

## SNx4LVC02A Quadruple 2-Input Positive-NOR Gates

### 1 Features

- Operate from 1.65V to 3.6V
- Specified from –40°C to 85°C, –40°C to 125°C, and –55°C to 125°C
- Inputs accept voltages to 5.5V
- Max  $t_{pd}$  of 4.4ns at 3.3V
- Typical  $V_{OLP}$  (output ground bounce) <0.8V at  $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$
- Typical  $V_{OHV}$  (output  $V_{OH}$  undershoot) >2V at  $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$
- Latch-up performance exceeds 250mA per JESD 17

### 2 Description

Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of these devices as translators in a mixed 3.3V/5V system environment.

The device performs the Boolean function  $Y = \overline{A + B}$  or  $Y = \overline{A} \cdot \overline{B}$  in positive logic.

Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of this device as a translator in a mixed 3.3V/5V system environment.

#### Device Information

PART NUMBER	PACKAGE SIZE <sup>(1)</sup>	PACKAGE SIZE <sup>(2)</sup>	BODY SIZE <sup>(3)</sup>
SNx4LVC02A	BQA (WQFN, 14)	3mm × 2.5mm	3mm × 2.5mm
	D (SOIC, 14)	8.65mm × 6mm	8.65mm × 3.9mm
	DB (SSOP, 14)	6.2mm × 7.8mm	6.2mm × 5.3mm
	NS (SOP, 14)	10.2mm × 7.8mm	10.3mm × 5.3mm
	PW (TSSOP, 14)	5mm × 6.4mm	5mm × 4.4mm
	RGY (VQFN, 14)	3.5mm × 3.5mm	3.5mm × 3.5mm
	FK (LCCC, 20)	8.9mm × 8.9mm	8.89mm × 8.89mm
	J (CDIP, 14)	19.55mm × 7.9mm	19.55mm × 6.7mm
	W (CFP, 14)	9.21mm × 9mm	9.21mm × 6.28mm

- (1) For more information, see [Section 10](#).
- (2) The package size (length × width) is a nominal value and includes pins, where applicable.
- (3) The body size (length × width) is a nominal value and does not include pins.



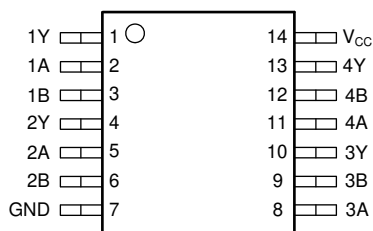
**Logic Diagram, Each Gate (Positive Logic)**



## Table of Contents

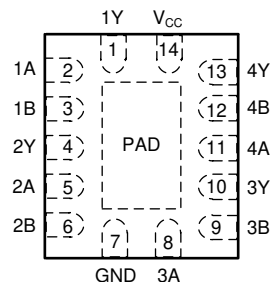
<b>1 Features</b> .....	<b>1</b>	<b>6 Detailed Description</b> .....	<b>9</b>
<b>2 Description</b> .....	<b>1</b>	6.1 Functional Block Diagram.....	9
<b>3 Pin Configuration and Functions</b> .....	<b>3</b>	6.2 Device Functional Modes.....	9
<b>4 Specifications</b> .....	<b>4</b>	<b>7 Application and Implementation</b> .....	<b>10</b>
4.1 Absolute Maximum Ratings .....	4	7.1 Power Supply Recommendations.....	10
4.2 ESD Ratings.....	4	7.2 Layout.....	10
4.3 Recommended Operating Conditions, SN54LVC02A.....	4	<b>8 Device and Documentation Support</b> .....	<b>11</b>
4.4 Recommended Operating Conditions, SN74LVC02A .....	4	8.1 Documentation Support.....	11
4.5 Thermal Information.....	5	8.2 Receiving Notification of Documentation Updates....	11
4.6 Electrical Characteristics, SN54LVC02A .....	5	8.3 Support Resources.....	11
4.7 Electrical Characteristics, SN74LVC02A .....	6	8.4 Trademarks.....	11
4.8 Switching Characteristics, SN54LVC02A .....	6	8.5 Electrostatic Discharge Caution.....	11
4.9 Switching Characteristics, SN74LVC02A .....	6	8.6 Glossary.....	11
4.10 Operating Characteristics.....	7	<b>9 Revision History</b> .....	<b>11</b>
<b>5 Parameter Measurement Information</b> .....	<b>8</b>	<b>10 Mechanical, Packaging, and Orderable Information</b> .....	<b>12</b>

## 3 Pin Configuration and Functions

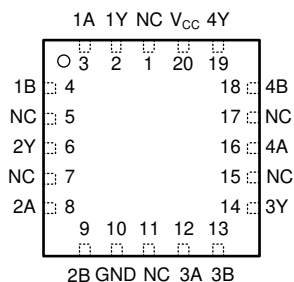


**Figure 3-1. SN54LVC02A J or W Package, 14-Pin (Top View)**

**SN74LVC02A D, DB, NS, or PW Package, 14-Pin SOIC, SSOP, SOP or TSSOP (Top View)**



**Figure 3-2. SN74LVC02A RGY or BQA Package, 14-Pin VQFN or WQFN (Top View)**



**Figure 3-3. SN54LVC02A FK Package, 20-Pin (Top View)**

**Table 3-1. Pin Functions**

NAME	PIN			TYPE <sup>(1)</sup>	DESCRIPTION
	SN74LVC02A D, DB, NS, PW, RGY, BQA	J, W	FK		
1Y	1	1	2	O	1Y Output
1A	2	2	3	I	1A Input
1B	3	3	4	I	1B Input
2Y	4	4	6	O	2Y Output
2A	5	5	8	I	2A Input
2B	6	6	9	I	2B Input
GND	7	7	10	—	Ground Pin
3A	8	8	12	I	3A Input
3B	9	9	13	I	3B Input
3Y	10	20	14	O	3Y Output
4A	11	11	16	I	4A Input
4B	12	12	18	I	4B Input
4Y	13	13	19	O	4Y Output
V <sub>CC</sub>	14	14	20	—	Power Pin
NC	—	—	1, 5, 7, 11, 15, 17	—	No Connection

(1) I = input, O = output

## 4 Specifications

### 4.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage range	–0.5	6.5	V
$V_I$	Input voltage range <sup>(1)</sup>	–0.5	6.5	V
$V_O$	Output voltage range <sup>(1) (2)</sup>	–0.5	$V_{CC} + 0.5$	V
$I_{IK}$	Input clamp current	$V_I < 0$		–50 mA
$I_{OK}$	Output clamp current	$V_O < 0$		–50 mA
$I_O$	Continuous output current		±50	mA
	Continuous current through $V_{CC}$ or GND		±100	mA
$T_{stg}$	Storage temperature range	–65	150	°C
$P_{tot}$	Power dissipation	$T_A = -40^{\circ}\text{C to } 125^{\circ}\text{C}^{(3) (4)}$		500 mW

(1) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

(2) The value of  $V_{CC}$  is provided in the recommended operating conditions table.

(3) For the D package: above 70°C, the value of  $P_{tot}$  derates linearly with 8 mW/K.

(4) For the DB, NS, and PW packages: above 60°C, the value of  $P_{tot}$  derates linearly with 5.5 mW/K.

### 4.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	±2000
		Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002 <sup>(2)</sup>	±1000

(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.

### 4.3 Recommended Operating Conditions, SN54LVC02A

			SN54LVC02A		UNIT
			–55°C to 125°C		
			MIN	MAX	
V <sub>CC</sub>	Supply voltage	Operating	2	3.6	V
		Data retention only	1.5		
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2.7V to 3.6V	2		V
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2.7V to 3.6V		0.8	V
V <sub>I</sub>	Input voltage		0	5.5	V
V <sub>O</sub>	Output voltage		0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 2.7V		–12	mA
		V <sub>CC</sub> = 3V		–24	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 2.7V		12	mA
		V <sub>CC</sub> = 3V		24	

### 4.4 Recommended Operating Conditions, SN74LVC02A

			SN74LVC02A						UNIT
			T <sub>A</sub> = 25°C		–40°C to 85°C		–40°C to 125°C		
			MIN	MAX	MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage	Operating	1.65	3.6	1.65	3.6	1.65	3.6	V
		Data retention only	1.5		1.5		1.5		

		SN74LVC02A						UNIT	
		T <sub>A</sub> = 25°C		–40°C to 85°C		–40°C to 125°C			
		MIN	MAX	MIN	MAX	MIN	MAX		
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 1.65V to 1.95V	0.65 × V <sub>CC</sub>	0.65 × V <sub>CC</sub>		0.65 × V <sub>CC</sub>		V	
		V <sub>CC</sub> = 2.3V to 2.7V	1.7	1.7		1.7			
		V <sub>CC</sub> = 2.7V to 3.6V	2	2		2			
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 1.65V to 1.95V	0.35 × V <sub>CC</sub>	0.35 × V <sub>CC</sub>		0.35 × V <sub>CC</sub>		V	
		V <sub>CC</sub> = 2.3V to 2.7 V	0.7	0.7		0.7			
		V <sub>CC</sub> = 2.7V to 3.6 V	0.8	0.8		0.8			
V <sub>I</sub>	Input voltage		0	5.5	0	5.5	0	5.5	V
V <sub>O</sub>	Output voltage		0	V <sub>CC</sub>	0	V <sub>CC</sub>	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 1.65V	–4		–4		–4		mA
		V <sub>CC</sub> = 2.3V	–8		–8		–8		
		V <sub>CC</sub> = 2.7V	–12		–12		–12		
		V <sub>CC</sub> = 3V	–24		–24		–24		
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 1.65V	4		4		4		mA
		V <sub>CC</sub> = 2.3V	8		8		8		
		V <sub>CC</sub> = 2.7V	12		12		12		
		V <sub>CC</sub> = 3V	24		24		24		

## 4.5 Thermal Information

THERMAL METRIC <sup>(1)</sup>		SN74LVC02A						UNIT
		BQA (WQFN)	D (SOIC)	DB (SSOP)	NS (SOP)	PW (TSSOP)	RGY (VQFN)	
		14 PINS	14 PINS	14 PINS	14 PINS	14 PINS	14 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	102.3	127.8	140.4	123.8	150.8	92.1	°C/W

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

## 4.6 Electrical Characteristics, SN54LVC02A

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	SN54LVC02A			UNIT
			–55°C to 125°C			
			MIN	TYP	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = –100μA	2.7V to 3.6V	V <sub>CC</sub> – 0.2			V
	I <sub>OH</sub> = –12mA	2.7V	2.2			
		3V	2.4			
		I <sub>OH</sub> = –24mA	3V	2.2		
V <sub>OL</sub>	I <sub>OL</sub> = 100μA	2.7V to 3.6V	0.2			V
	I <sub>OL</sub> = 12mA	2.7V	0.4			
	I <sub>OL</sub> = 24mA	3V	0.55			
I <sub>I</sub>	V <sub>I</sub> = 5.5V or GND	3.6V	±5			μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	3.6V	10			μA
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> – 0.6V, Other inputs at V <sub>CC</sub> or GND	2.7V to 3.6V	500			μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3V	5 <sup>(1)</sup>			pF

(1) T<sub>A</sub> = 25°C

## 4.7 Electrical Characteristics, SN74LVC02A

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

PARAMETER	TEST CONDITIONS	$V_{CC}$	SN74LVC02A						UNIT
			$T_A = 25^\circ\text{C}$			$-40^\circ\text{C to } 85^\circ\text{C}$		$-40^\circ\text{C to } 125^\circ\text{C}$	
			MIN	TYP	MAX	MIN	MAX	MIN MAX	
$V_{OH}$	$I_{OH} = -100\mu\text{A}$	1.65V to 3.6V	$V_{CC} - 0.2$			$V_{CC} - 0.2$		$V_{CC} - 0.3$	V
	$I_{OH} = -4\text{mA}$	1.65V	1.29			1.2		1.05	
	$I_{OH} = -8\text{mA}$	2.3V	1.9			1.7		1.55	
	$I_{OH} = -12\text{mA}$	2.7V	2.2			2.2		2.05	
		3V	2.4			2.4		2.25	
	$I_{OH} = -24\text{mA}$	3V	2.3			2.2		2	
$V_{OL}$	$I_{OL} = 100\mu\text{A}$	1.65V to 3.6V	0.1			0.2		0.3	V
	$I_{OL} = 4\text{mA}$	1.65V	0.24			0.45		0.6	
	$I_{OL} = 8\text{mA}$	2.3V	0.3			0.7		0.75	
	$I_{OL} = 12\text{mA}$	2.7V	0.4			0.4		0.6	
	$I_{OL} = 24\text{mA}$	3V	0.55			0.55		0.8	
$I_I$	$V_I = 5.5\text{V}$ or GND	3.6V	$\pm 1$			$\pm 5$		$\pm 20$	$\mu\text{A}$
$I_{CC}$	$V_I = V_{CC}$ or GND, $I_O = 0$	3.6V	1			10		40	$\mu\text{A}$
$\Delta I_{CC}$	One input at $V_{CC} - 0.6\text{V}$ , Other inputs at $V_{CC}$ or GND	2.7V to 3.6V	500			500		5000	$\mu\text{A}$
$C_i$	$V_I = V_{CC}$ or GND	3.3 V	5						pF

## 4.8 Switching Characteristics, SN54LVC02A

over recommended operating free-air temperature range (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	SN54LVC02A		UNIT
				−55°C to 125°C		
				MIN	MAX	
t <sub>pd</sub>	A or B	Y	2.7V	5.4		ns
			3.3V ± 0.3V	1	4.4	

## 4.9 Switching Characteristics, SN74LVC02A

over recommended operating free-air temperature range (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

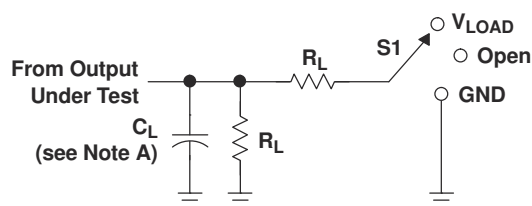
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	SN74LVC02A						UNIT
				$T_A = 25^\circ\text{C}$			$-40^\circ\text{C to } 85^\circ\text{C}$		$-40^\circ\text{C to } 125^\circ\text{C}$	
				MIN	TYP	MAX	MIN	MAX	MIN MAX	
$t_{pd}$	A or B	Y	$1.8\text{V} \pm 0.15\text{V}$	1	3.8	8.4	1	8.9	1 10.4	ns
			$2.5\text{V} \pm 0.2\text{V}$	1	2.9	6.9	1	7.4	1 9.5	
			2.7V	1	3	5.2	1	5.4	1 7	
			$3.3\text{V} \pm 0.3\text{V}$	1	3.6	4.2	1	4.4	1 5.5	
$t_{sk(o)}$			$3.3\text{V} \pm 0.3\text{V}$				1		1.5	ns

## 4.10 Operating Characteristics

$T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	V <sub>CC</sub>	TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance per gate	f = 10MHz	1.8V	7.5	pF
			2.5V	8.5	
			3.3V	9.5	

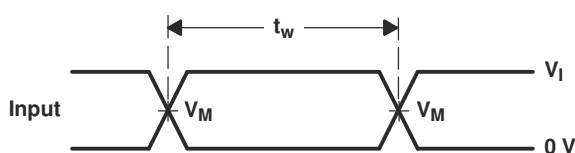
## 5 Parameter Measurement Information



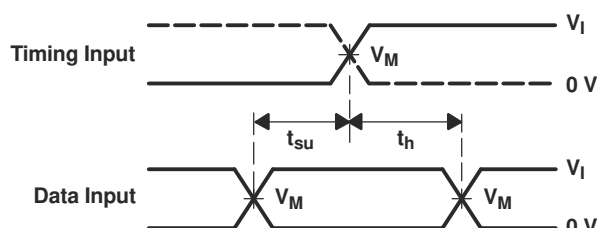
LOAD CIRCUIT

TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND

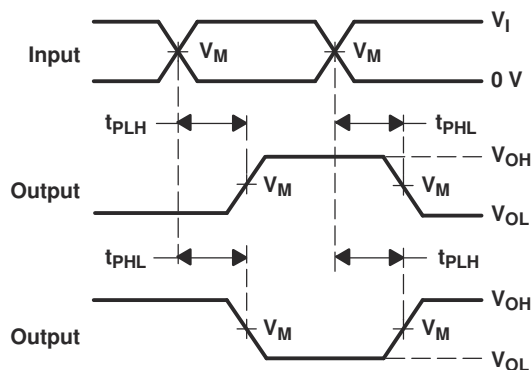
$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
	$V_I$	$t_r/t_f$					
$1.8\text{ V} \pm 0.15\text{ V}$	$V_{CC}$	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k $\Omega$	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	$V_{CC}$	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 $\Omega$	0.15 V
2.7 V	2.7 V	$\leq 2.5\text{ ns}$	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V
$3.3\text{ V} \pm 0.3\text{ V}$	2.7 V	$\leq 2.5\text{ ns}$	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V



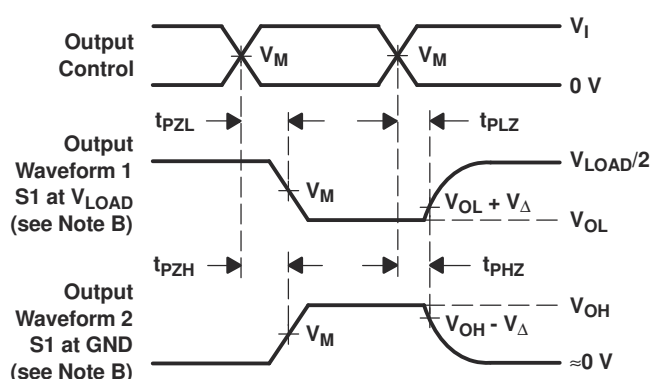
VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES  
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES  
LOW- AND HIGH-LEVEL ENABLING

- 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  $\leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ .
  - The outputs are measured one at a time, with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - All parameters and waveforms are not applicable to all devices.

Figure 5-1. Load Circuit and Voltage Waveforms



## 6 Detailed Description

### 6.1 Functional Block Diagram



Figure 6-1. Logic Diagram, Each Gate (Positive Logic)

### 6.2 Device Functional Modes

**Function Table  
(Each Gate)**

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

## 7 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.

### 7.1 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Recommended Operating Conditions*. Each  $V_{CC}$  terminal should have a good bypass capacitor to prevent power disturbance. A 0.1- $\mu\text{F}$  capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1- $\mu\text{F}$  and 1- $\mu\text{F}$  capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results, as shown in given example layout image.

### 7.2 Layout

#### 7.2.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must not ever be left floating. 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 3 of the 4 buffer gates are used. Such unused input pins 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 logic high or logic low voltage, as defined by the input voltage specifications, 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, the inputs are tied to GND or  $V_{CC}$ , whichever makes more sense for the logic function or is more convenient.

#### 7.2.2 Layout Example

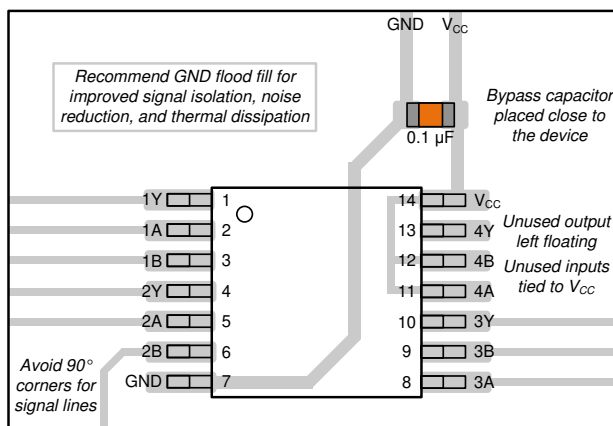


Figure 7-1. Example Layout for the SNx4LVC02A

## 8 Device and Documentation Support

### 8.1 Documentation Support

#### 8.1.1 Related Documentation

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

**Table 8-1. Related Links**

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN54LVC02A	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
SN74LVC02A	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>

### 8.2 Receiving Notification of Documentation Updates

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

### 8.3 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.

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](#).

### 8.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

### 8.5 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.

### 8.6 Glossary

[TI Glossary](#)

This glossary lists and explains terms, acronyms, and definitions.

## 9 Revision History

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

### Changes from Revision S (May 2024) to Revision T (December 2024) Page

- Updated RθJA values: D = 86 to 127.8, all values in °C/W.....5

### Changes from Revision R (March 2024) to Revision S (May 2024) Page

- Updated RθJA values: DB = 96 to 140.4, NS = 76 to 123.8, PW = 113 to 150.8, RGY = 47 to 92.1; Updated DB, NS, PW, and RGY packages for RθJC(top), RθJB, ΨJT, ΨJB, and RθJC(bot), all values in °C/W.....5

## 10 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)
<a href="#">5962-9760401Q2A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 9760401Q2A SNJ54LVC 02AFK
<a href="#">5962-9760401QCA</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9760401QC A SNJ54LVC02AJ
<a href="#">5962-9760401QDA</a>	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9760401QD A SNJ54LVC02AW
<a href="#">SN74LVC02ABQAR</a>	Active	Production	WQFN (BQA)   14	3000   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	LVC02A
SN74LVC02ABQAR.A	Active	Production	WQFN (BQA)   14	3000   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	LVC02A
<a href="#">SN74LVC02AD</a>	Active	Production	SOIC (D)   14	50   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC02A
SN74LVC02AD.B	Active	Production	SOIC (D)   14	50   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC02A
<a href="#">SN74LVC02ADBR</a>	Active	Production	SSOP (DB)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
SN74LVC02ADBR.A	Active	Production	SSOP (DB)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
SN74LVC02ADBR.B	Active	Production	SSOP (DB)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
<a href="#">SN74LVC02ADR</a>	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC02A
SN74LVC02ADR.A	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC02A
SN74LVC02ADR.B	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC02A
SN74LVC02ADRG4	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC02A
<a href="#">SN74LVC02ANSR</a>	Active	Production	SOP (NS)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC02A
SN74LVC02ANSR.A	Active	Production	SOP (NS)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC02A
SN74LVC02ANSR.B	Active	Production	SOP (NS)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC02A
<a href="#">SN74LVC02APW</a>	Active	Production	TSSOP (PW)   14	90   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
SN74LVC02APW.B	Active	Production	TSSOP (PW)   14	90   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
SN74LVC02APWE4	Active	Production	TSSOP (PW)   14	90   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
<a href="#">SN74LVC02APWR</a>	Active	Production	TSSOP (PW)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
SN74LVC02APWR.A	Active	Production	TSSOP (PW)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
SN74LVC02APWR.B	Active	Production	TSSOP (PW)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
SN74LVC02APWR1G4	Active	Production	TSSOP (PW)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A

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)
SN74LVC02APWR1G4.A	Active	Production	TSSOP (PW)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
SN74LVC02APWR1G4.B	Active	Production	TSSOP (PW)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
<a href="#">SN74LVC02APWT</a>	Active	Production	TSSOP (PW)   14	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
SN74LVC02APWT.B	Active	Production	TSSOP (PW)   14	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC02A
<a href="#">SN74LVC02ARGYR</a>	Active	Production	VQFN (RGY)   14	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LC02A
SN74LVC02ARGYR.A	Active	Production	VQFN (RGY)   14	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LC02A
SN74LVC02ARGYR.B	Active	Production	VQFN (RGY)   14	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LC02A
SN74LVC02ARGYRG4	Active	Production	VQFN (RGY)   14	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LC02A
SN74LVC02ARGYRG4.A	Active	Production	VQFN (RGY)   14	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LC02A
SN74LVC02ARGYRG4.B	Active	Production	VQFN (RGY)   14	3000   LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LC02A
<a href="#">SNJ54LVC02AFK</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9760401Q2A SNJ54LVC02AFK
<a href="#">SNJ54LVC02AJ</a>	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9760401QC A SNJ54LVC02AJ
<a href="#">SNJ54LVC02AW</a>	Active	Production	CFP (W)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9760401QD A SNJ54LVC02AW

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **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.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **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.

<sup>(5)</sup> **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 SN54LVC02A, SN74LVC02A :**

- Catalog : [SN74LVC02A](#)
- Automotive : [SN74LVC02A-Q1](#), [SN74LVC02A-Q1](#)
- Enhanced Product : [SN74LVC02A-EP](#), [SN74LVC02A-EP](#)
- Military : [SN54LVC02A](#)

**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



\*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
SN74LVC02ABQAR	WQFN	BQA	14	3000	180.0	12.4	2.8	3.3	1.1	4.0	12.0	Q1
SN74LVC02ADBR	SSOP	DB	14	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74LVC02ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LVC02ANSR	SOP	NS	14	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
SN74LVC02APWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LVC02APWR1G4	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LVC02APWT	TSSOP	PW	14	250	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LVC02ARGYR	VQFN	RGY	14	3000	330.0	12.4	3.75	3.75	1.15	8.0	12.0	Q1
SN74LVC02ARGYRG4	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)
SN74LVC02ABQAR	WQFN	BQA	14	3000	210.0	185.0	35.0
SN74LVC02ADBR	SSOP	DB	14	2000	353.0	353.0	32.0
SN74LVC02ADR	SOIC	D	14	2500	353.0	353.0	32.0
SN74LVC02ANSR	SOP	NS	14	2000	353.0	353.0	32.0
SN74LVC02APWR	TSSOP	PW	14	2000	353.0	353.0	32.0
SN74LVC02APWR1G4	TSSOP	PW	14	2000	353.0	353.0	32.0
SN74LVC02APWT	TSSOP	PW	14	250	353.0	353.0	32.0
SN74LVC02ARGYR	VQFN	RGY	14	3000	360.0	360.0	36.0
SN74LVC02ARGYRG4	VQFN	RGY	14	3000	353.0	353.0	32.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-9760401Q2A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-9760401QDA	W	CFP	14	25	506.98	26.16	6220	NA
SN74LVC02AD	D	SOIC	14	50	506.6	8	3940	4.32
SN74LVC02AD.B	D	SOIC	14	50	506.6	8	3940	4.32
SN74LVC02APW	PW	TSSOP	14	90	530	10.2	3600	3.5
SN74LVC02APW.B	PW	TSSOP	14	90	530	10.2	3600	3.5
SN74LVC02APWE4	PW	TSSOP	14	90	530	10.2	3600	3.5
SNJ54LVC02AFK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54LVC02AW	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



### VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



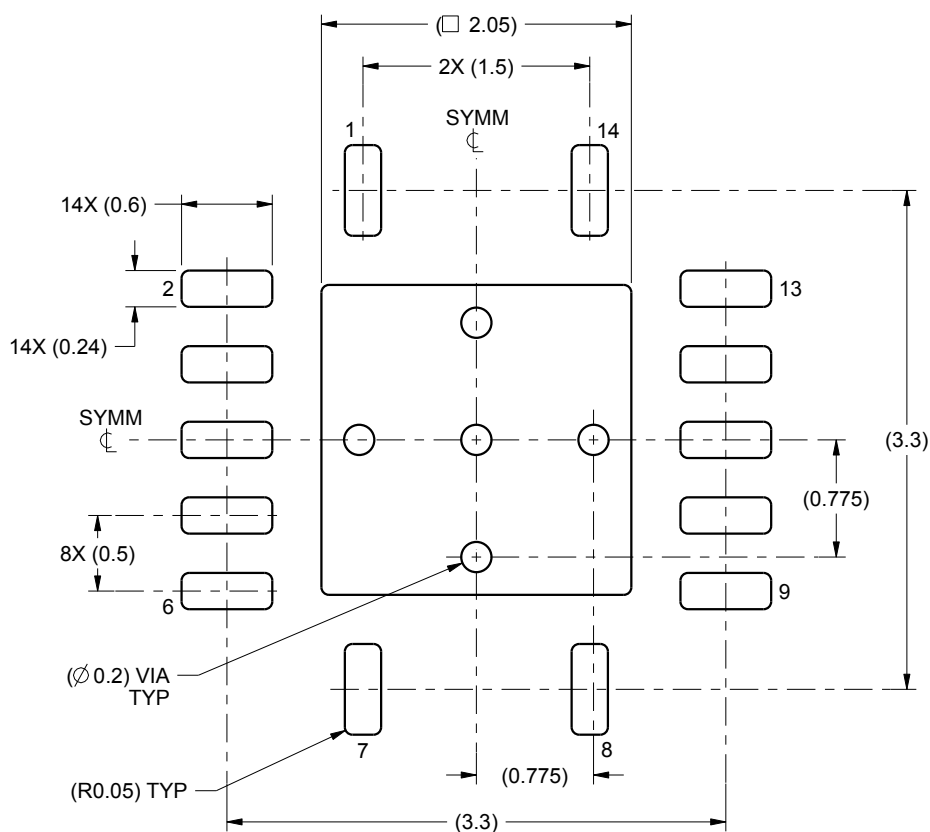
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

# EXAMPLE BOARD LAYOUT

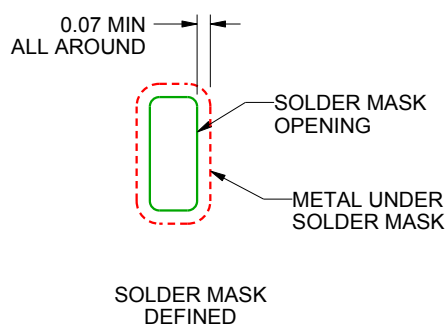
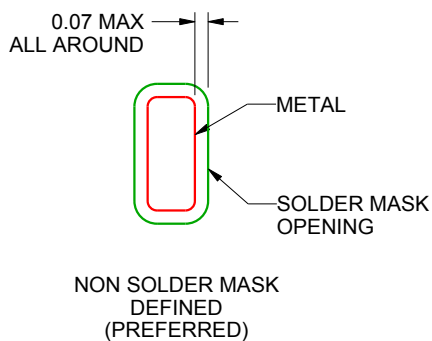
RGY0014A

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



LAND PATTERN EXAMPLE  
SCALE:20X



SOLDER MASK DETAILS

4219040/A 09/2015

NOTES: (continued)

- 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/slue271](http://www.ti.com/lit/slue271)).

# 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.

**D0014A****PACKAGE OUTLINE****SOIC - 1.75 mm max height**

SMALL OUTLINE INTEGRATED CIRCUIT



4220718/A 09/2016

**NOTES:**

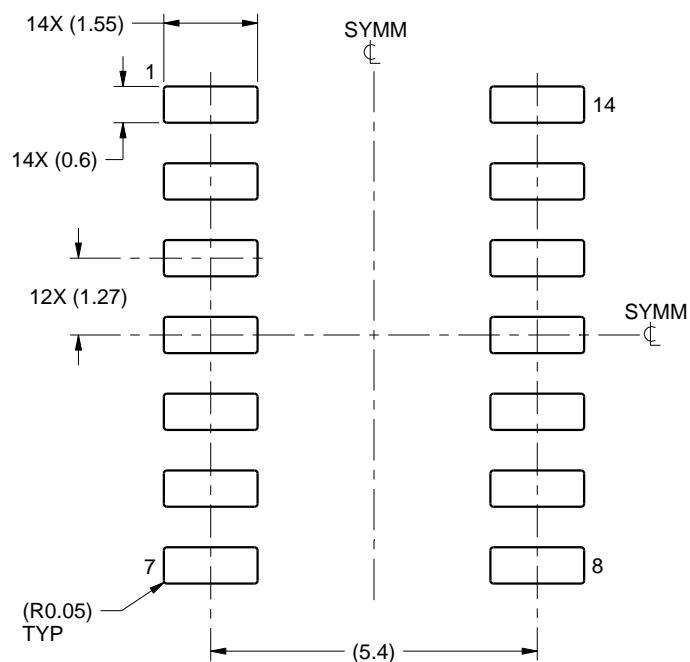
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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

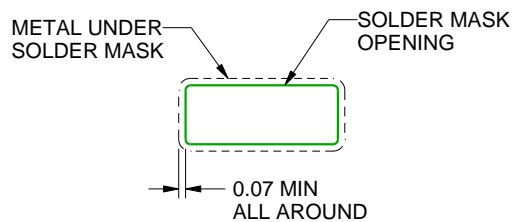
SMALL OUTLINE INTEGRATED CIRCUIT



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

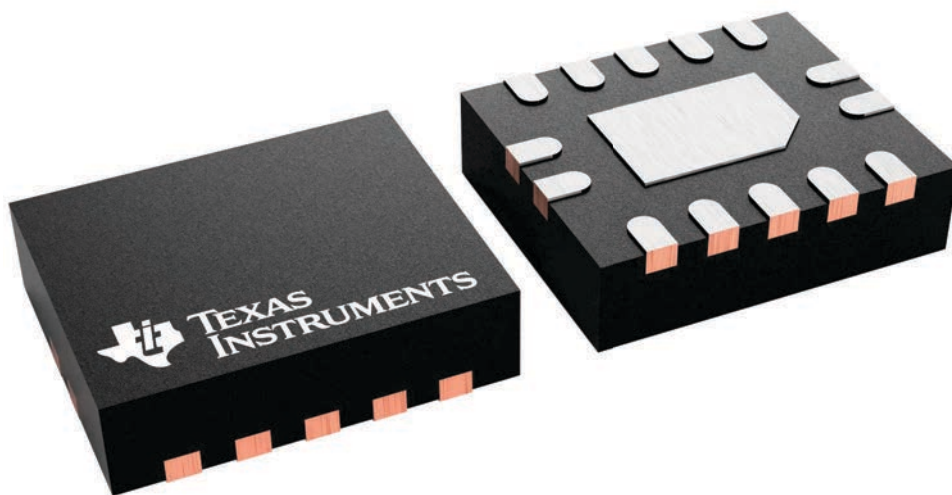
**BQA 14**

**WQFN - 0.8 mm max height**

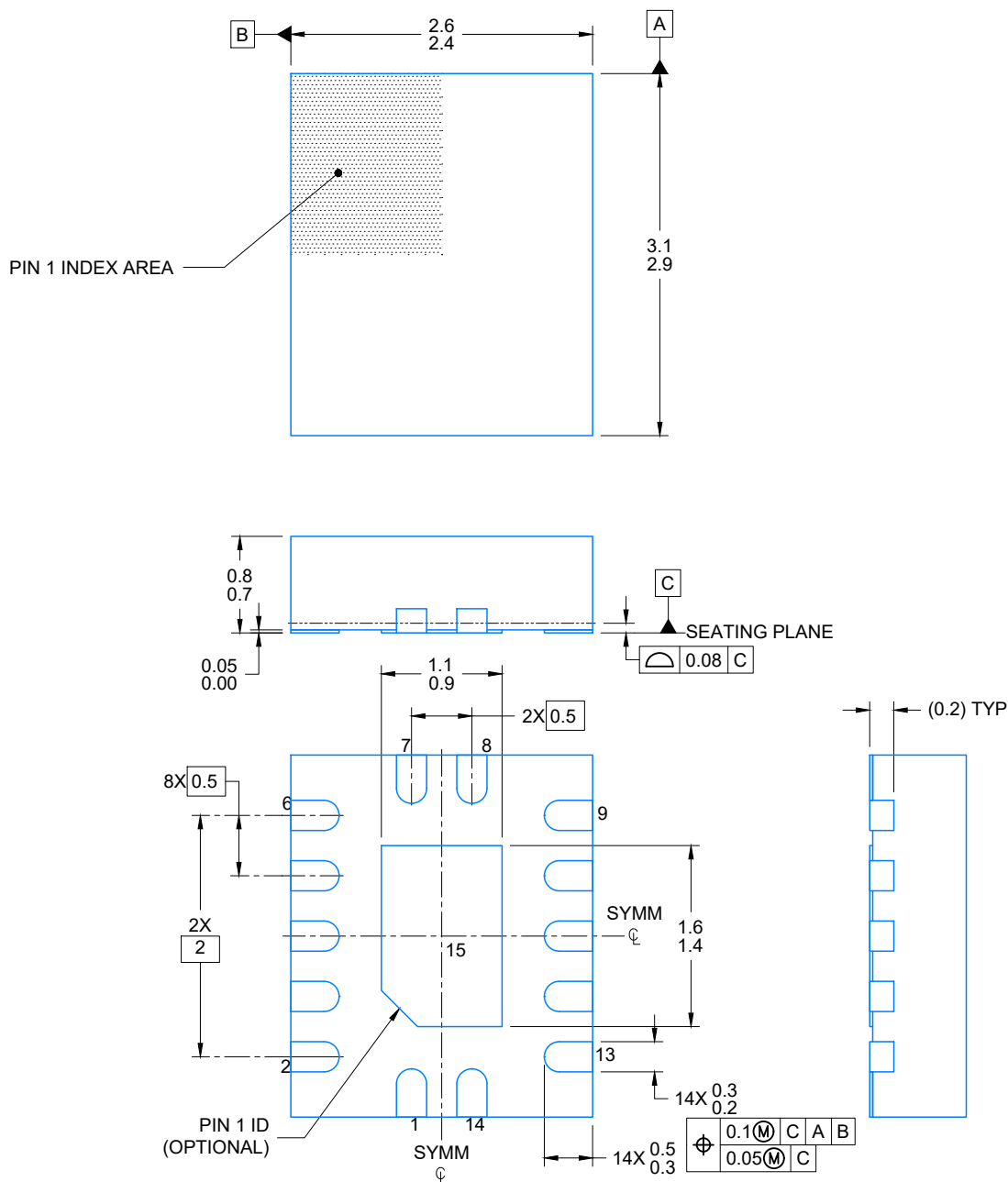
2.5 x 3, 0.5 mm pitch

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.



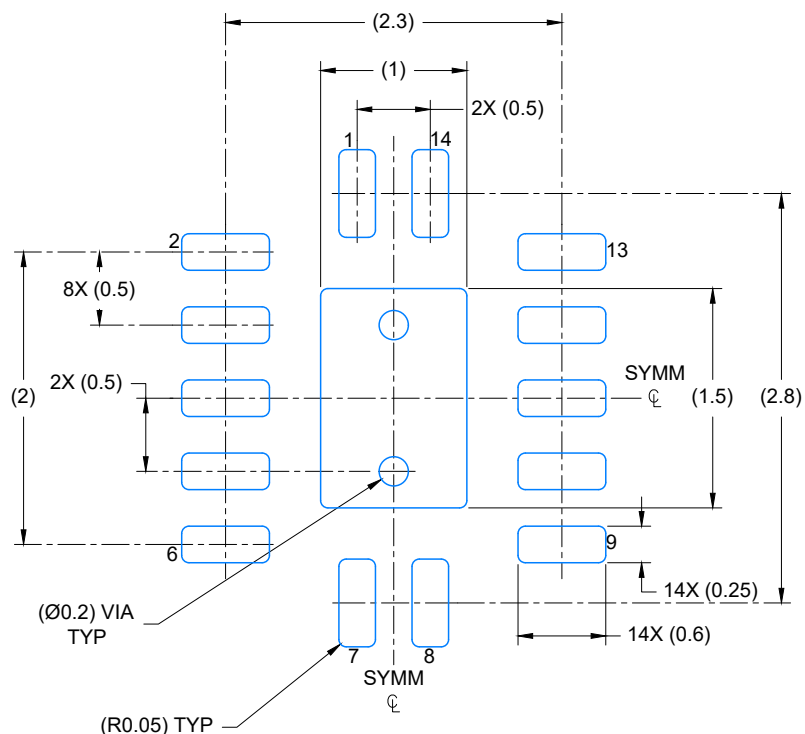
PLASTIC QUAD FLAT PACK-NO LEAD



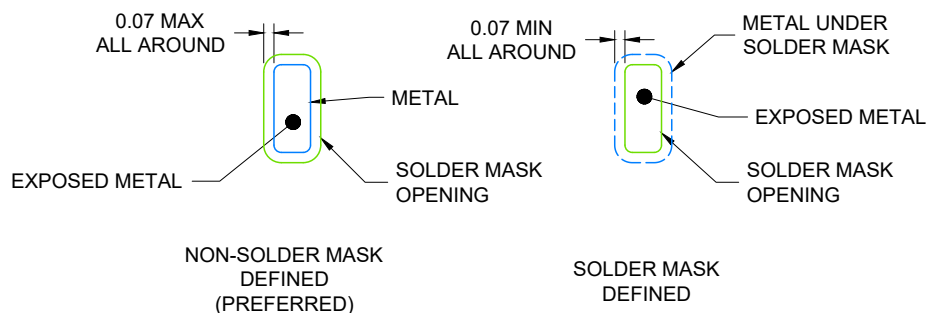
4224636/A 11/2018

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.



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 20X



4224636/A 11/2018

NOTES: (continued)

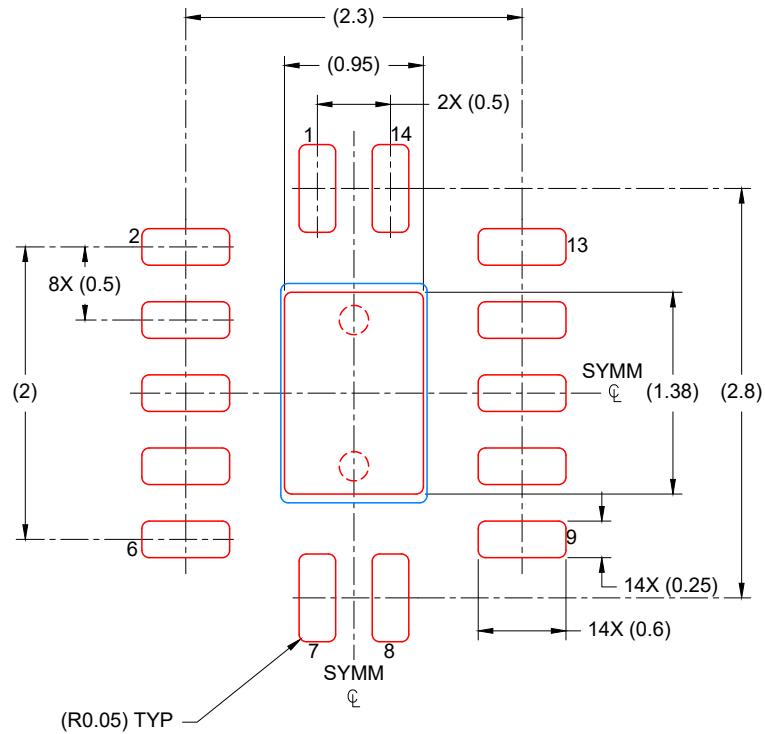
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/slue271](http://www.ti.com/lit/slue271)).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, 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



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

- 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



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

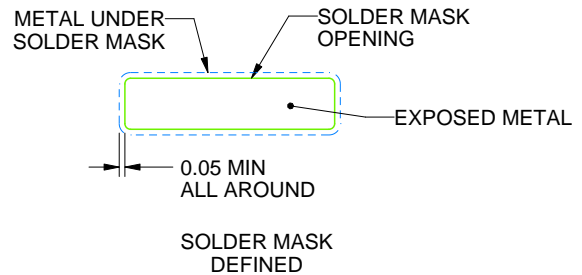
DB0014A

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\

**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

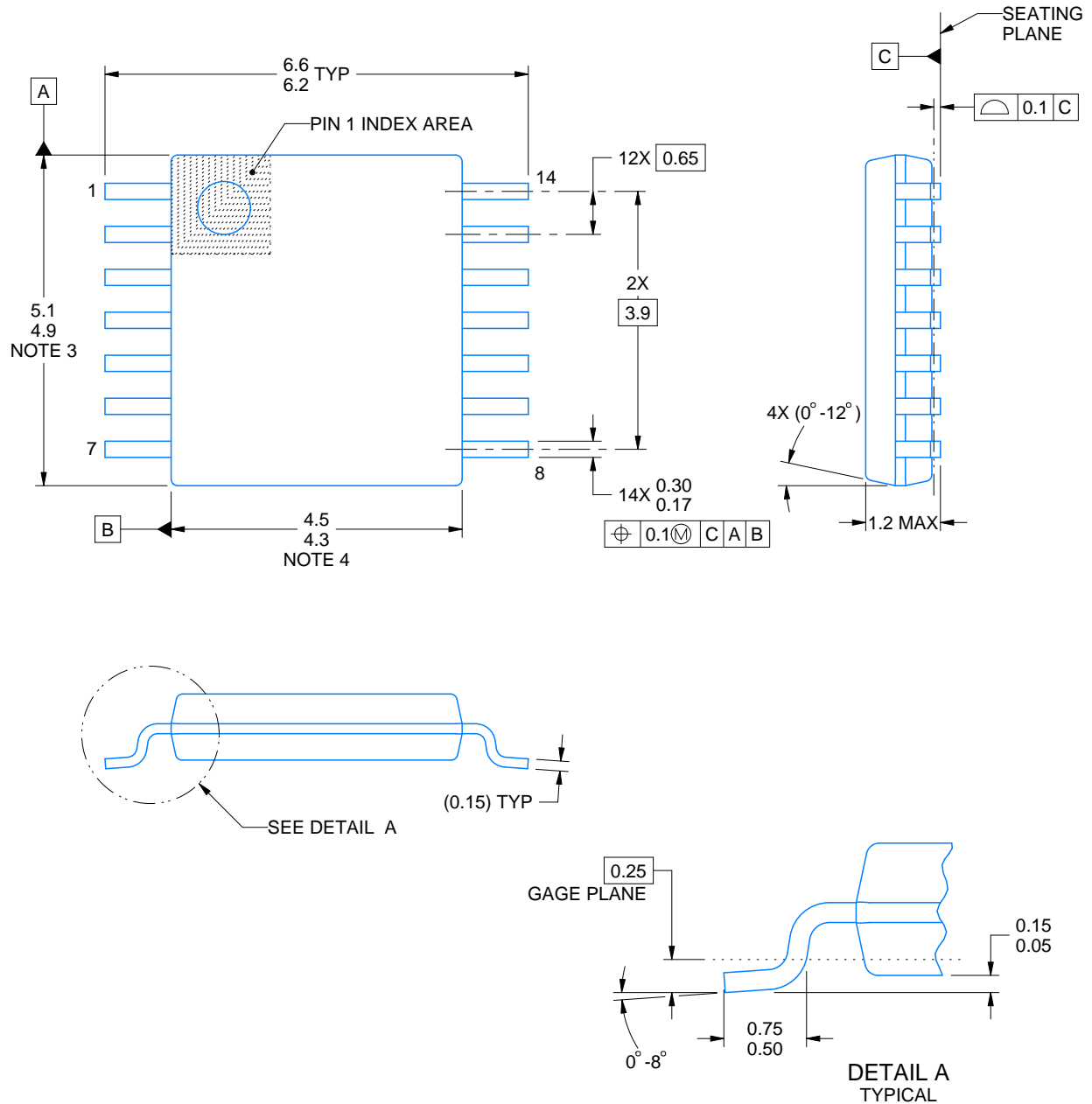
CERAMIC DUAL IN LINE PACKAGE



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



4214771/A 05/2017



4220202/B 12/2023

## 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



SOLDER MASK DETAILS

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