

## SNx4LVC00A Quadruple 2-Input Positive-NAND Gates

### 1 Features

- ESD protection exceeds JESD 22
  - 2000V Human-Body Model
  - 1000V Charged-Device Model
- SN74LVC00A operates from 1.65V to 3.6V
- SN54LVC00A operates from 2V to 3.6V
- SNx4LVC00A specified from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  and  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- SN54LVC00A specified from  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- Inputs accept voltages to 5.5V
- Max  $t_{pd}$  of 4.3ns at 3.3V
- Typical  $V_{OLP}$  (output ground bounce)  $< 0.8\text{V}$  at  $V_{CC} = 3.3\text{V}$ ,  $T_A = 25^{\circ}\text{C}$
- Typical  $V_{OHV}$  (output  $V_{OH}$  undershoot)  $> 2\text{V}$  at  $V_{CC} = 3.3\text{V}$ ,  $T_A = 25^{\circ}\text{C}$
- Latch-up performance exceeds 250 mA per JESD 17
- On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

### 2 Applications

- AV Receivers
- Audio Docks: Portable
- Blu-Ray Players and Home Theater
- MP3 Players or Recorders
- Personal Digital Assistants (PDAs)
- Power: Telecom/Server AC/DC Supply: Single Controller: Analog and Digital
- Solid State Drives (SSDs): Client and Enterprise
- TVs: LCD, Digital, and High-Definition (HDTV)
- Tablets: Enterprise
- Video Analytics: Server
- Wireless Headsets, Keyboards, and Mice

### 3 Description

The SN54LVC00A quadruple 2-input positive-NAND gate is designed for 2.7V to 3.6V  $V_{CC}$  operation, and the SN74LVC00A quadruple 2-input positive-NAND gate is designed for 1.65V to 3.6V  $V_{CC}$  operation.

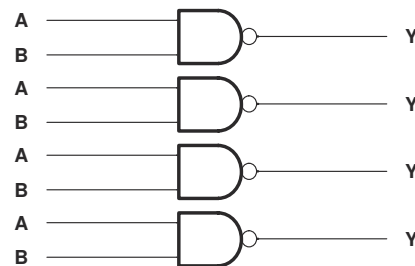
The SNx4LVC00A devices perform the Boolean function  $Y = \overline{A \cdot B}$  or  $Y = \overline{A} + \overline{B}$  in positive logic.

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.

#### Device Information

PART NUMBER	PACKAGE <sup>(1)</sup>	PACKAGE SIZE <sup>(2)</sup>	BODY SIZE <sup>(3)</sup>
SNx4LVC00A	BQA (WQFN, 14)	3mm × 2.5mm	3mm × 2.5mm
	D (SOIC, 14)	8.65mm × 6mm	8.65 mm × 3.91 mm
	DB (SSOP, 14)	6.2mm × 7.8mm	6.20 mm × 5.30 mm
	NS (SOP, 14)	10.2mm × 7.8mm	10.30 mm × 5.30 mm
	PW (TSSOP, 14)	5mm × 4.4mm	5.00 mm × 4.40 mm
	RGY (VQFN, 14)	3.5mm × 3.5mm	3.50 mm × 3.50 mm
	FK (LCCC, 20)	8.9mm × 8.9mm	8.89 mm × 8.89 mm
	J (CDIP, 14)	19.55mm × 7.9mm	19.55 mm × 6.7mm
	W (CFP, 14)	9.21mm × 9mm	9.21mm × 6.28mm

- For more information, see [Section 11](#).
- The package size (length × width) is a nominal value and includes pins, where applicable.
- The body size (length × width) is a nominal value and does not include pins.



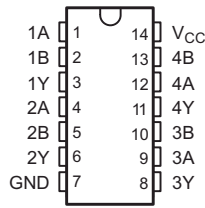
Simplified Schematic



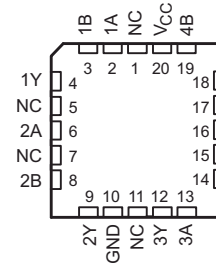
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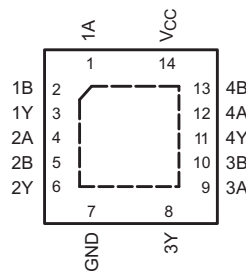
### 4 Pin Configuration and Functions



**Figure 4-1. SN54LVC00A J or W Package;  
SN74LVC00A D, DB, NS, or PW Package 14-Pin  
CDIP, CFP  
SOIC, SSOP, SO, or TSSOP (Top View)**



NC - No internal connection  
**Figure 4-2. SN54LVC00A FK Package 20-Pin LCCC  
(Top View)**



**Figure 4-3. SN74LVC00A BQA or RGY Package 14-Pin WQFN or VQFN (Top View)**

**Table 4-1. Pin Functions**

NAME	PIN				TYPE	DESCRIPTION
	SN74LVC00A		SN54LVC00A			
	D, DB, NS, PW	BQA, RGY	J, W	FK		
1A	1	1	1	2	I	Gate 1 input
1B	2	2	2	3	I	Gate 1 input
1Y	3	3	3	4	O	Gate 1 output
2A	4	4	4	6	I	Gate 2 input
2B	5	5	5	8	I	Gate 2 input
2Y	6	6	6	9	O	Gate 2 output
GND	7	7	7	10	I	Ground Pin
3Y	8	8	8	12	O	Gate 3 output
3A	9	9	9	13	I	Gate 3 input
3B	10	10	10	14	I	Gate 3 input
4Y	11	11	11	16	O	Gate 4 output
4A	12	12	12	18	I	Gate 4 input
4B	13	13	13	19	I	Gate 4 input
V <sub>CC</sub>	14	14	14	20	—	Positive supply
NC	—	—	—	1	—	No Connection
				5		
				7		
				11		
				15		
				17		

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT	
V <sub>CC</sub>	Supply voltage	-0.5	6.5	V	
V <sub>I</sub>	Input voltage <sup>(2)</sup>	-0.5	6.5	V	
V <sub>O</sub>	Output voltage <sup>(2)</sup> <sup>(3)</sup>	-0.5	V <sub>CC</sub> + 0.5	V	
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> < 0	-50	mA	
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0	-50	mA	
I <sub>O</sub>	Continuous output current		±50	mA	
V <sub>CC</sub>	Continuous current through GND		±100	mA	
P <sub>tot</sub>	Power dissipation <sup>(4)</sup> <sup>(5)</sup>	T <sub>A</sub> = -40°C to +125°C	500	mW	
T <sub>J</sub>	Junction temperature		150	°C	
T <sub>stg</sub>	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, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of V<sub>CC</sub> is provided in the *Recommended Operating Conditions* table.
- (4) For the D package: above 70°C, the value of P<sub>tot</sub> derates linearly with 8 mW/K.
- (5) For the DB, NS, and PW packages: above 60°C, the value of P<sub>tot</sub> derates linearly with 5.5 mW/K.

### 5.2 ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge		
	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	±2000	V
Charged device model (CDM), per JEDEC specification JESD22-C101 <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.

### 5.3 Recommended Operating Conditions, SN54LVC00A

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		SN54LVC00A		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> = 2.7 V to 3.6 V		V	
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2.7 V to 3.6 V		0.8	
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> = 2.7 V	-12	mA	
		V <sub>CC</sub> = 3 V	-24		
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 2.7 V	12	mA	
		V <sub>CC</sub> = 3 V	24		

- (1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. See [Implications of Slow or Floating CMOS Inputs](#), SCBA004.

## 5.4 Recommended Operating Conditions, SN74LVC00A

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		SN74LVC00A						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		
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V		0.65 × V <sub>CC</sub>		0.65 × V <sub>CC</sub>		0.65 × V <sub>CC</sub>		V
		V <sub>CC</sub> = 2.3 V to 2.7 V		1.7		1.7		1.7		
		V <sub>CC</sub> = 2.7 V to 3.6 V		2		2		2		
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V		0.35 × V <sub>CC</sub>		0.35 × V <sub>CC</sub>		0.35 × V <sub>CC</sub>		V
		V <sub>CC</sub> = 2.3 V to 2.7 V		0.7		0.7		0.7		
		V <sub>CC</sub> = 2.7 V 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	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>	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 1.65 V		–4		–4		–4		mA
		V <sub>CC</sub> = 2.3 V		–8		–8		–8		
		V <sub>CC</sub> = 2.7 V		–12		–12		–12		
		V <sub>CC</sub> = 3 V		–24		–24		–24		
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 1.65 V		4		4		4		mA
		V <sub>CC</sub> = 2.3 V		8		8		8		
		V <sub>CC</sub> = 2.7 V		12		12		12		
		V <sub>CC</sub> = 3 V		24		24		24		

(1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. See [Implications of Slow or Floating CMOS Inputs](#), SCBA004.

## 5.5 Thermal Information

THERMAL METRIC <sup>(1)</sup>		SN74LVC00A						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	86	96	76	113	47	°C/W

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

## 5.6 Electrical Characteristics, SN54LVC00A

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	SN54LVC00A		UNIT
			–55°C to +125°C		
			MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = –100 μA	2.7 V to 3.6 V	V <sub>CC</sub> – 0.2		V
	I <sub>OH</sub> = –12 mA	2.7 V	2.2		
	I <sub>OH</sub> = –24 mA	3 V	2.4		
V <sub>OL</sub>	I <sub>OL</sub> = 100 μA	2.7 V to 3.6 V	0.2		V
	I <sub>OL</sub> = 12 mA	2.7 V	0.4		
	I <sub>OL</sub> = 24 mA	3 V	0.55		
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	3.6 V	±5		μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	3.6 V	10		μA
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> – 0.6 V, Other inputs at V <sub>CC</sub> or GND	2.7 V to 3.6 V	500		μA

## 5.7 Electrical Characteristics, SN74LVC00A

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	SN74LVC00A						UNIT	
			T <sub>A</sub> = 25°C			–40°C to +85°C		–40°C to +125°C		
			MIN	TYP	MAX	MIN	MAX	MIN		MAX
V <sub>OH</sub>	I <sub>OH</sub> = –100 μA	1.65 V to 3.6 V	V <sub>CC</sub> – 0.2			V <sub>CC</sub> – 0.2		V <sub>CC</sub> – 0.3		V
	I <sub>OH</sub> = –4 mA	1.65 V	1.29			1.2		1.05		
	I <sub>OH</sub> = –8 mA	2.3 V	1.9			1.7		1.55		
	I <sub>OH</sub> = –12 mA	2.7 V	2.2			2.2		2.05		
		3 V	2.4			2.4		2.25		
I <sub>OH</sub> = –24 mA	3 V	2.3			2.2		2			
V <sub>OL</sub>	I <sub>OL</sub> = 100 μA	1.65 V to 3.6 V				0.1		0.2		V
	I <sub>OL</sub> = 4 mA	1.65 V				0.24		0.45		
	I <sub>OL</sub> = 8 mA	2.3 V				0.3		0.7		
	I <sub>OL</sub> = 12 mA	2.7 V				0.4		0.6		
	I <sub>OL</sub> = 24 mA	3 V				0.55		0.55		
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	3.6 V				±1		±5		μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	3.6 V				1		10		μA
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> – 0.6 V, Other inputs at V <sub>CC</sub> or GND	2.7 V to 3.6 V				500		500		μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V				5				pF

## 5.8 Switching Characteristics, SN54LVC00A

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>	SN54LVC00A		UNIT
				–55°C to +125°C		
				MIN	MAX	
t <sub>pd</sub>	A or B	Y	2.7 V	5.1		ns
			3.3 V ± 0.3 V	1	4.3	

### 5.9 Switching Characteristics, SN74LVC00A

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

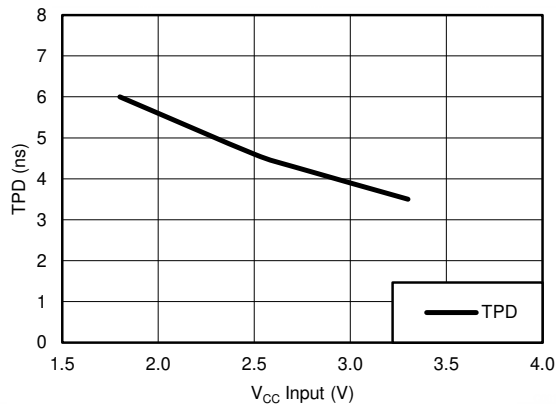
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	SN74LVC00A						UNIT	
				T <sub>A</sub> = 25°C			-40°C to +85°C		-40°C to +125°C		
				MIN	TYP	MAX	MIN	MAX	MIN		MAX
t <sub>pd</sub>	A or B	Y	1.8 V ± 0.15 V	1	6	12	1	12.5	1	14	ns
			2.5 V ± 0.2 V	1	4.6	5.9	1	6.4	1	7.9	
			2.7 V	1	4.3	4.9	1	5.1	1	6.5	
			3.3 V ± 0.3 V	1	3.5	4.1	1	4.3	1	5.5	
t <sub>sk(o)</sub>			3.3 V ± 0.3 V					1		1.5	ns

### 5.10 Operating Characteristics

T<sub>A</sub> = 25°C

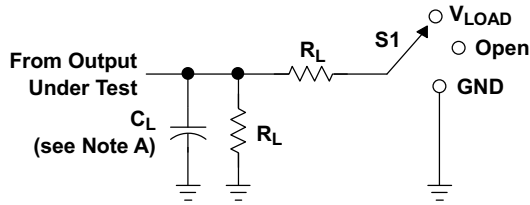
PARAMETER		TEST CONDITIONS	V <sub>CC</sub>	TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance per gate	f = 10 MHz	1.8 V	18	pF
			2.5 V	18	
			3.3 V	19	

### 5.11 Typical Characteristics



**Figure 5-1. TPD vs V<sub>CC</sub> (T<sub>A</sub> = 25°C)**

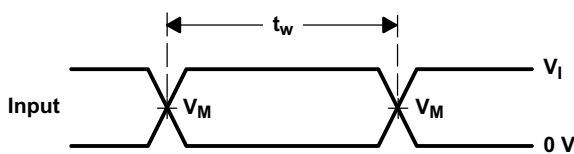
## 6 Parameter Measurement Information



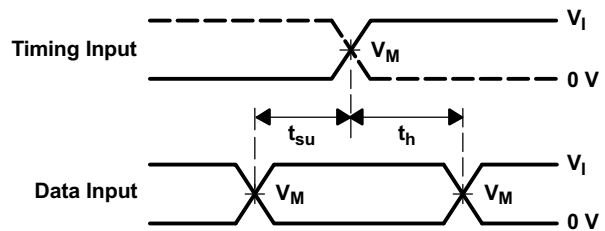
LOAD CIRCUIT

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

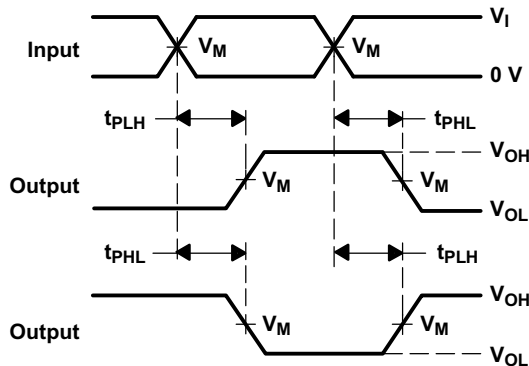
$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
	$V_I$	$t_r/t_f$					
$1.8\text{ V} \pm 0.15\text{ V}$	$V_{CC}$	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k $\Omega$	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	$V_{CC}$	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 $\Omega$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



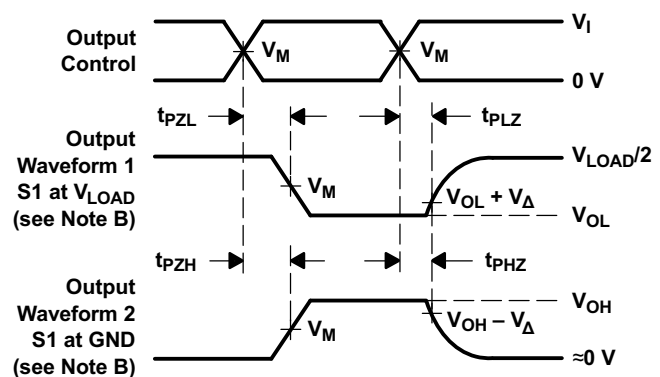
VOLTAGE WAVEFORMS  
PULSE DURATION



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

Figure 6-1. Load Circuit and Voltage Waveforms



## 7 Detailed Description

### 7.1 Overview

The maximum sink and source current is 24 mA.

Inputs can be driven from 1.8-V, 2.5-V, 3.3-V (LVTTTL), or 5-V (CMOS) devices. This feature allows the use of this device as translators in a mixed-system environment.

### 7.2 Functional Block Diagram



Figure 7-1. Logic Diagram, Each Gate (Positive Logic)

### 7.3 Feature Description

#### 7.3.1 Balanced High-Drive CMOS Push-Pull Outputs

A balanced output allows the device to sink and source similar currents. The high drive capability of this device creates fast edges into light loads so routing and load conditions should be considered to prevent ringing. Additionally, the outputs of this device are capable of driving larger currents than the device can sustain without being damaged. It is important for the power output of the device to be limited to avoid thermal runaway and damage due to over-current. The electrical and thermal limits defined in the [Section 5.1](#) must be followed at all times.

#### 7.3.2 Standard CMOS Inputs

Standard CMOS inputs are high impedance and are typically modelled as a resistor in parallel with the input capacitance given in the [Section 5.6](#) and [Section 5.7](#). The worst case resistance is calculated with the maximum input voltage, given in the [Section 5.1](#), and the maximum input leakage current, given in the [Section 5.6](#) and [Section 5.7](#), using ohm's law ( $R = V \div I$ ).

Signals applied to the inputs need to have fast edge rates, as defined by  $\Delta t/\Delta v$  in [Section 5.3](#) and [Section 5.4](#) to avoid excessive currents and oscillations. If a slow or noisy input signal is required, a device with a Schmitt-trigger input should be utilized to condition the input signal prior to the standard CMOS input.

#### 7.3.3 Clamp Diodes

The inputs and outputs to this device have negative clamping diodes.

**CAUTION**

Voltages beyond the values specified in the [Section 5.1](#) table can cause damage to the device. The input negative-voltage and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

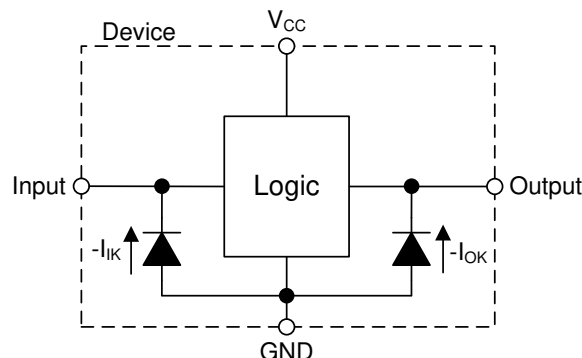


Figure 7-2. Electrical Placement of Clamping Diodes for Each Input and Output

### 7.3.4 Over-voltage Tolerant Inputs

Input signals to this device can be driven above the supply voltage so long as they remain below the maximum input voltage value specified in the [Section 5.1](#).

### 7.4 Device Functional Modes

[Table 7-1](#) lists the functional modes of SN54LVC00A and SN74LVC00A.

**Table 7-1. Function Table  
(Each Gate)**

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

## 8 Application and Implementation

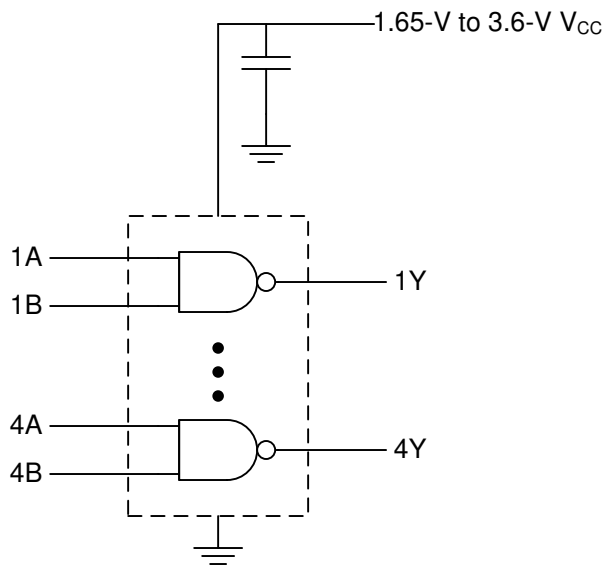
### Note

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

SN74LVC00A is a high-drive CMOS device that can be used for a multitude of buffer-type functions. It can produce 24 mA of drive current at 3.3 V. Therefore, this device is ideal for driving multiple inputs and for high-speed applications up to 100 MHz. The inputs and outputs are 5.5-V tolerant allowing the device to allowing the device to perform mixed-voltage input down translation. For example the A input can be 3.3 V and the B input can be 5 V, while  $V_{CC} = 2.5$  V and the device will operate properly to output a 2.5 V signal.

### 8.2 Typical Application



**Figure 8-1. Typical NAND Gate Application and Supply Voltage**

#### 8.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads; therefore, routing and load conditions should be considered to prevent ringing.

#### 8.2.2 Detailed Design Procedure

- Recommended Input Conditions
  - Rise time and fall time specs: See  $(\Delta t/\Delta V)$  in the [Section 5.4](#) table.
  - Specified high and low levels: See  $(V_{IH}$  and  $V_{IL})$  in the [Section 5.4](#) table.
  - Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid  $V_{CC}$ .
- Recommended Output Conditions
  - Load currents should not exceed 25 mA per output and 50 mA total for the part.
  - Outputs should not be pulled above 5.5 V.

### 8.2.3 Application Curve

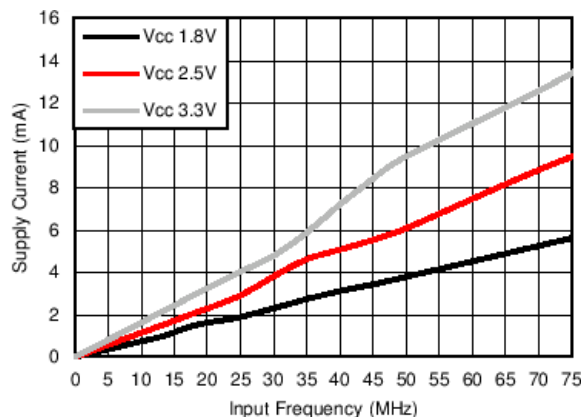


Figure 8-2. I<sub>CC</sub> vs Frequency

### Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in the [Section 5.4](#) table.

Each V<sub>CC</sub> pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1 μF is recommended; if there are multiple V<sub>CC</sub> pins, then 0.01 μF or 0.022 μF is recommended for each power pin. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1 μF and a 1 μF are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

### 8.3 Layout

#### 8.3.1 Layout Guidelines

When using multiple bit logic devices inputs should 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 3 of the 4 buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. [Section 8.3.2](#) specifies the rules that must be observed under all circumstances. 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 should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or V<sub>CC</sub>, whichever makes more sense or is more convenient. It is generally acceptable to float outputs, unless the part is a transceiver.

#### 8.3.2 Layout Example

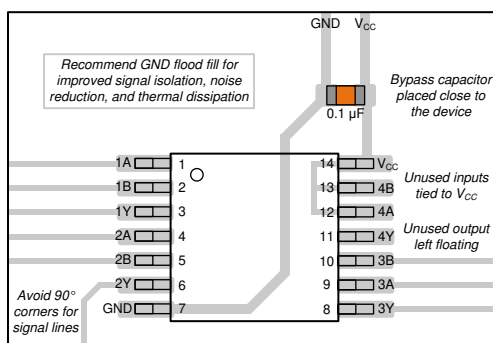


Figure 8-3. Layout Diagram for the SNx4LVC00A

## 9 Device and Documentation Support

### 9.1 Related Links

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

**Table 9-1. Related Links**

PARTS	PRODUCT FOLDER	ORDER NOW	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN54LVC00A	<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>
SN74LVC00A	<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>

### 9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* 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.

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](#).

#### 9.3.1 Community Resources

### 9.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.  
All trademarks are the property of their respective owners.

### 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 R (February 2016) to Revision S (March 2024)	Page
• Removed machine model from <i>Features</i> section .....	1
• Added new BQA package and SN54LVC00A packages in <i>Device Information</i> table.....	1
• Added BQA package in <i>Pin Configuration and Functions</i> section.....	3
• Removed machine model from <i>ESD Ratings</i> table.....	4
• Added BQA package in <i>Thermal Information</i> table.....	5
• Deleted I <sub>off</sub> throughout data sheet.....	9
• Added <i>Balanced High-Drive CMOS Push-Pull Outputs, Standard CMOS Inputs, Clamp Diodes, Over-voltage Tolerant Inputs</i> .....	9
• Added <i>Receiving Notification of Documentation Updates and Community Resources</i> .....	13

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<b>Changes from Revision Q (December 2014) to Revision R (February 2016)</b>	<b>Page</b>
• Added Junction temperature row to <i>Absolute Maximum Ratings</i> table.....	4
• Changed statement of "open drain: to "maximum sink and source current" statement in <i>Overview of Detailed Description</i> section.....	9
• Deleted "open drain" from <i>Application Information</i> section.....	11

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## 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 Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9753301Q2A	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9753301Q2A SNJ54LVC00AFK	<a href="#">Samples</a>
5962-9753301QCA	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9753301QCA SNJ54LVC00AJ	<a href="#">Samples</a>
5962-9753301QDA	ACTIVE	CFP	W	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9753301QDA SNJ54LVC00AW	<a href="#">Samples</a>
5962-9753301VDA	ACTIVE	CFP	W	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9753301VDA SNV54LVC00AW	<a href="#">Samples</a>
SN74LVC00AD	ACTIVE	SOIC	D	14	50	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC00A	<a href="#">Samples</a>
SN74LVC00ADBR	ACTIVE	SSOP	DB	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC00A	<a href="#">Samples</a>
SN74LVC00ADBRG4	ACTIVE	SSOP	DB	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC00A	<a href="#">Samples</a>
SN74LVC00ADE4	ACTIVE	SOIC	D	14	50	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC00A	<a href="#">Samples</a>
SN74LVC00ADR	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC00A	<a href="#">Samples</a>
SN74LVC00ADRG4	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC00A	<a href="#">Samples</a>
SN74LVC00ADT	ACTIVE	SOIC	D	14	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC00A	<a href="#">Samples</a>
SN74LVC00ANSR	ACTIVE	SO	NS	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC00A	<a href="#">Samples</a>
SN74LVC00ANSRG4	ACTIVE	SO	NS	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC00A	<a href="#">Samples</a>
SN74LVC00APW	ACTIVE	TSSOP	PW	14	90	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC00A	<a href="#">Samples</a>
SN74LVC00APWE4	ACTIVE	TSSOP	PW	14	90	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC00A	<a href="#">Samples</a>
SN74LVC00APWG4	ACTIVE	TSSOP	PW	14	90	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC00A	<a href="#">Samples</a>
SN74LVC00APWR	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 125	LC00A	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LVC00APWRE4	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC00A	<a href="#">Samples</a>
SN74LVC00APWRG4	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC00A	<a href="#">Samples</a>
SN74LVC00APWT	ACTIVE	TSSOP	PW	14	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC00A	<a href="#">Samples</a>
SN74LVC00ARGYR	ACTIVE	VQFN	RGY	14	3000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LC00A	<a href="#">Samples</a>
SNJ54LVC00AFK	ACTIVE	LCCC	FK	20	55	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9753301Q2A SNJ54LVC00AFK	<a href="#">Samples</a>
SNJ54LVC00AJ	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9753301QC A SNJ54LVC00AJ	<a href="#">Samples</a>
SNJ54LVC00AW	ACTIVE	CFP	W	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9753301QD A SNJ54LVC00AW	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.



(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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

**OTHER QUALIFIED VERSIONS OF SN54LVC00A, SN54LVC00A-SP, SN74LVC00A :**

- Catalog : [SN74LVC00A](#), [SN54LVC00A](#)
  
- Automotive : [SN74LVC00A-Q1](#), [SN74LVC00A-Q1](#)
  
- Enhanced Product : [SN74LVC00A-EP](#), [SN74LVC00A-EP](#)
  
- Military : [SN54LVC00A](#)
  
- Space : [SN54LVC00A-SP](#)

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
  
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

**TAPE AND REEL INFORMATION**

**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
SN74LVC00ADBR	SSOP	DB	14	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74LVC00ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LVC00ADT	SOIC	D	14	250	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LVC00ANSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74LVC00APWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LVC00APWRG4	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LVC00APWT	TSSOP	PW	14	250	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LVC00ARGYR	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)
SN74LVC00ADBR	SSOP	DB	14	2000	356.0	356.0	35.0
SN74LVC00ADR	SOIC	D	14	2500	333.2	345.9	28.6
SN74LVC00ADT	SOIC	D	14	250	210.0	185.0	35.0
SN74LVC00ANSR	SO	NS	14	2000	356.0	356.0	35.0
SN74LVC00APWR	TSSOP	PW	14	2000	356.0	356.0	35.0
SN74LVC00APWRG4	TSSOP	PW	14	2000	356.0	356.0	35.0
SN74LVC00APWT	TSSOP	PW	14	250	356.0	356.0	35.0
SN74LVC00ARGYR	VQFN	RGY	14	3000	356.0	356.0	35.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-9753301Q2A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-9753301QDA	W	CFP	14	25	506.98	26.16	6220	NA
5962-9753301VDA	W	CFP	14	25	506.98	26.16	6220	NA
SN74LVC00AD	D	SOIC	14	50	506.6	8	3940	4.32
SN74LVC00ADE4	D	SOIC	14	50	506.6	8	3940	4.32
SN74LVC00APW	PW	TSSOP	14	90	530	10.2	3600	3.5
SN74LVC00APWE4	PW	TSSOP	14	90	530	10.2	3600	3.5
SN74LVC00APWG4	PW	TSSOP	14	90	530	10.2	3600	3.5
SNJ54LVC00AFK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54LVC00AW	W	CFP	14	25	506.98	26.16	6220	NA

RGY (S-PVQFN-N14)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - This drawing is subject to change without notice.
  - QFN (Quad Flatpack No-Lead) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
  - Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
  - Package complies to JEDEC MO-241 variation BA.

RGY (S-PVQFN-N14)

PLASTIC QUAD FLATPACK NO-LEAD

**THERMAL INFORMATION**

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.



Bottom View

Exposed Thermal Pad Dimensions

4206353-2/P 03/14

NOTE: All linear dimensions are in millimeters

RGY (S-PVQFN-N14)

PLASTIC QUAD FLATPACK NO-LEAD



4208122-2/P 03/14

- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at [www.ti.com](http://www.ti.com) <<http://www.ti.com>>.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
  - Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

## 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

## GENERIC PACKAGE VIEW

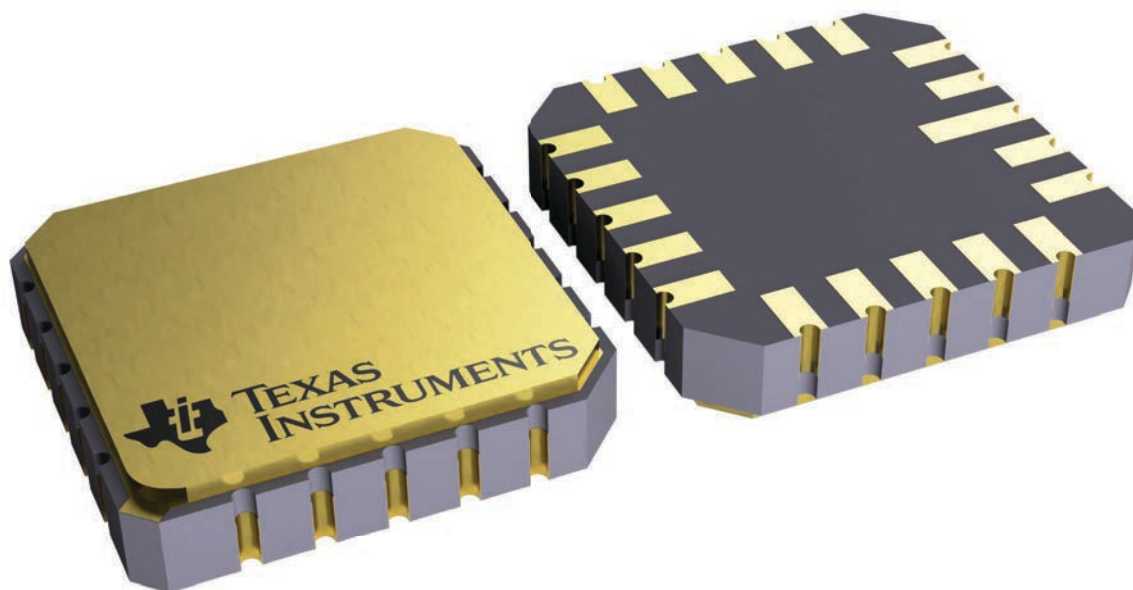
**FK 20**

**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



D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.





PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4211284-2/G 08/15

- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



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