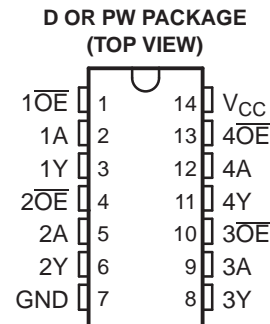


## 3.3-V ABT QUADRUPLE BUS BUFFER WITH 3-STATE OUTPUTS

### FEATURES

- Qualified for Automotive Applications
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Supports Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V  $V_{CC}$ )
- Supports Unregulated Battery Operation Down to 2.7 V
- Typical  $V_{OLP}$  (Output Ground Bounce) <0.8 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Bus-Hold Data Inputs Eliminate the Need for External Pullup Resistors



### DESCRIPTION/ORDERING INFORMATION

This bus buffer is designed specifically for low-voltage (3.3-V)  $V_{CC}$  operation, but with the capability to provide a TTL interface to a 5-V system environment.

The SN74LVT125-Q1 features independent line drivers with 3-state outputs. Each output is in the high-impedance state when the associated output-enable ( $\overline{OE}$ ) input is high.

Active bus-hold circuitry holds unused or undriven inputs at a valid logic state. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

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.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

### ORDERING INFORMATION<sup>(1)</sup>

$T_A$	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 125°C	SOIC – D	Tape and reel	SN74LVT125QDRQ1	LVT125Q
	TSSOP – PW	Tape and reel	SN74LVT125QPWRQ1	LVT125Q

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

(2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).

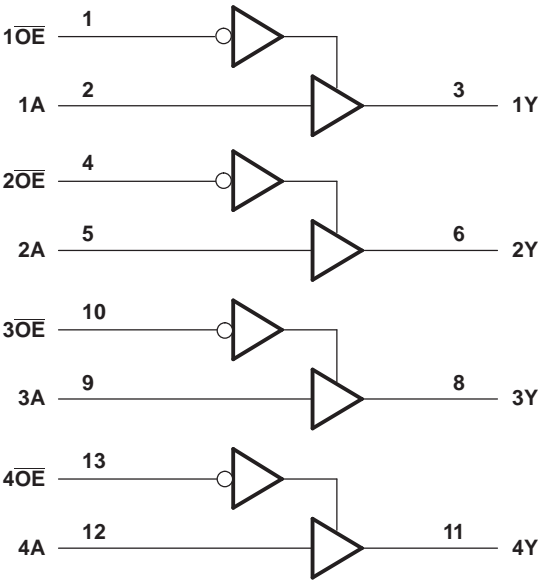


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FUNCTION TABLE

INPUTS		OUTPUT Y
$\overline{\text{OE}}$	A	
L	H	H
L	L	L
H	X	Z

LOGIC DIAGRAM (POSITIVE LOGIC)



Absolute Maximum Ratings<sup>(1)</sup>

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

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage range		−0.5	4.6	V
V <sub>I</sub>	Input voltage range <sup>(2)</sup>		−0.5	7	V
V <sub>O</sub>	Voltage range applied to any output in the high state or power-off state <sup>(2)</sup>		−0.5	7	V
I <sub>O</sub>	Current into any output in the low state			128	mA
I <sub>O</sub>	Current into any output in the high state <sup>(3)</sup>			64	mA
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
θ <sub>JA</sub>	Package thermal impedance <sup>(4)</sup>	D package		86	°C/W
		PW package		113	
T <sub>stg</sub>	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.
- (2) The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (3) This current flows only when the output is in the high state and  $V_O > V_{CC}$ .
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

## Recommended Operating Conditions<sup>(1)</sup>

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage	2.7	3.6	V
V <sub>IH</sub>	High-level input voltage	2		V
V <sub>IL</sub>	Low-level input voltage		0.8	V
V <sub>I</sub>	Input voltage		5.5	V
I <sub>OH</sub>	High-level output current		–32	mA
I <sub>OL</sub>	Low-level output current		32	mA
Δt/Δv	Input transition rise or fall rate	Outputs enabled		10 ns/V
T <sub>A</sub>	Operating free-air temperature	–40	125	°C

(1) All unused inputs of the device must be held at V<sub>CC</sub> 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		MIN	TYP <sup>(1)</sup>	MAX	UNIT
V <sub>IK</sub>	V <sub>CC</sub> = 2.7 V,	I <sub>I</sub> = –18 mA			–1.2	V
V <sub>OH</sub>	V <sub>CC</sub> = MIN to MAX, <sup>(2)</sup>	I <sub>OH</sub> = –100 μA	V <sub>CC</sub> – 0.2			V
	V <sub>CC</sub> = 2.7 V,	I <sub>OH</sub> = –8 mA	2.4			
	V <sub>CC</sub> = 3 V	I <sub>OH</sub> = –32 mA	2			
V <sub>OL</sub>	V <sub>CC</sub> = 2.7 V	I <sub>OL</sub> = 100 μA			0.2	V
		I <sub>OL</sub> = 24 mA			0.5	
	V <sub>CC</sub> = 3 V	I <sub>OL</sub> = 16 mA			0.4	
		I <sub>OL</sub> = 32 mA			0.5	
I <sub>I</sub>	V <sub>CC</sub> = 0 or MAX,	V <sub>I</sub> = 5.5 V			40	μA
	V <sub>CC</sub> = 3.6 V	V <sub>I</sub> = V <sub>CC</sub> or GND	Control inputs		±1	
		V <sub>I</sub> = V <sub>CC</sub>	Data inputs		1	
		V <sub>I</sub> = 0			–5	
I <sub>off</sub>	V <sub>CC</sub> = 0,	V <sub>I</sub> or V <sub>O</sub> = 0 to 4.5 V			±450	μA
I <sub>I(hold)</sub>	V <sub>CC</sub> = 3 V	V <sub>I</sub> = 0.8 V	Data inputs		75	μA
		V <sub>I</sub> = 2 V			–75	
I <sub>OZH</sub>	V <sub>CC</sub> = 3.6 V,	V <sub>O</sub> = 3 V			5	μA
I <sub>OZL</sub>	V <sub>CC</sub> = 3.6 V,	V <sub>O</sub> = 0.5 V			–5	μA
I <sub>CC</sub>	V <sub>CC</sub> = 3.6 V, V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	Outputs high	0.12	0.35		mA
		Outputs low	4.5	7		
		Outputs disabled	0.12	0.4		
ΔI <sub>CC</sub> <sup>(3)</sup>	V <sub>CC</sub> = 3 V to 3.6 V,	One input at V <sub>CC</sub> – 0.6 V, Other inputs at V <sub>CC</sub> or GND			0.2	mA
C <sub>I</sub>	V <sub>I</sub> = 3 V or 0			4		pF
C <sub>O</sub>	V <sub>O</sub> = 3 V or 0			8		pF

(1) All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

(2) For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

(3) This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V<sub>CC</sub> or GND.

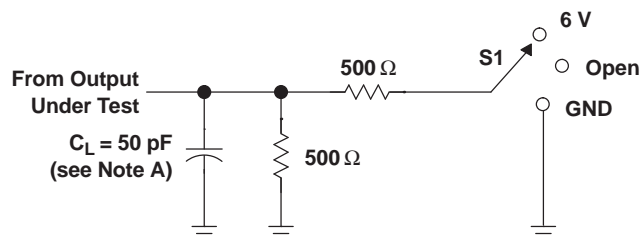
## Switching Characteristics

over recommended operating free-air temperature range,  $C_L = 50$  pF (unless otherwise noted) (see [Figure 1](#))

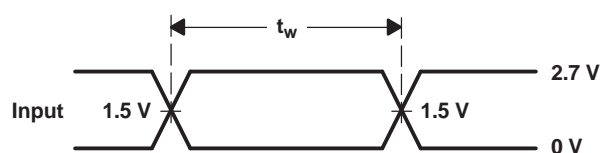
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 3.3 V ±0.3 V			V <sub>CC</sub> = 2.7 V		UNIT
			MIN	TYP <sup>(1)</sup>	MAX	MIN	MAX	
t <sub>PLH</sub>	A	Y	1	2.7	4.2	4.7		ns
t <sub>PHL</sub>			1	2.9	4.1	5.1		
t <sub>PZH</sub>	OE	Y	1	3.4	4.9	6.2		ns
t <sub>PZL</sub>			1.1	3.4	4.9	6.7		
t <sub>PHZ</sub>	OE	Y	1.8	3.7	5.3	5.9		ns
t <sub>PLZ</sub>			1.3	2.6	4.7	4.2		

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

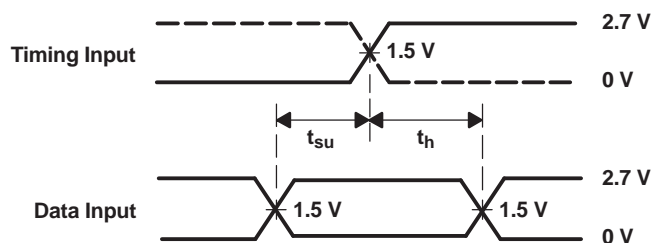
## PARAMETER MEASUREMENT INFORMATION



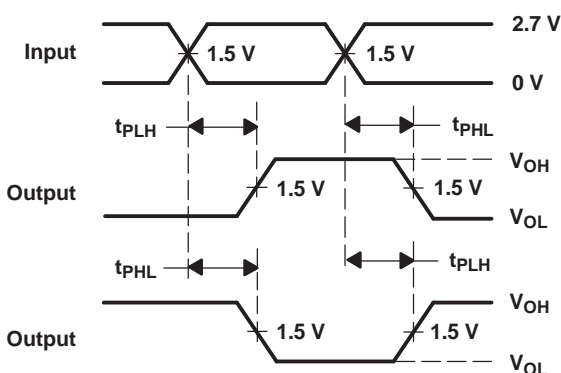
LOAD CIRCUIT FOR OUTPUTS



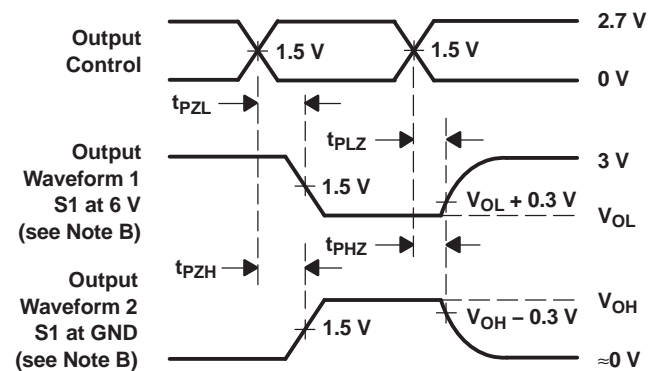
VOLTAGE WAVEFORMS  
PULSE DURATION



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:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns.  
D. The outputs are measured one at a time, with one transition per measurement.  
E. All parameters and waveforms are not applicable to all devices.

**Figure 1. Load Circuit and Voltage Waveforms**

## 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
SN74LVT125QDRG4Q1	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVT125Q	<a href="#">Samples</a>
SN74LVT125QDRQ1	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVT125Q	<a href="#">Samples</a>
SN74LVT125QPWRG4Q1	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVT125Q	<a href="#">Samples</a>
SN74LVT125QPWRQ1	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVT125Q	<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.

**OBSELETE:** 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.

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**OTHER QUALIFIED VERSIONS OF SN74LVT125-Q1 :**

- Catalog: [SN74LVT125](#)
- Enhanced Product: [SN74LVT125-EP](#)

**NOTE:** Qualified Version Definitions:

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

**TAPE AND REEL INFORMATION**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LVT125QPWRG4Q1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LVT125QPWRQ1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	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)
SN74LVT125QPWRG4Q1	TSSOP	PW	14	2000	853.0	449.0	35.0
SN74LVT125QPWRQ1	TSSOP	PW	14	2000	853.0	449.0	35.0

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040047-5/M 06/11

NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.

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



PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- 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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