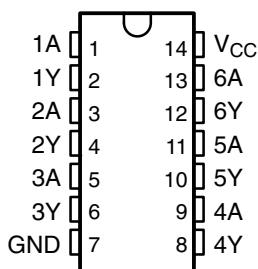
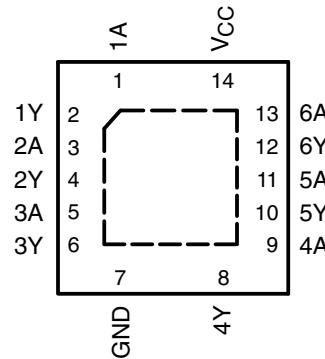


- Operating Range 2-V to 5.5-V V_{CC}
- Unbuffered Outputs
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

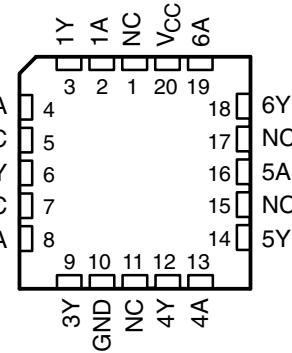
SN54AHCU04 . . . J OR W PACKAGE
SN74AHCU04 . . . D, DB, DGV, N, NS,
OR PW PACKAGE
(TOP VIEW)



SN74AHCU04 . . . RGY PACKAGE
(TOP VIEW)



SN54AHCU04 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

The 'AHCU04 devices contain six independent inverters. These devices perform the Boolean function $Y = \bar{A}$. Internal circuitry consists of single-stage inverters that can be used in analog applications such as crystal oscillators.

ORDERING INFORMATION

T_A	PACKAGE [†]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	QFN – RGY	Tape and reel	SN74AHCU04RGYR	HD04
	PDIP – N	Tube	SN74AHCU04N	SN74AHCU04N
	SOIC – D	Tube	SN74AHCU04D	AHCU04
		Tape and reel	SN74AHCU04DR	
	SOP – NS	Tape and reel	SN74AHCU04NSR	AHCU04
	SSOP – DB	Tape and reel	SN74AHCU04DBR	HD04
	TSSOP – PW	Tube	SN74AHCU04PW	HD04
		Tape and reel	SN74AHCU04PWR	
-55°C to 125°C	TVSOP – DGV	Tape and reel	SN74AHCU04DGVR	HD04
	CDIP – J	Tube	SNJ54AHCU04J	SNJ54AHCU04J
	CFP – W	Tube	SNJ54AHCU04W	SNJ54AHCU04W
LCCC – FK	LCCC – FK	Tube	SNJ54AHCU04FK	SNJ54AHCU04FK

[†] Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2003, Texas Instruments Incorporated
On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

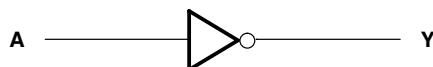
SN54AHCU04, SN74AHCU04 HEX INVERTERS

SCLS234K – OCTOBER 1995 – REVISED JULY 2003

FUNCTION TABLE (each inverter)

INPUT	OUTPUT
A	Y
H	L
L	H

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

[†] Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

1. The input and output ratings may be increased to the input and output ratings of the package thermal impedance is calculated in accordance with JESD 51-7.
2. The package thermal impedance is calculated in accordance with JESD 51-7.
3. The package thermal impedance is calculated in accordance with JESD 51-5.

recommended operating conditions (see Note 4)

			SN54AHCU04		SN74AHCU04		UNIT	
			MIN	MAX	MIN	MAX		
V _{CC}	Supply voltage			2	5.5	2	5.5	V
V _{IH}	High-level input voltage		V _{CC} = 2 V		1.7	1.7	V	
			V _{CC} = 3 V		2.4	2.4		
			V _{CC} = 5.5 V		4.4	4.4		
V _{IL}	Low-level input voltage		V _{CC} = 2 V		0.3	0.3	V	
			V _{CC} = 3 V		0.6	0.6		
			V _{CC} = 5.5 V		1.1	1.1		
V _I	Input voltage			0	5.5	0	5.5	V
V _O	Output voltage			0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current		V _{CC} = 2 V		-50	-50	µA	
			V _{CC} = 3.3 V ± 0.3 V		-4	-4	mA	
			V _{CC} = 5 V ± 0.5 V		-8	-8		
I _{OL}	Low-level output current		V _{CC} = 2 V		50	50	µA	
			V _{CC} = 3.3 V ± 0.3 V		4	4	mA	
			V _{CC} = 5 V ± 0.5 V		8	8		
T _A	Operating free-air temperature			-55	125	-40	85	°C

NOTE 4: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			SN54AHCU04		SN74AHCU04		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	I _{OH} = -50 µA	2 V	1.8	2		1.8		1.8		V
		3 V	2.7	3		2.7		2.7		
		4.5 V	4	4.5		4		4		
	I _{OH} = -4 mA	3 V	2.58			2.48		2.48		
	I _{OH} = -8 mA	4.5 V	3.94			3.8		3.8		
V _{OL}	I _{OL} = 50 µA	2 V	0.2			0.2		0.2		V
		3 V	0.3			0.3		0.3		
		4.5 V	0.5			0.5		0.5		
	I _{OL} = 4 mA	3 V	0.36			0.5		0.44		
	I _{OL} = 8 mA	4.5 V	0.36			0.5		0.44		
I _I	V _I = 5.5 V or GND	0 V to 5.5 V	±0.1			±1*		±1		µA
I _{CC}	V _I = V _{CC} or GND, I _O = 0	5.5 V	2			20		20		µA
C _i	V _I = V _{CC} or GND	5 V	2	10				10		pF

* On products compliant to MIL-PRF-38535, this parameter is not production tested at V_{CC} = 0 V.

SN54AHCU04, SN74AHCU04 HEX INVERTERS

SCLS234K – OCTOBER 1995 – REVISED JULY 2003

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			SN54AHCU04		SN74AHCU04		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	Y	$C_L = 15 \text{ pF}$		5*	7.1*	1*	8.5*	1	8.5	ns
t_{PHL}					5*	7.1*	1*	8.5*	1	8.5	
t_{PLH}	A	Y	$C_L = 50 \text{ pF}$		7.5	10.6	1	12	1	12	ns
t_{PHL}					7.5	10.6	1	12	1	12	

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			SN54AHCU04		SN74AHCU04		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	Y	$C_L = 15 \text{ pF}$		3.5*	5.5*	1*	6*	1	6.5	ns
t_{PHL}					3.5*	5.5*	1*	6*	1	6.5	
t_{PLH}	A	Y	$C_L = 50 \text{ pF}$		5	7	1	8	1	8	ns
t_{PHL}					5	7	1	8	1	8	

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

noise characteristics, $V_{CC} = 5 \text{ V}$, $C_L = 50 \text{ pF}$, $T_A = 25^\circ\text{C}$ (see Note 5)

PARAMETER	SN74AHCU04			UNIT
	MIN	TYP	MAX	
$V_{OL(P)}$ Quiet output, maximum dynamic V_{OL}		0.5		V
$V_{OL(V)}$ Quiet output, minimum dynamic V_{OL}		-0.5		V
$V_{OH(V)}$ Quiet output, minimum dynamic V_{OH}		4.3		V
$V_{IH(D)}$ High-level dynamic input voltage		4		V
$V_{IL(D)}$ Low-level dynamic input voltage		1		V

NOTE 5: Characteristics are for surface-mount packages only.

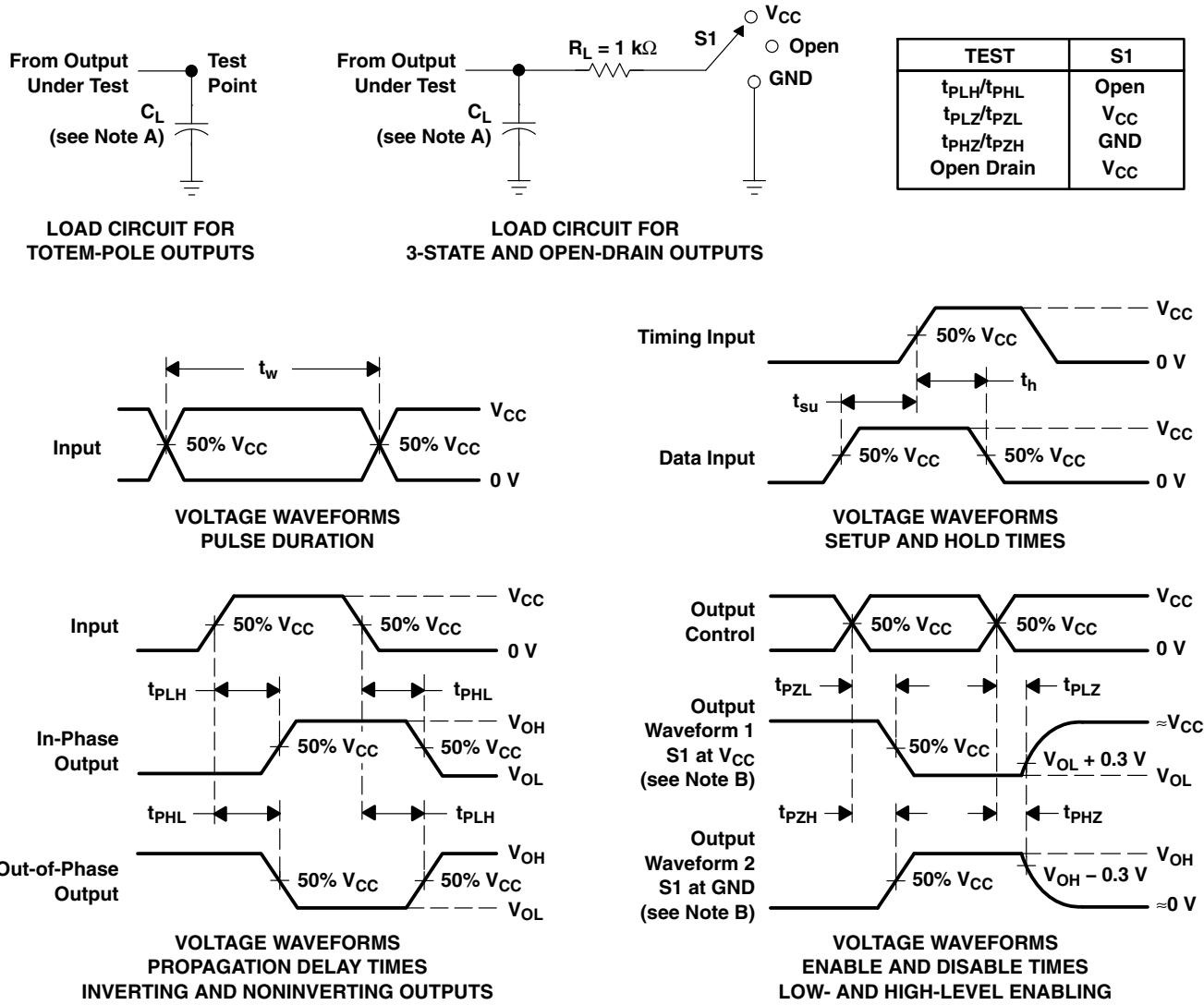
operating characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
C_{pd} Power dissipation capacitance	No load, $f = 1 \text{ MHz}$	7.3	pF



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

PARAMETER MEASUREMENT INFORMATION



NOTES:

- C_L includes probe and jig capacitance.
- Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $Z_O = 50 \Omega$, $t_r \leq 3$ ns, $t_f \leq 3$ ns.
- The outputs are measured one at a time with one input transition per measurement.
- All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

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)
5962-9680301QDA	Active	Production	CFP (W) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9680301QD A SNJ54AHCU04W
SN74AHCU04D	Obsolete	Production	SOIC (D) 14	-	-	Call TI	Call TI	-40 to 85	AHCU04
SN74AHCU04DBR	Active	Production	SSOP (DB) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HD04
SN74AHCU04DBR.A	Active	Production	SSOP (DB) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HD04
SN74AHCU04DR	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AHCU04
SN74AHCU04DR.A	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AHCU04
SN74AHCU04N	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	SN74AHCU04N
SN74AHCU04N.A	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	SN74AHCU04N
SN74AHCU04NSR	Active	Production	SOP (NS) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AHCU04
SN74AHCU04NSR.A	Active	Production	SOP (NS) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AHCU04
SN74AHCU04PW	Obsolete	Production	TSSOP (PW) 14	-	-	Call TI	Call TI	-40 to 85	HD04
SN74AHCU04PWR	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HD04
SN74AHCU04PWR.A	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HD04
SN74AHCU04PWRG4	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HD04
SNJ54AHCU04W	Active	Production	CFP (W) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9680301QD A SNJ54AHCU04W

⁽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.

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.

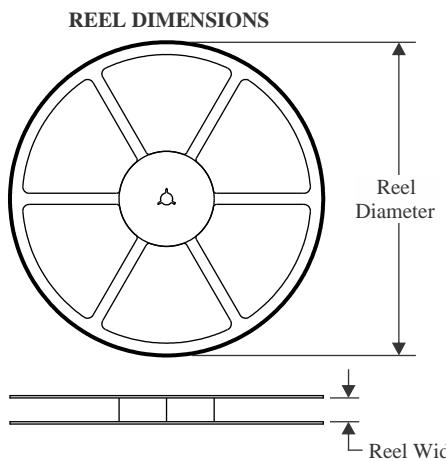
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN54AHCU04, SN74AHCU04 :

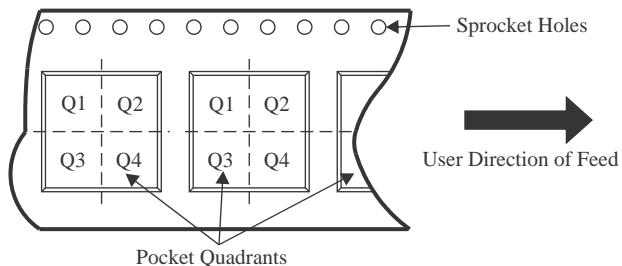
- Catalog : [SN74AHCU04](#)
- Automotive : [SN74AHCU04-Q1](#), [SN74AHCU04-Q1](#)
- Enhanced Product : [SN74AHCU04-EP](#), [SN74AHCU04-EP](#)
- Military : [SN54AHCU04](#)

NOTE: Qualified Version Definitions:

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

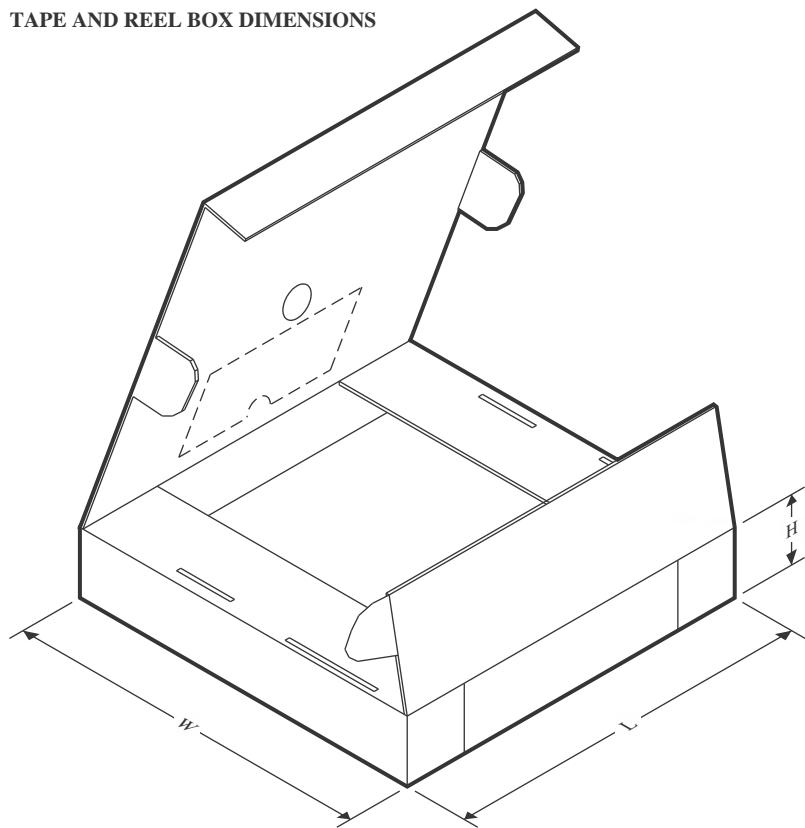
TAPE AND REEL INFORMATION


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
SN74AHCU04DBR	SSOP	DB	14	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74AHCU04DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74AHCU04NSR	SOP	NS	14	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
SN74AHCU04PWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AHCU04DBR	SSOP	DB	14	2000	353.0	353.0	32.0
SN74AHCU04DR	SOIC	D	14	2500	353.0	353.0	32.0
SN74AHCU04NSR	SOP	NS	14	2000	353.0	353.0	32.0
SN74AHCU04PWR	TSSOP	PW	14	2000	353.0	353.0	32.0

TUBE


*All dimensions are nominal

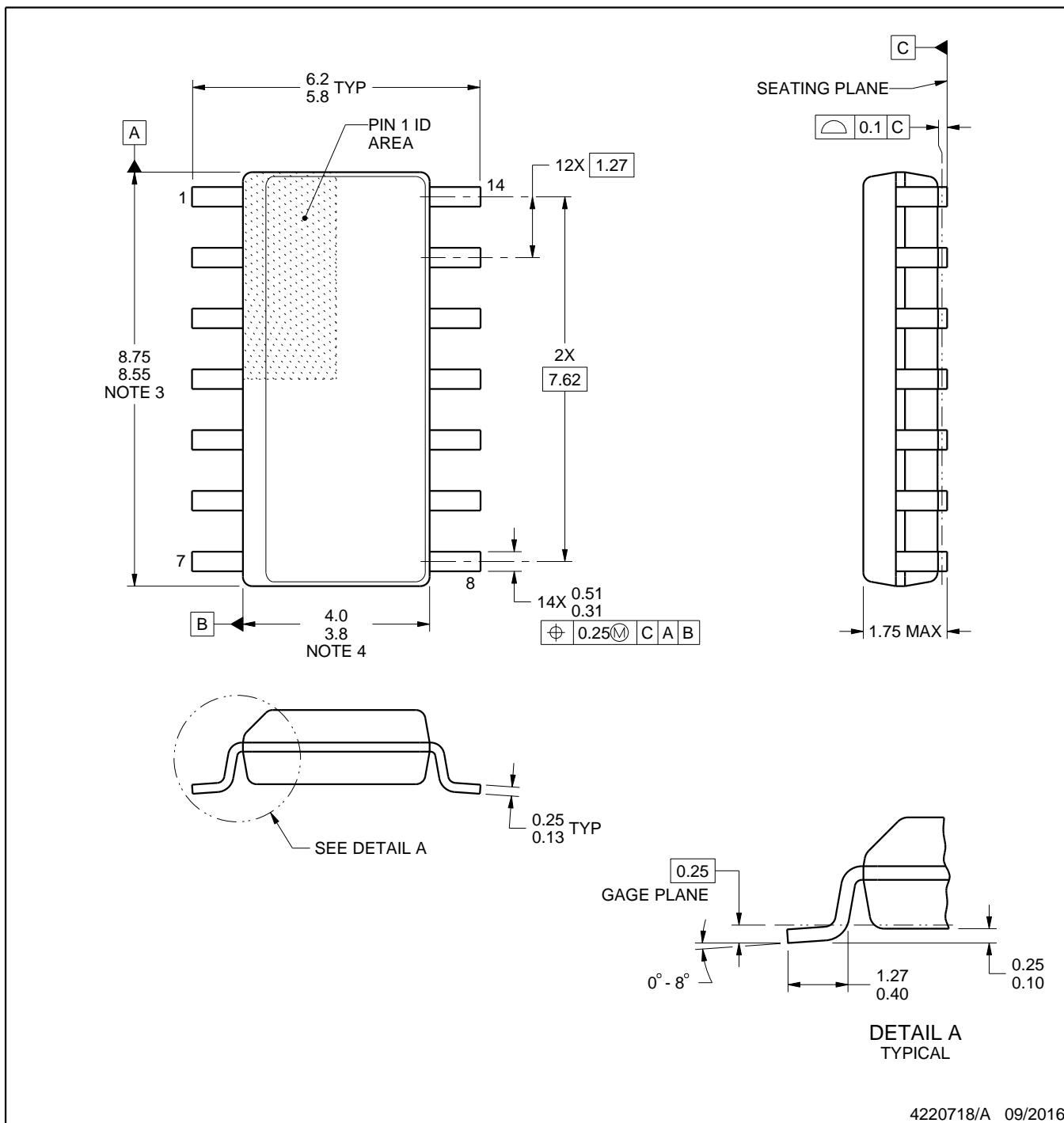
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μ m)	B (mm)
5962-9680301QDA	W	CFP	14	25	506.98	26.16	6220	NA
SN74AHCU04N	N	PDIP	14	25	506	13.97	11230	4.32
SN74AHCU04N	N	PDIP	14	25	506	13.97	11230	4.32
SN74AHCU04N.A	N	PDIP	14	25	506	13.97	11230	4.32
SN74AHCU04N.A	N	PDIP	14	25	506	13.97	11230	4.32
SNJ54AHCU04W	W	CFP	14	25	506.98	26.16	6220	NA

PACKAGE OUTLINE

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



NOTES:

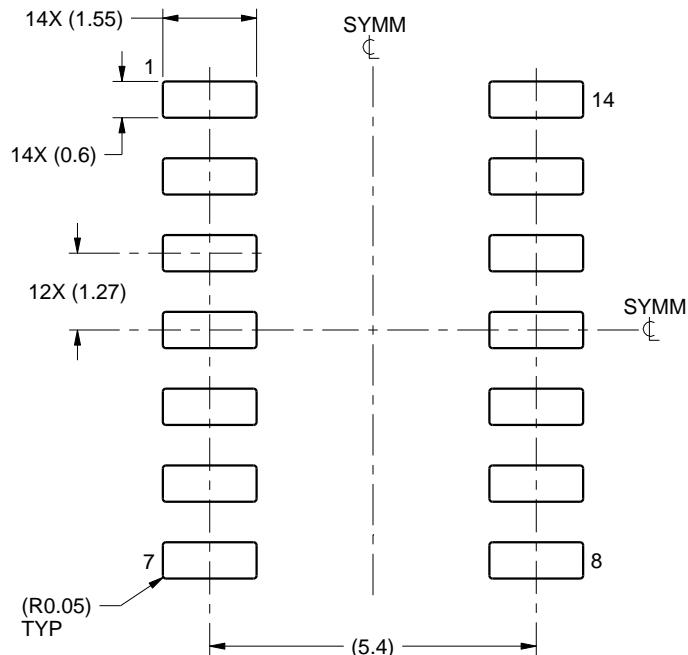
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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

EXAMPLE BOARD LAYOUT

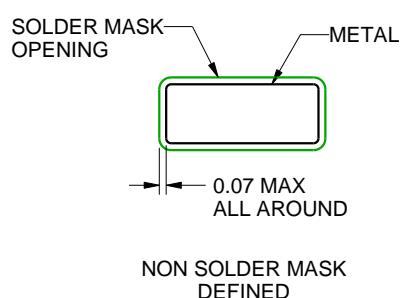
D0014A

SOIC - 1.75 mm max height

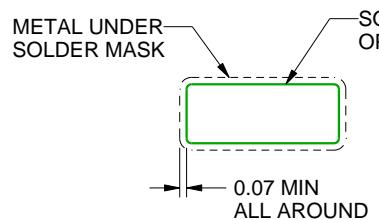
SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
SCALE:8X



NON SOLDER MASK
DEFINED



SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

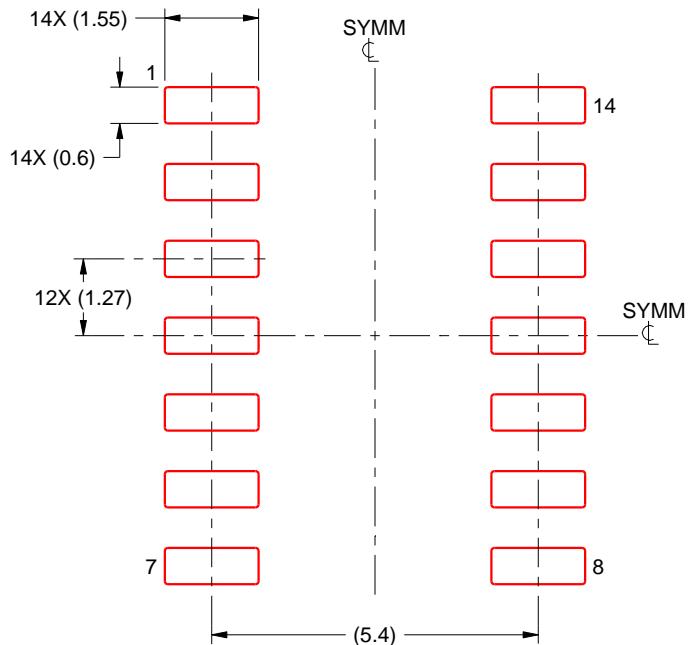
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



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

4220718/A 09/2016

NOTES: (continued)

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

MECHANICAL DATA

NS (R-PDSO-G)**

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

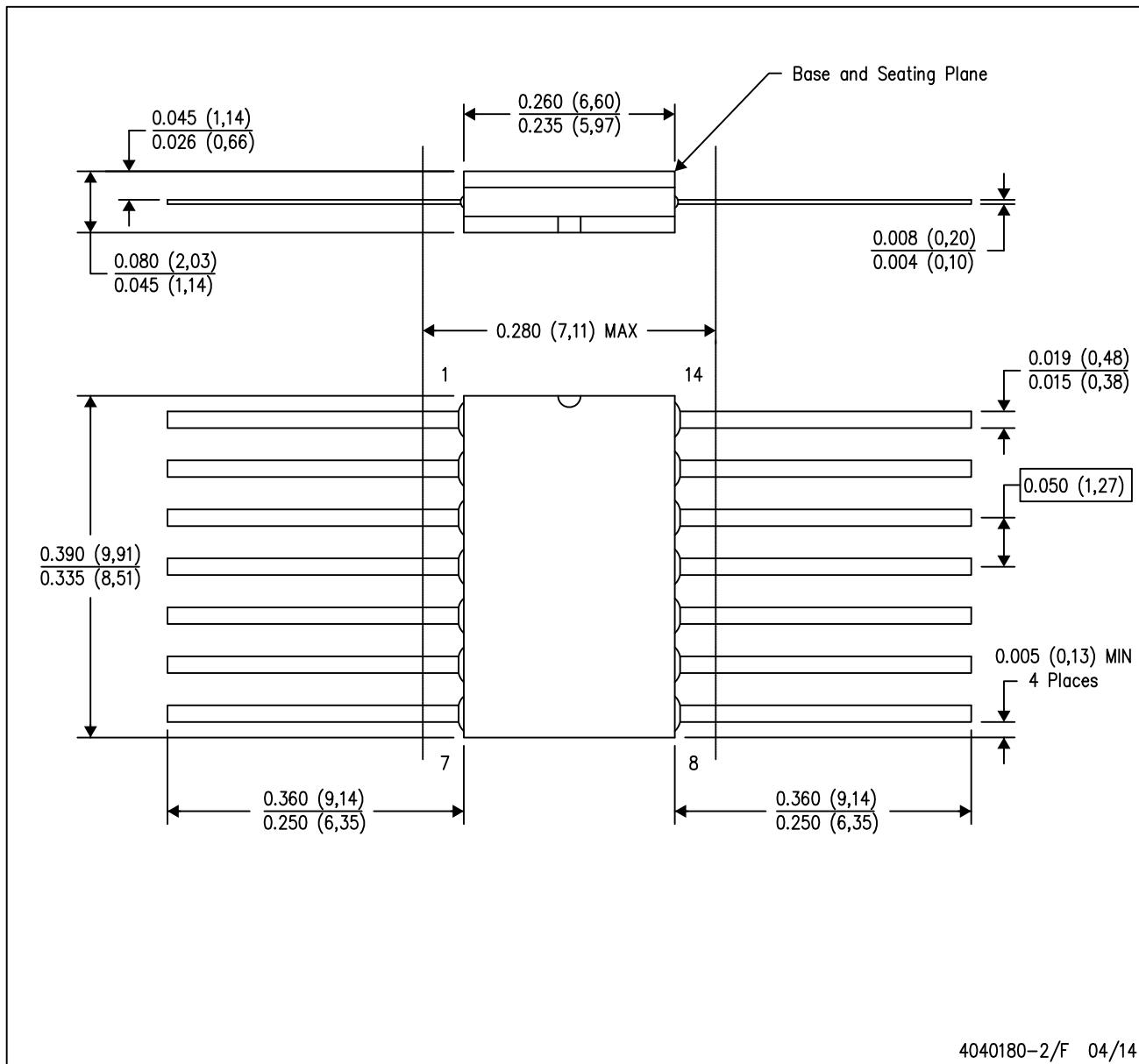


NOTES:

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

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



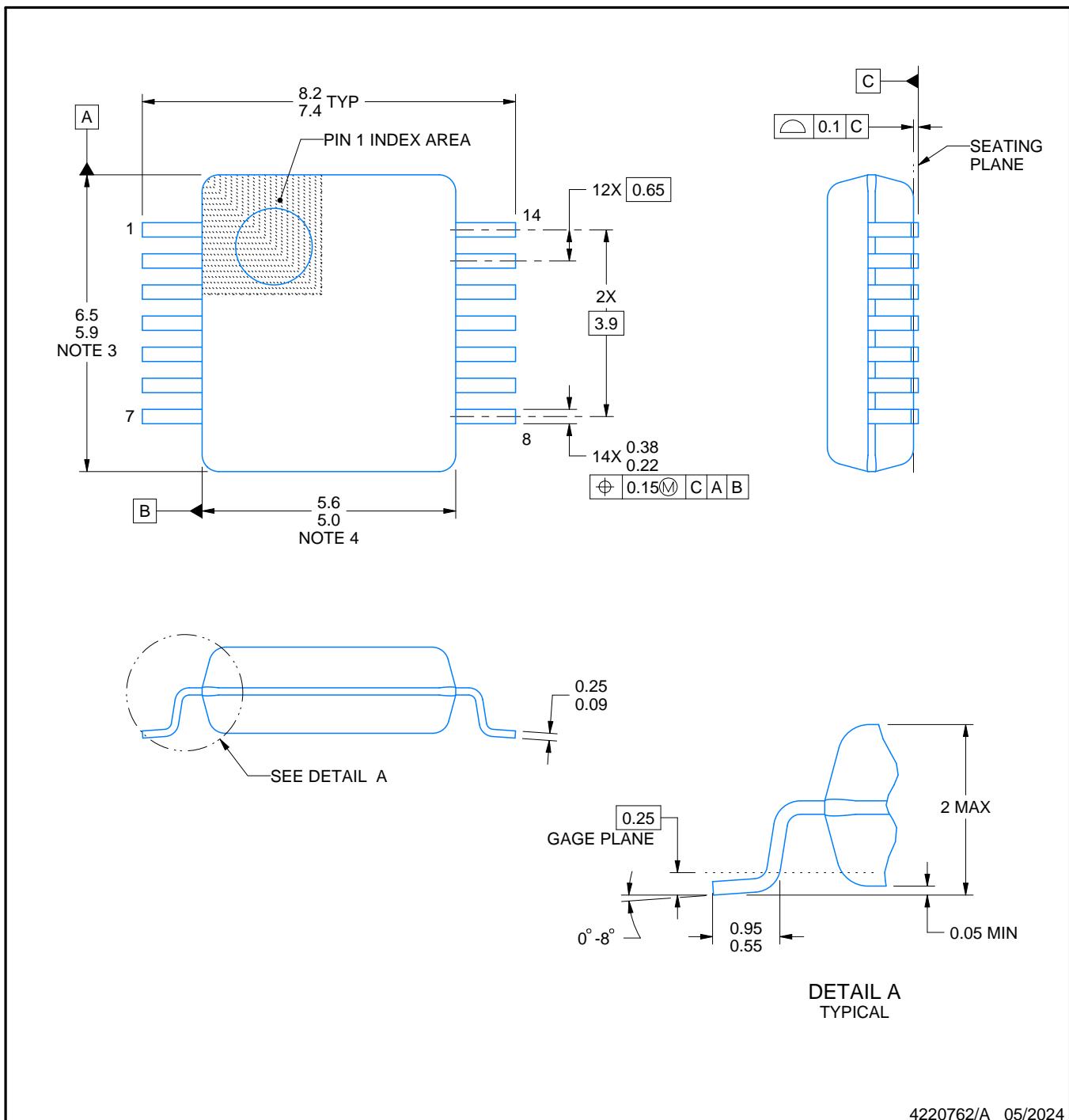
NOTES:

- 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

PACKAGE OUTLINE

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

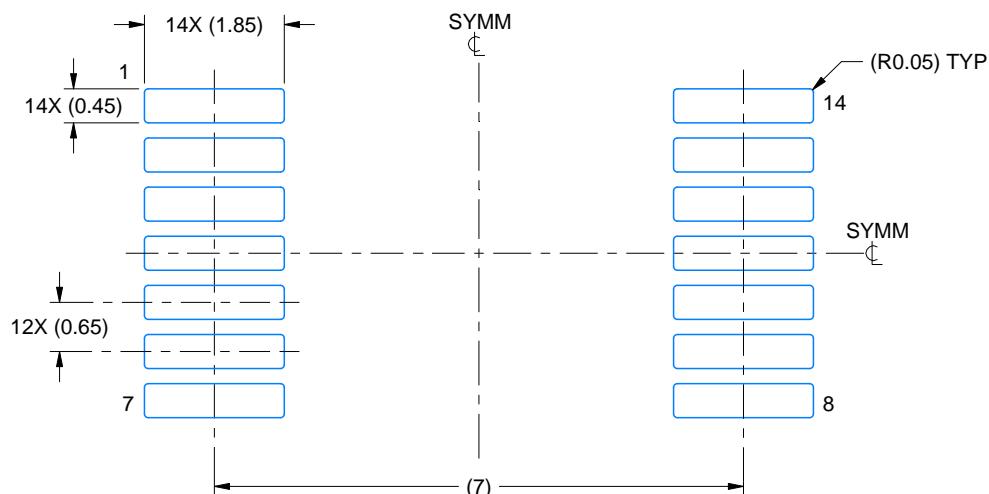
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-150.

EXAMPLE BOARD LAYOUT

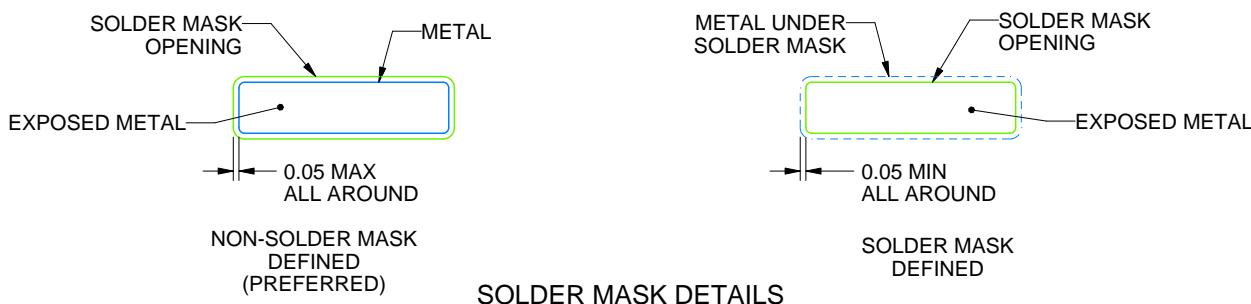
DB0014A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220762/A 05/2024

NOTES: (continued)

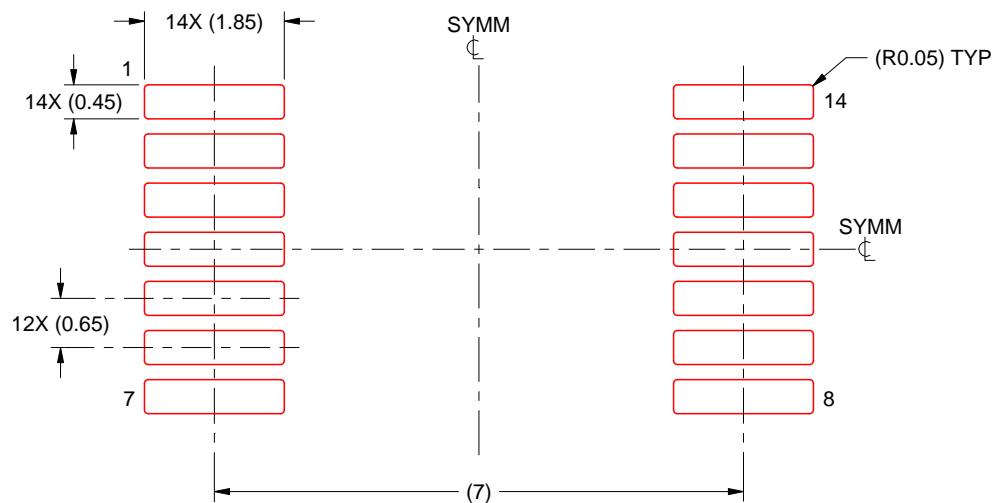
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DB0014A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



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

4220762/A 05/2024

NOTES: (continued)

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

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



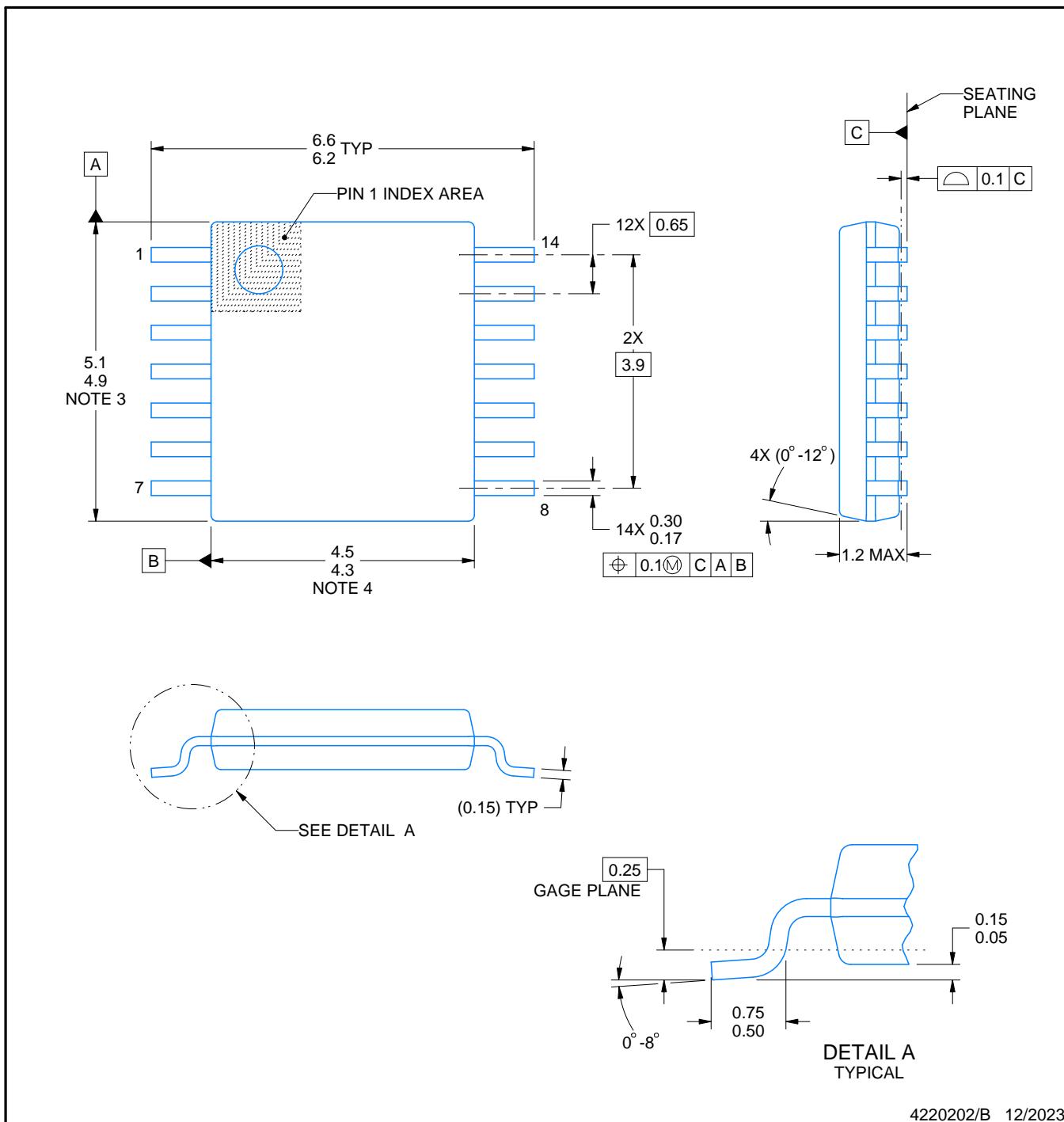
PACKAGE OUTLINE

PW0014A



TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

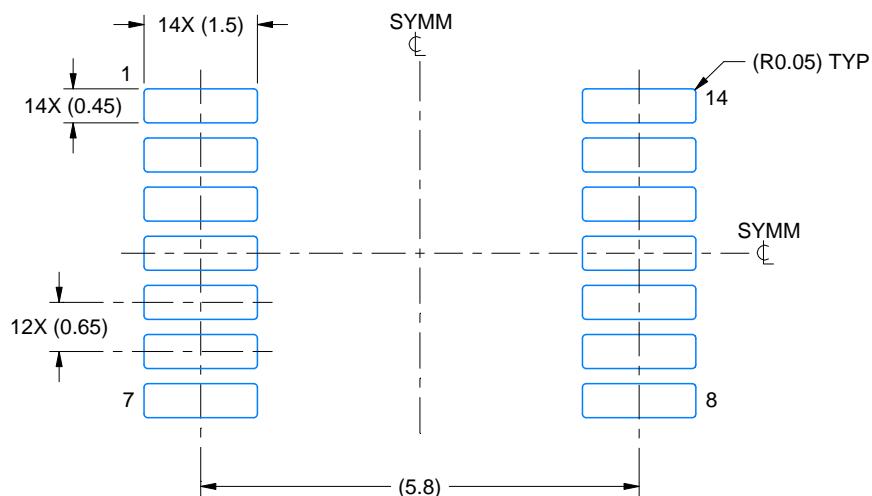
- All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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

EXAMPLE BOARD LAYOUT

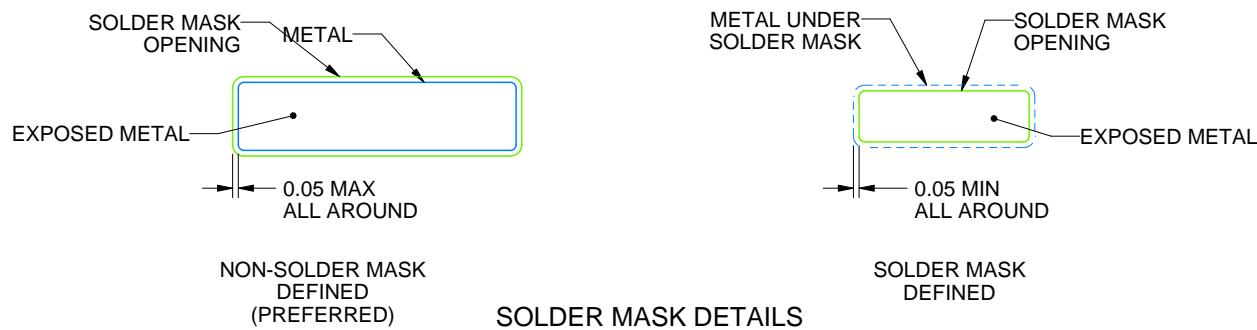
PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220202/B 12/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

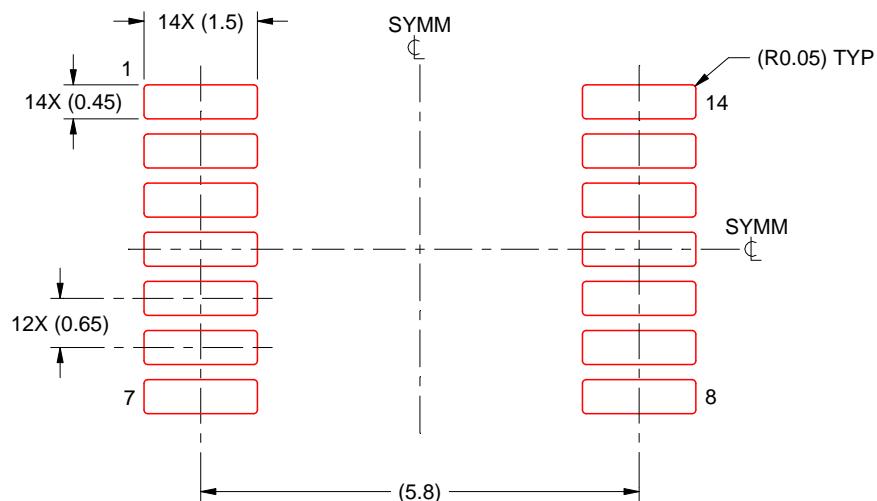
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220202/B 12/2023

NOTES: (continued)

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

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), 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 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](#), [TI's General Quality Guidelines](#), 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. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

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

Copyright © 2026, Texas Instruments Incorporated

Last updated 10/2025