











SN74LVC1G97

SCES416N - DECEMBER 2002 - REVISED JANUARY 2017

# **SN74LVC1G97 Configurable Multiple-Function Gate**

#### **Features**

- ESD Protection Exceeds JESD 22
  - 2000-V Human Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)
- Available in the Texas Instruments NanoFree™ Package
- Supports 5-V V<sub>CC</sub> Operation
- Inputs Accept Voltages to 5.5 V
- Supports Down Translation to V<sub>CC</sub>
- Max  $t_{pd}$  of 6.3 ns at 3.3 V
- Low Power Consumption, 10-µA Max I<sub>CC</sub>
- ±24-mA Output Drive at 3.3 V
- I<sub>off</sub> Supports Live Insertion, Partial-Power-Down Mode, and Back-Drive Protection
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- Choose From Nine Specific Logic Functions

# Applications

- **Barcode Scanners**
- Cable Solutions
- E-Books
- **Embedded PCs**
- Field Transmitter: Temperature or Pressure Sensors
- Fingerprint Biometrics
- HVAC: Heating, Ventilating, and Air Conditioning
- Network-Attached Storage (NAS)
- Server Motherboards and PSUs
- Software Defined Radios (SDR)
- TVs: High Definition (HDTV), LCD, and Digital
- Video Communications Systems
- Wireless Data Access Cards, Headsets, Keyboard, Mouse, and LAN Cards

## 3 Description

The SN74LVC1G97 device features configurable multiple functions. The output state is determined by eight patterns of 3-bit input. The user can choose the logic functions MUX, AND, OR, NAND, NOR, inverter, and noninverter. All inputs can be connected to V<sub>CC</sub> or GND.

This configurable multiple-function gate is designed for 1.65-V to 5.5-V  $V_{CC}$  operation.

This device functions as an independent gate, but because of Schmitt action, it may have different input threshold levels for positive-going (V<sub>T</sub>+) and negativegoing  $(V_T)$  signals.

NanoFree package technology is a major breakthrough in IC packaging concepts, using the die as the package.

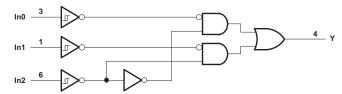
This device is fully specified for partial-power-down applications using  $I_{\text{off}}$ . The  $I_{\text{off}}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

## Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
SN74LVC1G97DBV	SOT-23 (6)	2.90 mm × 1.60 mm
SN74LVC1G97DCK	SC70 (6)	2.00 mm × 1.25 mm
SN74LVC1G97DRL		1.60 mm × 1.20 mm
SN74LVC1G97DRY	SOT (6)	1.45 mm × 1.00 mm
SN74LVC1G97DSF		1.00 mm × 1.00 mm
SN74LVC1G97YZP	DSBGA (6)	1.41 mm × 0.91 mm

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

## Logic Diagram (Positive Logic)



Page



Table of Conten	ts
-----------------	----

1	Features 1	8.2 Functional B	ock Diagram
2	Applications 1	8.3 Feature Des	cription
3	Description 1	8.4 Device Func	tional Modes
4	Revision History2	9 Application and	Implementation 1
5	Pin Configuration and Functions	9.1 Application I	nformation1
6	Specifications4	9.2 Typical Appli	cation1
Ū	6.1 Absolute Maximum Ratings 4	10 Power Supply	Recommendations 12
	6.2 ESD Ratings	11 Layout	
	6.3 Recommended Operating Conditions	11.1 Layout Guid	delines 1
	6.4 Thermal Information	11.2 Layout Exa	mple 1:
	6.5 Electrical Characteristics	12 Device and Do	cumentation Support 14
	6.6 Switching Characteristics	12.1 Documenta	tion Support1
	6.7 Switching Characteristics	12.2 Receiving N	Notification of Documentation Updates 1
	6.8 Operating Characteristics	12.3 Community	Resources1
	6.9 Typical Characteristics	12.4 Trademarks	s 1 <sub>0</sub>
7	Parameter Measurement Information	12.5 Electrostati	Discharge Caution1
8	Detailed Description 8		ckaging, and Orderable
	8.1 Overview 8	Information	14

## 4 Revision History

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

C	hanges from Revision M (June 2015) to Revision N	Page
•	Changed body size for SN74LVC1G97DRY to 1.45 mm × 1.00 mm	1
•	Changed body size for SN74LVC1G97DSF to 1.00 mm × 1.00 mm	1
•	Added Junction temperature, T <sub>J</sub> in <i>Absolute Maximum Ratings</i>	4
•	Added Operating free-air temperature, T <sub>A</sub> for BGA package in Recommended Operating Conditions	4
•	Added Receiving Notification of Documentation Updates section	14
_		

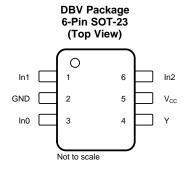
## Changes from Revision L (December 2013) to Revision M

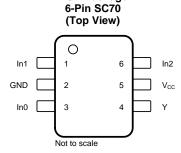
C	hanges from Revision K (October 2011) to Revision L			
•	Updated document to new TI data sheet format			
•	Removed Ordering Information table.			
•	Updated I <sub>off</sub> in Features			
•	Updated operating temperature range.			

Submit Documentation Feedback

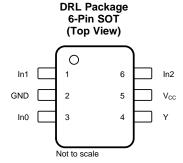


# 5 Pin Configuration and Functions

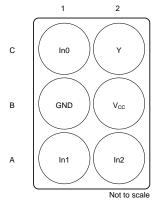




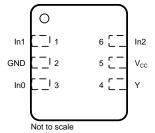
**DCK Package** 



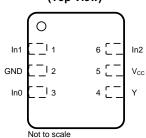
#### YZP Package 6-Pin DSBGA (Bottom View)



#### DRY Package 6-Pin SON (Top View)



#### DSF Package 6-Pin SON (Top View)



## **Pin Functions**

PIN			I/O	DESCRIPTION					
NAME	DCT, DCU, DRY	YZP	1/0	DESCRIPTION					
In0	3	C1	I	Input 0					
ln1	1	A1	I	Input 1					
ln2	6	A2	I	Input 2					
GND	2	B1	_	Ground					
V <sub>CC</sub>	5	B2	_	Power					
Υ	4	C2	0	Output					

Copyright © 2002–2017, Texas Instruments Incorporated

Submit Documentation Feedback



## 6 Specifications

## 6.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage	-0.5	6.5	V	
VI	Input voltage <sup>(2)</sup>		-0.5	6.5	V
Vo	Voltage applied to any output in the high-impedance or power-off state	-0.5	6.5	V	
Vo	Voltage applied to any output in the high or low state (2)(3)	-0.5	V <sub>CC</sub> + 0.5	V	
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> < 0 V		-50	mA
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0 V		-50	mA
Io	Continuous output current	·		±50	mA
	Continuous current through V <sub>CC</sub> or GND			±100	mA
TJ	Junction temperature			150	°C
T <sub>stg</sub>	Storage temperature		-65	150	°C

<sup>(1)</sup> 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.

## 6.2 ESD Ratings

				VALUE	UNIT
,	V/ECD)	Electrostatic	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	±2000	
\		discharge	Charged device model (CDM), per JEDEC specification JESD22-C101\(^{2}\)	±1000	V

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

## 6.3 Recommended Operating Conditions

See (1)

			MIN	MAX	UNIT
V	Cumply valtage	Operating	1.65	5.5	V
$V_{CC}$	Supply voltage	Data retention only	1.5		V
VI	Input voltage		0	5.5	V
Vo	Output voltage		0	V <sub>CC</sub>	V
Іон		V <sub>CC</sub> = 1.65 V		-4	
	High-level output current	V <sub>CC</sub> = 2.3 V		-8	
		V 0 V		-16	mA
		V <sub>CC</sub> = 3 V		-24	
		V <sub>CC</sub> = 4.5 V		-32	
		V <sub>CC</sub> = 1.65 V		4	
		V <sub>CC</sub> = 2.3 V		8	
I <sub>OL</sub>	Low-level output current	V 0 V		16	mA
		V <sub>CC</sub> = 3 V		24	
		V <sub>CC</sub> = 4.5 V		32	
_		BGA package	-40	85	°C
$T_A$	Operating free-air temperature	All other packages	-40	125	-0

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.

Product Folder Links: SN74LVC1G97

<sup>(2)</sup> The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

<sup>(3)</sup> The value of V<sub>CC</sub> is provided in the Recommended Operating Conditions table.

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



### 6.4 Thermal Information

		SN74LVC1G97						
THERMAL METRIC <sup>(1)</sup>		DBV (SOT-23)	DCK (SC70)	DRL (SOT)	YZP (DSBGA)	UNIT		
		6 PINS	6 PINS	6 PINS	6 PINS			
$R_{\theta JA}$	Junction-to-ambient thermal resistance	165	259	142	123	°C/W		

For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report.

## 6.5 Electrical Characteristics

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

		.,	-40°C	TO +85°C	-40°C		
PARAMETER	TEST CONDITIONS	V <sub>cc</sub>	MIN	TYP <sup>(1)</sup> MAX	MIN	TYP <sup>(1)</sup> MAX	UNIT
		1.65 V	0.79	1.16	0.79	1.16	
$V_{T+}$		2.3 V	1.11	1.56	1.11	1.56	
Positive-going input		3 V	1.5	1.87	1.5	1.87	V
threshold voltage		4.5 V	2.16	2.74	2.16	2.74	
		5.5 V	2.61	3.33	2.61	3.33	
		1.65 V	0.35	0.62	0.35	0.62	
$V_{T-}$		2.3 V	0.58	0.87	0.58	0.87	
Negative-going input		3 V	0.84	1.19	0.84	1.19	V
threshold voltage		4.5 V	1.41	1.9	1.41	1.9	
		5.5 V	1.87	2.29	1.87	2.29	
		1.65 V	0.3	0.62	0.3	0.62	
		2.3 V	0.4	0.8	0.4	0.8	
$\Delta V_T$ Hysteresis ( $V_{T+} - V_{T-}$ )		3 V	0.53	0.87	0.53	0.87	V
Trystorosis (V 4 V -)		4.5 V	0.71	1.04	0.71	1.04	
		5.5 V	0.71	1.11	0.71	1.11	
	$I_{OH} = -100 \ \mu A$	1.65 V to 5.5 V	$V_{CC} - 0.1$		$V_{CC} - 0.1$		V
	$I_{OH} = -4 \text{ mA}$	1.65 V	1.2		1.2		
$V_{OH}$	$I_{OH} = -8 \text{ mA}$	2.3 V	1.9		1.9		
VOH	I <sub>OH</sub> = −16 mA	3 V	2.4		2.4		V
	$I_{OH} = -24 \text{ mA}$	3 V	2.3		2.3		
	$I_{OH} = -32 \text{ mA}$	4.5 V	3.8		3.8		
	I <sub>OL</sub> = 100 μA	1.65 V to 5.5 V		0.1		0.1	
	I <sub>OL</sub> = 4 mA	1.65 V		0.45		0.45	
V <sub>OL</sub>	I <sub>OL</sub> = 8 mA	2.3 V		0.3		0.3	V
VOL	I <sub>OL</sub> = 16 mA	3 V		0.4		0.45	V
	I <sub>OL</sub> = 24 mA	3 V		0.55		0.55	
	I <sub>OL</sub> = 32 mA	4.5 V		0.55		0.58	
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	0 to 5.5 V		±5		±5	μΑ
l <sub>off</sub>	$V_I$ or $V_O = 5.5 \text{ V}$	0		±10		±10	μΑ
I <sub>CC</sub>	$V_I = 5.5 \text{ V or GND}, I_O = 0$	1.65 V to 5.5 V		10		10	μΑ
$\Delta I_{CC}$	One input at $V_{CC}$ – 0.6 V, Other inputs at $V_{CC}$ or GND	3 V to 5.5 V		500		500	μΑ
C <sub>I</sub>	$V_I = V_{CC}$ or GND	3.3 V		3.5		3.5	pF

<sup>(1)</sup> All typical values are at  $V_{CC}$  = 3.3 V,  $T_A$  = 25°C.

Product Folder Links: SN74LVC1G97



## 6.6 Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 2)

PARAMETER			J (				-40°C T	O 85°C				
		FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 1.8 V ± 0.15 V		V <sub>CC</sub> = 2.5 V ± 0.2 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		V <sub>CC</sub> = 5 V ± 0.5 V		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>		Any In	Y	3.2	14.4	2	8.3	1.5	6.3	1.1	5.1	ns

## 6.7 Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 2)

						-	-40°C T	O 125°C	;			
	PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 1.8 V ± 0.15 V		V <sub>CC</sub> = 2.5 V ± 0.2 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		V <sub>CC</sub> = 5 V ± 0.5 V		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t	d	Any In	Υ	3.2	16.4	2	9.3	1.5	7.3	1.1	6.1	ns

## 6.8 Operating Characteristics

 $T_A = 25^{\circ}C$ 

	PARAMETER	TEST	V <sub>CC</sub> = 1.8 V	V <sub>CC</sub> = 2.5 V	$V_{CC} = 3.3 \text{ V}$	V <sub>CC</sub> = 5 V	UNIT	
PARAMETER		CONDITIONS	TYP	TYP	TYP	TYP	ONIT	
C <sub>pd</sub> Power dissipation capacitance		f = 10 MHz	22	23	23	26	pF	

## 6.9 Typical Characteristics

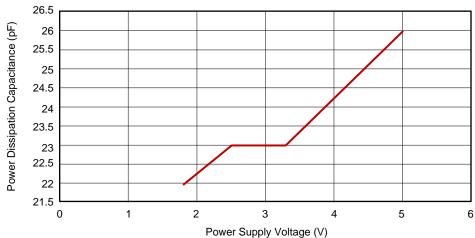


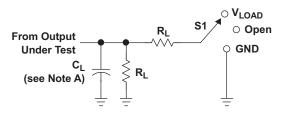
Figure 1. Power Dissipation Capacitance vs Power Supply Voltage

Submit Documentation Feedback

Copyright © 2002–2017, Texas Instruments Incorporated



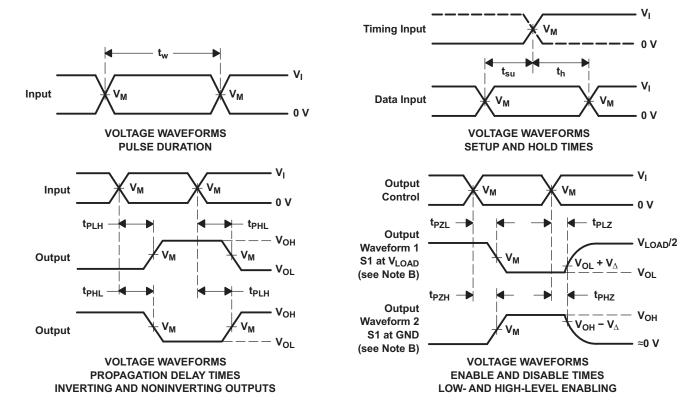
### 7 Parameter Measurement Information



TEST	S1
t <sub>PLH</sub> /t <sub>PHL</sub>	Open
t <sub>PLZ</sub> /t <sub>PZL</sub>	$V_{LOAD}$
t <sub>PHZ</sub> /t <sub>PZH</sub>	GND

LUAD	CINCUIT

	INF	PUTS	.,	V		-	.,
V <sub>CC</sub>	V <sub>I</sub> t <sub>r</sub> /t <sub>f</sub>		V <sub>M</sub>	V <sub>LOAD</sub>	CL	R <sub>L</sub>	$V_{\!\scriptscriptstyle \Delta}$
1.8 V ± 0.15 V	V <sub>CC</sub>	≤2 ns	V <sub>CC</sub> /2	2 × V <sub>CC</sub>	30 pF	<b>1 k</b> Ω	0.15 V
2.5 V ± 0.2 V	V <sub>CC</sub>	≤2 ns	V <sub>CC</sub> /2	2 × V <sub>CC</sub>	30 pF	<b>500</b> Ω	0.15 V
3.3 V ± 0.3 V	3 V	≤2.5 ns	1.5 V	6 V	50 pF	<b>500</b> Ω	0.3 V
5 V ± 0.5 V	V <sub>CC</sub>	≤2.5 ns	V <sub>CC</sub> /2	2 × V <sub>CC</sub>	50 pF	<b>500</b> Ω	0.3 V



NOTES: A. C<sub>L</sub> 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≤ 10 MHz, Z<sub>O</sub> = 50 W.
- 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 2. Load Circuit and Voltage Waveforms

Product Folder Links: SN74LVC1G97

Submit Documentation Feedback



## 8 Detailed Description

#### 8.1 Overview

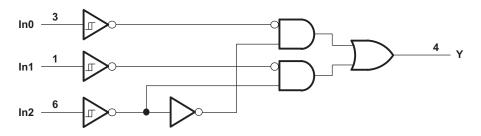
This configurable multiple-function gate is designed for 1.65-V to 5.5-V  $V_{CC}$  operation.

The SN74LVC1G97 device features configurable multiple functions. The output state is determined by eight patterns of 3-bit input. The user can choose variations of common logic functions, like AND, OR, and NOT. All inputs can be connected to  $V_{\rm CC}$  or GND.

This device functions as an independent gate, but because of Schmitt action, it may have different input threshold levels for positive-going  $(V_{T_{-}})$  and negative-going  $(V_{T_{-}})$  signals.

This device is fully-specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

## 8.2 Functional Block Diagram



### 8.3 Feature Description

The SN74LVC1G97 device has a wide operating  $V_{CC}$  range of 1.65 V to 5.5 V, which allows use in a broad range of systems. The 5.5-V I/Os allow down translation and also allow voltages at the inputs when  $V_{CC} = 0$  V.

#### 8.4 Device Functional Modes

Table 1 shows the functional modes of SN74LVC1G97.

**Table 1. Function Table** 

	INPUTS	OUTPUT	
ln2	In1	In0	Y
L	L	L	L
L	L	Н	L
L	Н	L	Н
L	Н	Н	Н
Н	L	L	L
Н	L	Н	Н
Н	Н	L	L
Н	Н	Н	Н

Submit Documentation Feedback



**Table 2. Function Selection Table** 

LOGIC FUNCTION	FIGURE NUMBER
2-to-1 data selector	Figure 3
2-input AND gate	Figure 4
2-input OR gate with one inverted input	Figure 5
2-input NAND gate with one inverted input	Figure 5
2-input AND gate with one inverted input	Figure 6
2-input NOR gate with one inverted input	Figure 6
2-input OR gate	Figure 7
Inverter	Figure 8
Noninverted buffer	Figure 9

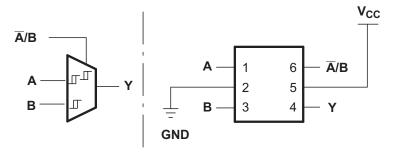


Figure 3. 2-to-1 Data Selector

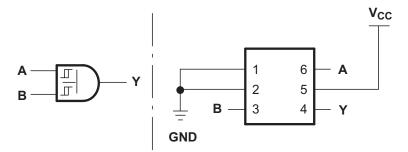


Figure 4. 2-Input AND Gate

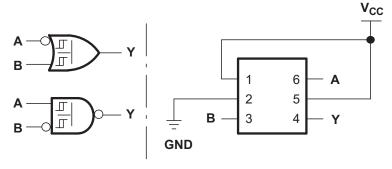


Figure 5. 2-Input OR Gate With One Inverted Input 2-Input NAND Gate With One Inverted Input

Copyright © 2002–2017, Texas Instruments Incorporated



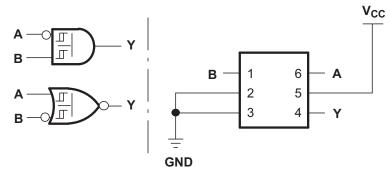


Figure 6. 2-Input AND Gate With One Inverted Input 2-Input NOR Gate With One Inverted Input

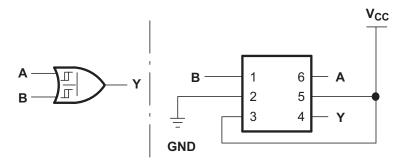


Figure 7. 2-Input OR Gate

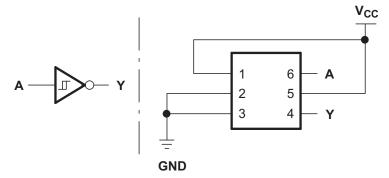


Figure 8. Inverter

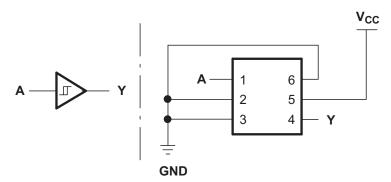


Figure 9. Noninverted Buffer

Submit Documentation Feedback



## 9 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. Validate and test the design implementation to confirm system functionality.

## 9.1 Application Information

The SN74LVC1G97 device offers flexible configuration for many design applications. This example describes basic power sequencing using the AND gate configuration. Power sequencing is often used in applications that require a processor or other delicate device with specific voltage timing requirements in order to protect the device from malfunctioning.

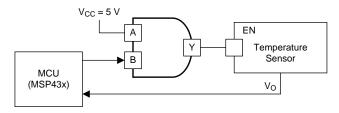


Figure 10. Simplified Application

## 9.2 Typical Application

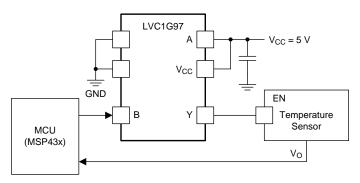


Figure 11. Typical Application

## 9.2.1 Design Requirements

- Recommended input conditions:
  - For rise time and fall time specifications, see  $\Delta t/\Delta v$  in the Recommended Operating Conditions table.
  - For specified high and low levels, see V<sub>IH</sub> and V<sub>II</sub> in the Recommended Operating Conditions table.
  - Inputs and outputs are overvoltage tolerant and can therefore go as high as 5.5 V at any valid V<sub>CC</sub>.
- · Recommended output conditions:
  - Load currents must not exceed ±50 mA.
- Frequency selection criterion:
  - Figure 12 illustrates the effects of frequency on output current.
  - Added trace resistance and capacitance can reduce maximum frequency capability. Follow the layout practices listed in the *Layout* section.

Product Folder Links: SN74LVC1G97



## **Typical Application (continued)**

## 9.2.2 Detailed Design Procedure

The SN74LVC1G97 device uses CMOS technology and has balanced output drive. Avoid bus contentions that can drive currents that can exceed maximum limits.

The SN74LVC1G97 allows for performing logical Boolean functions with digital signals. Maintain input signals as close as possible to either 0 V or  $V_{CC}$  for optimal operation.

#### 9.2.3 Application Curve

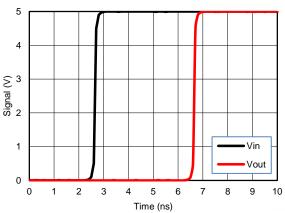


Figure 12. Simulated Input-to-Output Voltage Response Showing Propagation Delay at V<sub>CC</sub> = 5 V

# 10 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating listed in the *Recommended Operating Conditions* table.

To prevent power disturbance, ensure good bypass capacitance for each  $V_{CC}$  terminal. For devices with a single-supply, a 0.1- $\mu$ F bypass capacitor is recommended. If multiple pins are labeled  $V_{CC}$ , then a 0.01- $\mu$ F or 0.022- $\mu$ F capacitor is recommended for each  $V_{CC}$  because the  $V_{CC}$  pins are tied together internally. For devices with dual supply pins operating at different voltages, for example  $V_{CC}$  and  $V_{DD}$ , a 0.1- $\mu$ F bypass capacitor is recommended for each supply pin. To reject different frequencies of noise, use multiple bypass capacitors in parallel. Capacitors with values of 0.1  $\mu$ F and 1  $\mu$ F are commonly used in parallel. Place the bypass capacitor as close to the power terminal as possible for best results.

Submit Documentation Feedback



## 11 Layout

### 11.1 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 when only 3 of the 4 buffer gates are used. Such input pins must not be left unconnected, because the undefined voltages at the outside connections result in undefined operational states. Figure 13 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 must be applied to any particular unused input depends on the function of the device. Generally they are tied to GND or  $V_{\rm CC}$ , whichever makes more sense or is more convenient. It is generally acceptable to float outputs, unless the part is a transceiver. If the transceiver has an output enable pin, it disables the output section of the part when asserted, which does not disable the input section of the I/Os. Therefore, the I/Os cannot float when disabled.

## 11.2 Layout Example

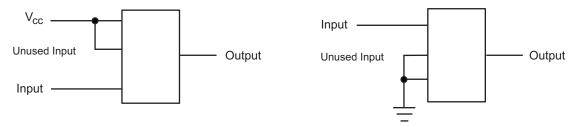


Figure 13. Layout Diagrams

Product Folder Links: SN74LVC1G97



## 12 Device and Documentation Support

## 12.1 Documentation Support

#### 12.1.1 Related Documentation

For related documentation see the following:

- Implications of Slow or Floating CMOS Inputs, SCBA004
- Selecting the Right Texas Instruments Signal Switch, SZZA030

## 12.2 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.

## 12.3 Community Resources

The following links connect to TI community resources. Linked contents are 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.

TI E2E™ Online Community TI's Engineer-to-Engineer (E2E) Community. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

#### 12.4 Trademarks

NanoFree, E2E are trademarks of Texas Instruments.

All other trademarks are the property of their respective owners.

#### 12.5 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## 13 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.

Product Folder Links: SN74LVC1G97

www.ti.com

2-Aug-2022

## **PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead finish/ Ball material	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LVC1G97DBVR	ACTIVE	SOT-23	DBV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(C975, C97K, C97R)	Samples
SN74LVC1G97DBVRE4	ACTIVE	SOT-23	DBV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(C975, C97K, C97R)	Samples
SN74LVC1G97DBVRG4	ACTIVE	SOT-23	DBV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(C975, C97K, C97R)	Samples
SN74LVC1G97DBVT	ACTIVE	SOT-23	DBV	6	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(C975, C97K, C97R)	Samples
SN74LVC1G97DBVTG4	ACTIVE	SOT-23	DBV	6	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(C975, C97K, C97R)	Samples
SN74LVC1G97DCK3	ACTIVE	SC70	DCK	6	3000	RoHS & Non-Green	SNBI	Level-1-260C-UNLIM	-40 to 125	CSZ	Samples
SN74LVC1G97DCKR	ACTIVE	SC70	DCK	6	3000	RoHS & Green	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 125	(CS5, CSF, CSJ, CS K, CSR)	Samples
SN74LVC1G97DCKRE4	ACTIVE	SC70	DCK	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CS5	Samples
SN74LVC1G97DCKRG4	ACTIVE	SC70	DCK	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CS5	Samples
SN74LVC1G97DCKT	ACTIVE	SC70	DCK	6	250	RoHS & Green	NIPDAU   SN	Level-1-260C-UNLIM	-40 to 125	(CS5, CSF, CSJ, CS K, CSR)	Samples
SN74LVC1G97DCKTG4	ACTIVE	SC70	DCK	6	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CS5	Samples
SN74LVC1G97DRLR	ACTIVE	SOT-5X3	DRL	6	4000	RoHS & Green	NIPDAU   NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(1K4, CS7, CSR)	Samples
SN74LVC1G97DRYR	ACTIVE	SON	DRY	6	5000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CS	Samples
SN74LVC1G97DSFR	ACTIVE	SON	DSF	6	5000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CS	Samples
SN74LVC1G97YZPR	ACTIVE	DSBGA	YZP	6	3000	RoHS & Green	SNAGCU	Level-1-260C-UNLIM	-40 to 85	CSN	Samples

<sup>(1)</sup> 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.

## PACKAGE OPTION ADDENDUM

www.ti.com 2-Aug-2022

(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 (CI) 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 SN74LVC1G97:

Automotive: SN74LVC1G97-Q1

■ Enhanced Product : SN74LVC1G97-EP

#### NOTE: Qualified Version Definitions:

- Automotive Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product Supports Defense, Aerospace and Medical Applications



www.ti.com 14-Sep-2023

## TAPE AND REEL INFORMATION





A0	Dimension designed to accommodate the component width
В0	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		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	(mm)	Pin1 Quadrant
SN74LVC1G97DBVR	SOT-23	DBV	6	3000	180.0	8.4	3.23	3.17	1.37	4.0	8.0	Q3
SN74LVC1G97DBVR	SOT-23	DBV	6	3000	178.0	9.2	3.3	3.23	1.55	4.0	8.0	Q3
SN74LVC1G97DBVT	SOT-23	DBV	6	250	180.0	8.4	3.23	3.17	1.37	4.0	8.0	Q3
SN74LVC1G97DBVT	SOT-23	DBV	6	250	178.0	9.2	3.3	3.23	1.55	4.0	8.0	Q3
SN74LVC1G97DCKR	SC70	DCK	6	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
SN74LVC1G97DCKRG4	SC70	DCK	6	3000	178.0	9.2	2.4	2.4	1.22	4.0	8.0	Q3
SN74LVC1G97DCKT	SC70	DCK	6	250	180.0	8.4	2.41	2.41	1.2	4.0	8.0	Q3
SN74LVC1G97DCKT	SC70	DCK	6	250	178.0	9.2	2.4	2.4	1.22	4.0	8.0	Q3
SN74LVC1G97DCKT	SC70	DCK	6	250	178.0	9.0	2.4	2.5	1.2	4.0	8.0	Q3
SN74LVC1G97DCKT	SC70	DCK	6	250	178.0	9.0	2.4	2.5	1.2	4.0	8.0	Q3
SN74LVC1G97DCKTG4	SC70	DCK	6	250	178.0	9.2	2.4	2.4	1.22	4.0	8.0	Q3
SN74LVC1G97DRLR	SOT-5X3	DRL	6	4000	180.0	8.4	1.98	1.78	0.69	4.0	8.0	Q3
SN74LVC1G97DRLR	SOT-5X3	DRL	6	4000	180.0	8.4	2.0	1.8	0.75	4.0	8.0	Q3
SN74LVC1G97DRYR	SON	DRY	6	5000	180.0	9.5	1.15	1.6	0.75	4.0	8.0	Q1
SN74LVC1G97DSFR	SON	DSF	6	5000	180.0	9.5	1.16	1.16	0.5	4.0	8.0	Q2
SN74LVC1G97YZPR	DSBGA	YZP	6	3000	178.0	9.2	1.02	1.52	0.63	4.0	8.0	Q1



www.ti.com 14-Sep-2023



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVC1G97DBVR	SOT-23	DBV	6	3000	202.0	201.0	28.0
SN74LVC1G97DBVR	SOT-23	DBV	6	3000	180.0	180.0	18.0
SN74LVC1G97DBVT	SOT-23	DBV	6	250	202.0	201.0	28.0
SN74LVC1G97DBVT	SOT-23	DBV	6	250	180.0	180.0	18.0
SN74LVC1G97DCKR	SC70	DCK	6	3000	210.0	185.0	35.0
SN74LVC1G97DCKRG4	SC70	DCK	6	3000	180.0	180.0	18.0
SN74LVC1G97DCKT	SC70	DCK	6	250	202.0	201.0	28.0
SN74LVC1G97DCKT	SC70	DCK	6	250	180.0	180.0	18.0
SN74LVC1G97DCKT	SC70	DCK	6	250	180.0	180.0	18.0
SN74LVC1G97DCKT	SC70	DCK	6	250	180.0	180.0	18.0
SN74LVC1G97DCKTG4	SC70	DCK	6	250	180.0	180.0	18.0
SN74LVC1G97DRLR	SOT-5X3	DRL	6	4000	202.0	201.0	28.0
SN74LVC1G97DRLR	SOT-5X3	DRL	6	4000	210.0	185.0	35.0
SN74LVC1G97DRYR	SON	DRY	6	5000	184.0	184.0	19.0
SN74LVC1G97DSFR	SON	DSF	6	5000	184.0	184.0	19.0
SN74LVC1G97YZPR	DSBGA	YZP	6	3000	220.0	220.0	35.0

# DCK (R-PDSO-G6)

# PLASTIC SMALL-OUTLINE PACKAGE



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. Mold flash and protrusion shall not exceed 0.15 per side.
- D. Falls within JEDEC MO-203 variation AB.



# DCK (R-PDSO-G6)

# PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. Publication IPC-7351 is recommended for alternate designs.
- E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.





SMALL OUTLINE TRANSISTOR



#### 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. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.25 per side.

- 4. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation. 5. Refernce JEDEC MO-178.



SMALL OUTLINE TRANSISTOR



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.



SMALL OUTLINE TRANSISTOR



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.





DIE SIZE BALL GRID ARRAY



#### NOTES:

NanoFree Is a trademark of Texas Instruments.

- 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. NanoFree<sup>™</sup> package configuration.



DIE SIZE BALL GRID ARRAY



NOTES: (continued)

Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints.
 For more information, see Texas Instruments literature number SBVA017 (www.ti.com/lit/sbva017).



DIE SIZE BALL GRID ARRAY



NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.





PLASTIC SMALL OUTLINE



## 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-293 Variation UAAD



PLASTIC SMALL OUTLINE



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.7. Land pattern design aligns to IPC-610, Bottom Termination Component (BTC) solder joint inspection criteria.



PLASTIC SMALL OUTLINE



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.





Images above are just a representation of the package family, actual package may vary. Refer to the product data sheet for package details.









#### 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.





NOTES: (continued)

3. For more information, see QFN/SON PCB application report in literature No. SLUA271 (www.ti.com/lit/slua271).





NOTES: (continued)

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







### 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. Reference JEDEC registration MO-287, variation X2AAF.





NOTES: (continued)

4. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).





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



## IMPORTANT NOTICE AND DISCLAIMER

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

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

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

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

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

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2023, Texas Instruments Incorporated