

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×cm²/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 Y |
|--------|---|-------------|
| A | B | |
| H | H | L |
| L | X | H |
| X | L | H |



Logic Diagram (Positive Logic)

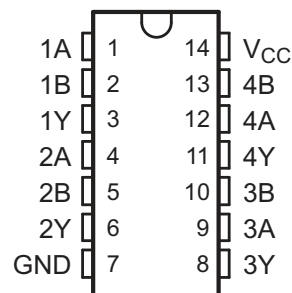
3 Description

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

| | | | |
|--|---|---|---|
| 1 Features | 1 | 6.6 Switching Characteristics, $V_{CC} = 5\text{ V}$ | 6 |
| 2 Applications | 1 | 6.7 Operating Characteristics..... | 6 |
| 3 Description | 1 | 7 Parameter Measurement Information | 7 |
| 4 Revision History | 2 | 8 Device and Documentation Support | 8 |
| 5 Bare Die Information | 3 | 8.1 Receiving Notification of Documentation Updates..... | 8 |
| 6 Specifications | 4 | 8.2 Support Resources..... | 8 |
| 6.1 Absolute Maximum Ratings..... | 4 | 8.3 Trademarks..... | 8 |
| 6.2 Recommended Operating Conditions..... | 4 | 8.4 Electrostatic Discharge Caution..... | 8 |
| 6.3 Thermal Information..... | 5 | 8.5 Glossary..... | 8 |
| 6.4 Electrical Characteristics..... | 5 | 9 Mechanical, Packaging, and Orderable Information | 8 |
| 6.5 Switching Characteristics, $V_{CC} = 3.3\text{ V}$ | 6 | | |

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 <i>SEU</i> from the <i>Features</i> section..... | 1 |
| • Changed <i>SEL</i> immune to 86 MeV \times cm ² /mg..... | 1 |

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

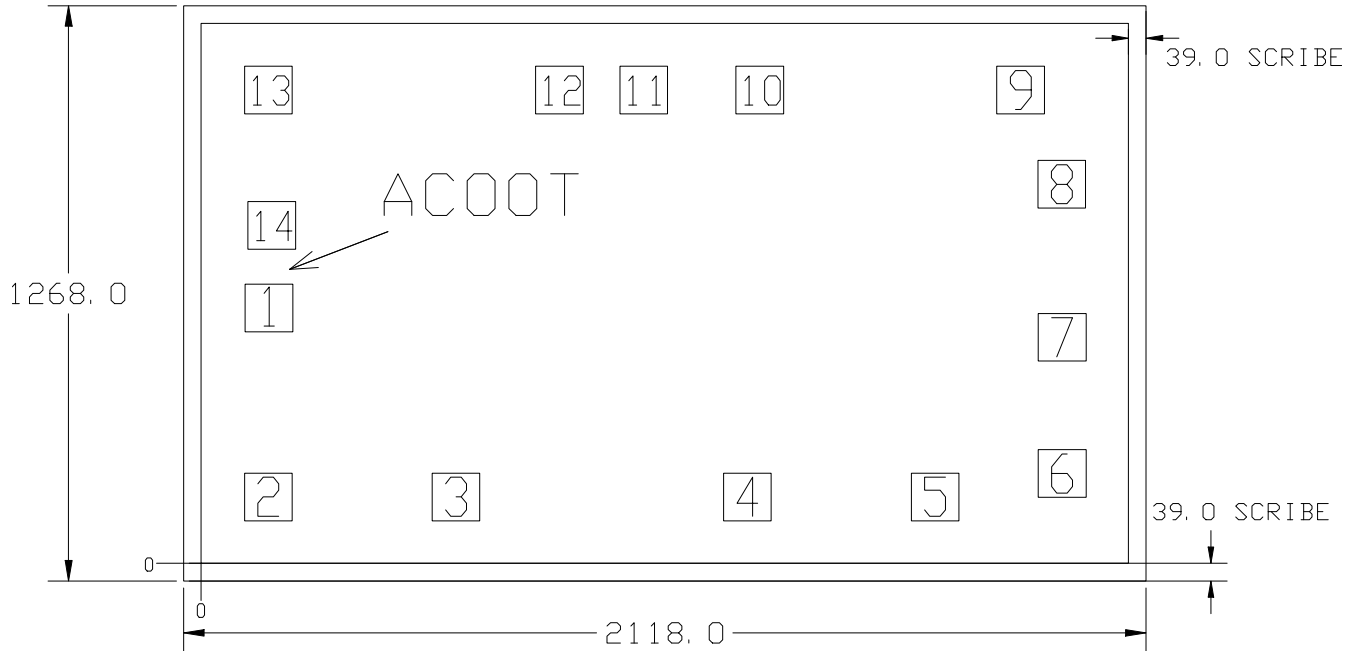
| | |
|---|---|
| • Added KGD package information | 1 |
| • Added <i>Device and Documentation Support</i> section and <i>Mechanical, Packaging, and Orderable Information</i> section | 1 |
| • Added <i>Bare Die Information</i> , image, and <i>Bond Pad Coordinates in Microns</i> | 3 |
| • Added parameter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

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

| | |
|--|---|
| • Changed <i>Features</i> bullets..... | 1 |
| • Deleted <i>Ordering Information</i> 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 _{θJA} | Junction-to-ambient thermal resistance | 83.1 | 125.4 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 26.6 | 30.85 | |
| R _{θJB} | Junction-to-board thermal resistance | 47.9 | 43.4 | |
| ψ _{JT} | Junction-to-top characterization parameter | N/A | N/A | |
| ψ _{JB} | Junction-to-board characterization parameter | N/A | N/A | |
| R _{θJC(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 | | |
| | | 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 | | |
| | | 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, $V_{CC} = 3.3\text{ V}$

over recommended operating free-air temperature range, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see [Figure 7-1](#))

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $T_A = 25^\circ\text{C}$ | | | 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, $V_{CC} = 5\text{ V}$

over recommended operating free-air temperature range, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see [Figure 7-1](#))

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $T_A = 25^\circ\text{C}$ | | | 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 | |

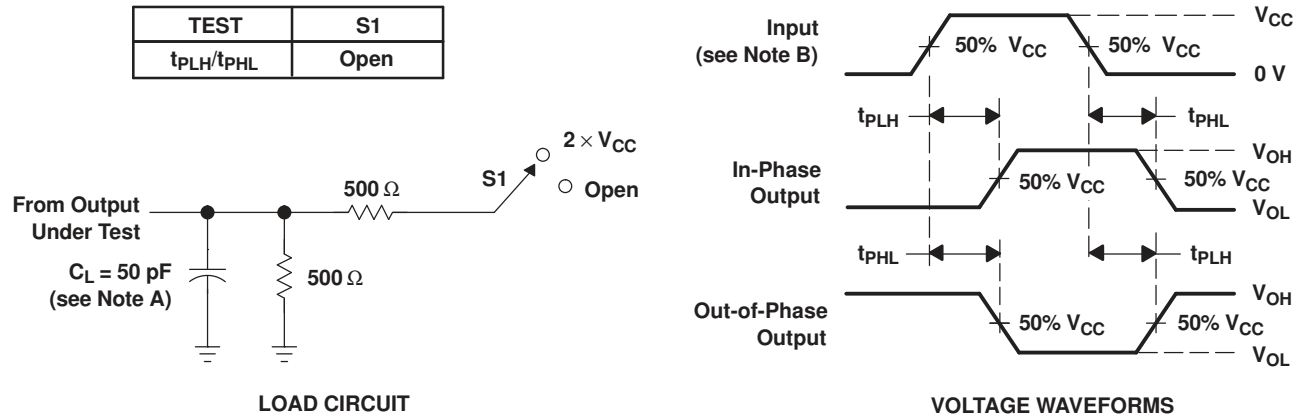
(1) Specification limits for KGD are based on SMD 5962-8754903

6.7 Operating Characteristics

$V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|--|---|-----|------|
| C_{pd} Power dissipation capacitance | $C_L = 50\text{ pF}$, $f = 1\text{ MHz}$ | 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: $PRR \leq 1\ \text{MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 2.5\ \text{ns}$, $t_f \leq 2.5\ \text{ns}$.
 - 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.

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](#).

8.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

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 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 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|------------------------------------|-------------------------|
| 5962-8754903VCA | ACTIVE | CDIP | J | 14 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-8754903VC A SNV54AC00J | Samples |
| 5962-8754903VDA | ACTIVE | CFP | W | 14 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-8754903VD A SNV54AC00W | Samples |
| 5962R8754903V9A | ACTIVE | XCEPT | KGD | 0 | 95 | RoHS & Green | Call TI | N / A for Pkg Type | -55 to 125 | | Samples |
| 5962R8754903VCA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962R8754903VC A SNVR54AC00J | Samples |
| 5962R8754903VDA | ACTIVE | CFP | W | 14 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962R8754903VD A SNVR54AC00W | 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 SN54AC00-SP :

- Catalog : [SN54AC00](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

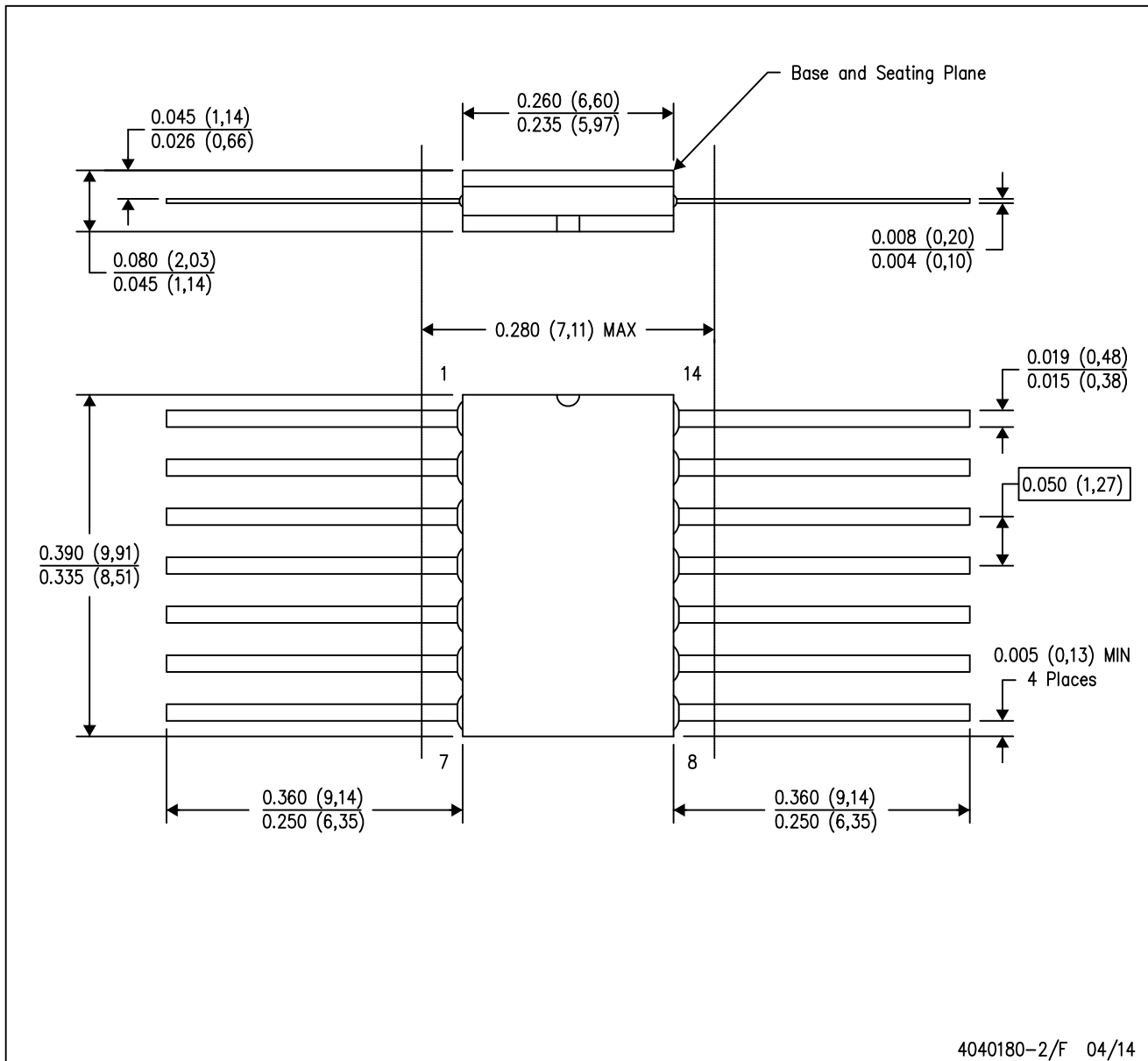
TUBE


*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-----------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-8754903VDA | W | CFP | 14 | 1 | 506.98 | 26.16 | 6220 | NA |
| 5962R8754903VCA | J | CDIP | 14 | 25 | 506.98 | 15.24 | 13440 | NA |
| 5962R8754903VDA | W | CFP | 14 | 1 | 506.98 | 26.16 | 6220 | NA |

W (R-GDFP-F14)

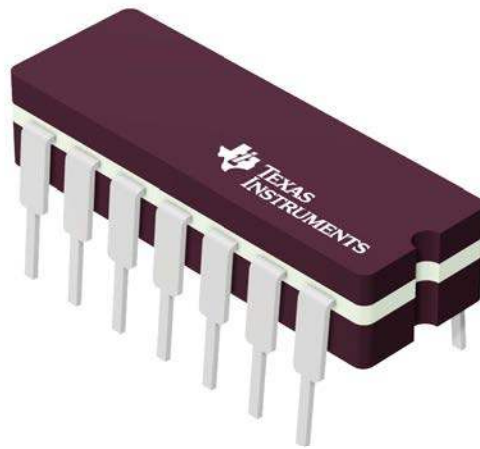
CERAMIC DUAL FLATPACK



- 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

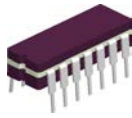
J 14

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

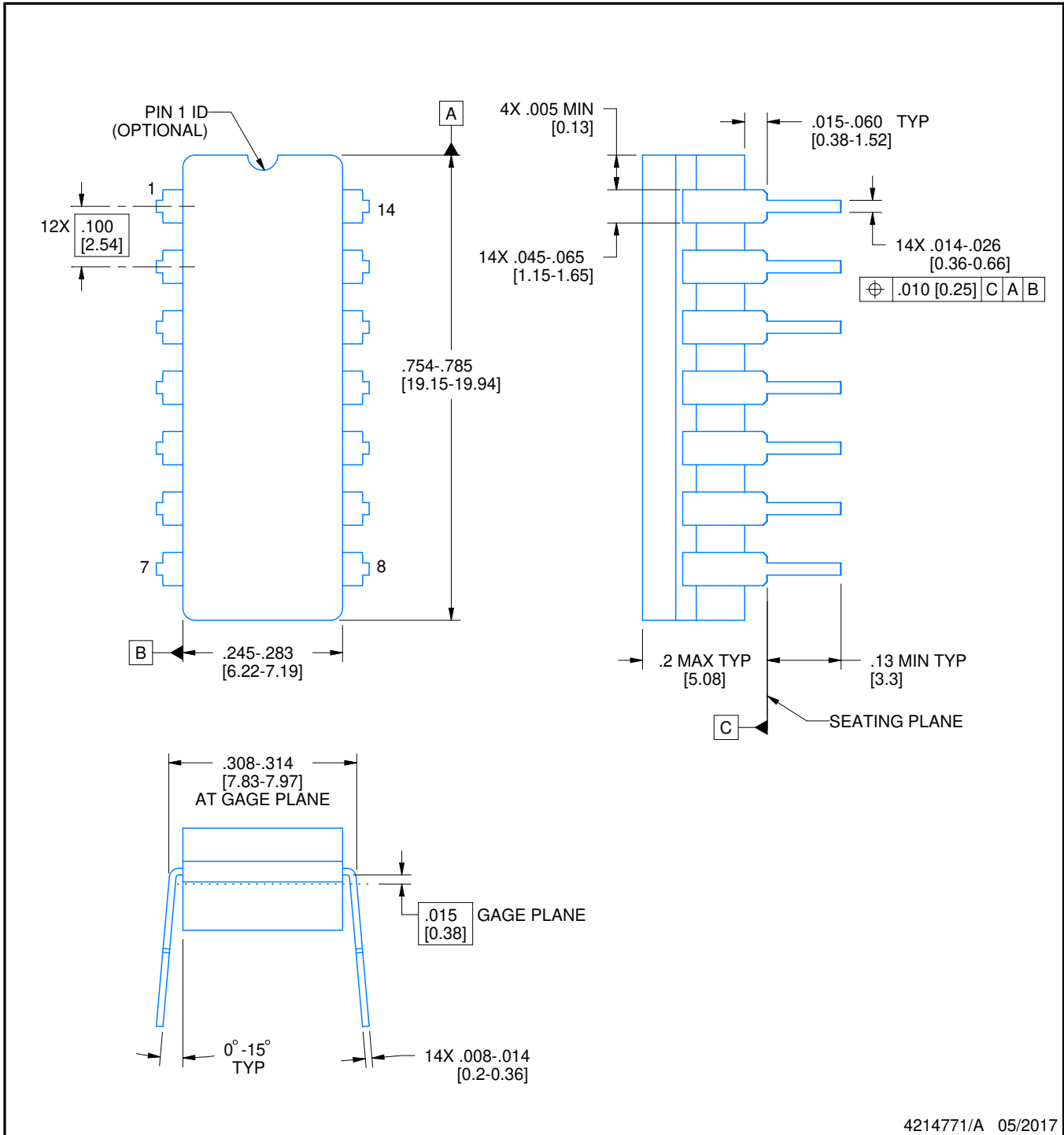


J0014A

PACKAGE OUTLINE

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

NOTES:

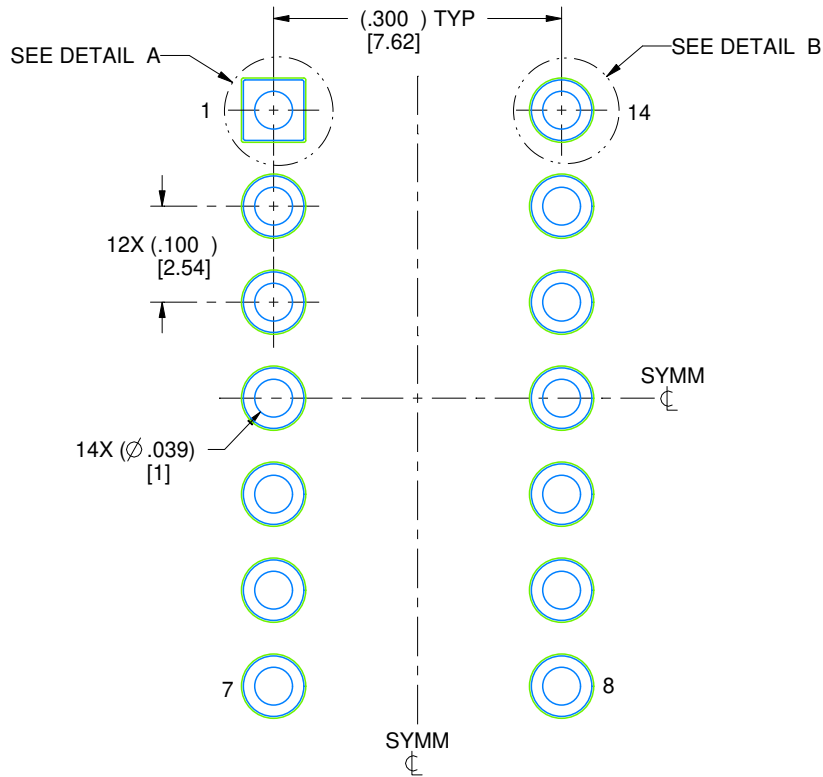
1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with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

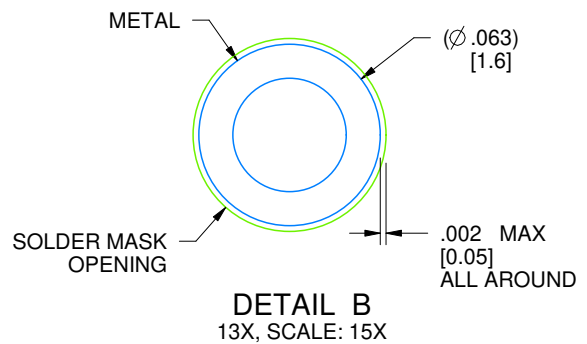
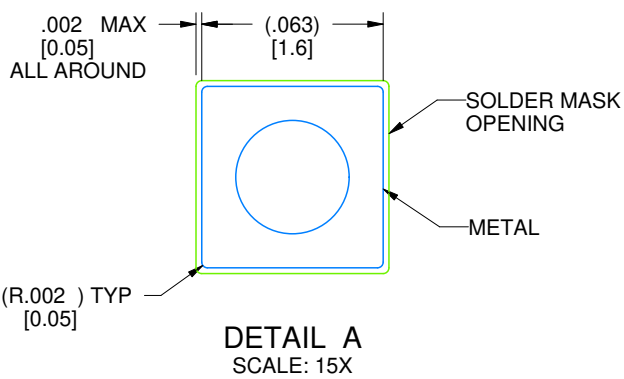
J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



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



4214771/A 05/2017

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2022, Texas Instruments Incorporated