

SINGLE INVERTER GATE

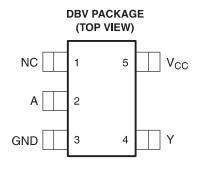
FEATURES

- Supports 5-V V_{CC} Operation
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 3.3 ns at 3.3 V
- Low Power Consumption, 10-μA Max I_{CC}
- ±24-mA Output Drive at 3.3 V
- I_{off} Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- **ESD Protection Exceeds JESD 22**
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

SUPPORTS DEFENSE, AEROSPACE, AND MEDICAL APPLICATIONS

- **Controlled Baseline**
- One Assembly/Test Site
- One Fabrication Site
- Available in Military (-55°C/125°C) Temperature Range⁽¹⁾
- **Extended Product Life Cycle**
- **Extended Product-Change Notification**
- **Product Traceability**

(1) Custom temperature ranges available



NC - No internal connection

DESCRIPTION/ORDERING INFORMATION

This single inverter gate is designed for 1.65-V to 5.5-V V_{CC} operation.

The SN74LVC1G04 performs the Boolean function $Y = \overline{A}$.

NanoStar™ and 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 Ioff. The Ioff circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

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



ORDERING INFORMATION

T _A	PACKAGE ⁽¹⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING(2)
-55°C to 125°C	SOT (SOT-23) - DBV	Reel of 3000	SN74LVC1G04MDBVREP	SBKM

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.
- (2) DBV: The actual top-side marking has one additional character that designates the assembly/test site.

FUNCTION TABLE

INPUT A	OUTPUT Y
Н	٦
L	Н

LOGIC DIAGRAM (POSITIVE LOGIC)



www.ti.com

Absolute Maximum Ratings(1)

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range	-0.5	6.5	V	
VI	Input voltage range		-0.5	6.5	V
Vo	Voltage range applied to any output in the	e high-impedance or power-off state (2)	-0.5	6.5	V
Vo	Voltage range applied to any output in the	e high or low state (2)(3)	-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
Io	Continuous output current			±50	mA
	Continuous current through V _{CC} or GND			±100	mA
θ_{JA}	Package thermal impedance (4)		206	°C/W	
T _{stg}	Storage temperature range		-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.

Copyright © 2007–2008, Texas Instruments Incorporated

Submit Documentation Feedback

⁽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_{CC} is provided in the recommended operating conditions table.

⁽⁴⁾ The package thermal impedance is calculated in accordance with JESD 51-7.



Recommended Operating Conditions⁽¹⁾

			MIN	MAX	UNIT
\ /	Cumphicushiana	Operating	1.65	5.5	V
V_{CC}	Supply voltage	Data retention only	1.5		V
		V _{CC} = 1.65 V to 1.95 V	0.65 × V _{CC}		
.,	High level in a value of	V _{CC} = 2.3 V to 2.7 V	1.7		\ /
V_{IH}	High-level input voltage	V _{CC} = 3 V to 3.6 V	2		V
		V _{CC} = 4.5 V to 5.5 V	0.7 × V _{CC}		
		V _{CC} = 1.65 V to 1.95 V		0.35 × V _{CC}	
\ /	/ _{IL} Low-level input voltage	V _{CC} = 2.3 V to 2.7 V		0.7	\ /
VIL		V _{CC} = 3 V to 3.6 V		0.8	V
		V _{CC} = 4.5 V to 5.5 V	0.3 × V _{CC}		
VI	Input voltage	,	0	5.5	V
Vo	Output voltage		0	V _{CC}	V
		V _{CC} = 1.65 V		-4	
		V _{CC} = 2.3 V		-8	
I_{OH}	High-level output current			-16	mA
		V _{CC} = 3 V	-24		
		V _{CC} = 4.5 V		-32	
		V _{CC} = 1.65 V		4	
		V _{CC} = 2.3 V		8	
I_{OL}	Low-level output current		16 24		mA
		V _{CC} = 3 V			
		V _{CC} = 4.5 V		32	
		$V_{CC} = 1.8 \text{ V} \pm 0.15 \text{ V}, 2.5 \text{ V} \pm 0.2 \text{ V}$		20	
Δt/Δν	Input transition rise or fall rate	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	10		ns/V
		$V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$		5	
T _A	Operating free-air temperature	,	-55	125	°C

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



Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V _{cc}	MIN	TYP ⁽¹⁾ MAX	UNIT
	$I_{OH} = -100 \mu A$	3.6V	V _{CC} - 0.1		
	$I_{OH} = -4 \text{ mA}$	1.65 V	1.2		
V	$I_{OH} = -8 \text{ mA}$	2.3 V	1.9		V
V _{OH}	$I_{OH} = -16 \text{ mA}$	3 V	2.4		V
	$I_{OH} = -24 \text{ mA}$	3 V	2.3		
	$I_{OH} = -32 \text{ mA}$	4.5 V	3.8		
	I _{OL} = 100 μA	3.6 V to 5.5 V		0.1	
	I _{OL} = 4 mA	1.65 V		0.45	
V	I _{OL} = 8 mA	2.3 V		0.3	V
V _{OL}	I _{OL} = 16 mA	3 V		0.4	V
	I _{OL} = 24 mA	3 V		0.55	
	I _{OL} = 32 mA	4.5 V		0.55	
I _I A input	V _I = 5.5 V or GND	0 to 5.5 V		±5	μΑ
I _{off}	V_I or $V_O = 5.5 \text{ V}$	0		±10	μΑ
I _{CC}	$V_I = 5.5 \text{ V or GND}$ $I_O = 0$	1.65 V to 5.5 V		10	μΑ
ΔI _{CC}	One input at $V_{CC} - 0.6 \text{ V}$, Other inputs at V_{CC} or GND	3 V to 5.5 V		500	μΑ
C _I	V _I = V _{CC} or GND	3.3 V		3.5	pF

⁽¹⁾ All typical values are at $V_{CC} = 3.3 \text{ V}$, $T_A = 25^{\circ}\text{C}$.

Switching Characteristics

over recommended operating free-air temperature range, $C_L = 30 \text{ pF}$ or 50 pF (unless otherwise noted) (see Figure 2)

PARAMETER	FROM	TO (OUTPUT)		V _{CC} = 1.8 V ± 0.15 V		V _{CC} = 2.5 V ± 0.2 V		V _{CC} = 3.3 V ± 0.3 V		V _{CC} = 5 V ± 0.5 V	
	(INPUT)	(001701)	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t _{pd}	Α	Υ	3	13.9	1.4	8.0	1	5.7	1	4.5	ns

Operating Characteristics

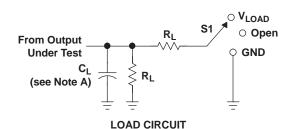
 $T_A = 25$ °C

	PARAMETER	TEST CONDITIONS	V _{CC} = 1.8 V TYP	V _{CC} = 2.5 V TYP	V _{CC} = 3.3 V TYP	V _{CC} = 5 V	UNIT TYP
C_{pd}	Power dissipation capacitance	f = 10 MHz	16	18	18	20	pF

Copyright © 2007–2008, Texas Instruments Incorporated

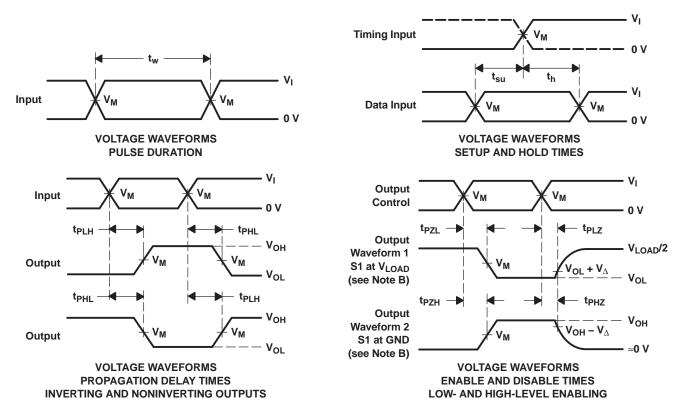


PARAMETER MEASUREMENT INFORMATION



TEST	S1
t _{PLH} /t _{PHL}	Open
t _{PLZ} /t _{PZL}	V _{LOAD}
t _{PHZ} /t _{PZH}	GND

V	INF	PUTS	.,	V	_	В	V
V _{CC}	VI	t _r /t _f	V _M	V _{LOAD}	CL	R _L	V_{Δ}
1.8 V ± 0.15 V	V _{CC}	≤2 ns	V _{CC} /2	2×V _{CC}	15 pF	1 ΜΩ	0.15 V
2.5 V \pm 0.2 V	V _{CC}	≤2 ns	V _{CC} /2	2×V _{CC}	15 pF	1 Μ Ω	0.15 V
3.3 V \pm 0.3 V	3 V	≤2.5 ns	1.5 V	6 V	15 pF	1 Μ Ω	0.3 V
5 V \pm 0.5 V	V _{CC}	≤2.5 ns	V _{CC} /2	2×V _{CC}	15 pF	1 Μ Ω	0.3 V



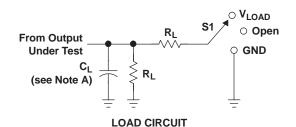
NOTES: A. C_L includes probe and jig capacitance.

- 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 MHz, Z_0 = 50 Ω .
- 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 1. Load Circuit and Voltage Waveforms

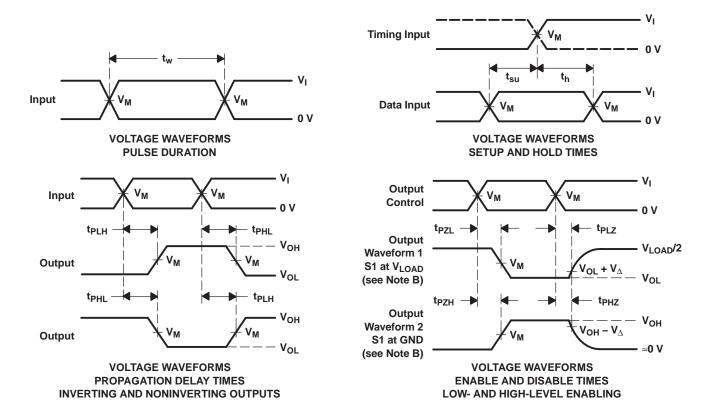


PARAMETER MEASUREMENT INFORMATION



TEST	S1
t _{PLH} /t _{PHL}	Open
t _{PLZ} /t _{PZL}	V_{LOAD}
t _{PHZ} /t _{PZH}	GND

V	INI	PUTS	V	V		Б	V
V _{CC}	V_{I}	t _r /t _f	V _M	V _{LOAD}	CL	R _L	V_{Δ}
1.8 V ± 0.15 V	V _{CC}	≤2 ns	V _{CC} /2	2×V _{CC}	30 pF	1 k Ω	0.15 V
2.5 V \pm 0.2 V	V _{CC}	≤2 ns	V _{CC} /2	2×V _{CC}	30 pF	500 Ω	0.15 V
3.3 V \pm 0.3 V	3 V	≤2.5 ns	1.5 V	6 V	50 pF	500 Ω	0.3 V
5 V \pm 0.5 V	V _{CC}	≤2.5 ns	V _{CC} /2	2×V _{CC}	50 pF	500 Ω	0.3 V



- 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 MHz, Z_O = 50 Ω .
 - 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



1-Mar-2012

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
SN74LVC1G04MDBVREP	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
V62/07625-01XE	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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 SN74LVC1G04-EP:

Catalog: SN74LVC1G04

Automotive: SN74LVC1G04-Q1





1-Mar-2012

NOTE: Qualified Version Definitions:

- Catalog TI's standard catalog product
- Automotive Q100 devices qualified for high-reliability automotive applications targeting zero defects

DBV (R-PDSO-G5)

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-178 Variation AA.



DBV (R-PDSO-G5)

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.



IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

Applications

Automotive and Transportation www.ti.com/automotive

e2e.ti.com

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

		•	
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video

RFID <u>www.ti-rfid.com</u>
OMAP Mobile Processors www.ti.com/omap

Products

Audio

Wireless Connectivity www.ti.com/wirelessconnectivity

www.ti.com/audio

TI E2E Community Home Page

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2012, Texas Instruments Incorporated