVE | PDIP | P | 8 | 50 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | TL082CP | Samples |
| TL082CPSR | ACTIVE | SO | PS | 8 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | T082 | Samples |
| TL082CPSRG4 | ACTIVE | SO | PS | 8 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | T082 | Samples |
| TL082CPWR | ACTIVE | TSSOP | PW | 8 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | T082 | Samples |
| TL082CPWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | TBD | Call TI | Call TI | 0 to 70 | | Samples |
| TL082HIDDFR | ACTIVE | SOT-23-THIN | DDF | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 082F | Samples |
| TL082HIDR | ACTIVE | SOIC | D | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TL082D | Samples |
| TL082HIPWR | ACTIVE | TSSOP | PW | 8 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 082HPW | Samples |
| TL082IDR | ACTIVE | SOIC | D | 8 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TL082I | Samples |
| TL082IDRE4 | ACTIVE | SOIC | D | 8 | 2500 | TBD | Call TI | Call TI | -40 to 85 | | Samples |
| TL082IP | ACTIVE | PDIP | P | 8 | 50 | RoHS & Green | NIPDAU | N / A for Pkg Type | -40 to 85 | TL082IP | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|------------------------------|-------------------------|
| TL082IPE4 | ACTIVE | PDIP | P | 8 | 50 | TBD | Call TI | Call TI | -40 to 85 | | Samples |
| TL082IPWR | ACTIVE | TSSOP | PW | 8 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | Z082 | Samples |
| TL082MFKB | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9851501Q2A TL082MFKB | Samples |
| TL082MJG | ACTIVE | CDIP | JG | 8 | 50 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | TL082MJG | Samples |
| TL082MJGB | ACTIVE | CDIP | JG | 8 | 50 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 9851501QPA TL082M | Samples |
| TL084ACDR | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | TL084AC | Samples |
| TL084ACN | ACTIVE | PDIP | N | 14 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | TL084ACN | Samples |
| TL084ACNSR | ACTIVE | SO | NS | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | TL084A | Samples |
| TL084BCDR | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | TL084BC | Samples |
| TL084BCDRG4 | ACTIVE | SOIC | D | 14 | 2500 | TBD | Call TI | Call TI | 0 to 70 | | Samples |
| TL084BCN | ACTIVE | PDIP | N | 14 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | TL084BCN | Samples |
| TL084BCNE4 | ACTIVE | PDIP | N | 14 | 25 | TBD | Call TI | Call TI | 0 to 70 | | Samples |
| TL084CDR | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | TL084C | Samples |
| TL084CN | ACTIVE | PDIP | N | 14 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | TL084CN | Samples |
| TL084CNSR | ACTIVE | SO | NS | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | TL084 | Samples |
| TL084CPWR | ACTIVE | TSSOP | PW | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | T084 | Samples |
| TL084HIDR | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TL084HID | Samples |
| TL084HIDYYR | ACTIVE | SOT-23-THIN | DYY | 14 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | T084HDYY | Samples |
| TL084HIPWR | ACTIVE | TSSOP | PW | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TL084PW | Samples |
| TL084IDR | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TL084I | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|----------------------------------|-------------------------|
| TL084IDRE4 | ACTIVE | SOIC | D | 14 | 2500 | TBD | Call TI | Call TI | -40 to 85 | | Samples |
| TL084IDRG4 | ACTIVE | SOIC | D | 14 | 2500 | TBD | Call TI | Call TI | -40 to 85 | | Samples |
| TL084IN | ACTIVE | PDIP | N | 14 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | -40 to 85 | TL084IN | Samples |
| TL084MFK | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | TL084MFK | Samples |
| TL084MFKB | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9851503Q2A TL084 MFKB | Samples |
| TL084MJ | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | TL084MJ | Samples |
| TL084MJB | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9851503QC A TL084MJB | Samples |
| TL084QDR | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TL084Q | Samples |
| TL084QDRG4 | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TL084Q | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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

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

⁽⁶⁾ Lead finish/Ball material - Orderable Devices 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.

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 |
| 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 |
| 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 | 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 |
| TL082ACDR | 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 |

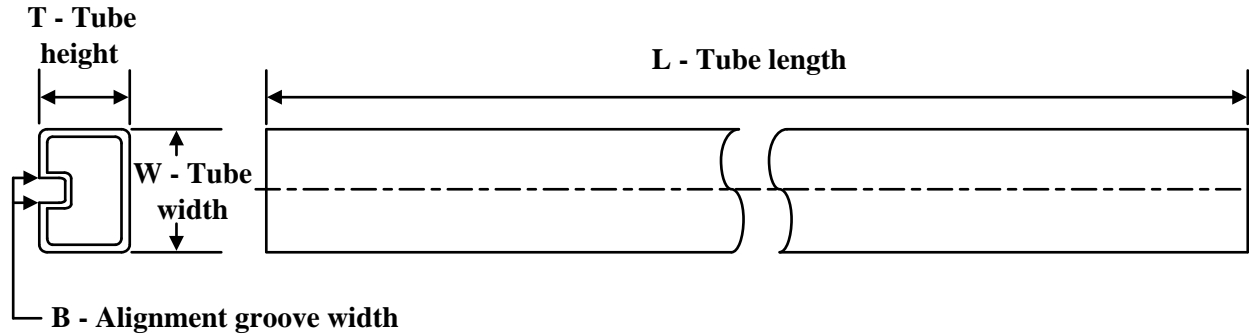
| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TL082BCDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TL082BCDR | 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 |
| TL082CDR | 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 |
| 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 |
| 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 |
| TL082IDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 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 |
| 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 | SO | NS | 14 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| TL084BCDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TL084BCDR | 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 |
| TL084CDR | 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 |
| TL084CDR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| TL084CNSR | SO | NS | 14 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | 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 |
| 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 |
| 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 |
| TL084IDR | 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

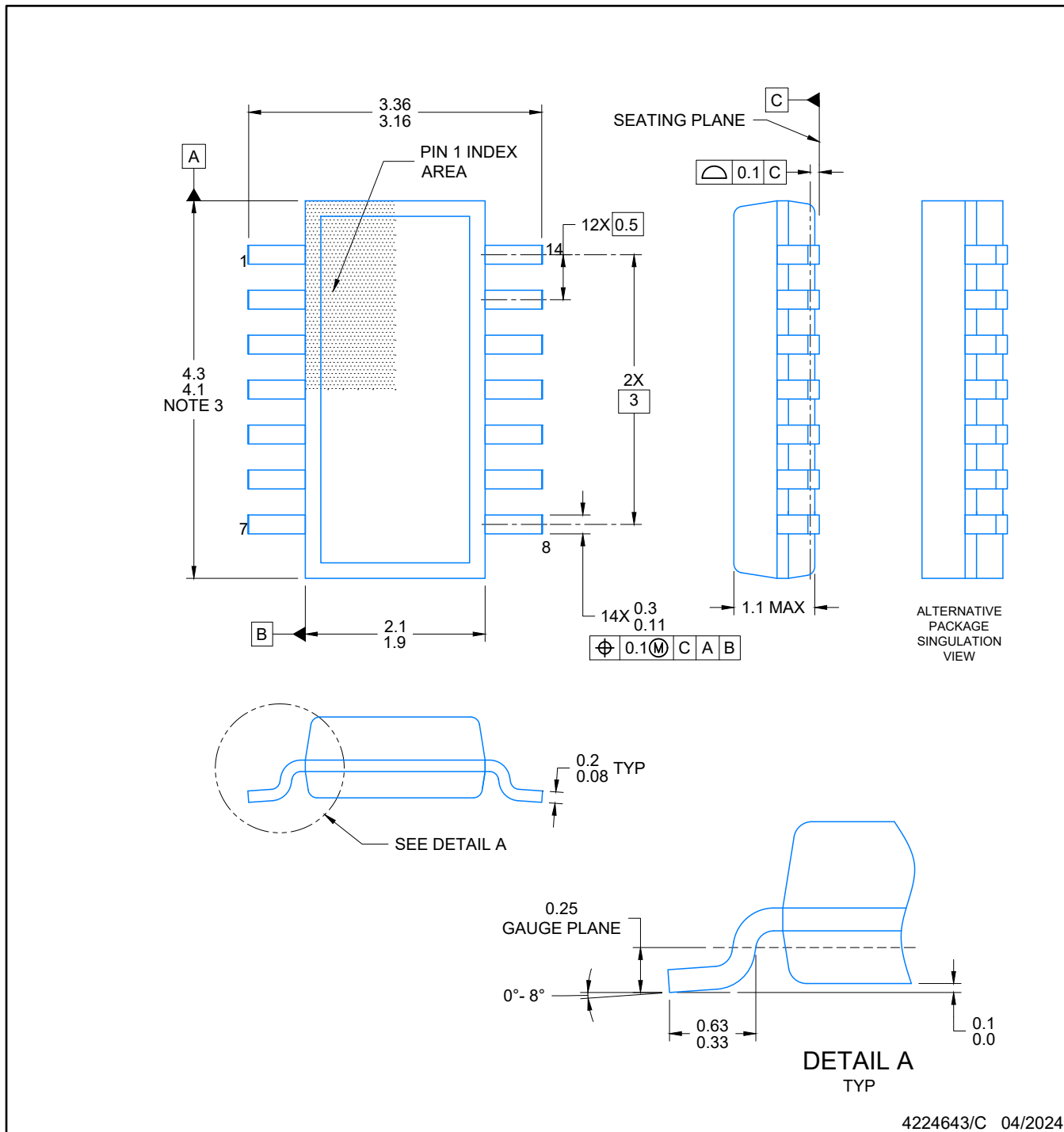
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TL081ACDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL081ACDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TL081BCDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL081BCDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TL081CDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL081CDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TL081CPSR | SO | PS | 8 | 2000 | 356.0 | 356.0 | 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 | 356.0 | 356.0 | 35.0 |
| TL081IDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TL081IDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL082ACDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL082ACDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL082ACDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TL082ACPSR | SO | PS | 8 | 2000 | 356.0 | 356.0 | 35.0 |
| TL082BCDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL082BCDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TL082CDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL082CDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TL082CDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL082CPSR | SO | PS | 8 | 2000 | 356.0 | 356.0 | 35.0 |
| TL082CPWR | TSSOP | PW | 8 | 2000 | 356.0 | 356.0 | 35.0 |
| TL082CPWR | TSSOP | PW | 8 | 2000 | 356.0 | 356.0 | 35.0 |
| TL082HIDDFR | SOT-23-THIN | DDF | 8 | 3000 | 210.0 | 185.0 | 35.0 |
| TL082HIDR | SOIC | D | 8 | 3000 | 356.0 | 356.0 | 35.0 |
| TL082HIPWR | TSSOP | PW | 8 | 3000 | 356.0 | 356.0 | 35.0 |
| TL082IDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| TL082IDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL082IDR | SOIC | D | 8 | 2500 | 356.0 | 356.0 | 35.0 |
| TL082IPWR | TSSOP | PW | 8 | 2000 | 356.0 | 356.0 | 35.0 |
| TL082IPWR | TSSOP | PW | 8 | 2000 | 356.0 | 356.0 | 35.0 |
| TL084ACDR | SOIC | D | 14 | 2500 | 333.2 | 345.9 | 28.6 |
| TL084ACNSR | SO | NS | 14 | 2000 | 356.0 | 356.0 | 35.0 |
| TL084BCDR | SOIC | D | 14 | 2500 | 333.2 | 345.9 | 28.6 |
| TL084BCDR | SOIC | D | 14 | 2500 | 356.0 | 356.0 | 35.0 |
| TL084CDR | SOIC | D | 14 | 2500 | 356.0 | 356.0 | 35.0 |
| TL084CDR | SOIC | D | 14 | 2500 | 356.0 | 356.0 | 35.0 |
| TL084CDR | SOIC | D | 14 | 2500 | 333.2 | 345.9 | 28.6 |
| TL084CNSR | SO | NS | 14 | 2000 | 356.0 | 356.0 | 35.0 |
| TL084CPWR | TSSOP | PW | 14 | 2000 | 356.0 | 356.0 | 35.0 |
| TL084CPWR | TSSOP | PW | 14 | 2000 | 356.0 | 356.0 | 35.0 |
| TL084HIDR | SOIC | D | 14 | 2500 | 356.0 | 356.0 | 35.0 |
| TL084HIDYYR | SOT-23-THIN | DYY | 14 | 3000 | 336.6 | 336.6 | 31.8 |
| TL084HIPWR | TSSOP | PW | 14 | 2000 | 356.0 | 356.0 | 35.0 |
| TL084IDR | SOIC | D | 14 | 2500 | 333.2 | 345.9 | 28.6 |
| TL084IDR | SOIC | D | 14 | 2500 | 356.0 | 356.0 | 35.0 |
| TL084QDR | SOIC | D | 14 | 2500 | 356.0 | 356.0 | 35.0 |
| TL084QDRG4 | SOIC | D | 14 | 2500 | 350.0 | 350.0 | 43.0 |

TUBE


*All dimensions are nominal

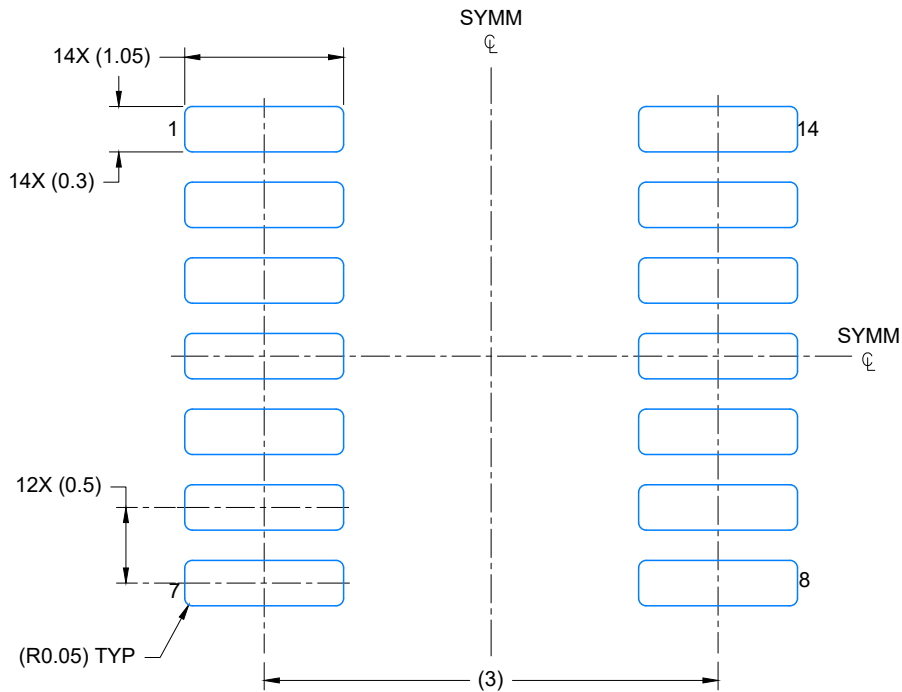
| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (µm) | B (mm) |
|-----------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-9851501Q2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| 5962-9851503Q2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TL081ACP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TL081BCP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TL081CP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TL081IP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TL082ACP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TL082BCP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TL082CP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TL082IP | P | PDIP | 8 | 50 | 506 | 13.97 | 11230 | 4.32 |
| TL082MFKB | 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 | 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 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084CN | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084CN | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084CNE4 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084CNE4 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084IN | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084IN | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084IN | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084INE4 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084INE4 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084INE4 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084INE4 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| TL084MFK | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| TL084MFKB | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |



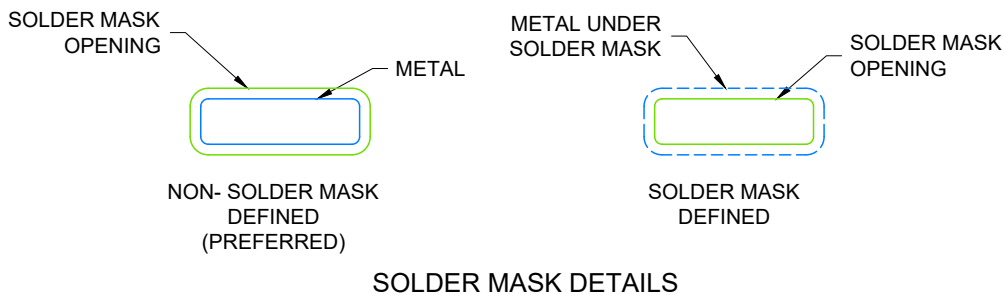
4224643/C 04/2024

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



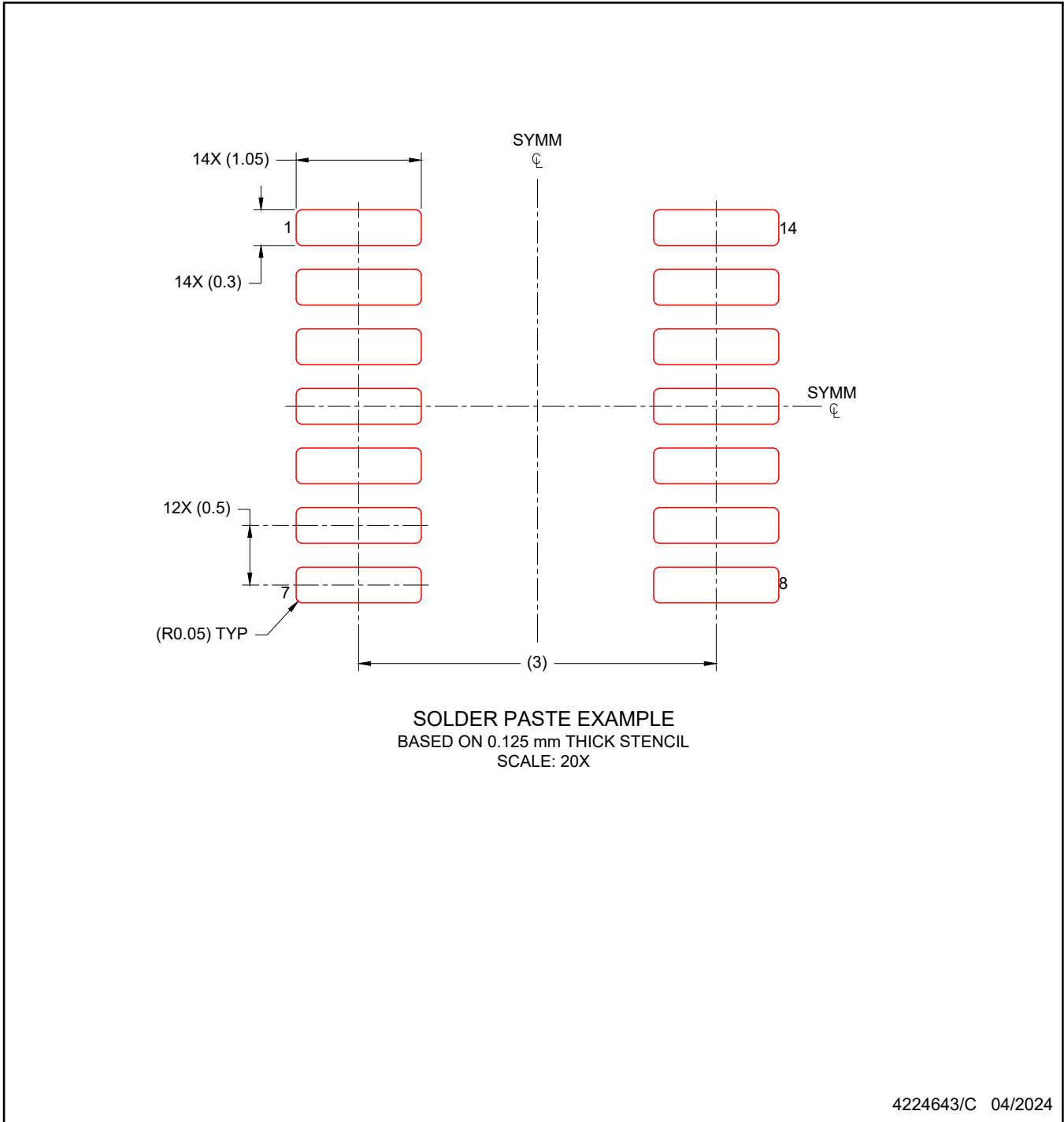
LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X



4224643/C 04/2024

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.



NOTES: (continued)

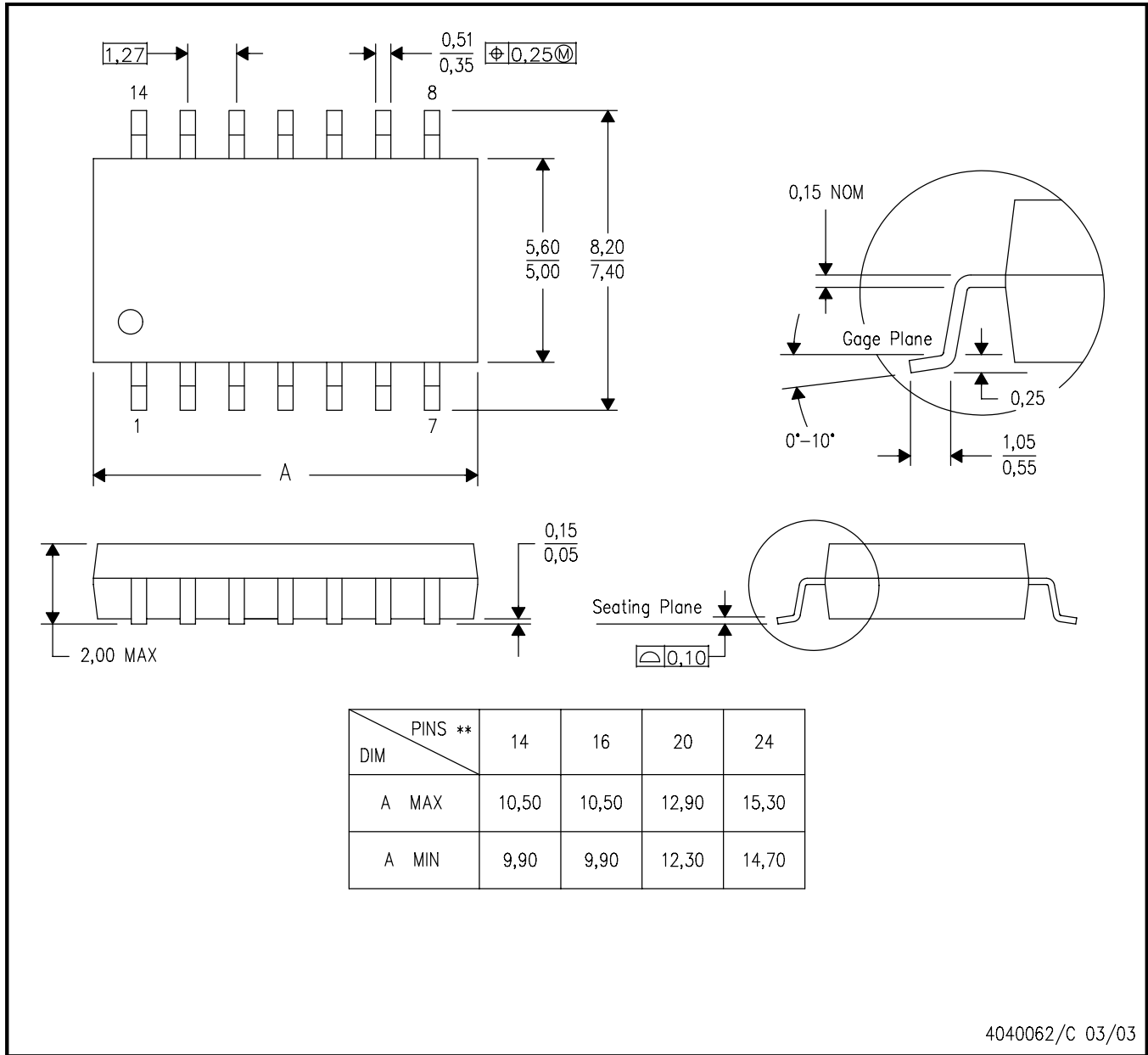
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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.

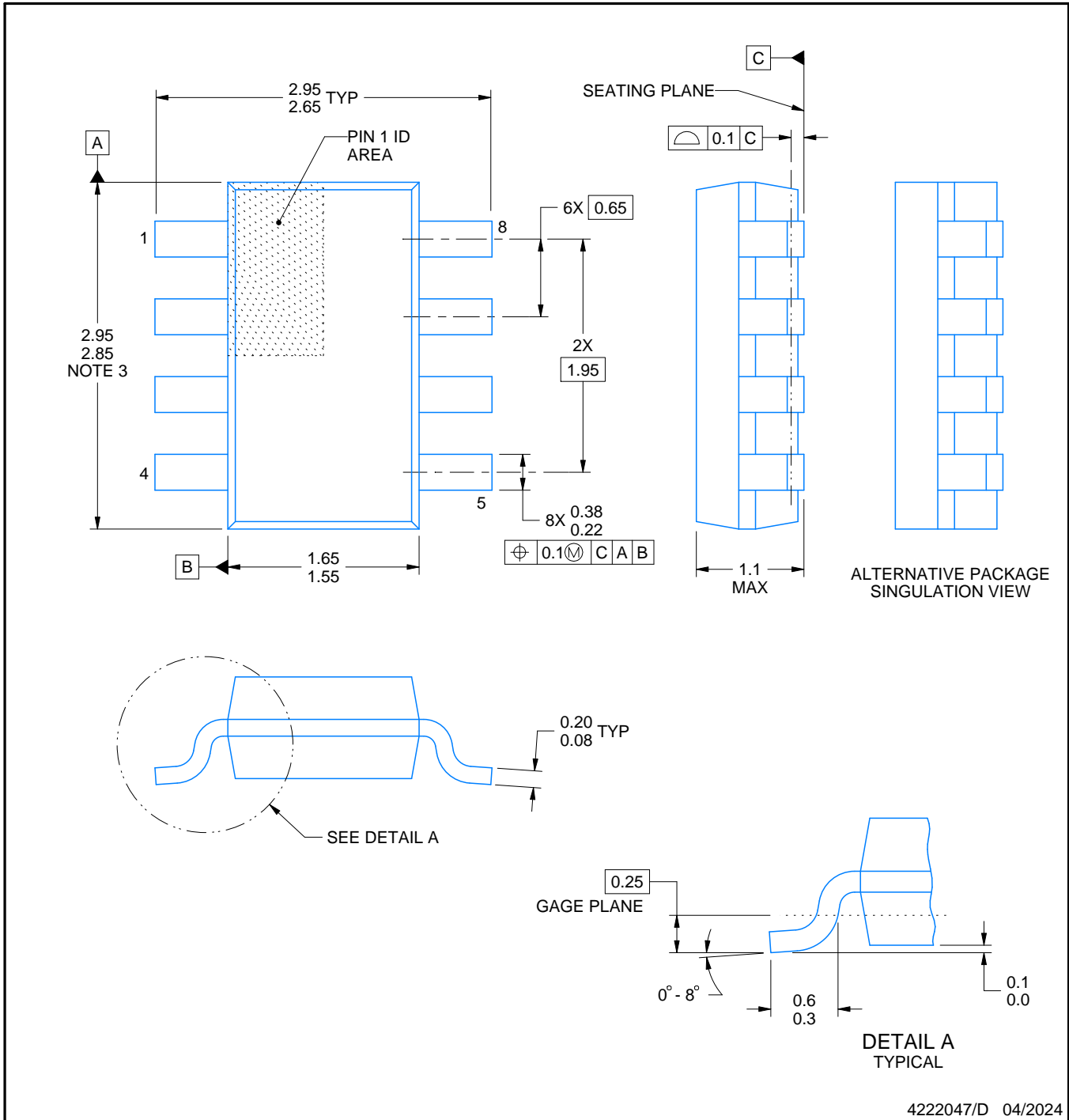
DDF0008A



PACKAGE OUTLINE

SOT-23 - 1.1 mm max height

PLASTIC SMALL OUTLINE



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.

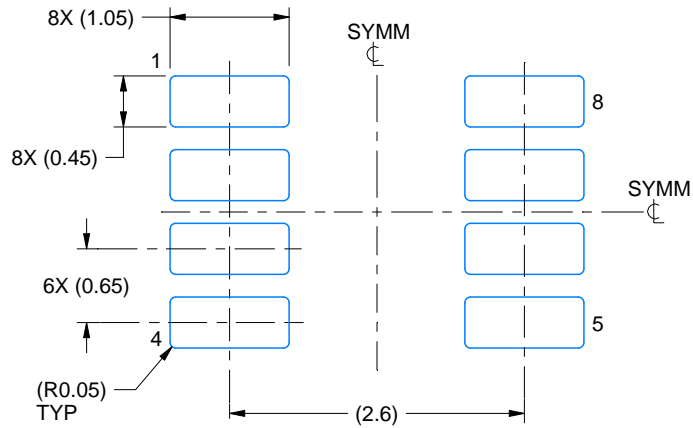
4222047/D 04/2024

EXAMPLE BOARD LAYOUT

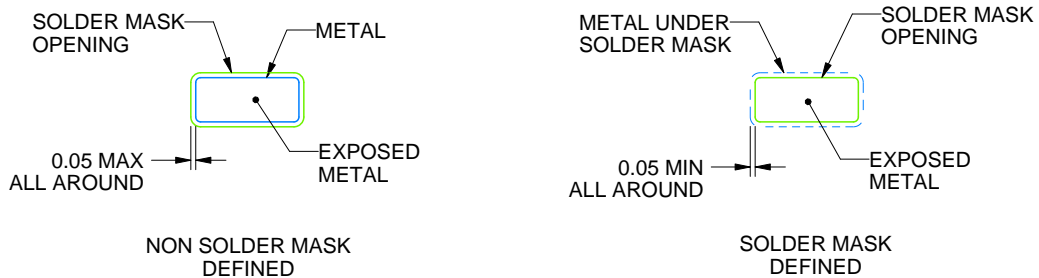
DDF0008A

SOT-23 - 1.1 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4222047/D 04/2024

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 - 1.1 mm max height

PLASTIC SMALL OUTLINE



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

4222047/D 04/2024

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.

GENERIC PACKAGE VIEW

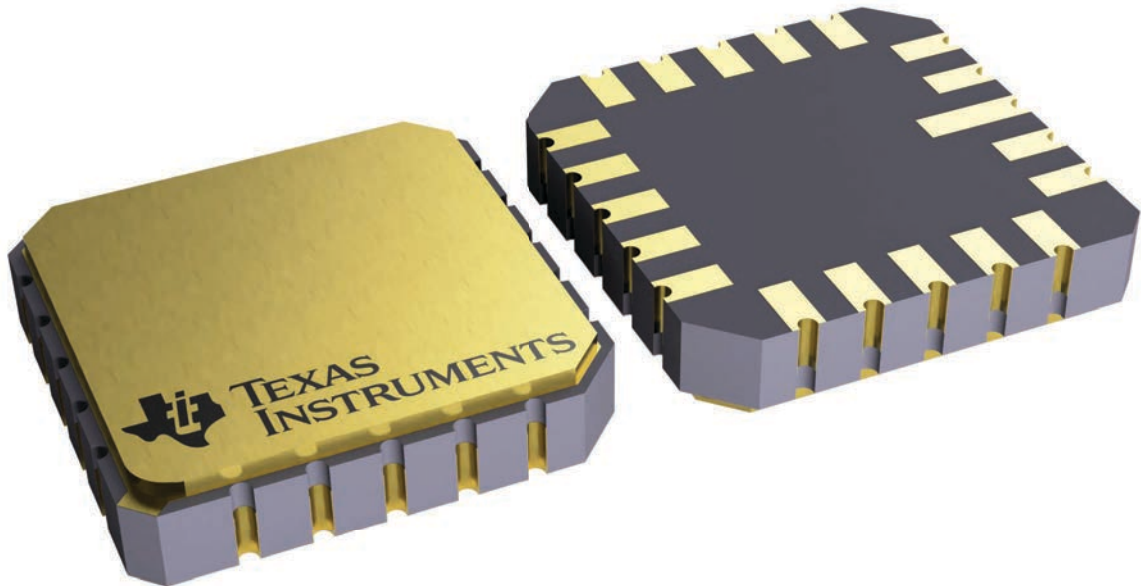
FK 20

LCCC - 2.03 mm max height

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

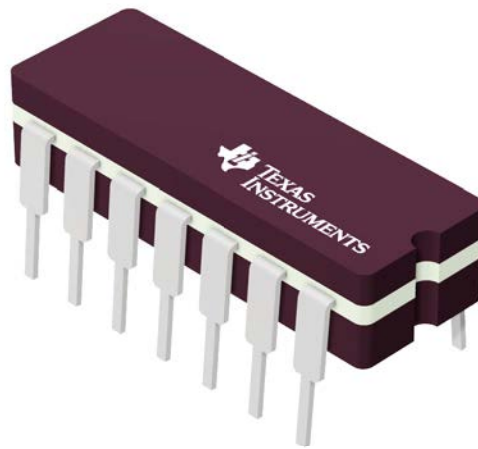
This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



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

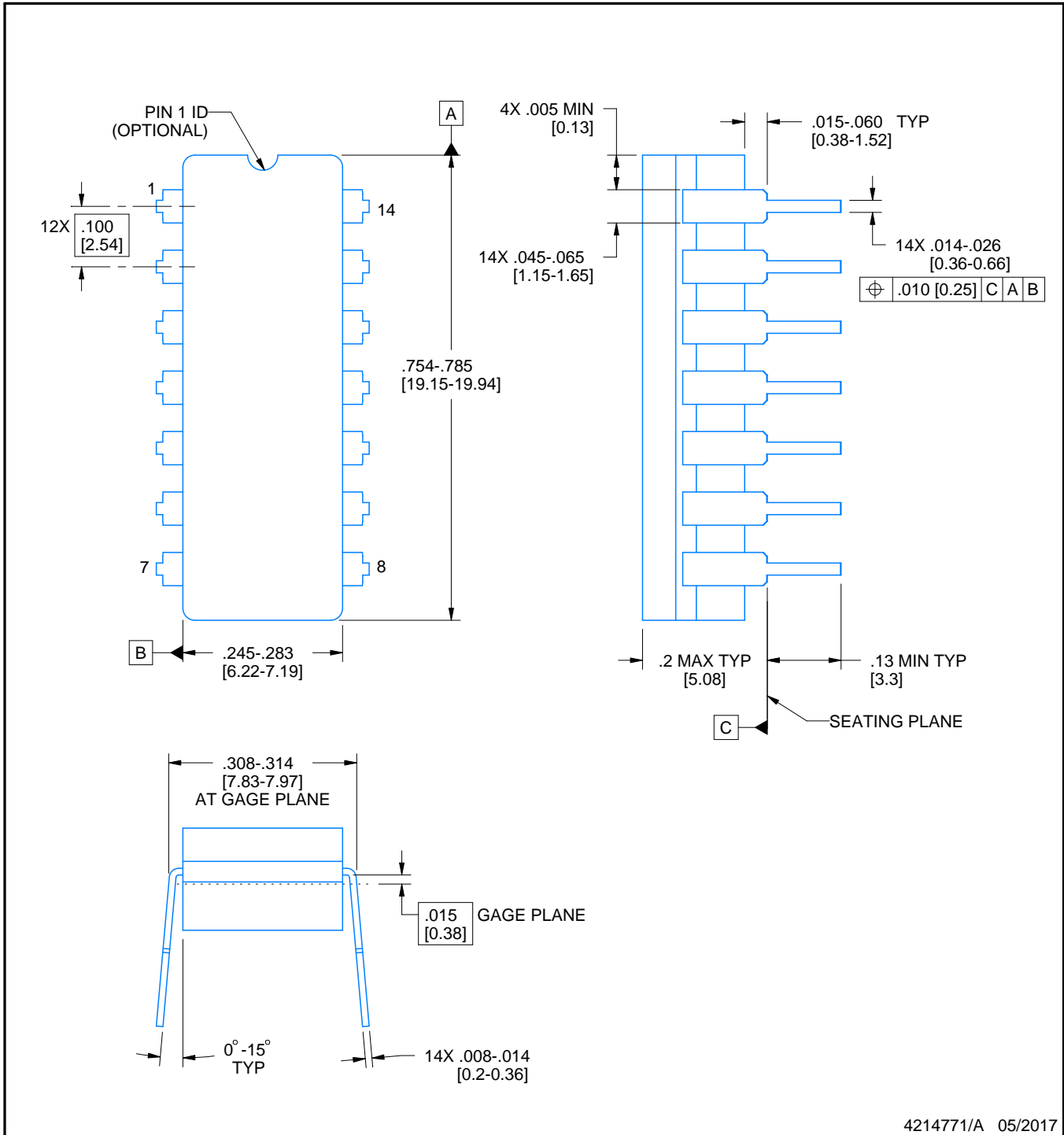
J0014A



PACKAGE OUTLINE

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

NOTES:

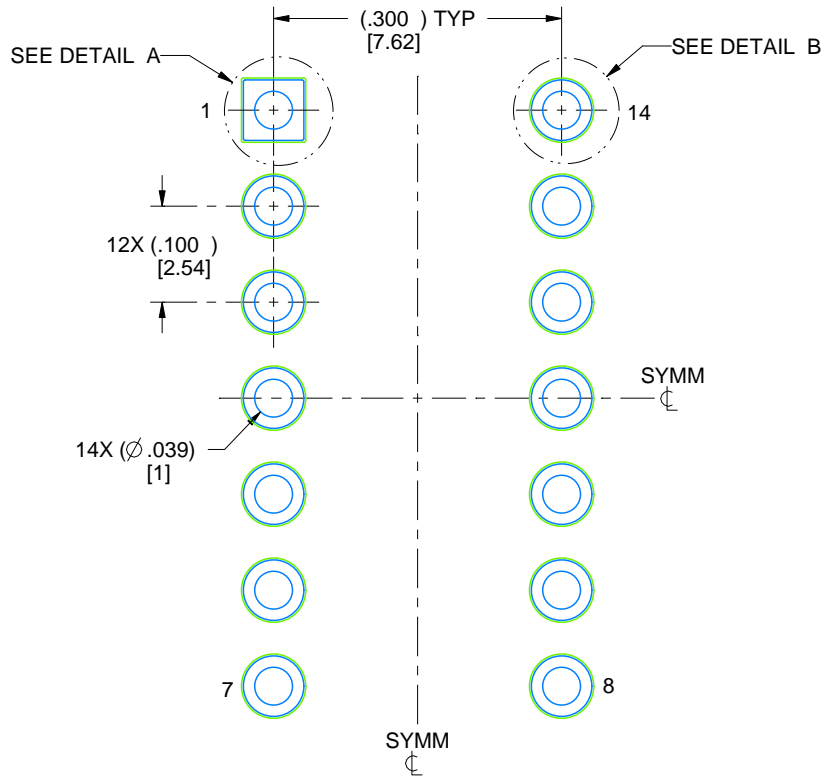
1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with 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.

EXAMPLE BOARD LAYOUT

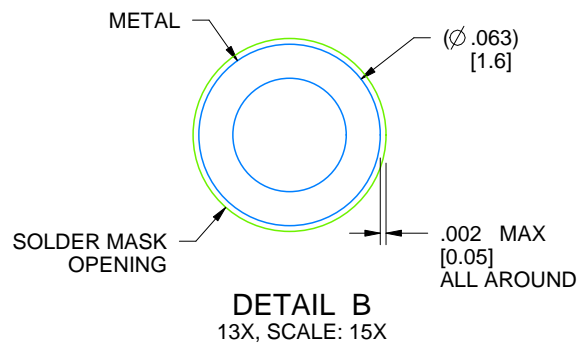
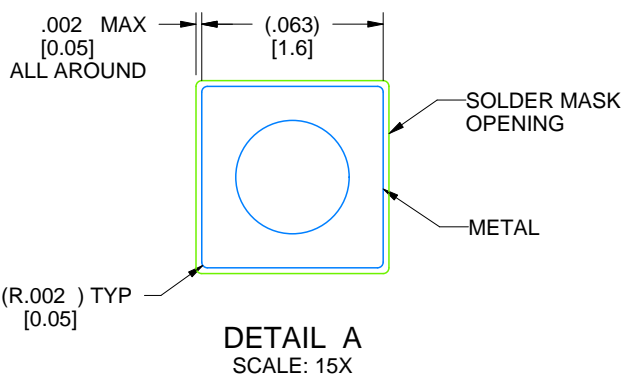
J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



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



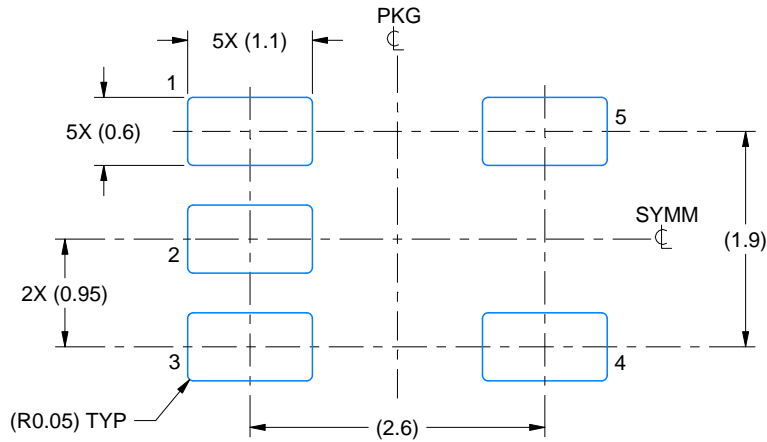
4214771/A 05/2017

EXAMPLE BOARD LAYOUT

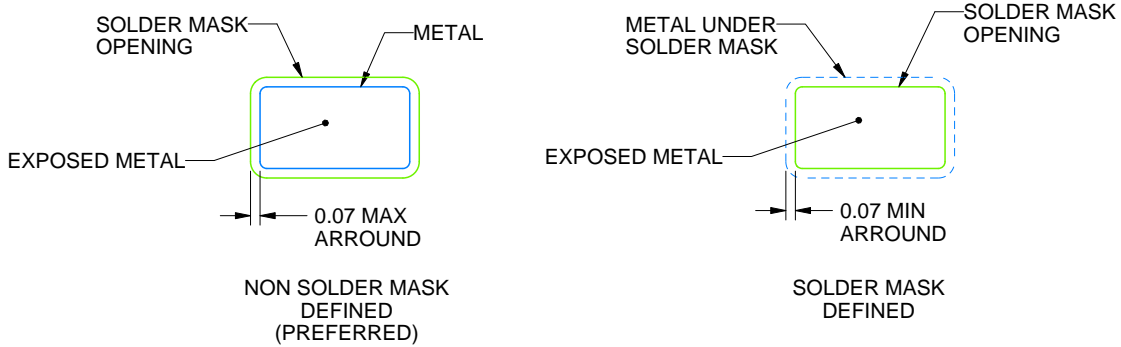
DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

4214839/J 02/2024

NOTES: (continued)

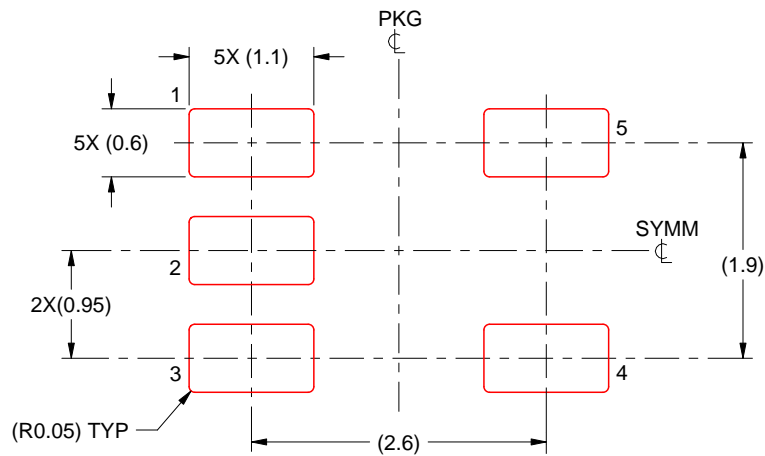
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

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

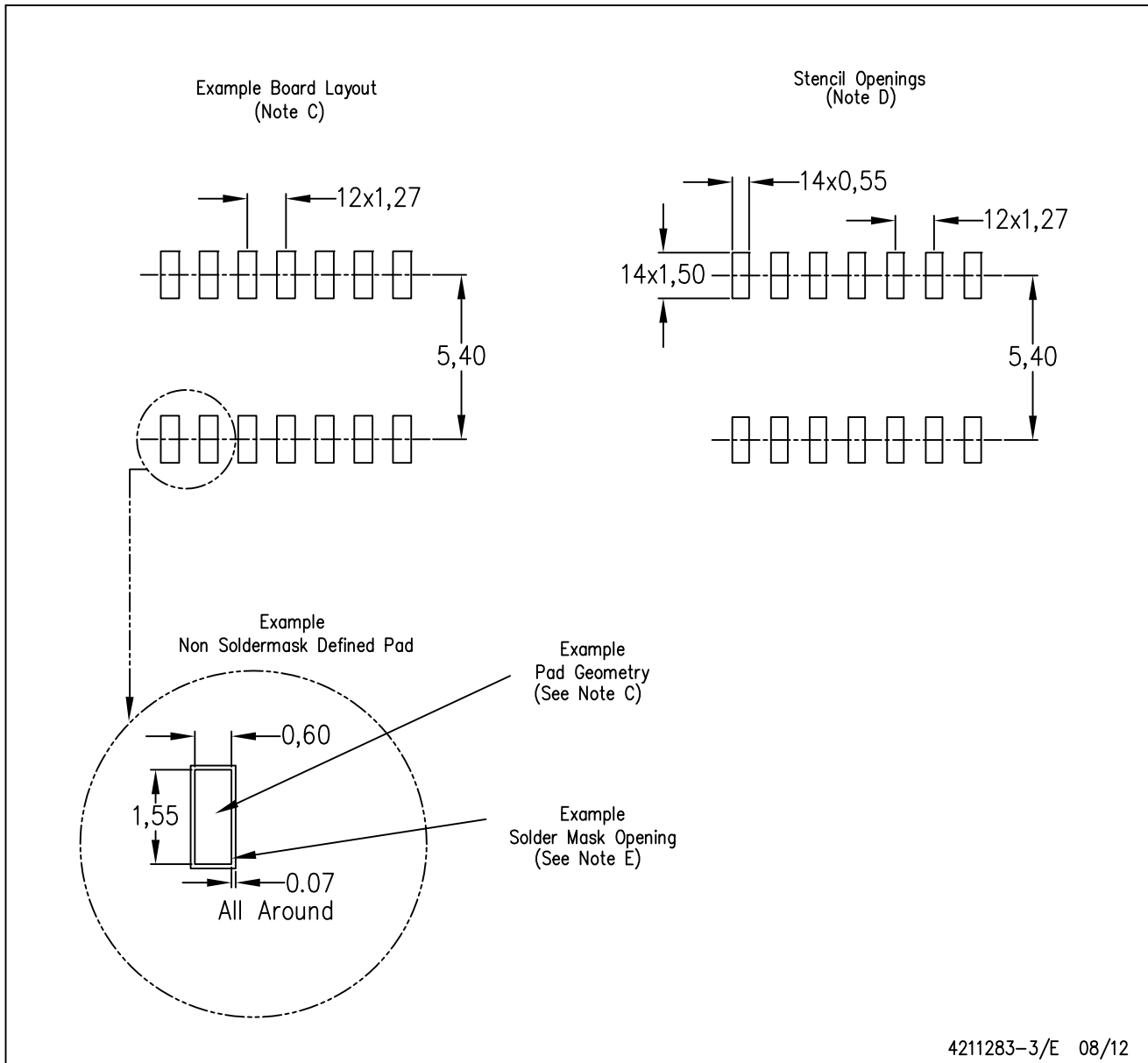
4214839/J 02/2024

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.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE

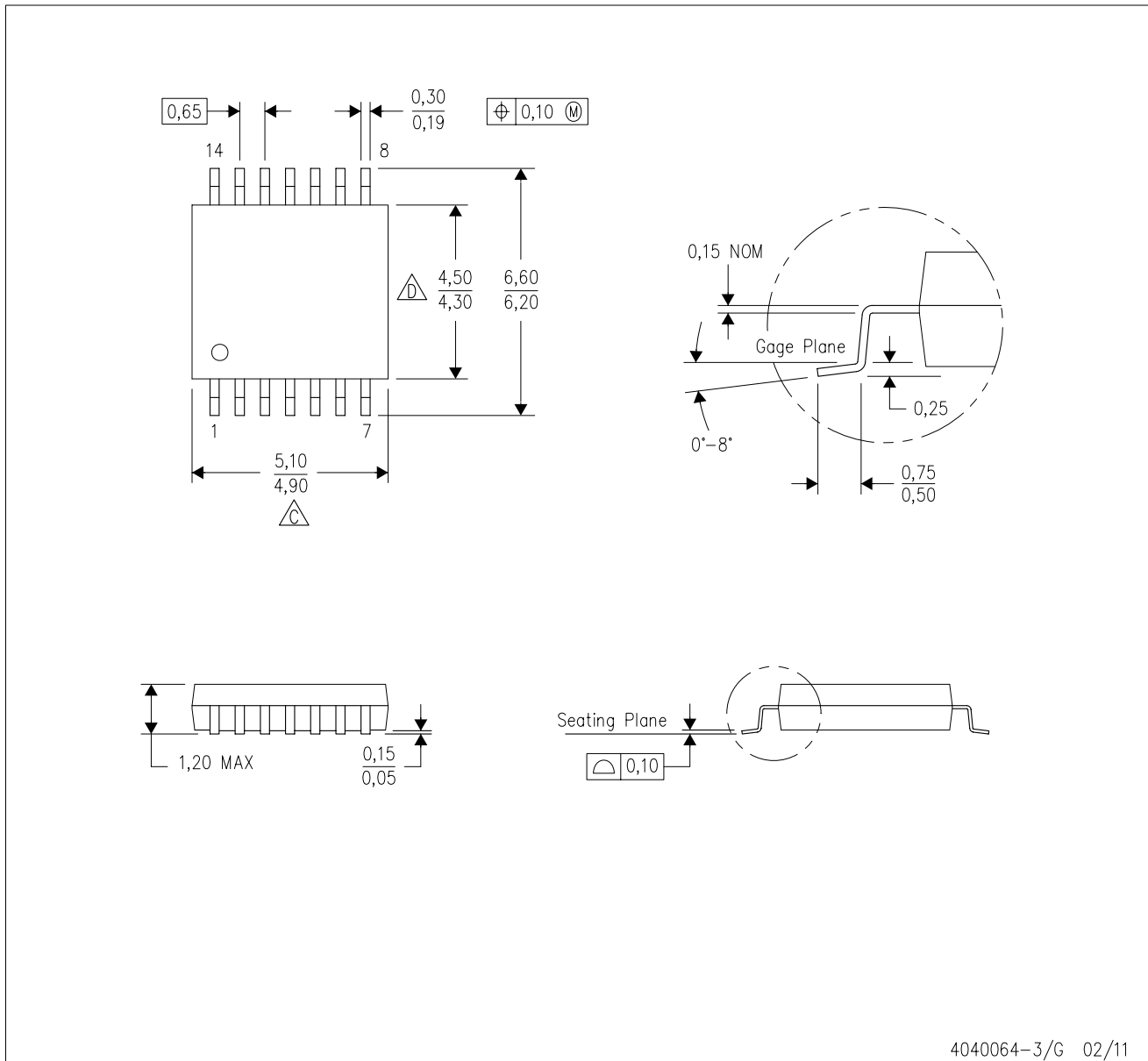


4211283-3/E 08/12

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

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
 - E. Falls within JEDEC MO-153



D0008A

PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

NOTES:

- 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.
- This drawing is subject to change without notice.
- 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.
- This dimension does not include interlead flash.
- Reference JEDEC registration MS-012, variation AA.

EXAMPLE BOARD LAYOUT

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

4214825/C 02/2019

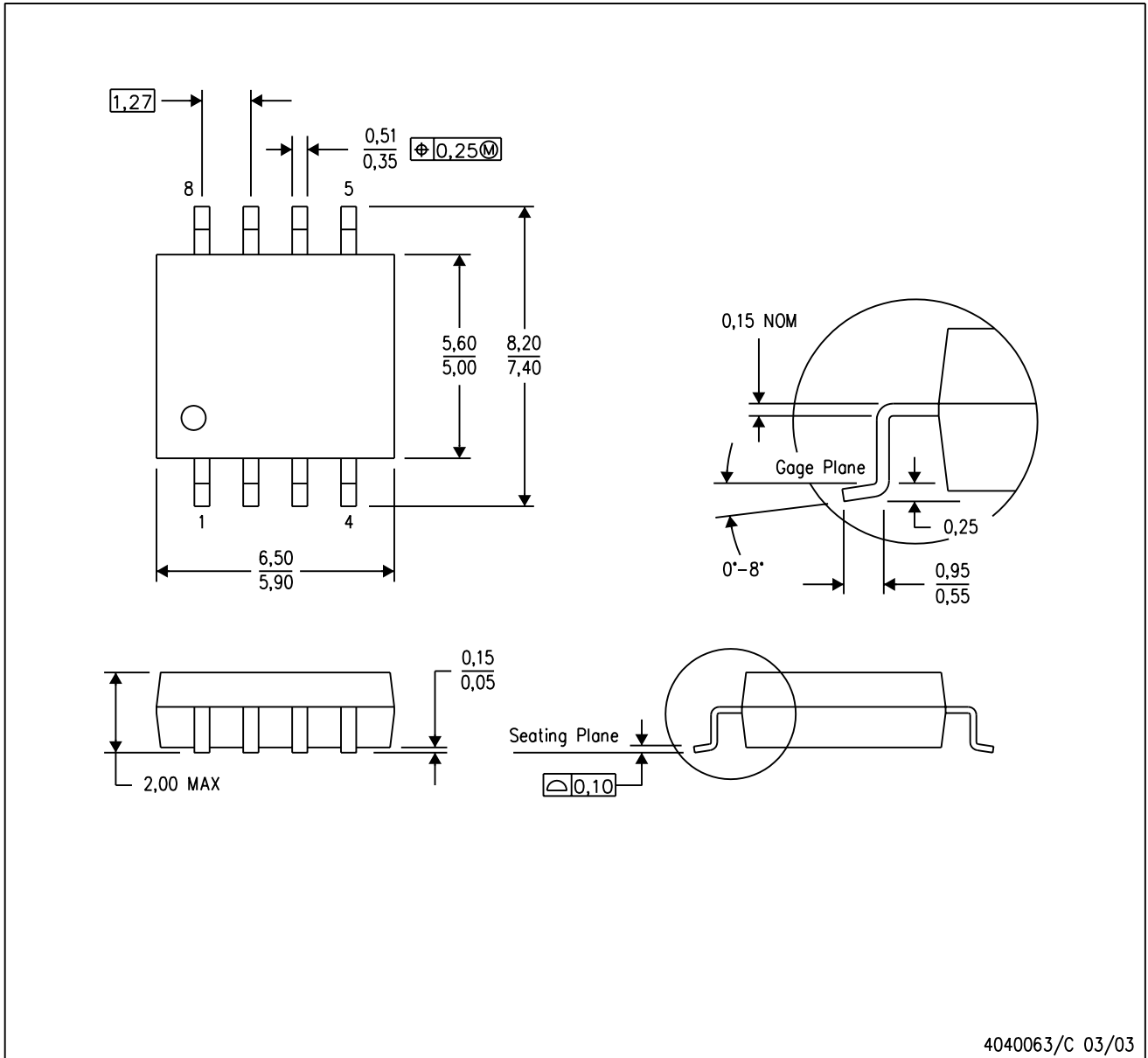
NOTES: (continued)

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

MECHANICAL DATA

PS (R-PDSO-G8)

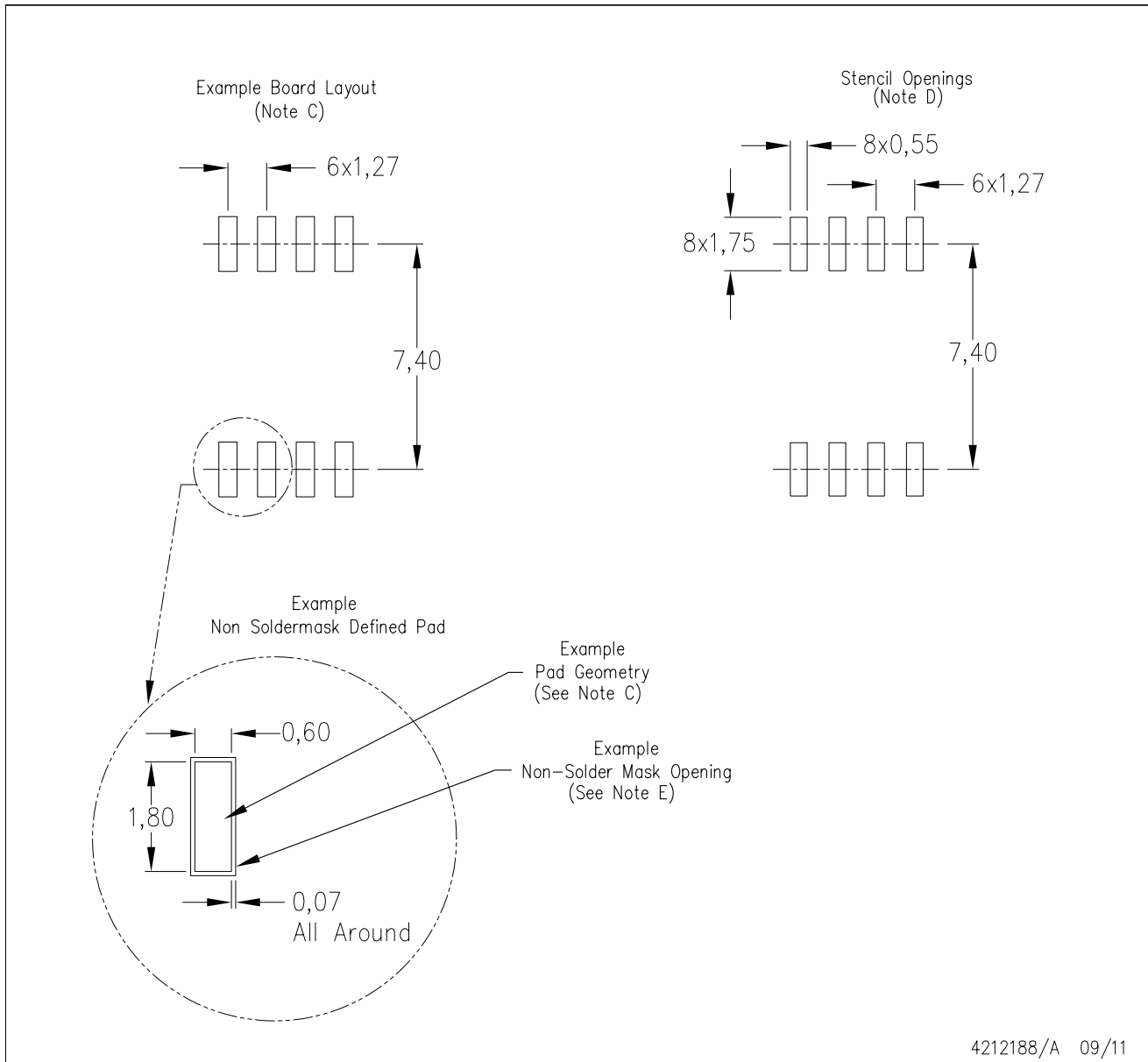
PLASTIC SMALL-OUTLINE PACKAGE



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

PS (R-PDSO-G8)

PLASTIC SMALL OUTLINE



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

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



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

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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.

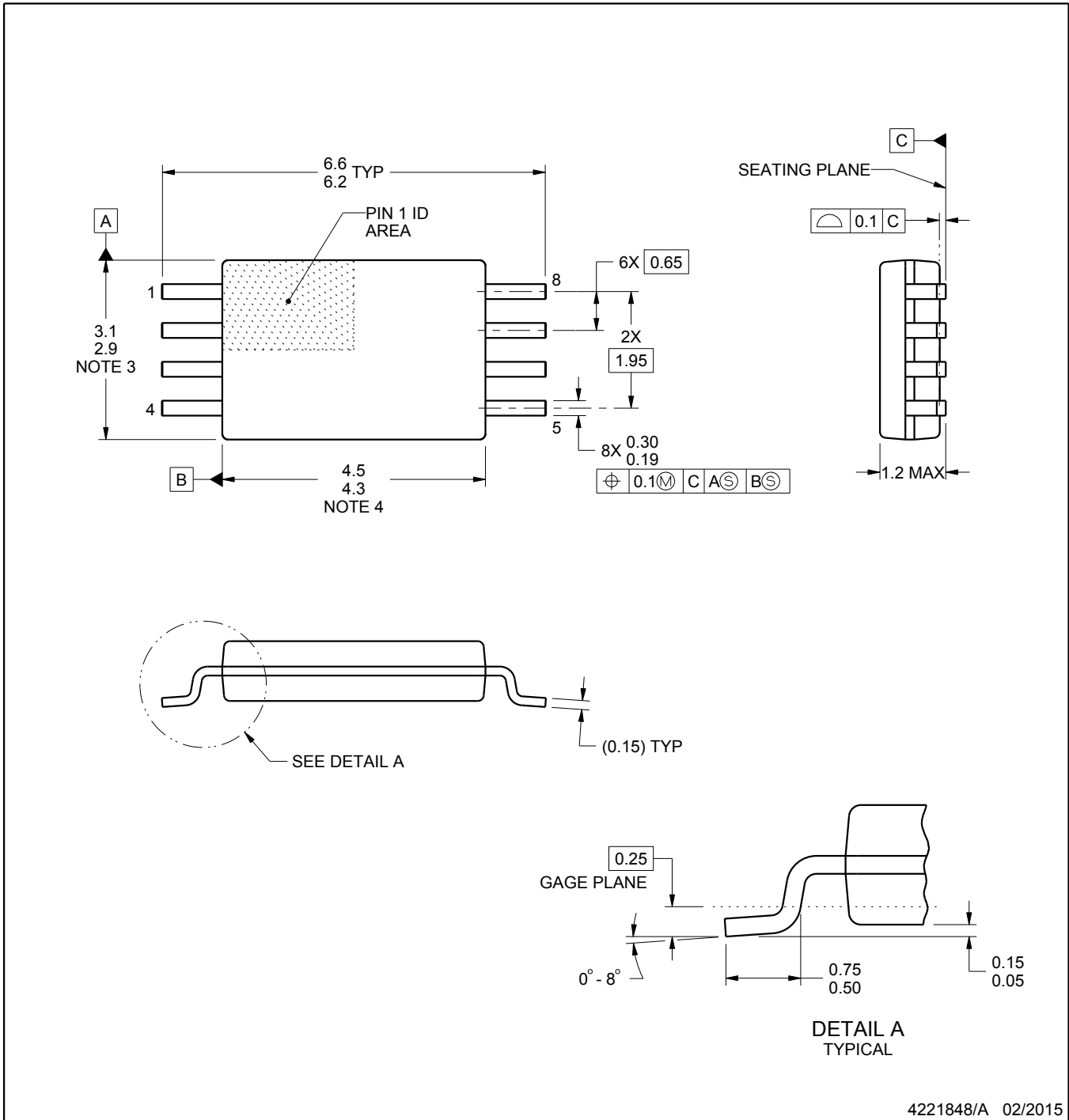
PW0008A



PACKAGE OUTLINE

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4221848/A 02/2015

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, variation AA.

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)

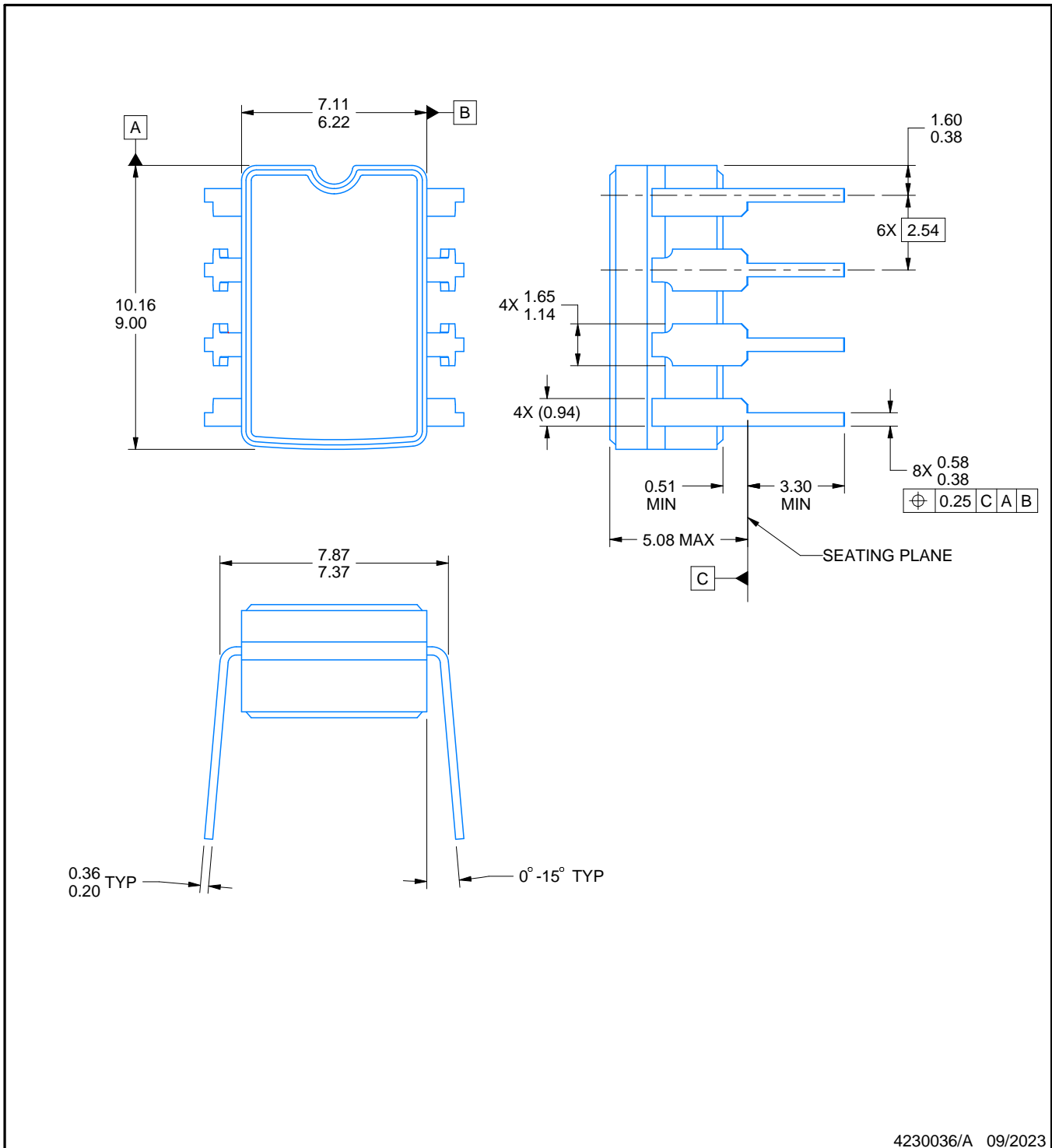
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

JG0008A

CDIP - 5.08 mm max height

CERAMIC DUAL IN-LINE PACKAGE



NOTES:

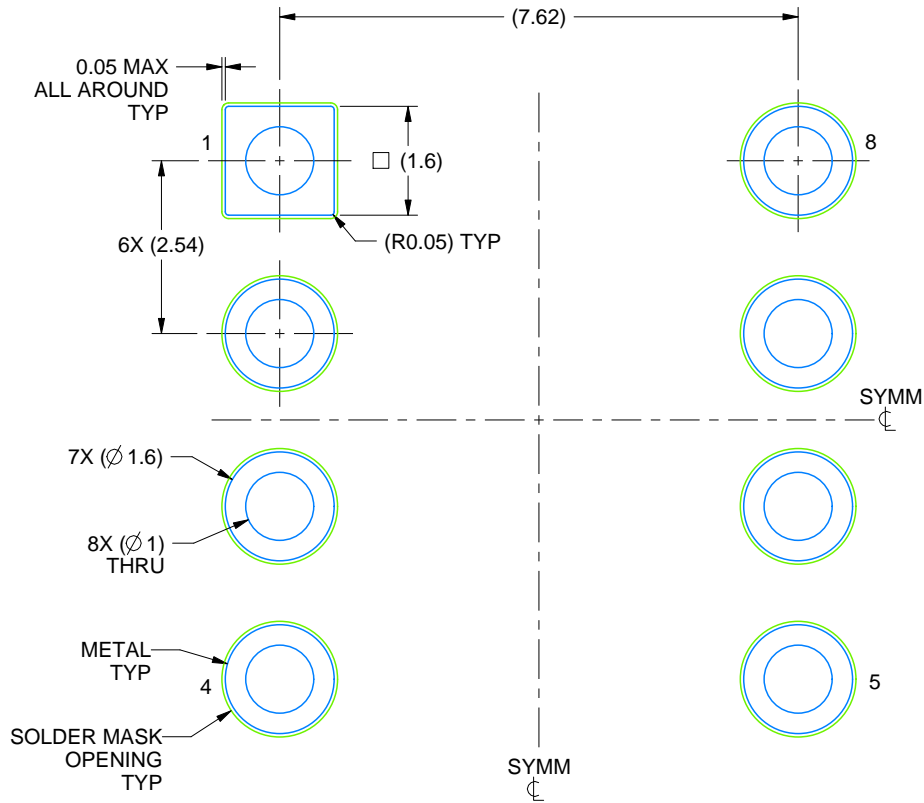
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package can be hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided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

EXAMPLE BOARD LAYOUT

JG0008A

CDIP - 5.08 mm max height

CERAMIC DUAL IN-LINE PACKAGE



LAND PATTERN EXAMPLE
NON SOLDER MASK DEFINED
SCALE: 9X

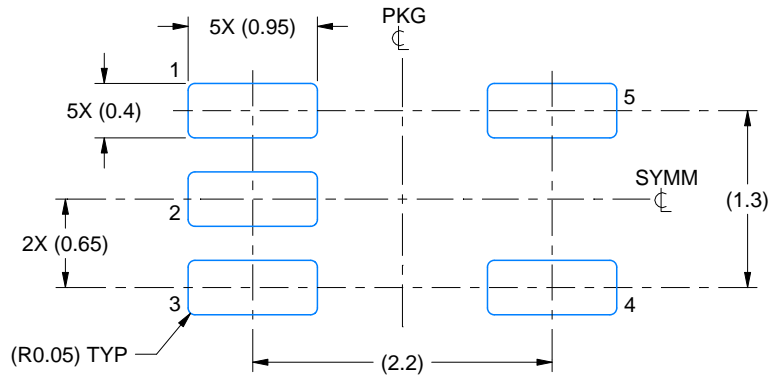
4230036/A 09/2023

EXAMPLE BOARD LAYOUT

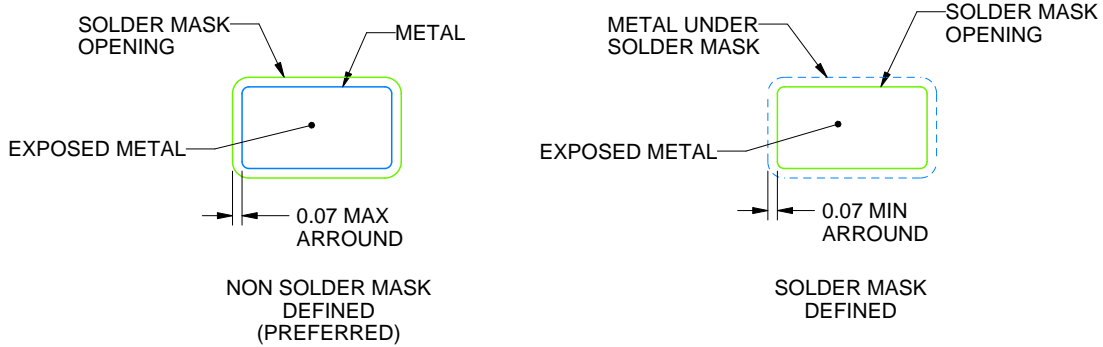
DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X



SOLDER MASK DETAILS

4214834/E 06/2024

NOTES: (continued)

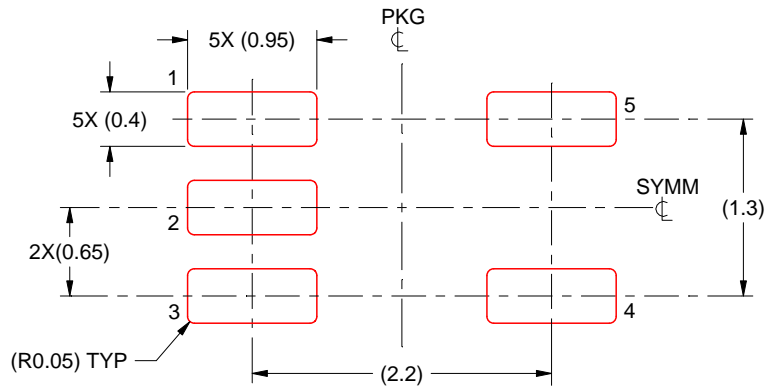
- 7. Publication IPC-7351 may have alternate designs.
- 8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE: 18X

4214834/E 06/2024

NOTES: (continued)

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