# SN54AC00-SP Radiation Hardened Quad 2 Input NAND Gate

## 1 Features

- 5962R87549:
  - Radiation hardness assurance (RHA) up to TID 100 krad (Si)
  - SEL immune to 86 MeV×cm$^2$/mg
- 5962-87549:
  - Total ionizing dose 50 krad (Si)
- 2 V to 6 V $V_{CC}$ operation
- Inputs accept voltages to 6 V
- Maximum $t_{pd}$ of 7 ns at 5 V

## 2 Applications

- Satellite payloads
- Satellite power on reset logic
- RHA known good Die (KGD) offering for space hybrids

**Pin Functions (Each Gate)**

| INPUTS | | OUTPUT |
|---|---|---|
| A | B | Y |
| H | H | L |
| L | X | H |
| X | L | H |


**Logic Diagram (Positive Logic)**

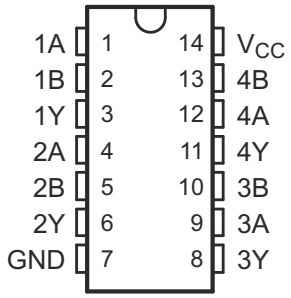
## 3 Description

The SN54AC00 device contains four independent 2-input NAND gates. Each gate performs the Boolean function of $Y = \overline{A \bullet B}$ or $Y = \overline{A} + \overline{B}$ in positive logic.

**Device Information**(1)

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|---|---|---|
| SN54AC00-SP | CDIP (14) | 5.97 mm × 9.21 mm |
| | CFP (14) | 6.67 mm × 19.56 mm |
| | KGD (0) | Not applicable |

(1) For all available packages, see the orderable addendum at the end of the data sheet.




**J or W Package**
**(Top View)**

# Table of Contents



## 4 Revision History

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

**Changes from Revision B (October 2015) to Revision C (April 2022)** **Page**

- Updated the numbering format for tables, figures, and cross-references throughout the document....1
- Removed *SEU* from the *Features* section....1
- Changed *SEL* immune to 86 MeV×cm$^2$/mg....1

**Changes from Revision A (December 2013) to Revision B (February 2015)** **Page**

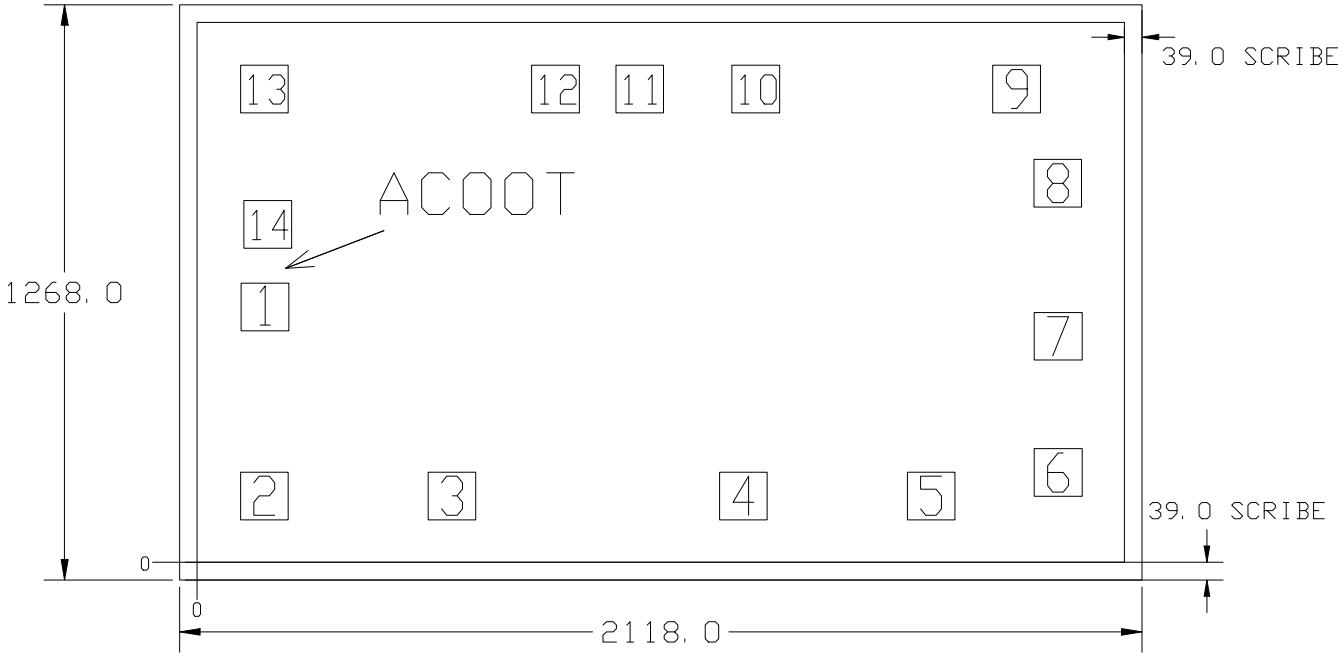
- Added KGD package information....1
- Added *Device and Documentation Support* section and *Mechanical, Packaging, and Orderable Information* section....1
- Added *Bare Die Information*, image, and *Bond Pad Coordinates in Microns*....3
- Added parameter information for KGD to *Section 6.5* and *Section 6.6*....6

**Changes from Revision * (October 2008) to Revision A (December 2013)** **Page**

- Changed *Features* bullets....1
- Deleted *Ordering Information* table....1

## 5 Bare Die Information

| DIE THICKNESS | BACKSIDE FINISH | BACKSIDE POTENTIAL | BOND PAD METALLIZATION COMPOSITION | BOND PAD THICKNESS |
|---|---|---|---|---|
| 15 mils | Silicon with backgrind | Floating | TiW/AlCu2 | 15800 nm |




**Bond Pad Coordinates in Microns**

| DESCRIPTION | PAD NUMBER | X MIN | Y MIN | X MAX | Y MAX |
|---|---|---|---|---|---|
| 1A | 1 | 96.3 | 510.5 | 201.3 | 615.5 |
| 1B | 2 | 95 | 94 | 200 | 199 |
| 1Y | 3 | 508 | 94 | 613 | 199 |
| 2A | 4 | 1149 | 94 | 1254 | 199 |
| 2B | 5 | 1562 | 94 | 1667 | 199 |
| 2Y | 6 | 1841.5 | 145.5 | 1946.5 | 250.5 |
| GND | 7 | 1841.5 | 445.5 | 1946.5 | 550.5 |
| 3Y | 8 | 1841 | 783 | 1946 | 888 |
| 3A | 9 | 1750.5 | 991 | 1855.5 | 1096 |
| 3B | 10 | 1176.5 | 991 | 1281.5 | 1096 |
| 4Y | 11 | 921 | 991 | 1026 | 1096 |
| 4A | 12 | 736 | 991 | 841 | 1096 |
| 4B | 13 | 95 | 991 | 200 | 1096 |
| VCC | 14 | 102.5 | 692 | 207.5 | 797 |

# 6 Specifications

## 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | –0.5 | 7 | V |
| $V_I$ | Input voltage(2) | | –0.5 | $V_{CC}$ + 0.5 | V |
| $V_O$ | Output voltage(2) | | –0.5 | $V_{CC}$ + 0.5 | V |
| $I_{IK}$ | Input clamp current | $V_I$ < 0 or $V_I$ > $V_{CC}$ | | ±20 | mA |
| $I_{OK}$ | Output clamp current | $V_O$ < 0 or $V_O$ > $V_{CC}$ | | ±20 | mA |
| $I_O$ | Continuous output current | $V_O$ = 0 to $V_{CC}$ | | ±50 | mA |
| | Continuous current through $V_{CC}$ or GND | | | ±200 | mA |
| $T_J$ | Junction temperature | | | 150 | °C |
| $T_{stg}$ | Storage temperature | | –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) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## 6.2 Recommended Operating Conditions

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 2 | 6 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 3 V | 2.1 | | V |
| | | $V_{CC}$ = 4.5 V | 3.15 | | |
| | | $V_{CC}$ = 5.5 V | 3.85 | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 3 V | | 0.9 | V |
| | | $V_{CC}$ = 4.5 V | | 1.35 | |
| | | $V_{CC}$ = 5.5 V | | 1.65 | |
| $V_I$ | Input voltage | | 0 | $V_{CC}$ | V |
| $V_O$ | Output voltage | | 0 | $V_{CC}$ | V |
| $I_{OH}$ | High-level output current | $V_{CC}$ = 3 V | | 12 | mA |
| | | $V_{CC}$ = 4.5 V | | 24 | |
| | | $V_{CC}$ = 5.5 V | | 24 | |
| $I_{OL}$ | Low-level output current | $V_{CC}$ = 3 V | | 12 | mA |
| | | $V_{CC}$ = 4.5 V | | 24 | |
| | | $V_{CC}$ = 5.5 V | | 24 | |
| Δt/Δv | Input transition rise or fall rate | | | 8 | ns/V |
| $T_A$ | Operating free-air temperature | | –55 | 125 | °C |

## 6.3 Thermal Information

| THERMAL METRIC[1] [2] | | SN54AC00-SP | | UNIT |
|---|---|---|---|---|
| | | J | W | |
| | | 14 PINS | 14 PINS | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 83.1 | 125.4 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 26.6 | 30.85 | |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 47.9 | 43.4 | |
| $\psi_{JT}$ | Junction-to-top characterization parameter | N/A | N/A | |
| $\psi_{JB}$ | Junction-to-board characterization parameter | N/A | N/A | |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | N/A | N/A | |

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.
(2) The package thermal impedance is calculated in accordance with JESD 51-7 and Mil Std 883 method 1012.1 (see www.JEDEC.org).

## 6.4 Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | $V_{CC}$ | $T_A$ = 25°C | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | | |
| $V_{OH}$ | $I_{OH}$ = –50 µA | 3 V | 2.9 | | | 2.9 | | V |
| | | 4.5 V | 4.4 | | | 4.4 | | |
| | | 5.5 V | 5.4 | | | 5.4 | | |
| | $I_{OH}$ = –12 mA | 3 V | 2.56 | | | 2.4 | | |
| | $I_{OH}$ = –24 mA | 4.5 V | 3.86 | | | 3.7 | | |
| | | 5.5 V | 4.86 | | | 4.7 | | |
| | $I_{OH}$ = –50 mA[1] | 5.5 V | | | | 3.85 | | |
| $V_{OL}$ | $I_{OL}$ = 50 µA | 3 V | | | 0.1 | | 0.1 | V |
| | | 4.5 V | | | 0.1 | | 0.1 | |
| | | 5.5 V | | | 0.1 | | 0.1 | |
| | $I_{OL}$ = 12 mA | 3 V | | | 0.36 | | 0.5 | |
| | $I_{OL}$ = 24 mA | 4.5 V | | | 0.36 | | 0.5 | |
| | | 5.5 V | | | 0.36 | | 0.5 | |
| | $I_{OL}$ = 50 mA[1] | 5.5 V | | | | | 1.65 | |
| $I_I$ | $V_I$ = $V_{CC}$ or GND | 5.5 V | | | ±0.1 | | ±1 | µA |
| $I_{CC}$ | $V_I$ = $V_{CC}$ or GND, $I_O$ = 0 | 5.5 V | | | 4 | | 40 | µA |
| $C_i$ | $V_I$ = $V_{CC}$ or GND | 5 V | | 2.6 | | | | pF |

(1) Not more than one output should be tested at a time, and the duration of the test should not exceed 2 ms.

## 6.5 Switching Characteristics, $V_{CC}$ = 3.3 V

over recommended operating free-air temperature range, $V_{CC}$ = 3.3 V ±0.3 V (unless otherwise noted) (see Figure 7-1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $T_A$ = 25°C | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | | |
| $t_{PLH}$ | A or B | Y | 2 | 7 | 9.5 | 1 | 11 | ns |
| $t_{PHL}$ | | | 1.5 | 5.5 | 8 | 1 | 9 | |
| $t_{PLH}$ (KGD only)(1) | A or B | Y | 1 | 7 | 9.5 | 1 | 11 | ns |
| $t_{PHL}$ (KGD only)(1) | | | 1 | 5.5 | 9.5 | 1 | 11 | |

(1) Specification limits for KGD are based on SMD 5962-8754903

## 6.6 Switching Characteristics, $V_{CC}$ = 5 V

over recommended operating free-air temperature range, $V_{CC}$ = 5 V ±0.5 V (unless otherwise noted) (see Figure 7-1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $T_A$ = 25°C | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | | |
| $t_{PLH}$ | A or B | Y | 1.5 | 6 | 8 | 1 | 8.5 | ns |
| $t_{PHL}$ | | | 1.5 | 4.5 | 6.5 | 1 | 7 | |
| $t_{PLH}$ (KGD only)(1) | A or B | Y | 1.5 | 6 | 8 | 1 | 8.5 | ns |
| $t_{PHL}$ (KGD only)(1) | | | 1.5 | 4.5 | 8 | 1 | 8.5 | |

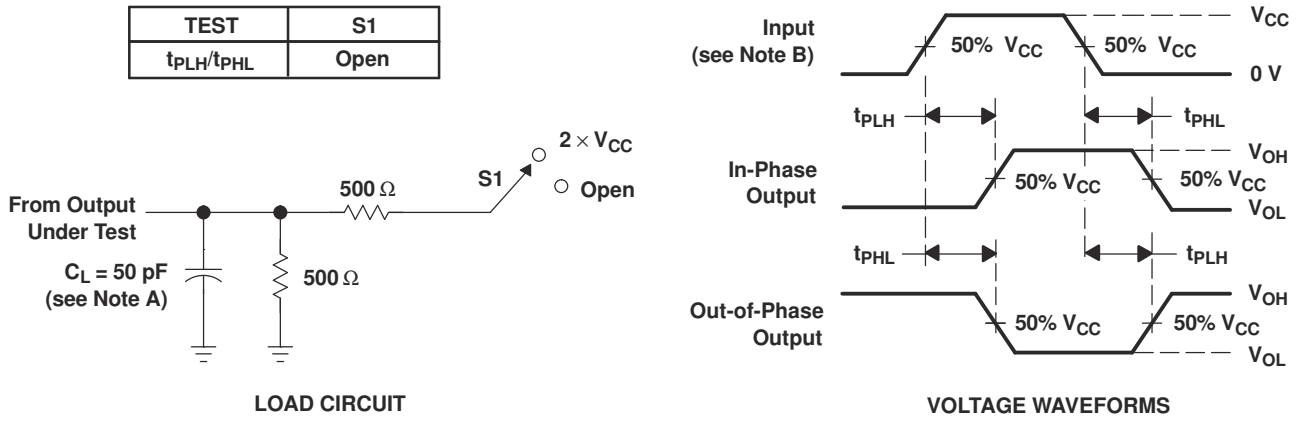
(1) Specification limits for KGD are based on SMD 5962-8754903

## 6.7 Operating Characteristics

$V_{CC}$ = 5 V, $T_A$ = 25°C

| PARAMETER | | TEST CONDITIONS | TYP | UNIT |
|---|---|---|---|---|
| $C_{pd}$ | Power dissipation capacitance | $C_L$ = 50 pF, $f$ = 1 MHz | 40 | pF |

# 7 Parameter Measurement Information




NOTES: A. $C_L$ includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $Z_O$ = 50 Ω, $t_r$ ≤ 2.5 ns, $t_f$ ≤ 2.5 ns.
C. The outputs are measured one at a time with one input transition per measurement.

**Figure 7-1. Load Circuit and Voltage Waveforms**

# 8 Device and Documentation Support

## 8.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Subscribe to updates* 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.

## 8.2 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.

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## 8.4 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.

## 8.5 Glossary

| | |
|---|---|
| TI Glossary | This glossary lists and explains terms, acronyms, and definitions. |

# 9 Mechanical, Packaging, and Orderable Information

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

## PACKAGING INFORMATION

| Orderable part number | Status (1) | Material type (2) | Package \| Pins | Package qty \| Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|---|---|---|---|---|---|---|---|---|---|
| 5962-8754903VCA | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-8754903VC A SNV54AC00J |
| 5962-8754903VCA.A | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-8754903VC A SNV54AC00J |
| 5962-8754903VDA | Active | Production | CFP (W) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-8754903VD A SNV54AC00W |
| 5962-8754903VDA.A | Active | Production | CFP (W) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962-8754903VD A SNV54AC00W |
| 5962R8754903V9A | Active | Production | XCEPT (KGD) \| 0 | 95 \| JEDEC TRAY (5+1) | Yes | Call TI | N/A for Pkg Type | -55 to 125 | |
| 5962R8754903V9A.A | Active | Production | XCEPT (KGD) \| 0 | 95 \| JEDEC TRAY (5+1) | Yes | Call TI | N/A for Pkg Type | -55 to 125 | |
| 5962R8754903VCA | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962R8754903VC A SNVR54AC00J |
| 5962R8754903VCA.A | Active | Production | CDIP (J) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962R8754903VC A SNVR54AC00J |
| 5962R8754903VDA | Active | Production | CFP (W) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962R8754903VD A SNVR54AC00W |
| 5962R8754903VDA.A | Active | Production | CFP (W) \| 14 | 25 \| TUBE | No | SNPB | N/A for Pkg Type | -55 to 125 | 5962R8754903VD A SNVR54AC00W |

(1) **Status:** For more details on status, see our product life cycle.

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

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

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

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

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

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



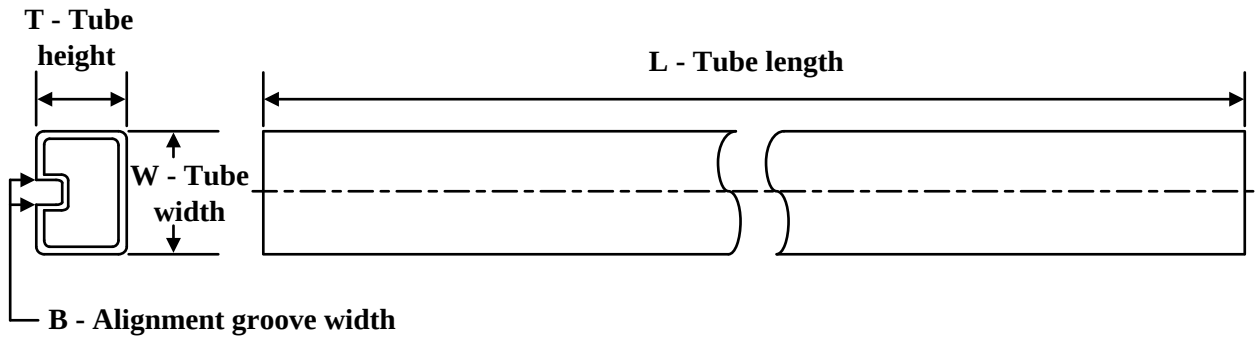
**OTHER QUALIFIED VERSIONS OF SN54AC00-SP :**

- Catalog : SN54AC00

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

## TUBE



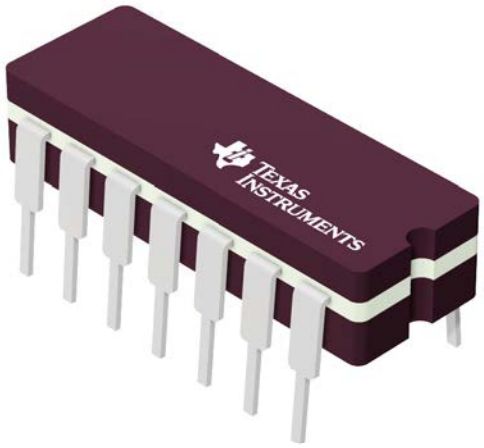

*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (µm) | B (mm) |
|---|---|---|---|---|---|---|---|---|
| 5962-8754903VDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| 5962-8754903VDA.A | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| 5962R8754903VCA | J | CDIP | 14 | 25 | 506.98 | 15.24 | 13440 | NA |
| 5962R8754903VCA.A | J | CDIP | 14 | 25 | 506.98 | 15.24 | 13440 | NA |
| 5962R8754903VDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| 5962R8754903VDA.A | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |

# GENERIC PACKAGE VIEW

## J 14 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.

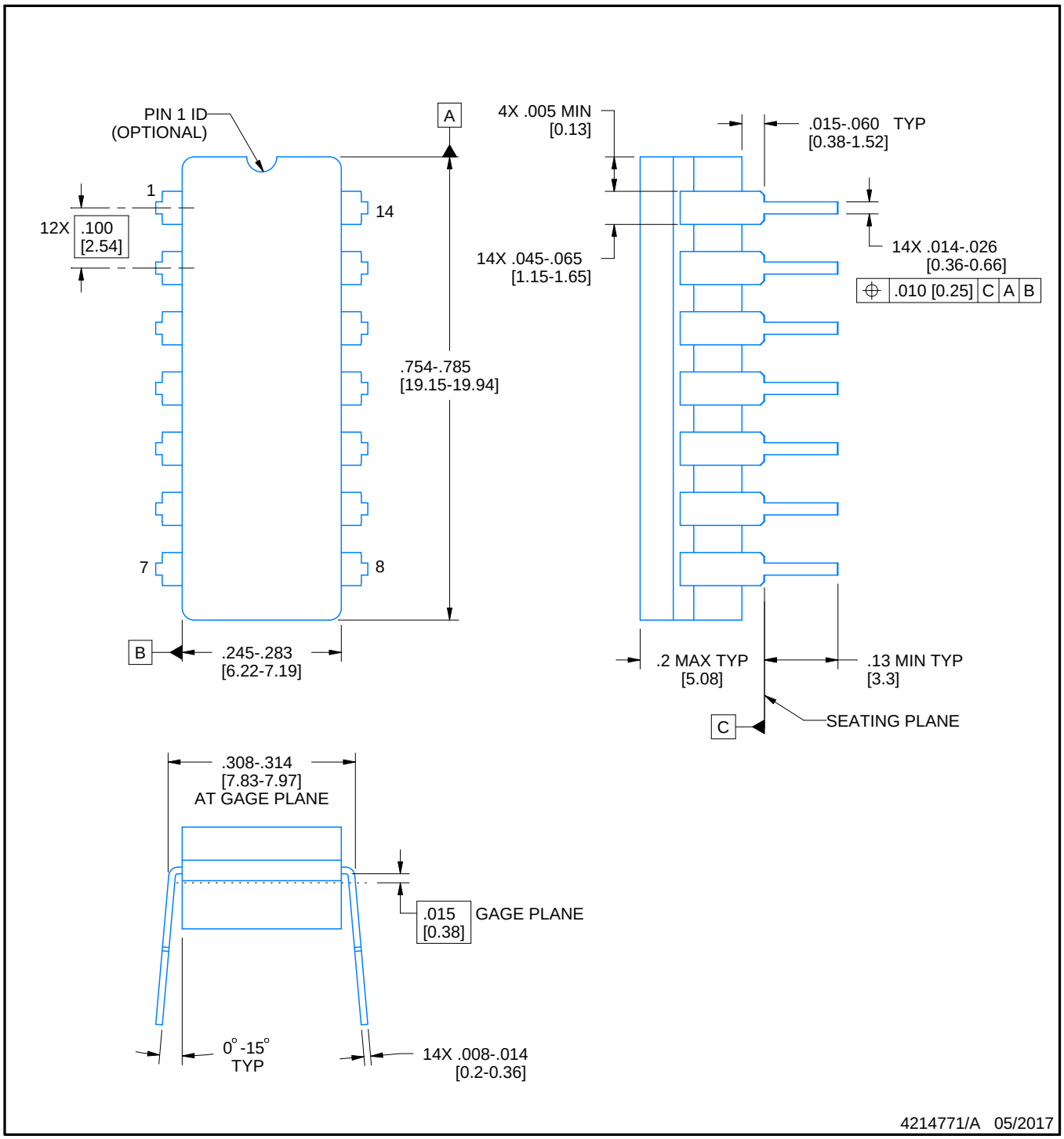
4040083-5/G

# PACKAGE OUTLINE

## J0014A

## CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE




NOTES:

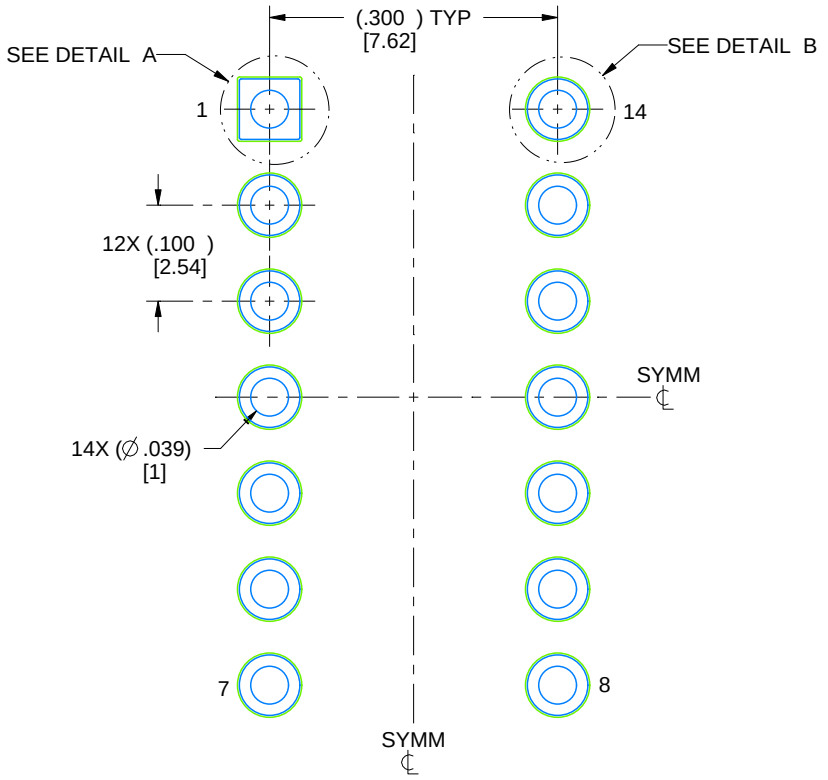
1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermitically sealed with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

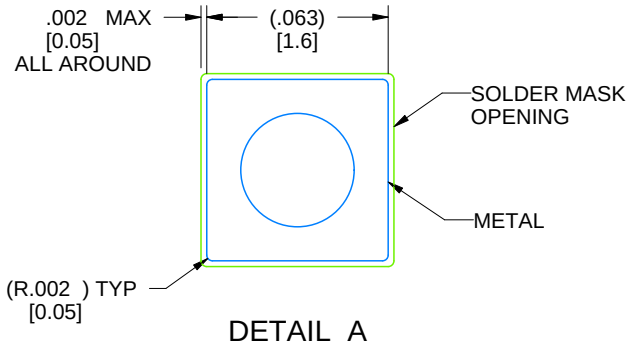
## J0014A

## CDIP - 5.08 mm max height

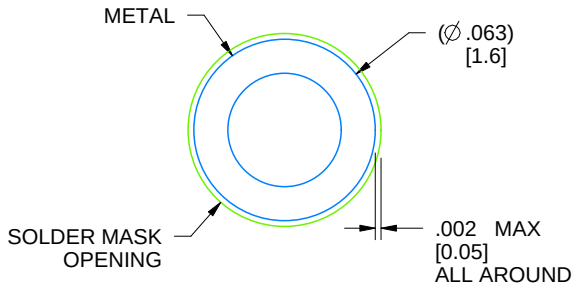
CERAMIC DUAL IN LINE PACKAGE




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



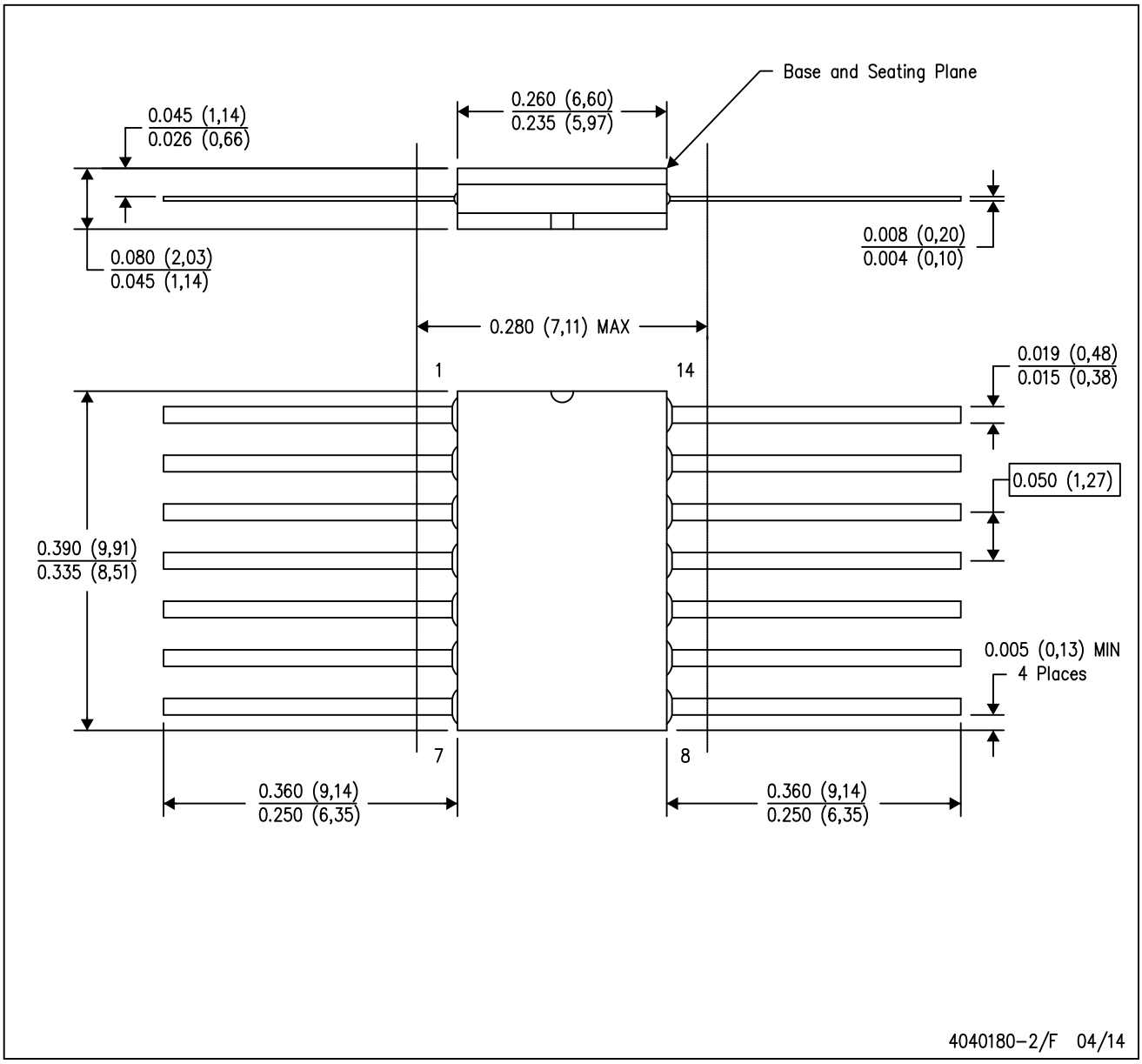

DETAIL A
SCALE: 15X




DETAIL B
13X, SCALE: 15X

4214771/A 05/2017

W (R–GDFP–F14) CERAMIC DUAL FLATPACK




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

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