

SNx4AHC14 Hex Schmitt-Trigger Inverters

1 Features

- ESD protection exceeds JESD 22:
 - 2000V Human-Body Model (A114-A)
 - 200V Machine Model (A115-A)
 - 1000V Charged-Device Model (C101)
- Operating range: 2V to 5.5V
- $\pm 8\text{mA}$ output drive at 5V
- Schmitt-Trigger inputs enable input noise resistance
- Low power consumption: 20 μA maximum I_{cc}
- Latch-up performance exceeds 250mA per JESD 17

2 Applications

- [UPS](#)
- White goods
- [Computer peripherals](#)
- Printers
- [AC servo drives](#)
- Desktop computers

3 Description

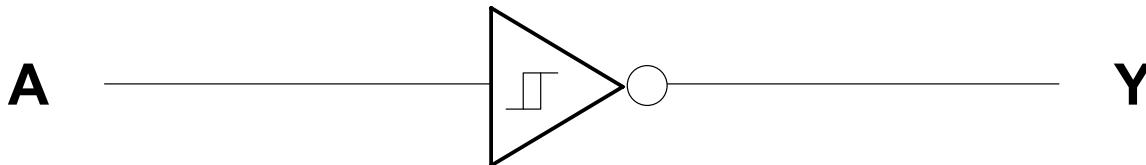
The SNx4AHC14 devices contain six independent inverters. These devices perform the boolean function $Y = \bar{A}$.

Each circuit functions as an independent inverter, but, because of the Schmitt-Trigger action, the inverters have different input threshold levels for positive-going (V_{T+}) and negative-going (V_{T-}) signals.

Device Information

PART NUMBER	RATING	PACKAGE ⁽¹⁾
SN54AHC14	Military	J (CDIP, 14)
		W (CFP, 14)
		FK (LCCC, 20)
		BQA (WQFN, 14)
SN74AHC14	Commercial	D (SOIC, 14)
		DB (SSOP, 14)
		N (PDIP, 14)
		NS (SO, 14)
		PW (TSSOP, 14)
		DGV (TWSOP, 14)
		RGY (VQFN, 14)
		BQA (WQFN, 14)

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



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Logic Diagram (Positive Logic)



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4 Pin Configuration and Functions

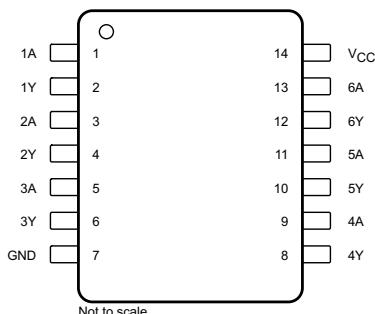


Figure 4-1. D, DB, DGV, J, N, NS, PW, or W Package, 14-Pin SOIC, SSOP, TVSOP, CDIP, PDIP, SO, TSSOP, or CFP (Top View)

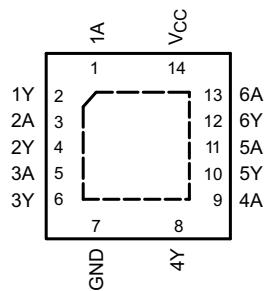


Figure 4-2. RGY or BQA Package, 14-Pin VQFN or WQFN (Top View)

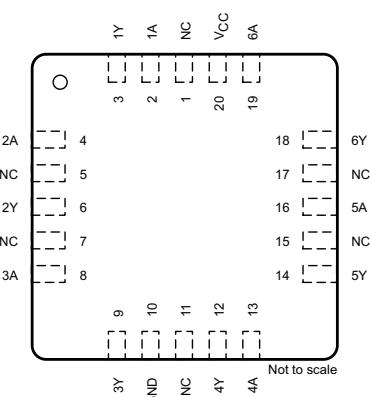


Figure 4-3. FK Package, 20-Pin LCCC (Top View)

Table 4-1. Pin Functions

NAME	PIN		TYPE ⁽¹⁾	DESCRIPTION
	SOIC, SSOP, TVSOP, CDIP, PDIP, SO, TSSOP, CFP, VQFN	LCCC		
1A	1	2	I	Channel 1 Input
1Y	2	3	O	Channel 1 Output
2A	3	4	I	Channel 2 Input
2Y	4	6	O	Channel 2 Output
3A	5	8	I	Channel 3 Input
3Y	6	9	O	Channel 3 Output
4A	9	13	I	Channel 4 Input
4Y	8	12	O	Channel 4 Output
5A	11	16	I	Channel 5 Input
5Y	10	14	O	Channel 5 Output
6A	13	19	I	Channel 6 Input
6Y	12	18	O	Channel 6 Output
GND	7	10	—	Ground
NC	—	1, 5, 7, 11, 15, 17	—	No internal connection
V _{CC}	14	20	—	Power supply

(1) I = input, O = output

5 Specifications

5.1 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 ⁽²⁾	Input voltage		-0.5	7	V
V_O ⁽²⁾	Output voltage		-0.5	$V_{CC} + 0.5$	V
I_{IK}	Input clamp current	$V_I < 0$		-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}		± 25	mA
	Continuous current through V_{CC} or GND			± 50	mA
T_J	Virtual operating 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.

5.2 ESD Ratings

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

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

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

5.3 Recommended Operating Conditions

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage		2	5.5	V
V_I	Input voltage		0	5.5	V
V_O	Output voltage		0	V_{CC}	V
I_{OH}	High-level output current	$V_{CC} = 2$ V		-50	µA
		$V_{CC} = 3.3$ V ± 0.3 V		-4	mA
		$V_{CC} = 5$ V ± 0.5 V		-8	
I_{OL}	Low-level output current	$V_{CC} = 2$ V		50	µA
		$V_{CC} = 3.3$ V ± 0.3 V		4	mA
		$V_{CC} = 5$ V ± 0.5 V		8	
T_A	Operating free-air temperature	SN54AHC14	-55	125	°C
		SN74AHC14	-40	125	

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See TI application report, *Implications of Slow or Floating CMOS Inputs* (SCBA004).

5.4 Thermal Information

THERMAL METRIC ⁽¹⁾		SN74AHC14								UNIT
		D (SOIC)	DB (SSOP)	DGV (TSSOP)	N (PDIP)	NS (SO)	PW (TSSOP)	RGY (VQFN)	BQA (WQFN)	
		14 PINS	14 PINS	14 PINS	14 PINS	14 PINS	14 PINS	14 PINS	14 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	124.5	137.8	141.9	61.9	94.7	147.7	87.1	88.3	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	78.8	90	61.1	49.5	52.5	77.4	92.6	90.9	°C/W
R _{θJB}	Junction-to-board thermal resistance	81	98.3	71.3	41.7	53.4	90.9	62.5	56.8	°C/W
Ψ _{JT}	Junction-to-top characterization parameter	37	42.7	9.7	34.7	21.3	27.2	22.8	9.9	°C/W
Ψ _{JB}	Junction-to-board characterization parameter	80.6	97	70.6	41.7	53.1	90.2	61.7	56.7	°C/W
R _{θJC(bot)}	Junction-to-case (bottom) thermal resistance	N/A	N/A	N/A	N/A	N/A	N/A	45.1	33.4	°C/W

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

5.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V _{T+} Positive-going input threshold voltage	V _{CC} = 3 V	1.2	2.2		V
	V _{CC} = 4.5 V	1.75	3.15		
	V _{CC} = 5.5 V	2.15	3.85		
V _{T-} Negative-going input threshold voltage	V _{CC} = 3 V	0.9	1.9		V
	V _{CC} = 4.5 V	1.35	2.75		
	V _{CC} = 5.5 V	1.65	3.35		
ΔV _T Hysteresis (V _{T+} – V _{T-})	V _{CC} = 3 V	0.3	1.2		V
	V _{CC} = 4.5 V	0.4	1.4		
	V _{CC} = 5.5 V	0.5	1.6		
V _{OH} I _{OH} = –50 µA I _{OL} = –4 mA, V _{CC} = 3 V I _{OL} = –8 mA, V _{CC} = 4.5 V	V _{CC} = 2 V	1.9	2		V
	V _{CC} = 3 V	2.9	3		
	V _{CC} = 4.5 V	4.4	4.5		
	T _A = 25°C	2.58			
	SNx4AHC14	2.48			
	T _A = 25°C	3.94			
	SNx4AHC14	3.8			

5.5 Electrical Characteristics (continued)

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OL}	$I_{OH} = 50 \mu A$	$V_{CC} = 2 V$		0.1	V
		$V_{CC} = 3 V$		0.1	
		$V_{CC} = 4.5 V$		0.1	
	$I_{OH} = 4 mA, V_{CC} = 3 V$	$T_A = 25^\circ C$		0.36	
		SN54AHC14		0.5	
		SN74AHC14	$T_A = -40^\circ C$ to $85^\circ C$	0.44	
			$T_A = -40^\circ C$ to $125^\circ C$	0.5	
	$I_{OL} = 8 mA, V_{CC} = 4.5 V$	$T_A = 25^\circ C$		0.36	
		SN54AHC14		0.5	
		SN74AHC14	$T_A = -40^\circ C$ to $85^\circ C$	0.44	
			$T_A = -40^\circ C$ to $125^\circ C$	0.5	
I_I	$V_I = 5.5 V$ or GND, $V_{CC} = 0 V$ to $5.5 V$	$T_A = 25^\circ C$		± 0.1	μA
		SNx4AHC14		$\pm 1^{(1)}$	
I_{CC}	$V_I = V_{CC}$ or GND, $I_O = 0$, $V_{CC} = 5.5 V$	$T_A = 25^\circ C$		1	μA
		SNx4AHC14		20	
C_I	$V_I = V_{CC}$ or GND, $V_{CC} = 5 V$	$T_A = 25^\circ C$		2 10	pF
		SN74AHC14		10	
C_{pd}	Power dissipation capacitance	No load, $f = 1 MHz$, $V_{CC} = 5 V$		9	pF
NOISE⁽²⁾					
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}	$V_{CC} = 5 V$, $C_L = 50 pF$, $T_A = 25^\circ C$		0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}	$V_{CC} = 5 V$, $C_L = 50 pF$, $T_A = 25^\circ C$		-0.4	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}	$V_{CC} = 5 V$, $C_L = 50 pF$, $T_A = 25^\circ C$		4.6	V
$V_{IH(D)}$	High-level dynamic input voltage	$V_{CC} = 5 V$, $C_L = 50 pF$, $T_A = 25^\circ C$		3.5	V
$V_{IL(D)}$	Low-level dynamic input voltage	$V_{CC} = 5 V$, $C_L = 50 pF$, $T_A = 25^\circ C$		1.5	V

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

(2) Characteristics are for surface-mount packages only.

5.6 Switching Characteristics, $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$

$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ and over operating free-air temperature range (unless otherwise noted; see [Parameter Measurement Information](#))

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	From A (input) to Y (output), $C_L = 15 \text{ pF}$	$T_A = 25^\circ\text{C}$	8.3 ⁽¹⁾	12.8 ⁽¹⁾	ns
		SN54AHC14	1 ⁽¹⁾	15 ⁽¹⁾	
		SN74AHC14	1	16	
t_{PHL}	From A (input) to Y (output), $C_L = 15 \text{ pF}$	$T_A = 25^\circ\text{C}$	8.3 ⁽¹⁾	12.8 ⁽¹⁾	ns
		SN54AHC14	1 ⁽¹⁾	15 ⁽¹⁾	
		SN74AHC14	1	16	
t_{PLH}	From A (input) to Y (output), $C_L = 50 \text{ pF}$	$T_A = 25^\circ\text{C}$	10.8	16.3	ns
		SN54AHC14	1	18.5	
		SN74AHC14	1	19.5	
t_{PHL}	From A (input) to Y (output), $C_L = 50 \text{ pF}$	$T_A = 25^\circ\text{C}$	10.8	16.3	ns
		SN54AHC14	1	18.5	
		SN74AHC14	1	19.5	

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

5.7 Switching Characteristics, $V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$

$V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$ and over operating free-air temperature range (unless otherwise noted; see [Parameter Measurement Information](#))

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	From A (input) to Y (output), $C_L = 15 \text{ pF}$	$T_A = 25^\circ\text{C}$	5.5 ⁽¹⁾	8.6 ⁽¹⁾	ns
		SN54AHC14	1 ⁽¹⁾	10 ⁽¹⁾	
		SN74AHC14	1	10	
t_{PHL}	From A (input) to Y (output), $C_L = 15 \text{ pF}$	$T_A = 25^\circ\text{C}$	5.5 ⁽¹⁾	8.6 ⁽¹⁾	ns
		SN54AHC14	1 ⁽¹⁾	10 ⁽¹⁾	
		SN74AHC14	1	10	
t_{PLH}	From A (input) to Y (output), $C_L = 50 \text{ pF}$	$T_A = 25^\circ\text{C}$	7	10.6	ns
		SNx4AHC14	1	12	
t_{PHL}	From A (input) to Y (output), $C_L = 50 \text{ pF}$	$T_A = 25^\circ\text{C}$	7	10.6	ns
		SNx4AHC14	1	12	

5.8 Typical Characteristics

$C_L = 50 \text{ pF}$ (unless otherwise noted)

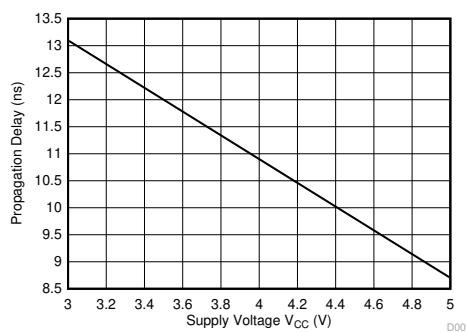


Figure 5-1. Propagation Delay vs Supply Voltage

6 Parameter Measurement Information

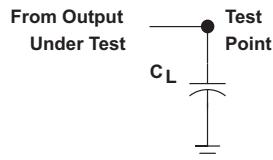


Figure 6-1. Load Circuit For Totem-Pole Outputs

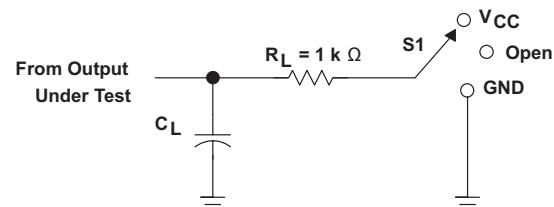


Figure 6-2. Load Circuit For 3-State and Open-Drain Outputs

Table 6-1. Measurement Information

TEST	S1
t_{PLH}, t_{PHL}	Open
t_{PLZ}, t_{PZL}	V_{CC}
t_{PHZ}, t_{PZH}	GND
Open drain	V_{CC}

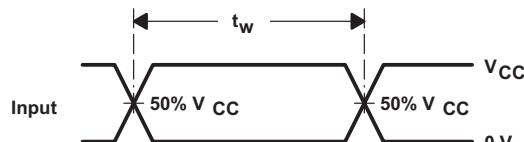


Figure 6-3. Voltage Waveforms Pulse Duration

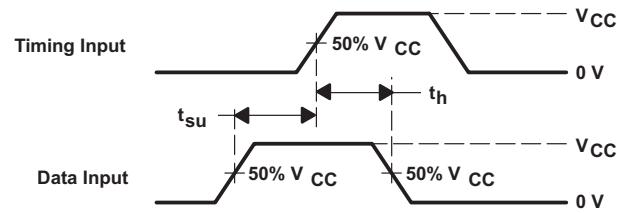


Figure 6-4. Voltage Waveforms Setup and Hold Times

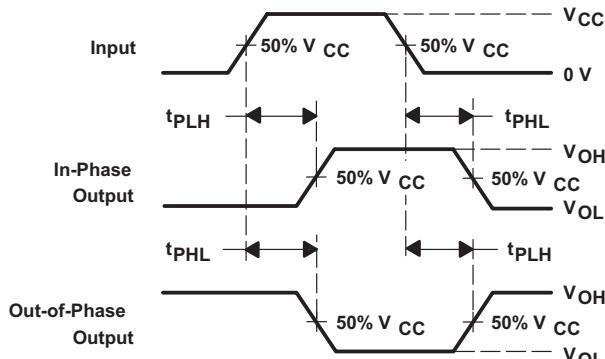
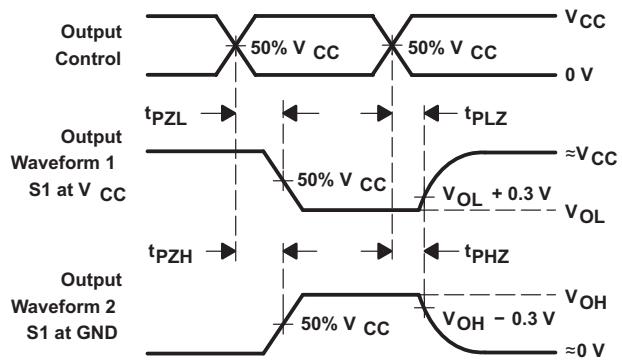


Figure 6-5. Voltage Waveforms Propagation Delay Times Inverting and Noninverting Outputs



- A. C_L includes probe and jig capacitance.
- B. 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.
- C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 3 \text{ ns}$, $t_f \leq 3 \text{ ns}$.
- D. The outputs are measured one at a time with one input transition per measurement.
- E. All parameters and waveforms are not applicable to all devices.

Figure 6-6. Voltage Waveforms Enable and Disable Times Low- and High-Level Enabling

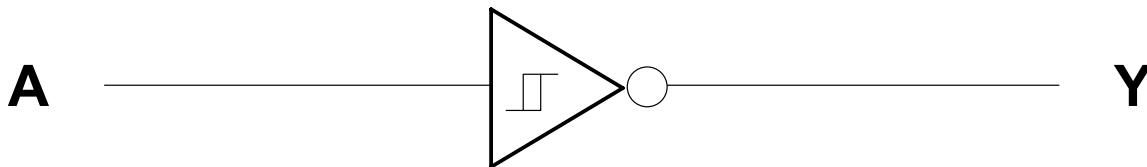
7 Detailed Description

7.1 Overview

The SNx4AHC14 Schmitt-Trigger devices contain six independent inverters. They perform the Boolean function $Y = \bar{A}$ in positive logic.

Schmitt-Trigger inputs are designed to provide a minimum separation between positive and negative switching thresholds. This allows for noisy or slow inputs that would cause problems such as oscillation or excessive current draw with normal CMOS inputs.

7.2 Functional Block Diagram



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7.3 Feature Description

The wide operating range of the device allows it to be used in a variety of systems that use different logic levels. The output can drive up to 10 LSTTL loads each. The balanced drive outputs can source or sink 8 mA at 5-V V_{CC} .

7.4 Device Functional Modes

Table 7-1 lists the functional modes of the SNx4AHC14.

Table 7-1. Function Table

INPUT A	OUTPUT Y
H	L
L	H

8 Application and Implementation

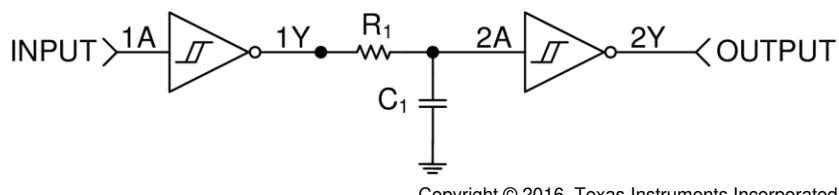
Note

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 SN74AHC14 device is a Schmitt-Trigger input CMOS device that can be used for a multitude of inverting buffer type functions. The application shown here takes advantage of the Schmitt-Trigger inputs to produce a delay for a logic input.

8.2 Typical Application



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Figure 8-1. Simplified Application Schematic

8.2.1 Design Requirements

This device uses CMOS technology. Take care to avoid bus contention because it can drive currents that would exceed maximum limits. Parallel output drive can create fast edges into light loads so consider routing and load conditions to prevent ringing.

8.2.2 Detailed Design Procedure

This circuit is designed around an RC network that produces a slow input to the second inverter. The RC time constant, τ , is calculated from: $\tau = RC$.

The delay time for this circuit is from $t_{delay(min)} = -\ln |1 - V_{T+(min)} / V_{CC}| \tau$ to $t_{delay(max)} = -\ln |1 - V_{T+(max)} / V_{CC}| \tau$. It must be noted that the delay is consistent for each device, but because the switching threshold is only ensured between the minimum and maximum value, the output pulse length varies between devices. These values must be calculated by using the minimum and maximum V_{T+} values in the [Electrical Characteristics](#).

The resistor value must be chosen such that the maximum current to and from the SN74AHC14 is 8 mA at 5-V V_{CC} .

8.2.3 Application Curve

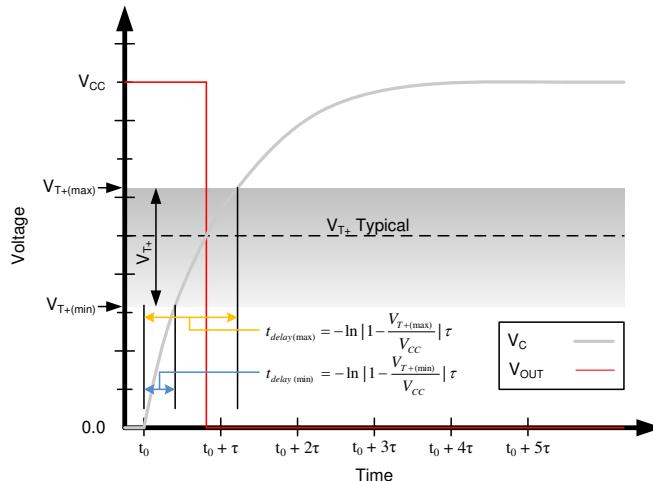


Figure 8-2. Ideal Capacitor Voltage and Output Voltage With Positive Switching Threshold

8.3 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Recommended Operating Conditions*. The V_{CC} terminal must have a good bypass capacitor to prevent power disturbance. TI recommends using a 0.1- μ F capacitor on the V_{CC} terminal, and must be placed as close as possible to the pin for best results.

8.4 Layout

8.4.1 Layout Guidelines

When using multiple bit logic devices, inputs must never float. In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or only three of the four buffer gates are used. Such inputs must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally they are tied to GND or V_{CC} , whichever makes more sense or is more convenient. Floating outputs are generally acceptable, unless the part is a transceiver.

8.4.2 Layout Example

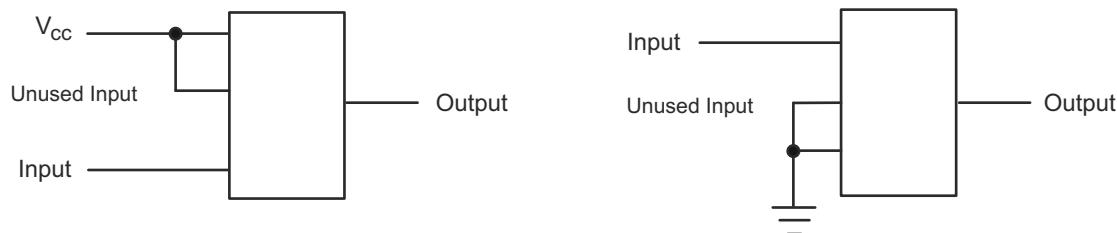


Figure 8-3. Layout Diagram

9 Device and Documentation Support

9.1 Documentation Support

9.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, *Implications of Slow or Floating CMOS Inputs* application report

9.2 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.

9.3 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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9.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

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9.5 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.

9.6 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 O (October 2023) to Revision P (February 2024)	Page
• Updated R _{θJA} values: DB = 112.4 to 137.8, R _{GY} = 63.8 to 87.1; Updated DB and R _{GY} packages for R _{θJC} (top), R _{θJB} , Ψ _{JT} , Ψ _{JB} , and R _{θJC} (bot), all values in °C/W.....	5

Changes from Revision N (June 2023) to Revision O (October 2023)	Page
• Deleted machine model.....	4
• Updated R _{θJA} values: D = 99.3 to 124.5, PW = 128.8 to 147.7; Updated D and PW packages for R _{θJC} (top), R _{θJB} , Ψ _{JT} , Ψ _{JB} , and R _{θJC} (bot), all values in °C/W.....	5

11 Mechanical, Packaging, and Orderable Information

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

PACKAGING INFORMATION

Orderable part number	Status (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)
5962-9680201Q2A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9680201Q2A SNJ54AHC14FK
5962-9680201QCA	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9680201QC A SNJ54AHC14J
5962-9680201QDA	Active	Production	CFP (W) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9680201QD A SNJ54AHC14W
5962-9682001QCA	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9682001QC A SNJ54AHC08J
5962-9682001QDA	Active	Production	CFP (W) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9682001QD A SNJ54AHC08W
SN74AHC14BQAR	Active	Production	WQFN (BQA) 14	3000 LARGE T&R	Yes	SELECTIVE AG (TOP SIDE)	Level-1-260C-UNLIM	-40 to 125	AHC14
SN74AHC14BQAR.A	Active	Production	WQFN (BQA) 14	3000 LARGE T&R	Yes	SELECTIVE AG (TOP SIDE)	Level-1-260C-UNLIM	-40 to 125	AHC14
SN74AHC14D	Obsolete	Production	SOIC (D) 14	-	-	Call TI	Call TI	-40 to 125	AHC14
SN74AHC14DBR	Active	Production	SSOP (DB) 14	2000 LARGE T&R	Yes	NIPDAU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14DBR.A	Active	Production	SSOP (DB) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14DGVR	Active	Production	TVSOP (DGV) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14DGVR.A	Active	Production	TVSOP (DGV) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14DR	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	NIPDAU NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC14
SN74AHC14DR.A	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC14
SN74AHC14DRE4	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC14
SN74AHC14DRG3	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	AHC14
SN74AHC14DRG3.A	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	AHC14
SN74AHC14DRG4	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC14
SN74AHC14DRG4.A	Active	Production	SOIC (D) 14	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC14

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)
SN74AHC14N	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 125	SN74AHC14N
SN74AHC14N.A	Active	Production	PDIP (N) 14	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 125	SN74AHC14N
SN74AHC14NSR	Active	Production	SOP (NS) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC14
SN74AHC14NSR.A	Active	Production	SOP (NS) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC14
SN74AHC14PW	Obsolete	Production	TSSOP (PW) 14	-	-	Call TI	Call TI	-40 to 125	HA14
SN74AHC14PWR	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14PWR.A	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14PWRG3	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14PWRG3.A	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14PWRG4	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14PWRG4.A	Active	Production	TSSOP (PW) 14	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14RGYR	Active	Production	VQFN (RGY) 14	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14RGYR.A	Active	Production	VQFN (RGY) 14	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14RGYRG4	Active	Production	VQFN (RGY) 14	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SN74AHC14RGYRG4.A	Active	Production	VQFN (RGY) 14	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA14
SNJ54AHC08J	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9682001QC A SNJ54AHC08J
SNJ54AHC08W	Active	Production	CFP (W) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9682001QD A SNJ54AHC08W
SNJ54AHC14FK	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 9680201Q2A SNJ54AHC 14FK
SNJ54AHC14FK.A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 9680201Q2A SNJ54AHC 14FK
SNJ54AHC14J	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9680201QC A SNJ54AHC14J

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)
SNJ54AHC14J.A	Active	Production	CDIP (J) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9680201QC A SNJ54AHC14J
SNJ54AHC14W	Active	Production	CFP (W) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9680201QD A SNJ54AHC14W
SNJ54AHC14W.A	Active	Production	CFP (W) 14	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9680201QD A SNJ54AHC14W

⁽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.

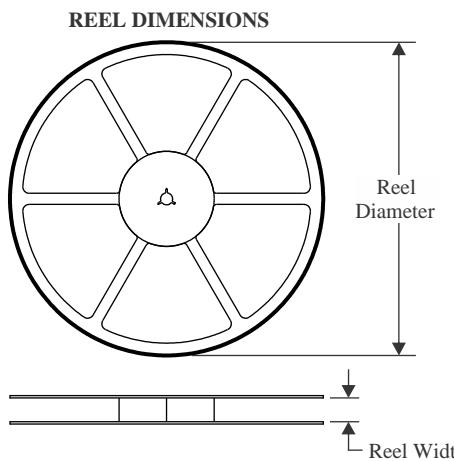
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN54AHC14, SN74AHC14 :

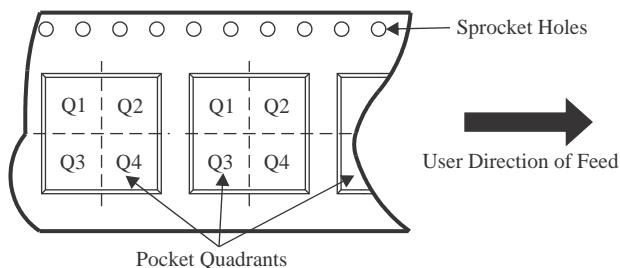
- Catalog : [SN74AHC14](#)
- Enhanced Product : [SN74AHC14-EP](#), [SN74AHC14-EP](#)
- Military : [SN54AHC14](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications

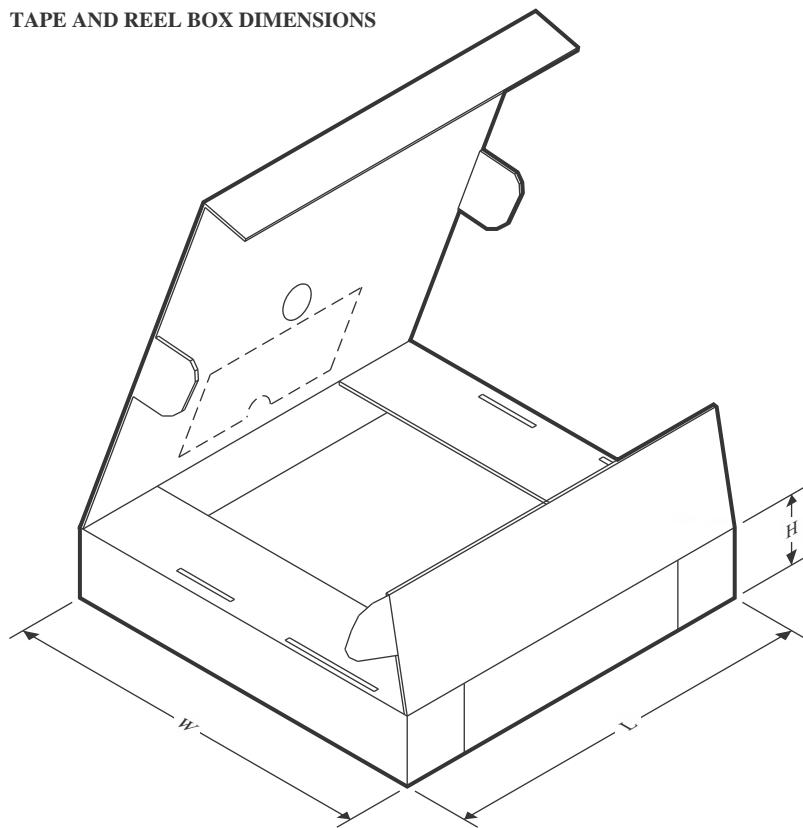
TAPE AND REEL INFORMATION


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


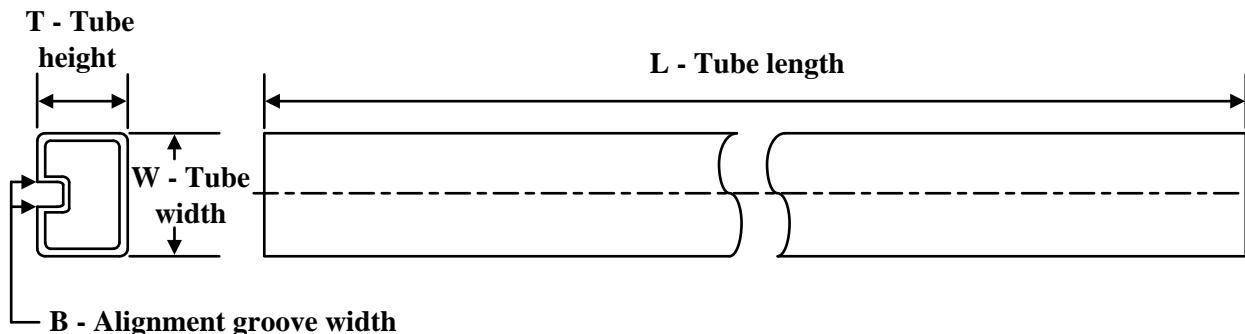
*All dimensions are nominal

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
SN74AHC14BQAR	WQFN	BQA	14	3000	180.0	12.4	2.8	3.3	1.1	4.0	12.0	Q1
SN74AHC14DBR	SSOP	DB	14	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74AHC14DGVR	TVSOP	DGV	14	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74AHC14DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74AHC14DRG3	SOIC	D	14	2500	330.0	16.8	6.5	9.5	2.1	8.0	16.0	Q1
SN74AHC14DRG4	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74AHC14NSR	SOP	NS	14	2000	330.0	16.4	8.45	10.55	2.5	12.0	16.2	Q1
SN74AHC14PWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AHC14PWRG3	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AHC14PWRG4	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AHC14RGYR	VQFN	RGY	14	3000	330.0	12.4	3.75	3.75	1.15	8.0	12.0	Q1
SN74AHC14RGYRG4	VQFN	RGY	14	3000	330.0	12.4	3.75	3.75	1.15	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)
SN74AHC14BQAR	WQFN	BQA	14	3000	210.0	185.0	35.0
SN74AHC14DBR	SSOP	DB	14	2000	353.0	353.0	32.0
SN74AHC14DGVR	TVSOP	DGV	14	2000	353.0	353.0	32.0
SN74AHC14DR	SOIC	D	14	2500	353.0	353.0	32.0
SN74AHC14DRG3	SOIC	D	14	2500	364.0	364.0	27.0
SN74AHC14DRG4	SOIC	D	14	2500	353.0	353.0	32.0
SN74AHC14NSR	SOP	NS	14	2000	353.0	353.0	32.0
SN74AHC14PWR	TSSOP	PW	14	2000	356.0	356.0	35.0
SN74AHC14PWRG3	TSSOP	PW	14	2000	364.0	364.0	27.0
SN74AHC14PWRG4	TSSOP	PW	14	2000	353.0	353.0	32.0
SN74AHC14RGYR	VQFN	RGY	14	3000	360.0	360.0	36.0
SN74AHC14RGYRG4	VQFN	RGY	14	3000	360.0	360.0	36.0

TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-9680201Q2A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-9680201QDA	W	CFP	14	25	506.98	26.16	6220	NA
5962-9682001QDA	W	CFP	14	25	506.98	26.16	6220	NA
SN74AHC14N	N	PDIP	14	25	506	13.97	11230	4.32
SN74AHC14N	N	PDIP	14	25	506	13.97	11230	4.32
SN74AHC14N.A	N	PDIP	14	25	506	13.97	11230	4.32
SN74AHC14N.A	N	PDIP	14	25	506	13.97	11230	4.32
SNJ54AHC08W	W	CFP	14	25	506.98	26.16	6220	NA
SNJ54AHC14FK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54AHC14FK.A	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54AHC14W	W	CFP	14	25	506.98	26.16	6220	NA
SNJ54AHC14W.A	W	CFP	14	25	506.98	26.16	6220	NA

GENERIC PACKAGE VIEW

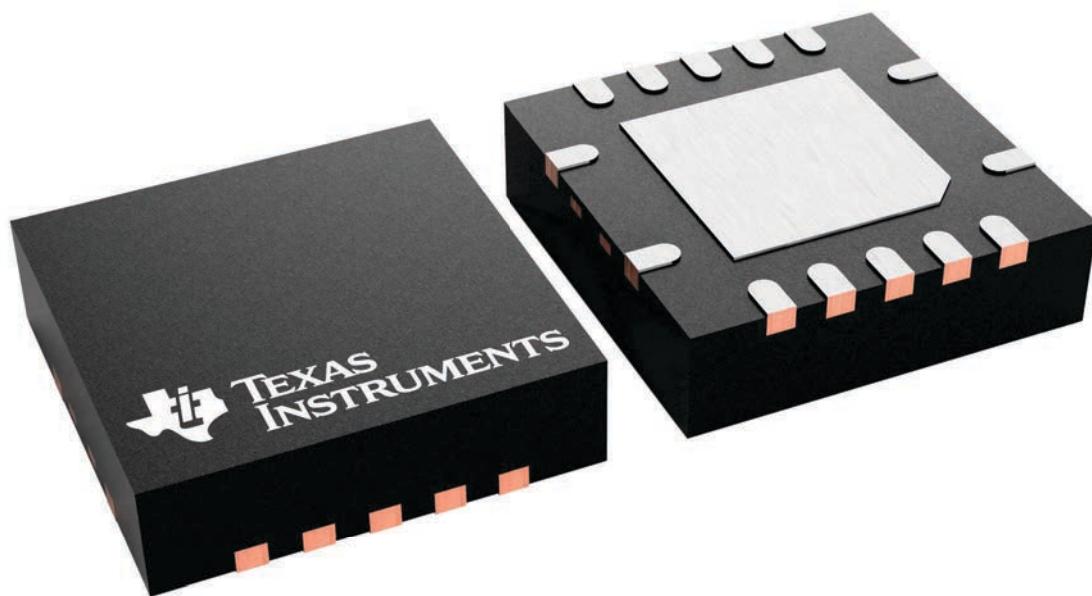
RGY 14

VQFN - 1 mm max height

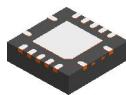
3.5 x 3.5, 0.5 mm pitch

PLASTIC QUAD FLATPACK - NO LEAD

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



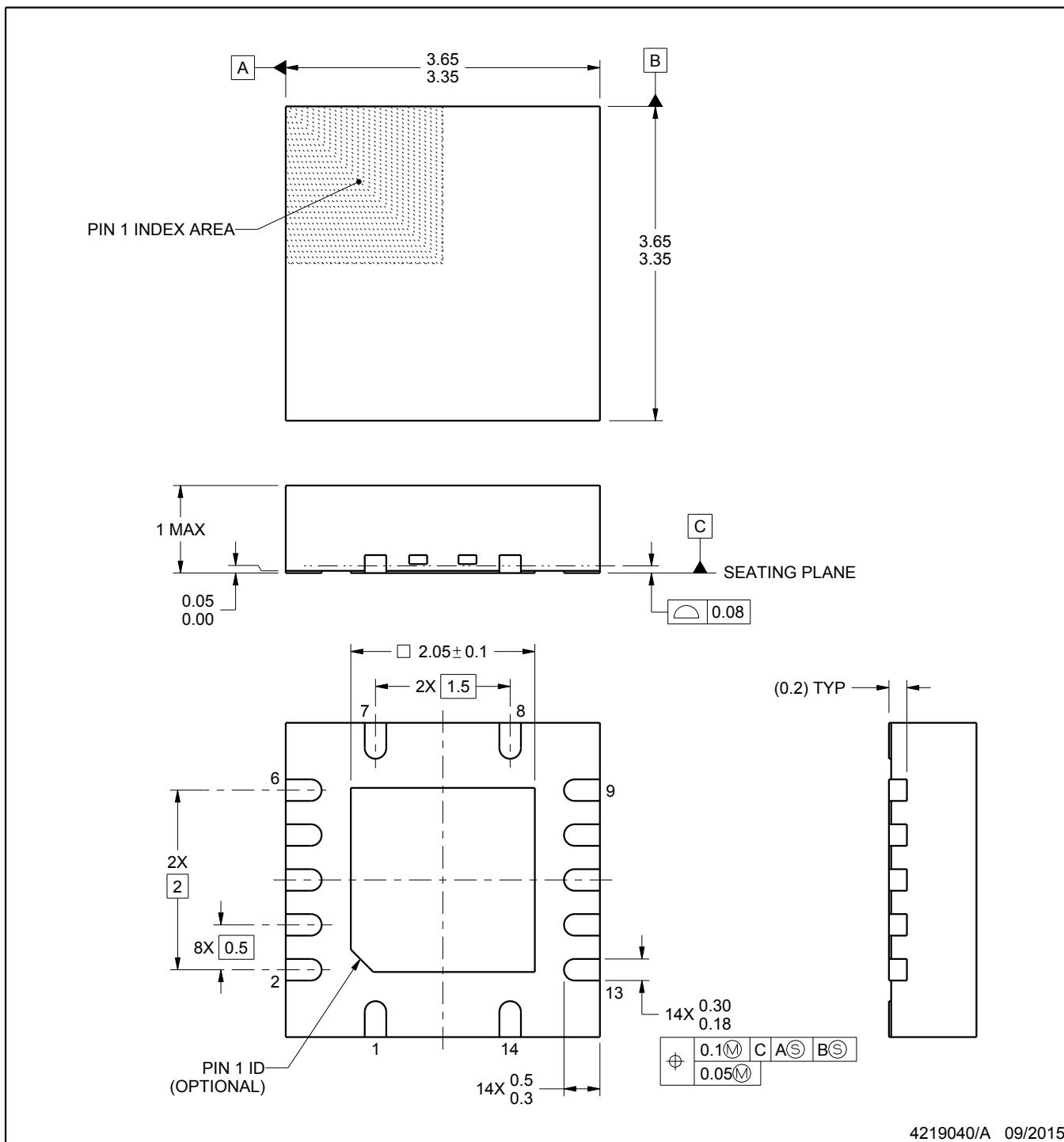
4231541/A



PACKAGE OUTLINE

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



4219040/A 09/2015

NOTES:

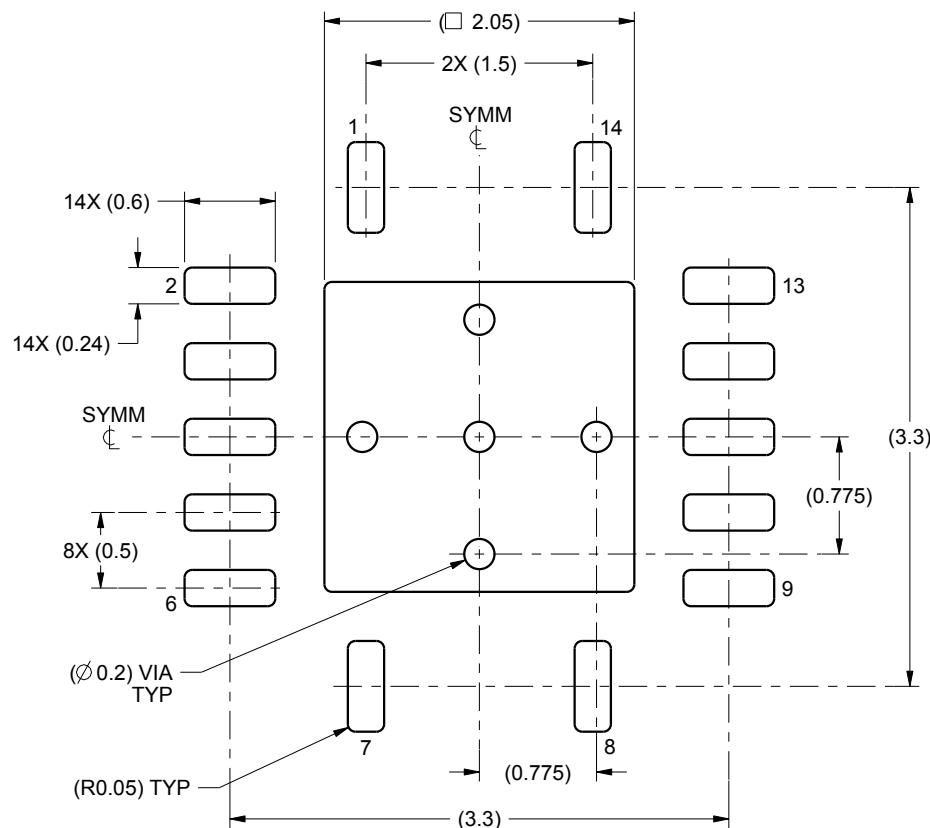
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

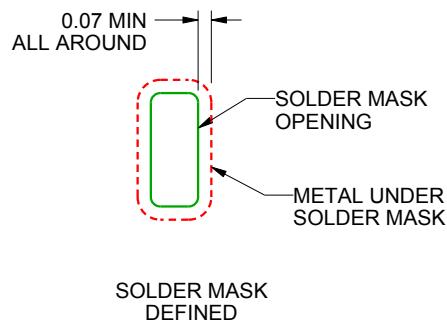
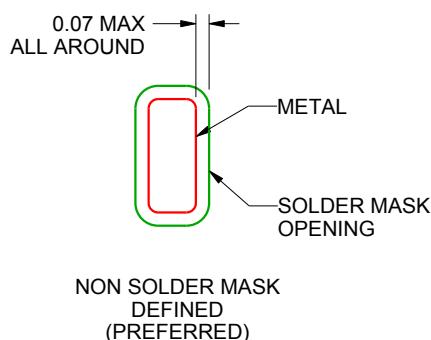
RGY0014A

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



LAND PATTERN EXAMPLE



SOLDER MASK DETAILS

4219040/A 09/2015

NOTES: (continued)

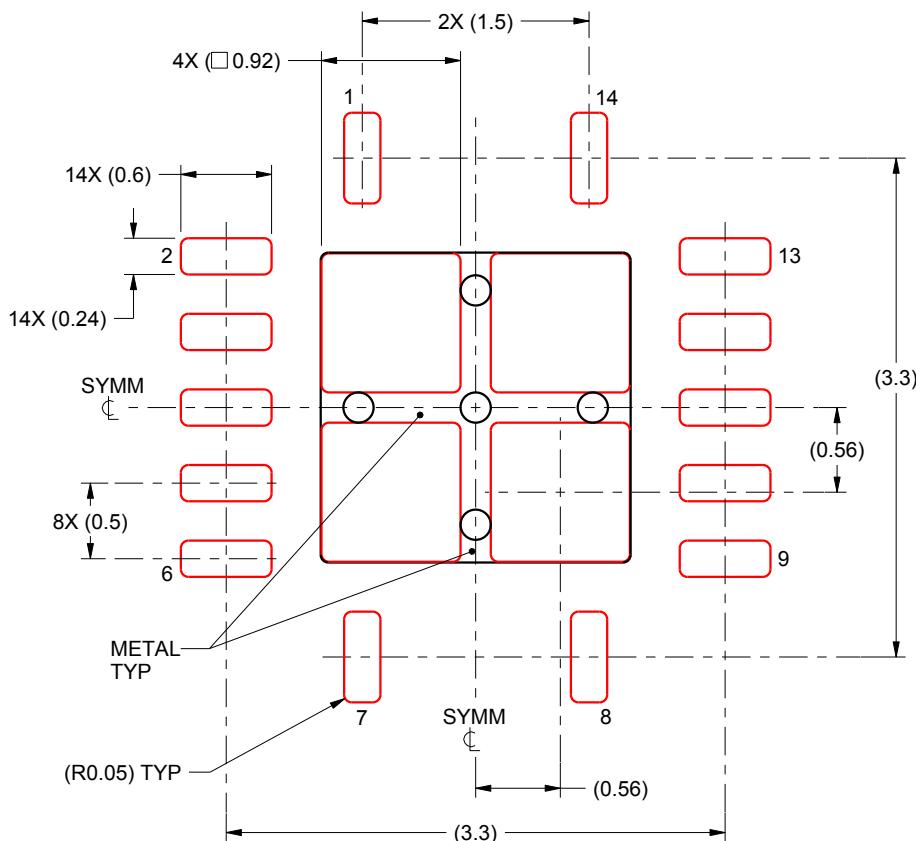
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

EXAMPLE STENCIL DESIGN

RGY0014A

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
80% PRINTED SOLDER COVERAGE BY AREA
SCALE:20X

4219040/A 09/2015

NOTES: (continued)

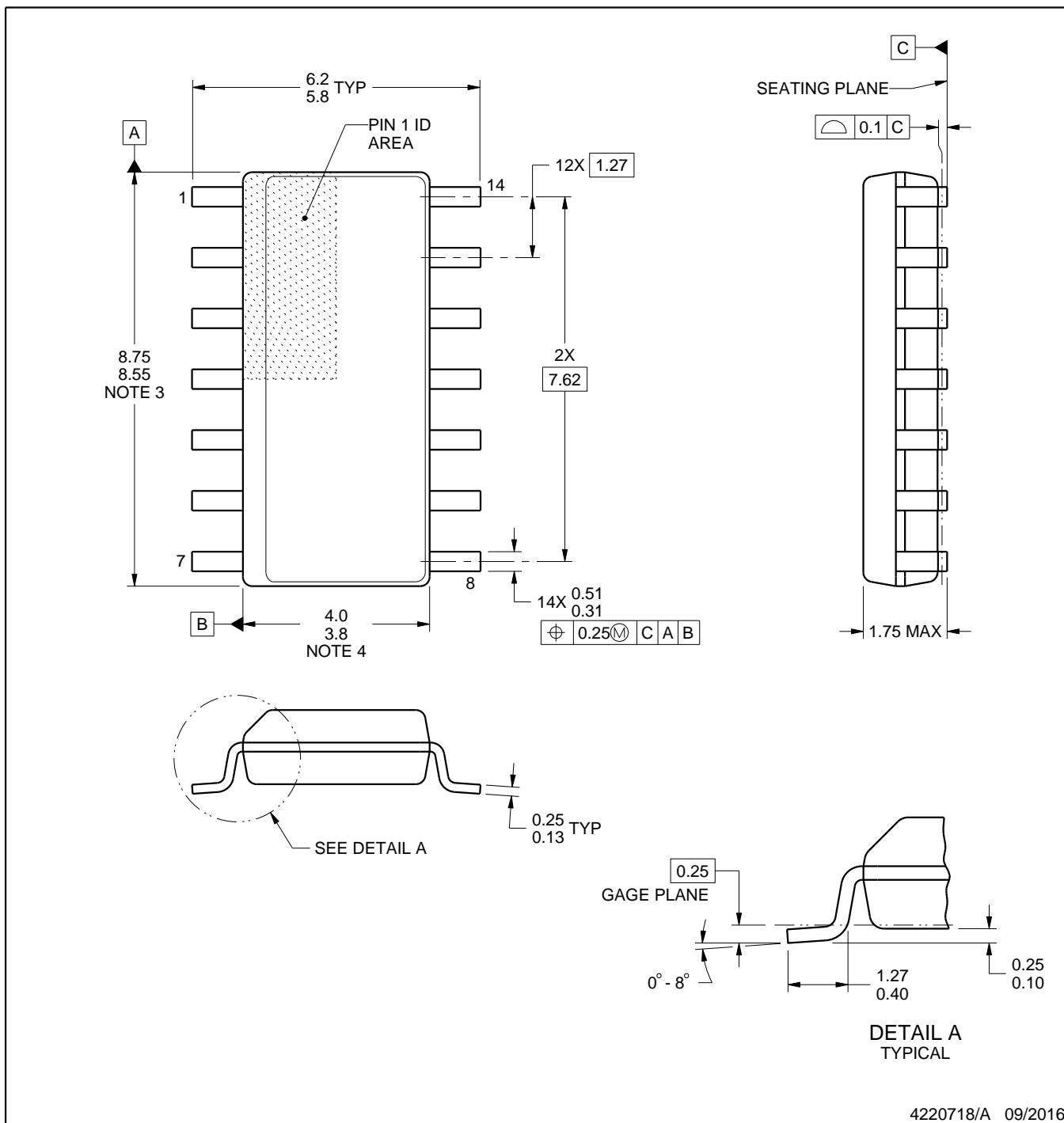
5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

PACKAGE OUTLINE

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



NOTES:

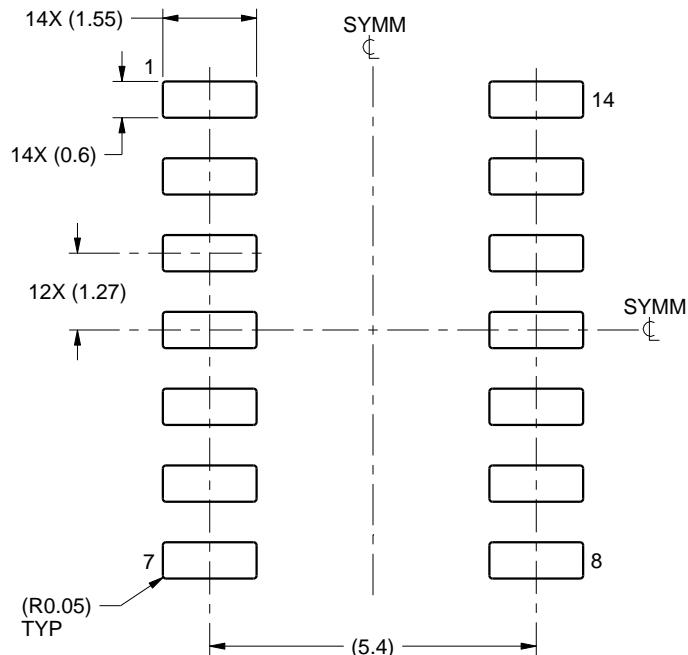
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate 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

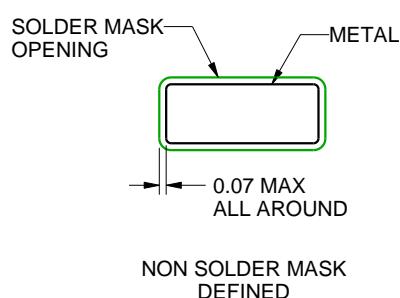
D0014A

SOIC - 1.75 mm max height

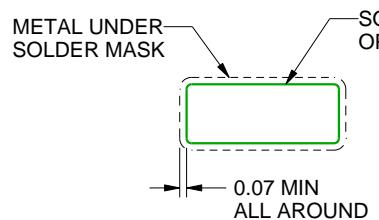
SMALL OUTLINE INTEGRATED CIRCUIT



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.

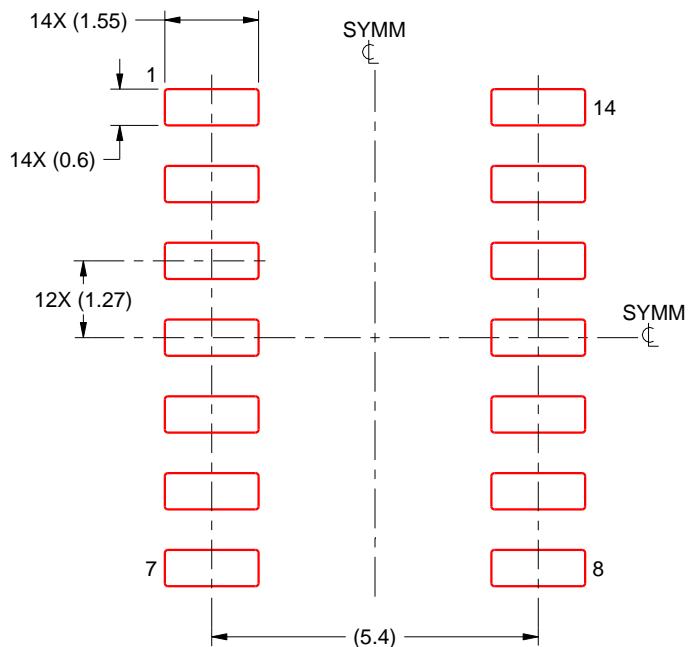
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

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.

GENERIC PACKAGE VIEW

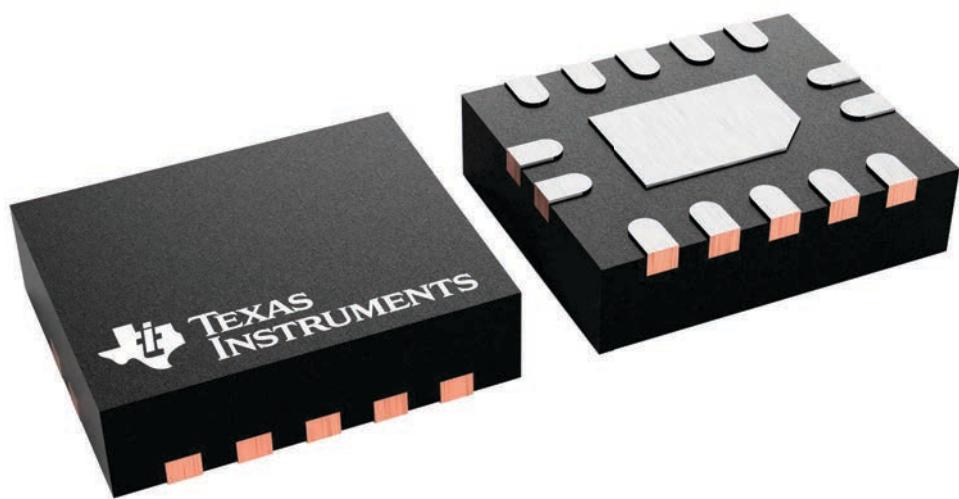
BQA 14

WQFN - 0.8 mm max height

2.5 x 3, 0.5 mm pitch

PLASTIC QUAD FLATPACK - NO LEAD

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

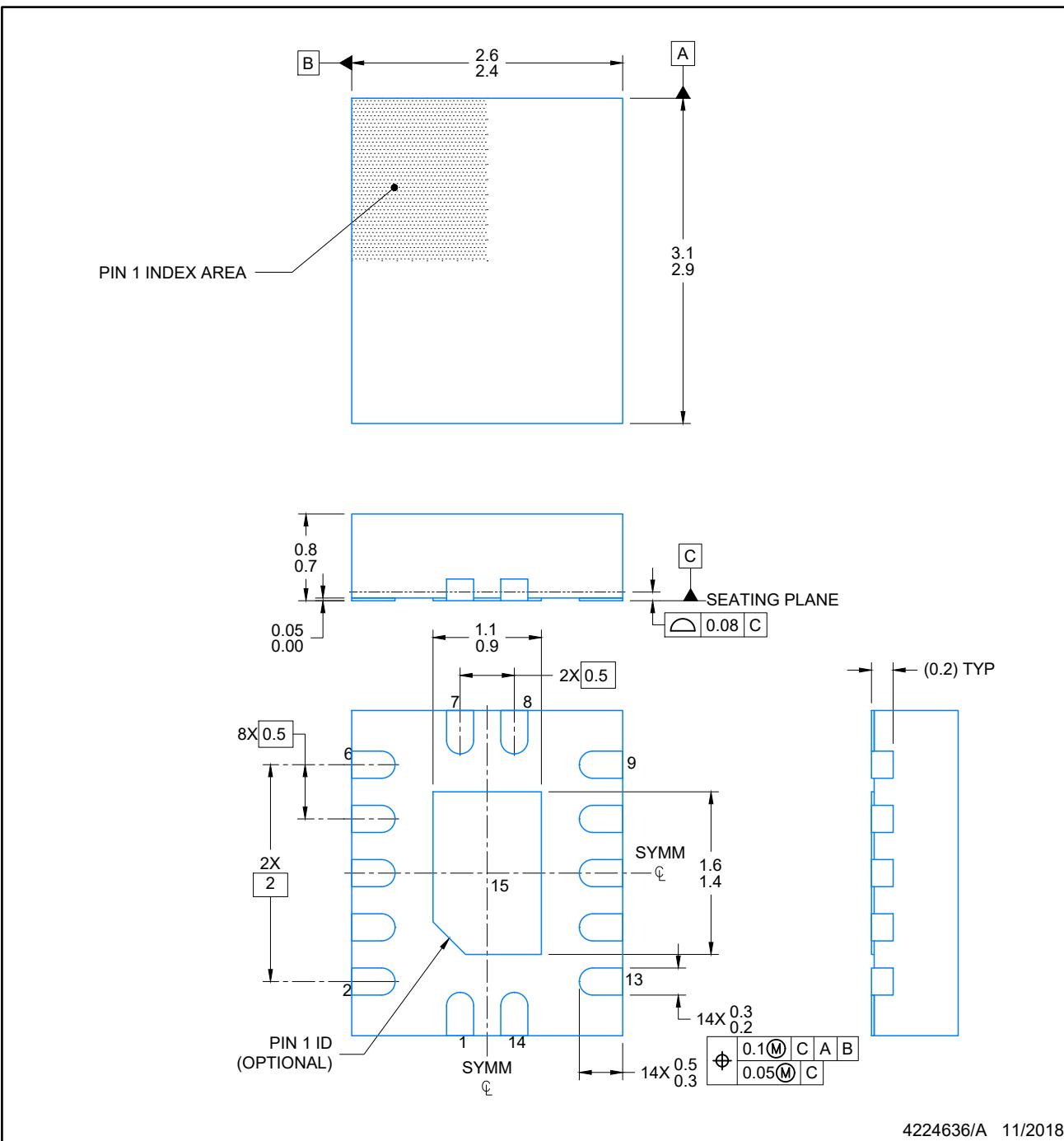


4227145/A

PACKAGE OUTLINE

WQFN - 0.8 mm max height

PLASTIC QUAD FLAT PACK-NO LEAD



4224636/A 11/2018

NOTES:

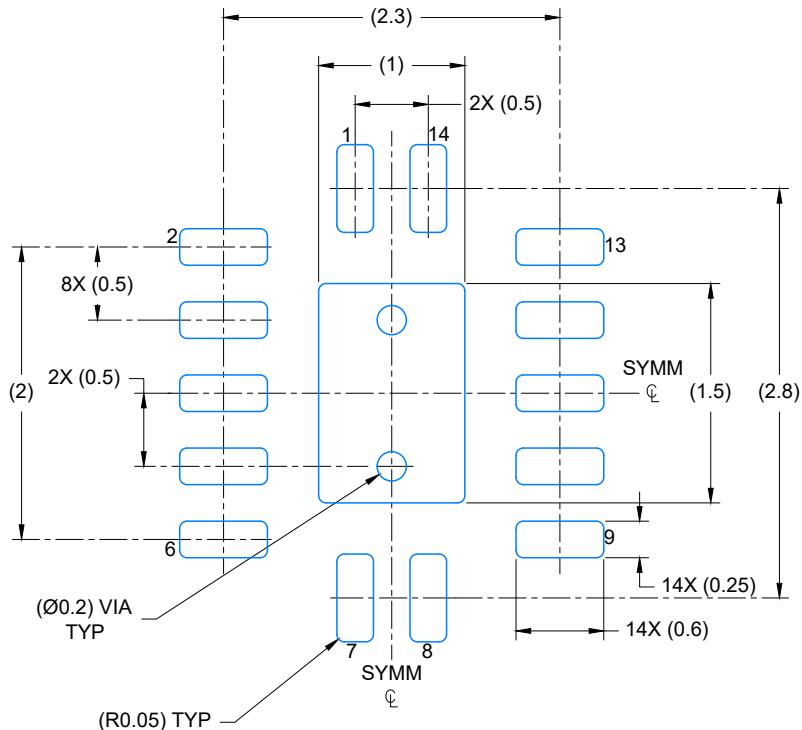
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for optimal thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

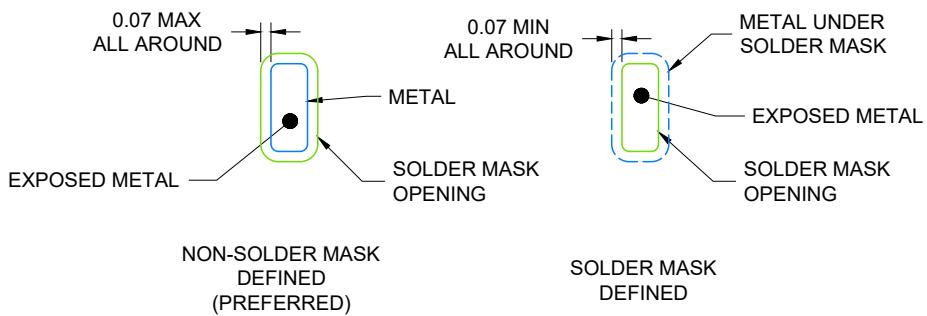
BQA0014A

WQFN - 0.8 mm max height

PLASTIC QUAD FLAT PACK-NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X



4224636/A 11/2018

NOTES: (continued)

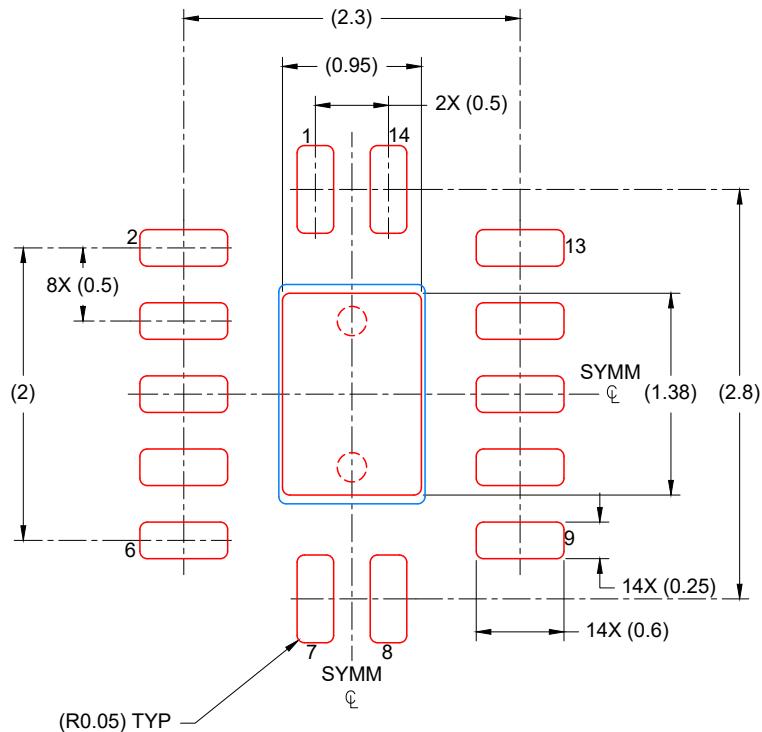
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

BQA0014A

WQFN - 0.8 mm max height

PLASTIC QUAD FLAT PACK-NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
88% PRINTED COVERAGE BY AREA
SCALE: 20X

4224636/A 11/2018

NOTES: (continued)

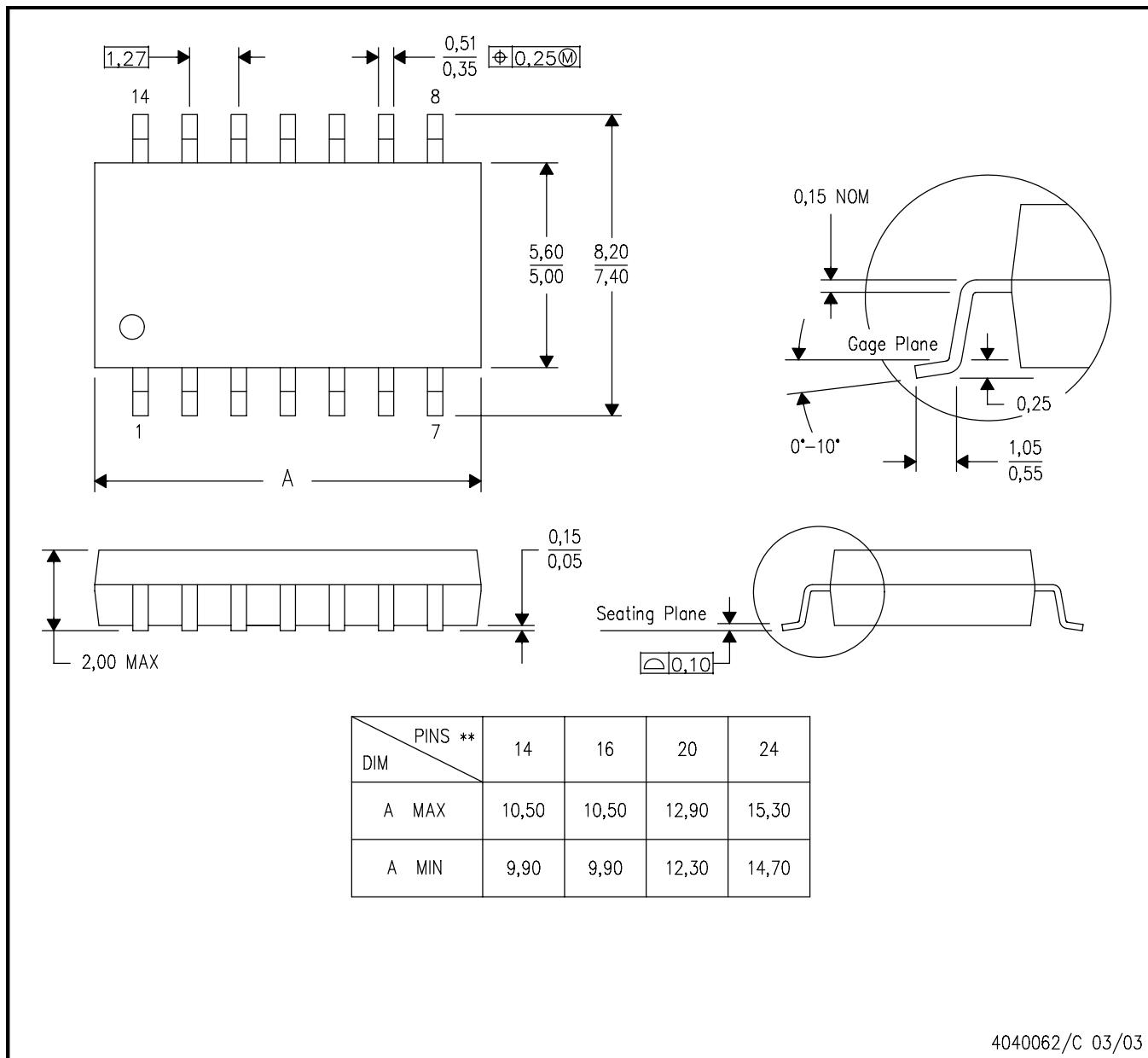
6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

MECHANICAL DATA

NS (R-PDSO-G)**

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

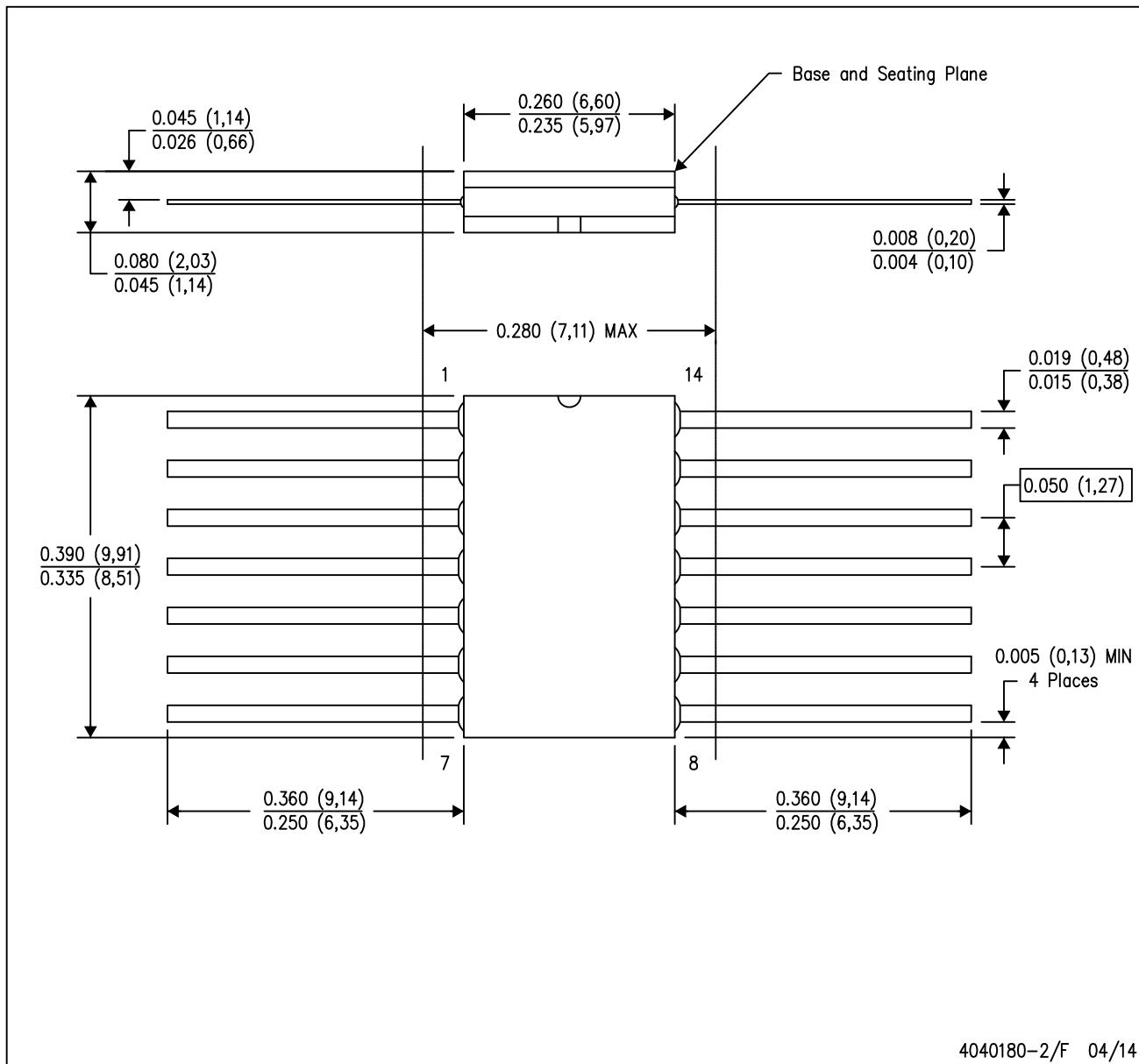


NOTES:

- 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



4040180-2/F 04/14

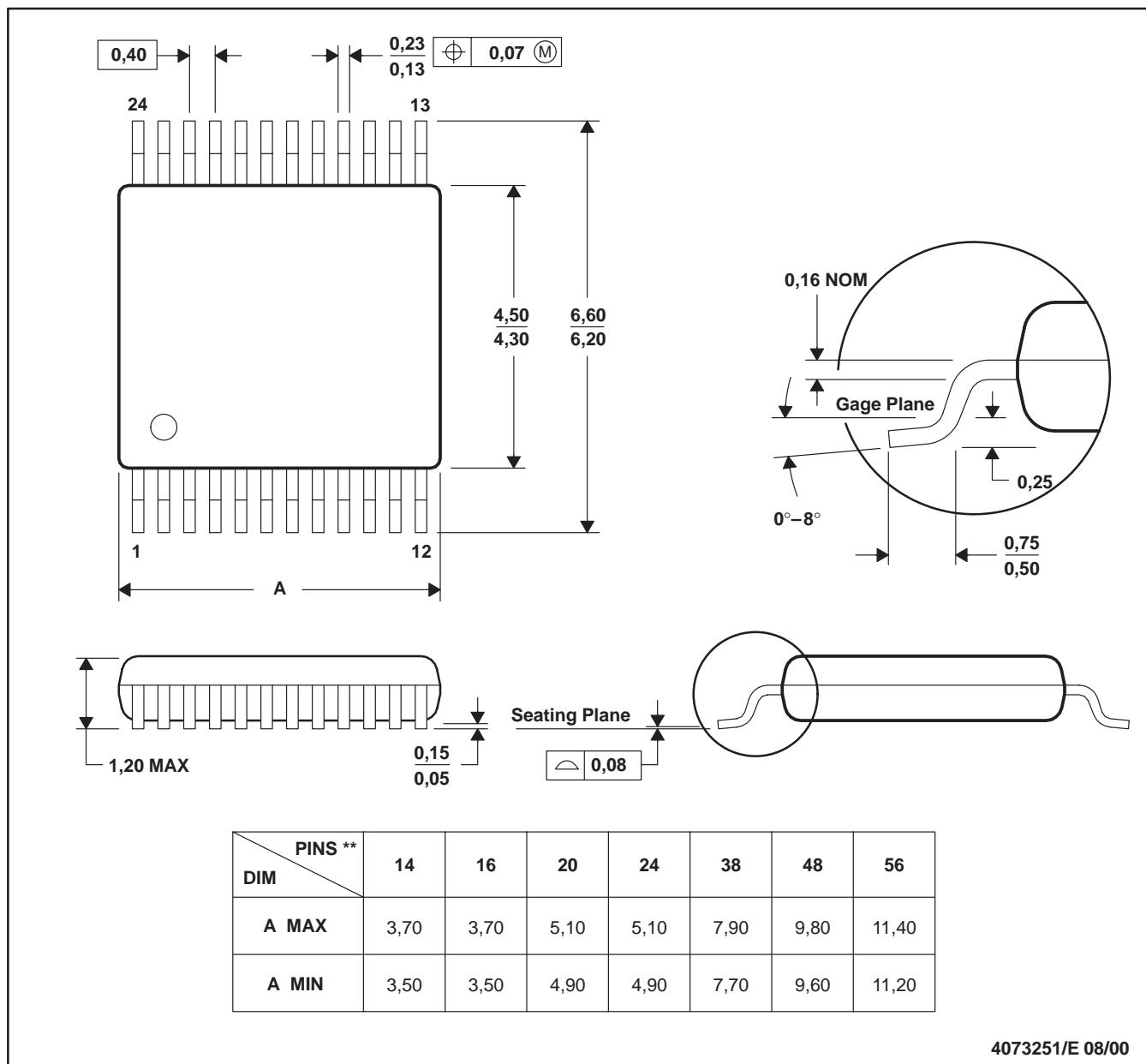
NOTES:

- 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

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN

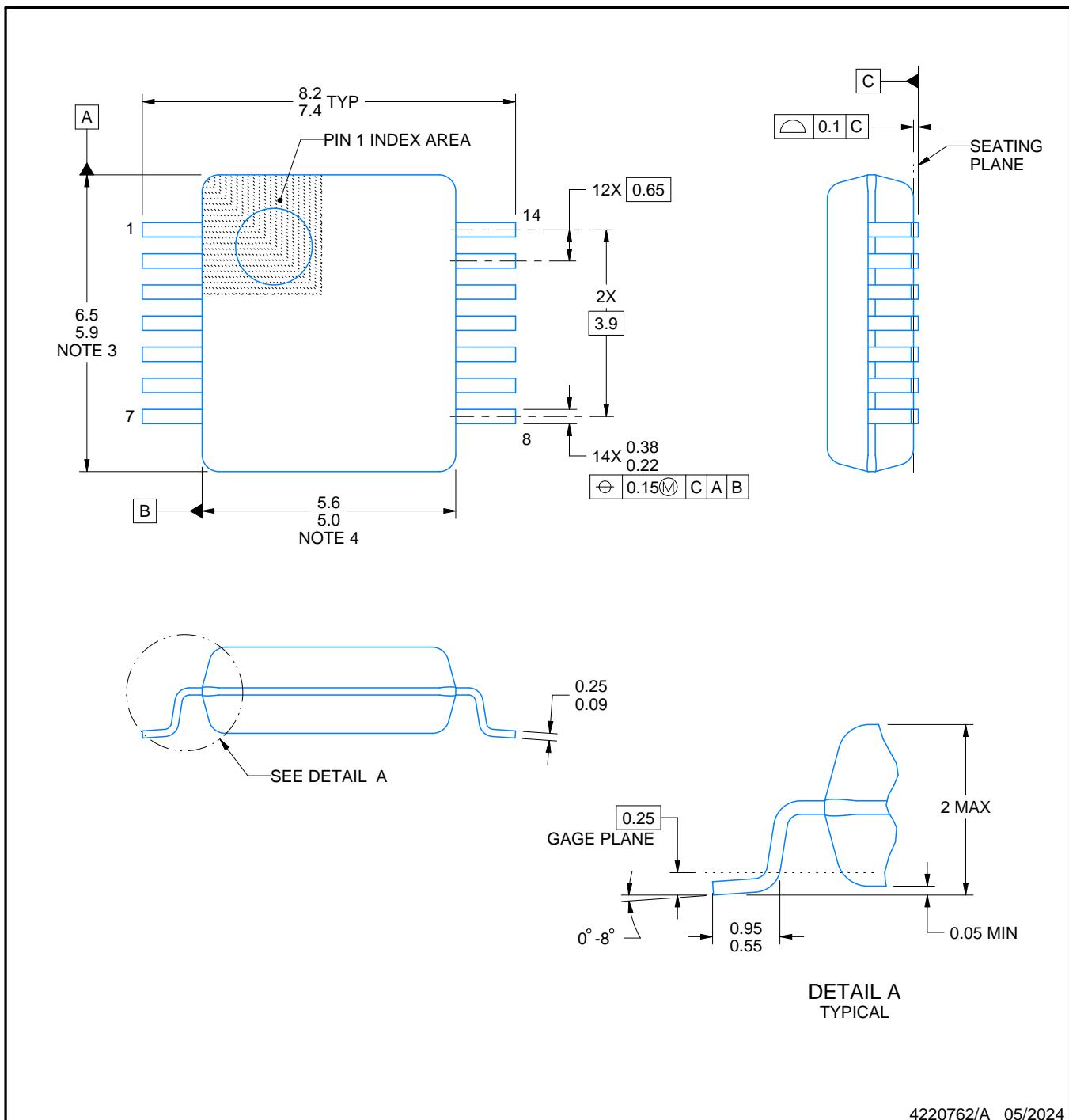


NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

PACKAGE OUTLINE

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

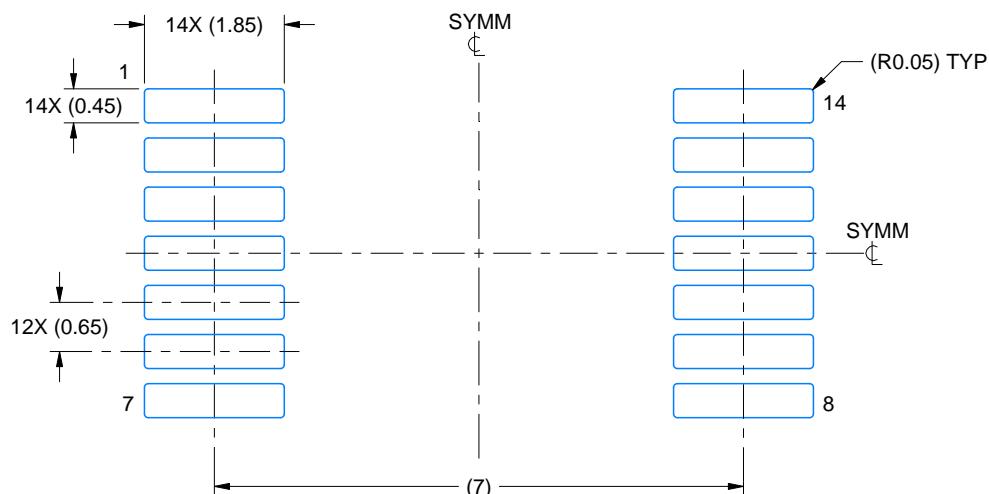
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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

EXAMPLE BOARD LAYOUT

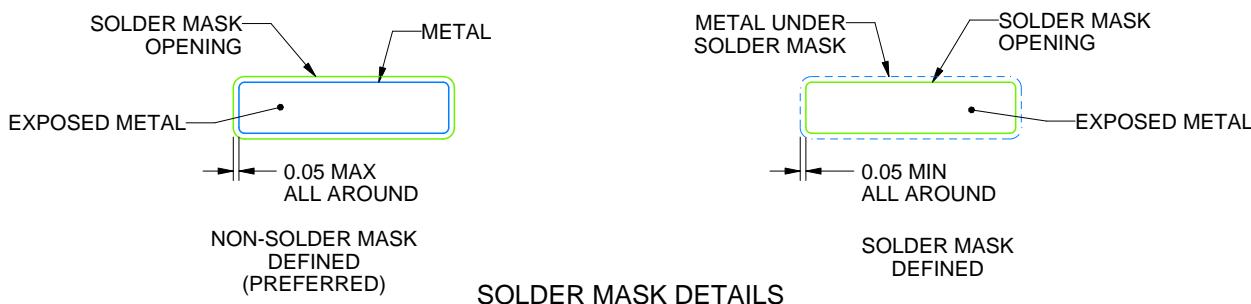
DB0014A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220762/A 05/2024

NOTES: (continued)

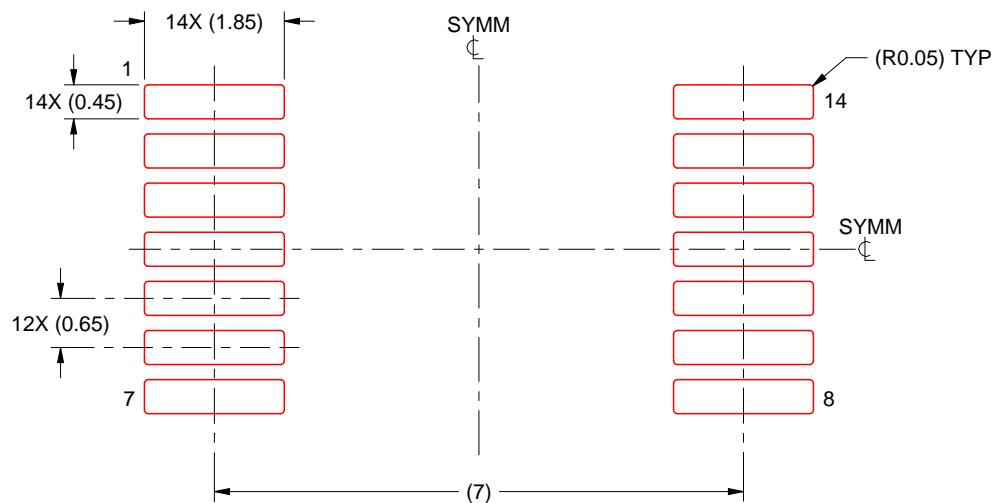
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

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.

GENERIC PACKAGE VIEW

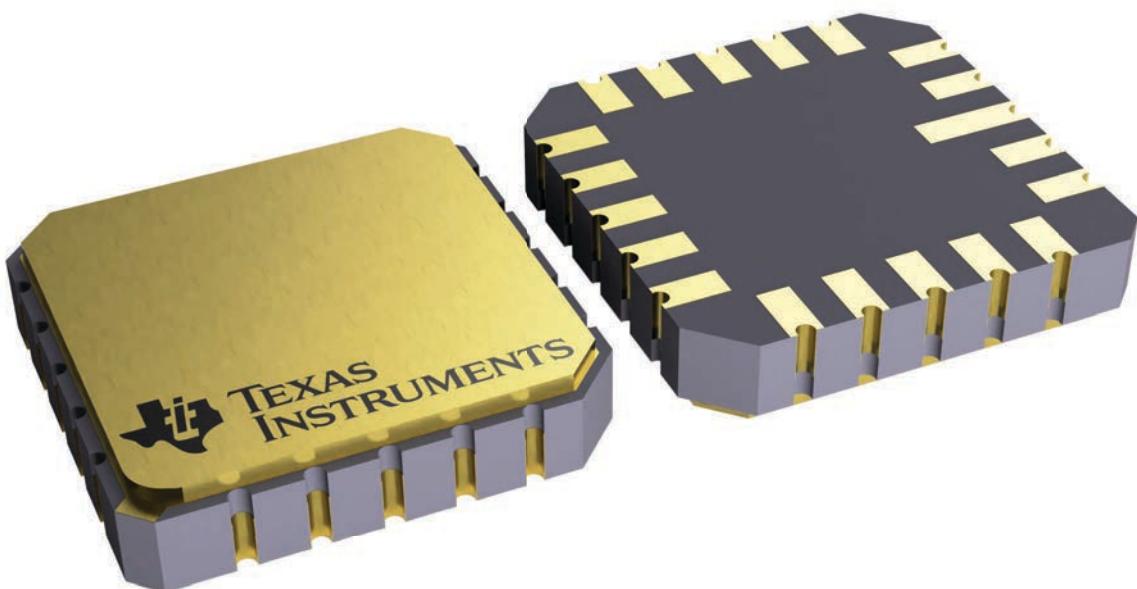
FK 20

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.



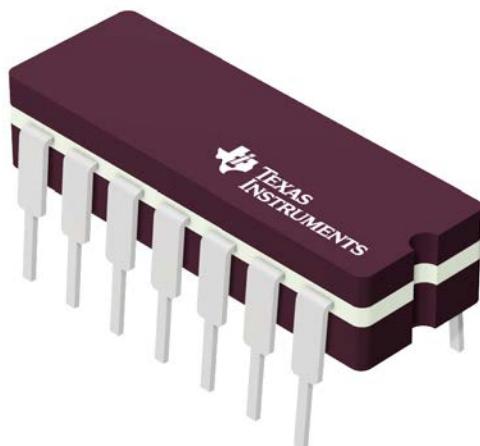
4229370VA\

GENERIC PACKAGE VIEW

J 14

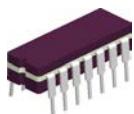
CDIP - 5.08 mm max height

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

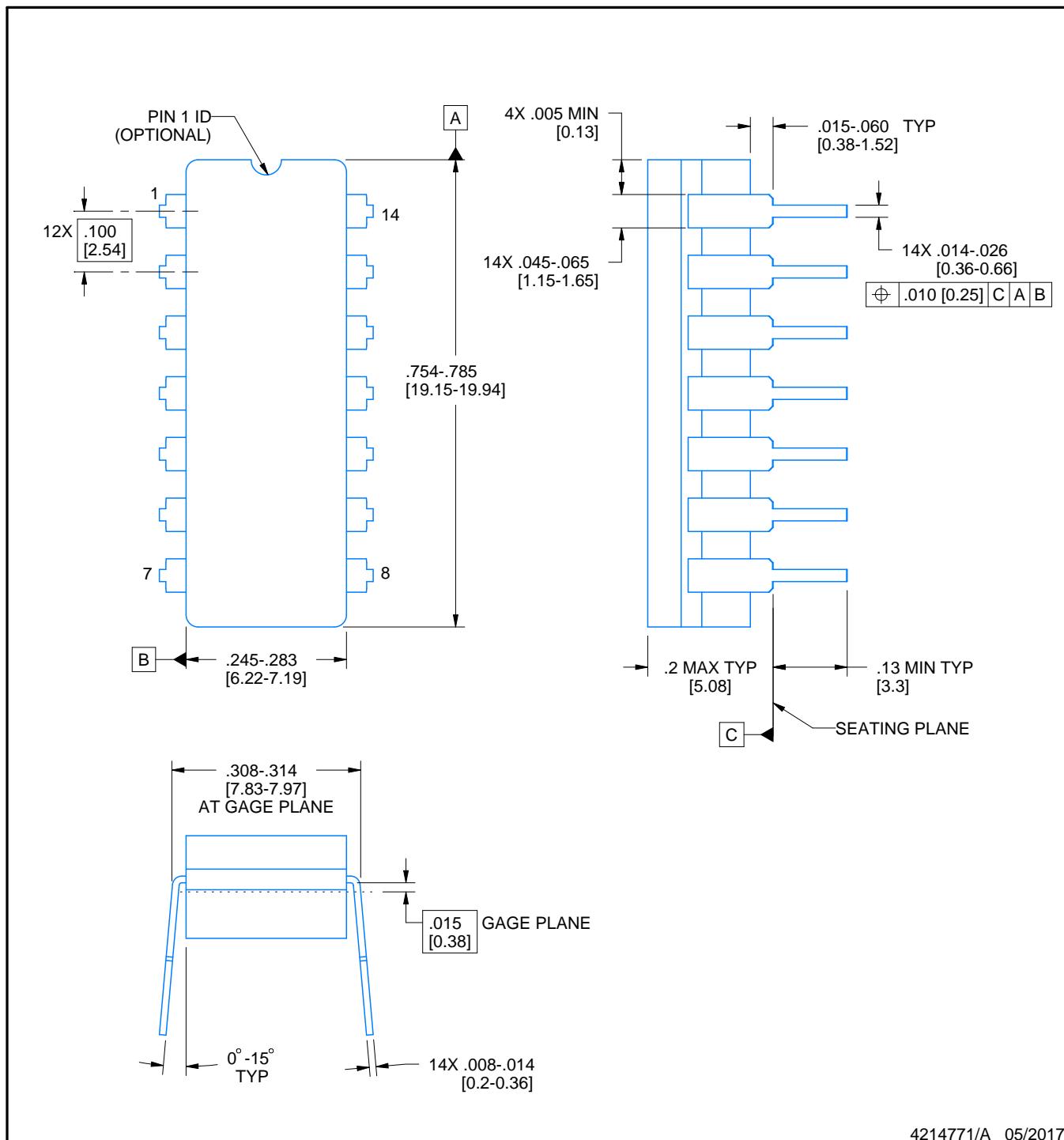


PACKAGE OUTLINE

J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

NOTES:

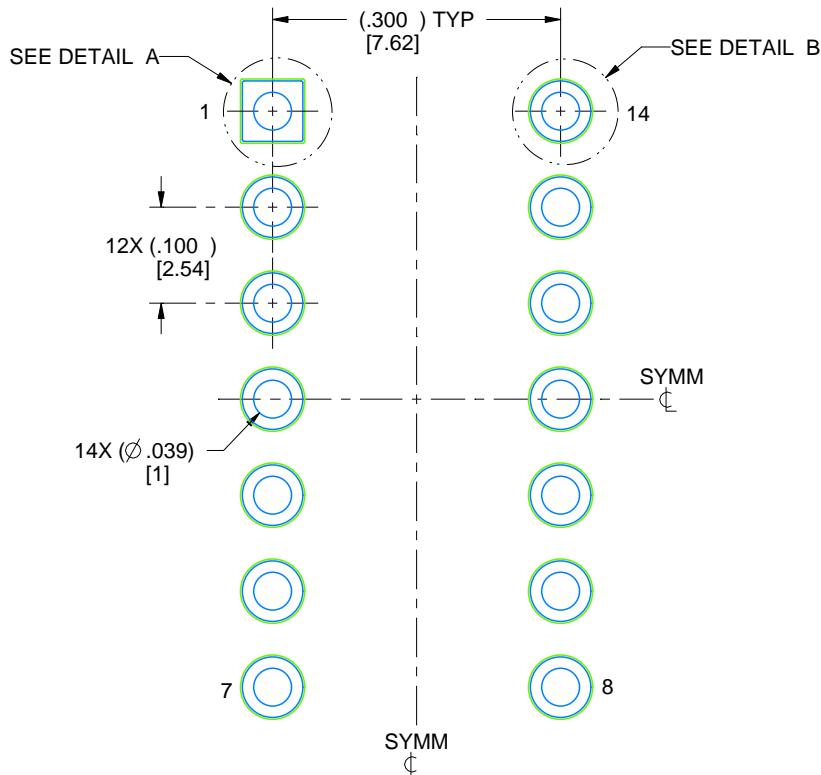
1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with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

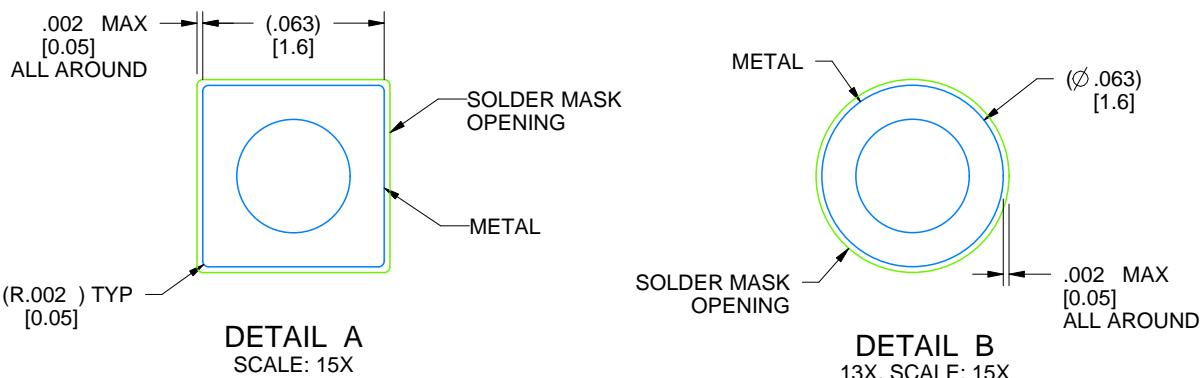
J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



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

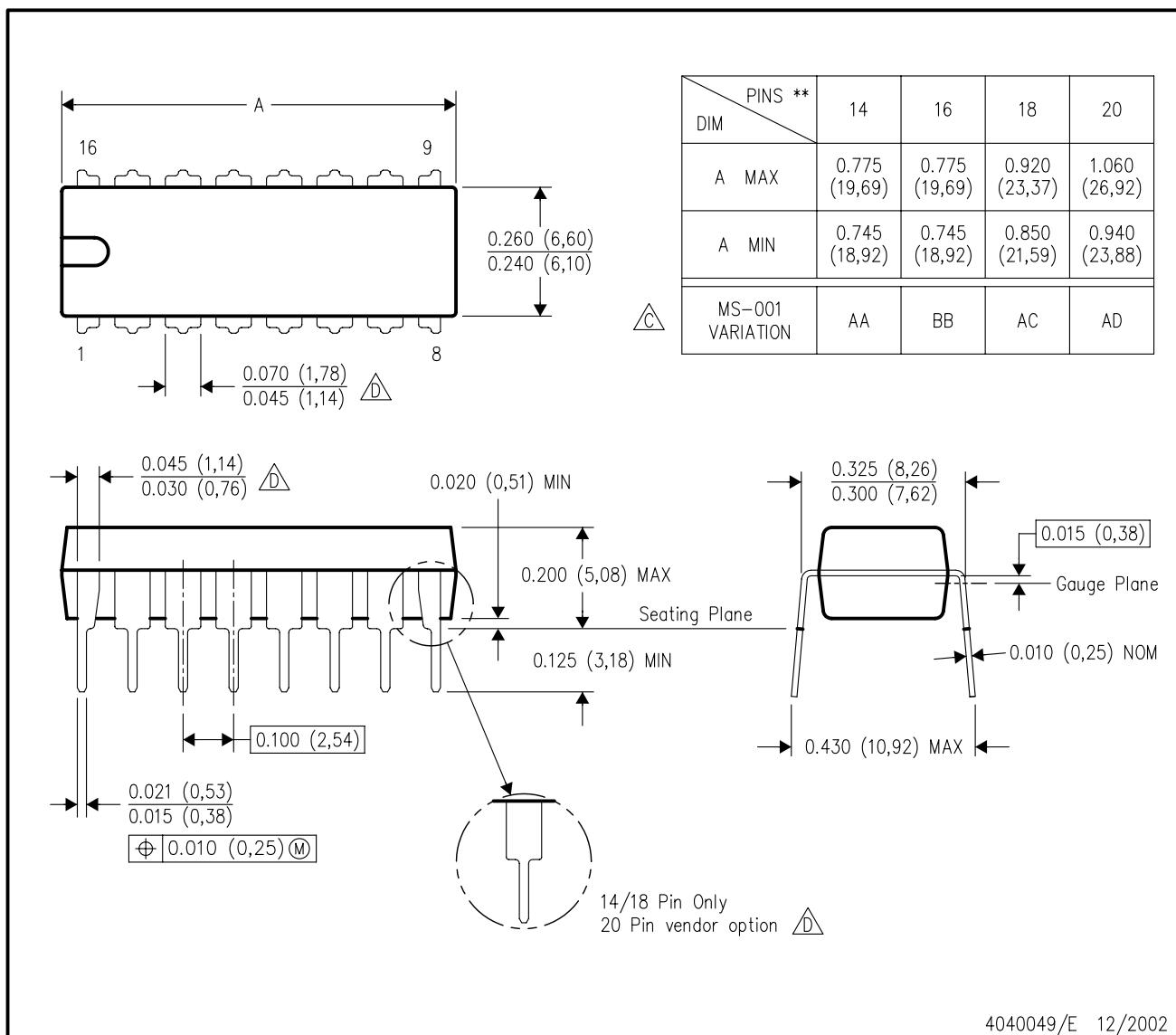


4214771/A 05/2017

N (R-PDIP-T**)

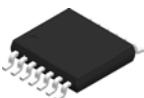
16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



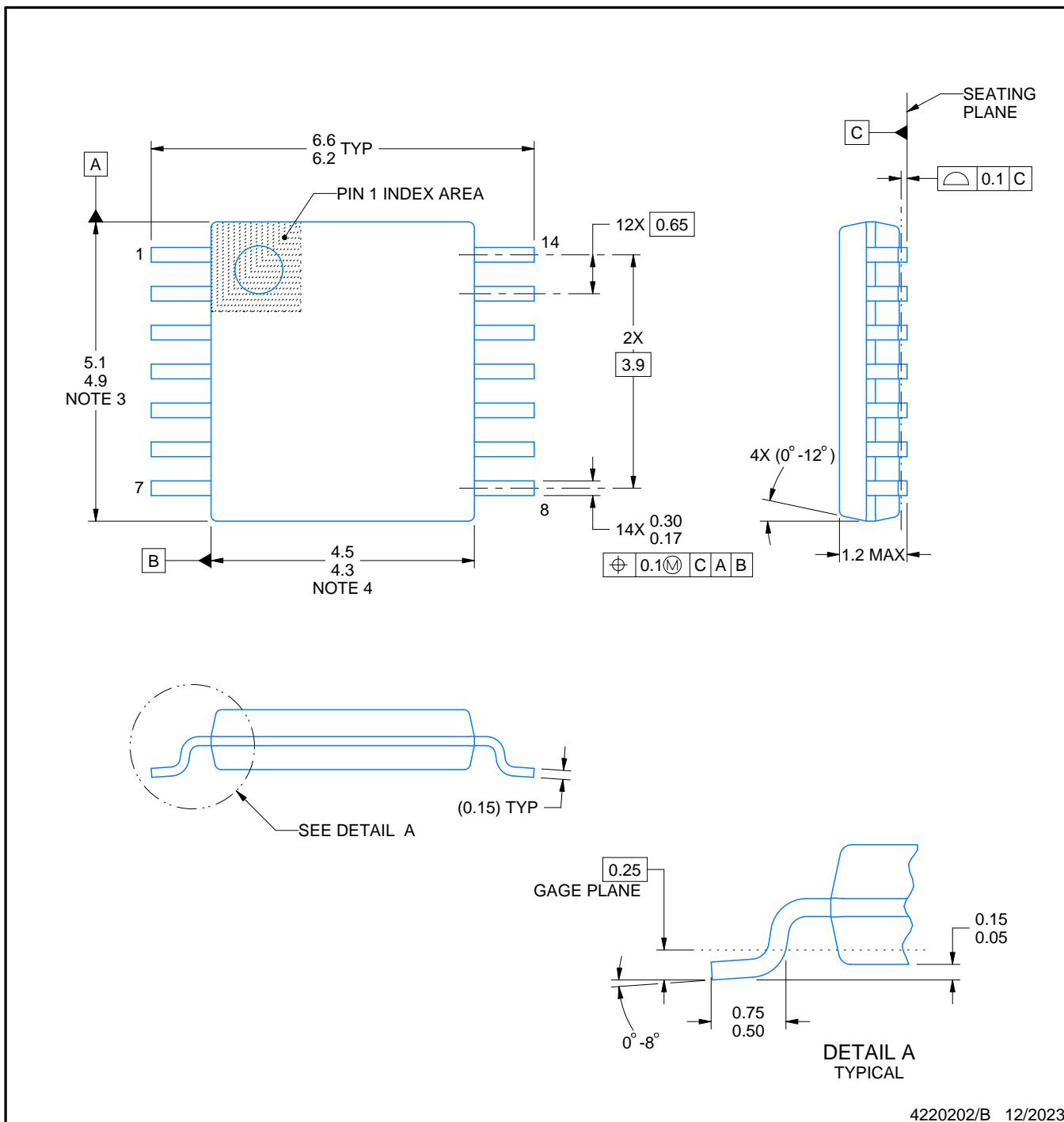
PACKAGE OUTLINE

PW0014A



TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

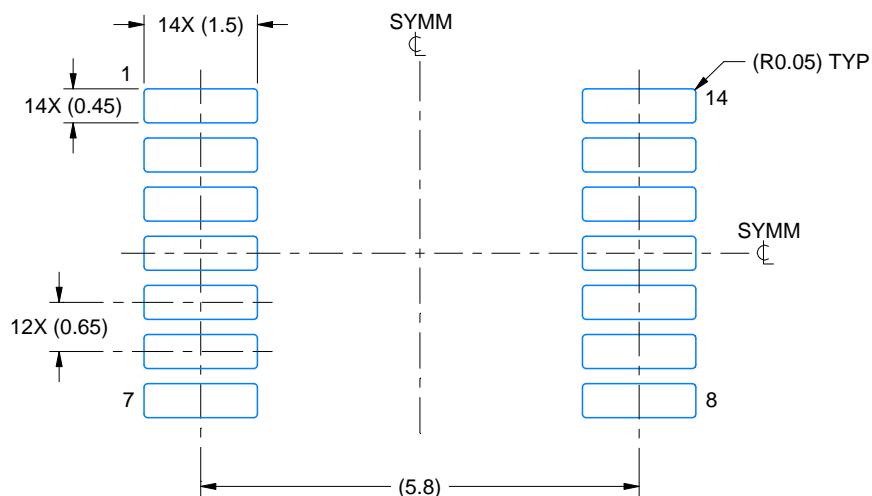
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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

EXAMPLE BOARD LAYOUT

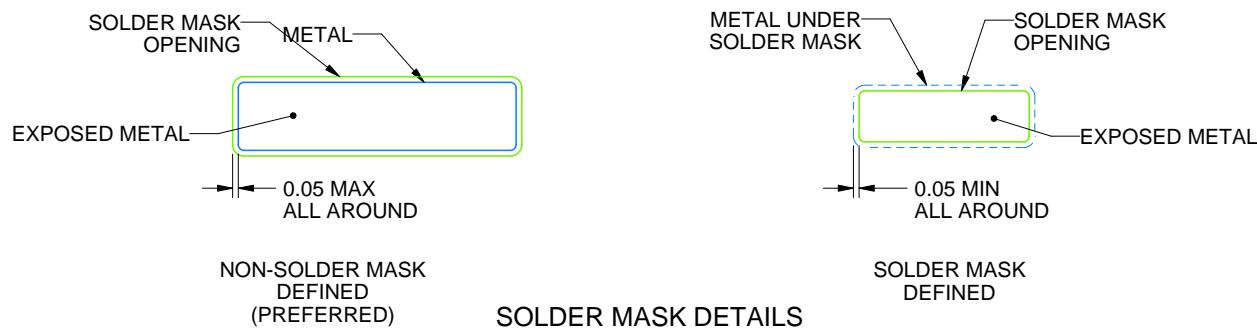
PW0014A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220202/B 12/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

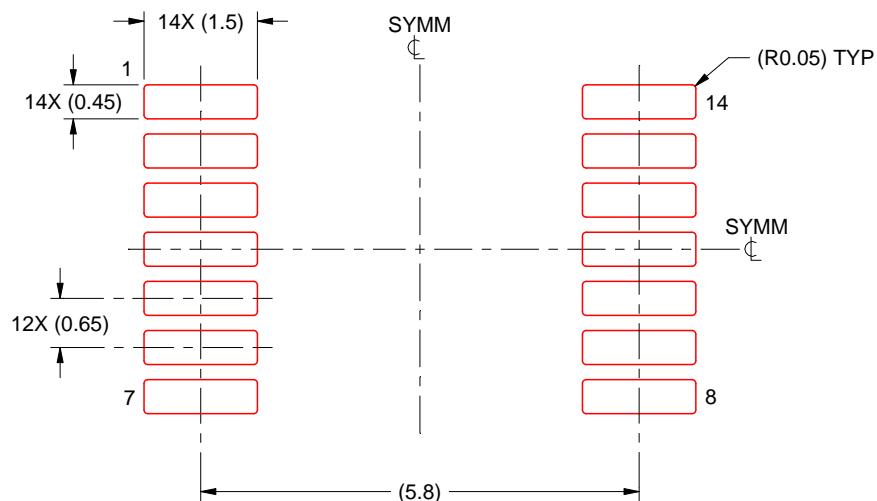
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

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.

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