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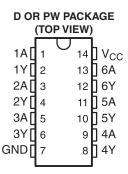
SCAS783D - OCTOBER 2004-REVISED JULY 2012

# HEX BUFFER/DRIVER WITH OPEN-DRAIN OUTPUTS

Check for Samples: SN74LVC07A-Q1

#### **FEATURES**

- Qualified for Automotive Applications
- Operates From 1.65 V to 5 V
- Inputs and Open-Drain Outputs Accept Voltages up to 5.5 V
- Latch-Up Performance Exceeds 250 mA Per JESD 17



#### **DESCRIPTION/ORDERING INFORMATION**

This hex buffer/driver is designed for 1.65-V to 5.5-V V<sub>CC</sub> operation.

The outputs of the SN74LVC07A device are open drain and can be connected to other open-drain outputs to implement active-low wired-OR or active-high wired-AND functions. The maximum sink current is 24 mA.

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

#### ORDERING INFORMATION(1)

T <sub>A</sub>	PACK	AGE <sup>(2)</sup>	ORDERABLE PART NUMBER	TOP-SIDE MARKING		
40°C +- 40°C	SOIC - D	Reel of 2500	SN74LVC07AQDRQ1	LVC07AQ		
–40°C to 125°C	TSSOP – PW	Reel of 2000	SN74LVC07AQPWRQ1	LVC07AQ		

<sup>(1)</sup> 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.

## Table 1. FUNCTION TABLE (EACH BUFFER/DRIVER)

INPUT A	OUTPUT Y
Н	Н
L	L

#### LOGIC DIAGRAM, EACH BUFFER/DRIVER (POSITIVE LOGIC)





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.

<sup>(2)</sup> Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.



### 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	
$V_{I}$	Input voltage range <sup>(2)</sup>	-0.5	6.5	V		
Vo	Output voltage range		-0.5	6.5	V	
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> < 0		-50	mA	
$I_{OK}$	Output clamp current	V <sub>O</sub> < 0		-50	mA	
Io	Continuous output current			±50	mA	
	Continuous current through V <sub>CC</sub> or GND			±100	mA	
0	Daglage thermal impedance (3)	D package		86	°C/W	
$\theta_{JA}$	Package thermal impedance (3)	PW package		113	C/VV	
T <sub>stg</sub>	Storage temperature range		-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.

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

			MIN	MAX	UNIT	
$V_{CC}$	Supply voltage		1.65	5.5	V	
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>			
$V_{IH}$	High-level input voltage	$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7		V	
		V <sub>CC</sub> = 2.7 V to 3.6 V	2			
		V <sub>CC</sub> = 1.65 V to 1.95 V		0.35 × V <sub>CC</sub>		
$V_{IL}$	Low-level input voltage	V <sub>CC</sub> = 2.3 V to 2.7 V		0.7	V	
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$		0.8		
VI	Input voltage		0	5.5	V	
Vo	Output voltage		0	5.5	V	
		V <sub>CC</sub> = 1.65 V		4		
	Low lovel output outront	V <sub>CC</sub> = 2.3 V		12	A	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 2.7 V		12	mA	
		V <sub>CC</sub> = 3 V		24		
T <sub>A</sub>	Operating free-air temperature		-40	125	°C	

<sup>(1)</sup> All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. See the TI application report, Implications of Slow or Floating CMOS Inputs, literature number SCBA004.

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

<sup>(3)</sup> The package thermal impedance is calculated in accordance with JESD 51-7.

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### **Electrical Characteristics**

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

PARAMETER	TEST CONDITIONS	V <sub>cc</sub>	MIN TYP <sup>(1)</sup> MAX	UNIT
	$I_{OL} = 100 \ \mu A$	1.65 V to 3.6 V	0.2	
$V_{OL}$	$I_{OL} = 4 \text{ mA}$	1.65 V	0.45	
	1 12 m/s	2.3 V	0.7	V
	I <sub>OL</sub> = 12 mA	2.7 V	0.4	
	$I_{OL} = 24 \text{ mA}$	3 V	0.65	
I <sub>I</sub>	$V_I = 5.5 \text{ V or GND}$	3.6 V	±5	μΑ
I <sub>CC</sub>	$V_I = V_{CC}$ or GND, $I_O = 0$	3.6 V	10	μΑ
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	μΑ
C <sub>i</sub>	$V_I = V_{CC}$ or GND	3.3 V	5	pF

<sup>(1)</sup> 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 (unless otherwise noted) (see Figure 1 through Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 1.8 V ± 0.15 V		V <sub>CC</sub> = 2 ± 0.2		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		UNIT
	(INPUT)	(OUTPUT)	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	Α	Y	1	3.5	1	2.8		3	1	2.9	ns

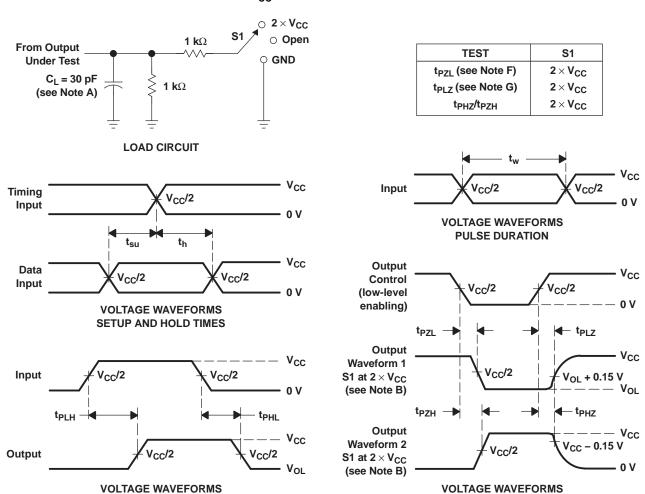
## **Operating Characteristics**

 $T_A = 25$ °C

	PARAMETER	TEST	V <sub>CC</sub> = 1.8 V	V <sub>CC</sub> = 2.5 V	V <sub>CC</sub> = 3.3 V	UNIT
	FARAWETER	CONDITIONS	TYP	TYP	TYP	ONII
$C_{pd}$	Power dissipation capacitance per buffer/driver	f = 10 MHz	1.8	2	2.5	рF



## PARAMETER MEASUREMENT INFORMATION $V_{CC} = 1.8 \text{ V} \pm 0.15 \text{ V}$



NOTES: A. C<sub>L</sub> includes probe and jig capacitance.

PROPAGATION DELAY TIMES

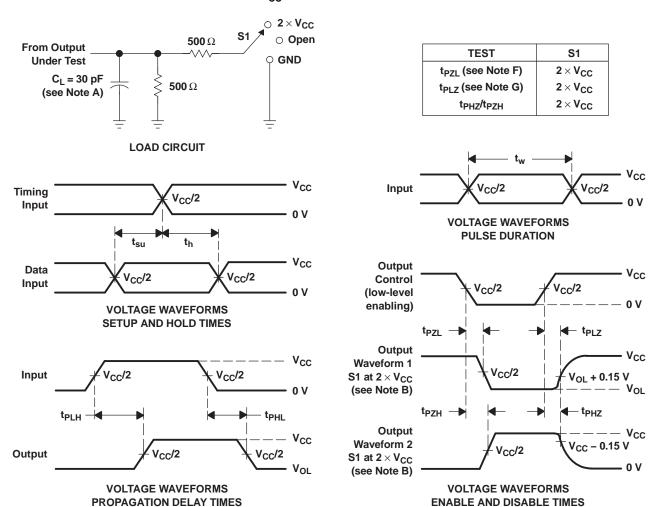
- B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
- C. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_O$  = 50  $\Omega$ ,  $t_f \leq$  2 ns.
- D. The outputs are measured one at a time, with one transition per measurement.
- E. Since this device has open-drain outputs, t<sub>PLZ</sub> and t<sub>PZL</sub> are the same as t<sub>pd</sub>.
- F. t<sub>PZI</sub> is measured at V<sub>CC</sub>/2.
- G.  $t_{PLZ}$  is measured at  $V_{OL}$  + 0.15 V.
- H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**ENABLE AND DISABLE TIMES** 



## PARAMETER MEASUREMENT INFORMATION $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$

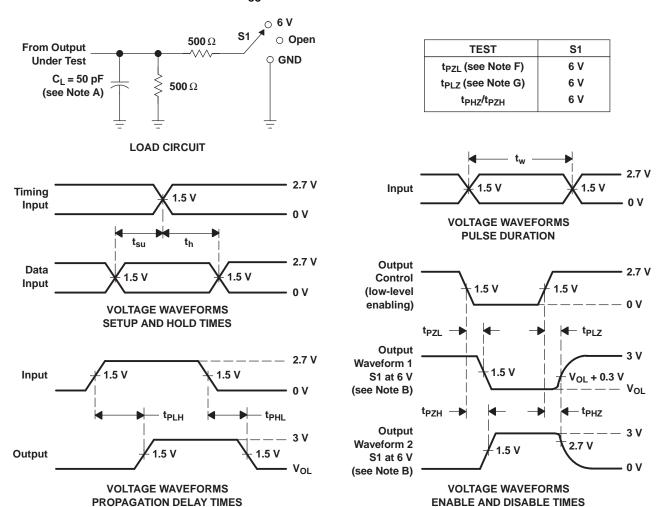


- NOTES: A. C<sub>L</sub> includes probe and jig capacitance.
  - B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
  - C. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_{O}$  = 50  $\Omega$ ,  $t_{f} \leq$  2 ns.  $t_{f} \leq$  2 ns.
  - D. The outputs are measured one at a time, with one transition per measurement.
  - E. Since this device has open-drain outputs, t<sub>PLZ</sub> and t<sub>PZL</sub> are the same as t<sub>pd</sub>.
  - F. t<sub>PZI</sub> is measured at V<sub>CC</sub>/2.
  - G.  $t_{PLZ}$  is measured at  $V_{OL}$  + 0.15 V.
  - H. All parameters and waveforms are not applicable to all devices.

Figure 2. Load Circuit and Voltage Waveforms



## PARAMETER MEASUREMENT INFORMATION $V_{CC} = 2.7$ and 3.3 V $\pm$ 0.3 V

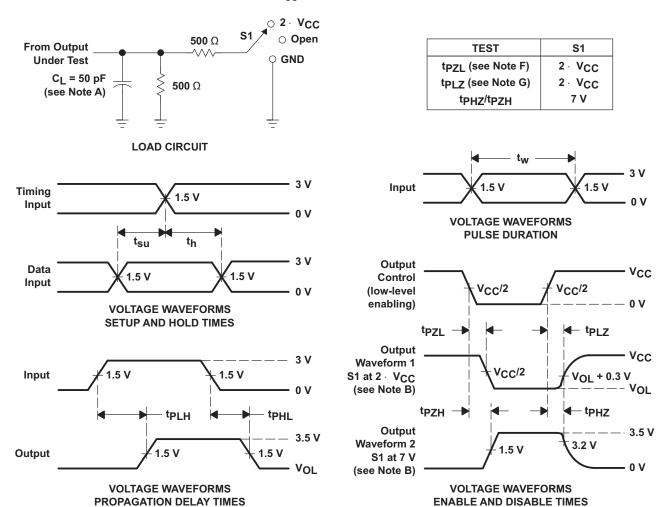


- NOTES: A.  $C_L$  includes probe and jig capacitance.
  - B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
  - C. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_0 = 50~\Omega$ ,  $t_f \leq$  2.5 ns,  $t_f \leq$  2.5 ns.
  - D. The outputs are measured one at a time, with one transition per measurement.
  - E. Since this device has open-drain outputs, t<sub>PLZ</sub> and t<sub>PZL</sub> are the same as t<sub>pd</sub>.
  - F. t<sub>PZI</sub> is measured at 1.5 V.
  - G.  $t_{PLZ}$  is measured at  $V_{OL}$  + 0.3 V.
  - H. All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuit and Voltage Waveforms



## PARAMETER MEASUREMENT INFORMATION $V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$



- 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 $\leq$  10 MHz,  $Z_O$  = 50  $\Omega$ ,  $t_f \leq$  2.5 ns,  $t_f \leq$  2.5 ns.
  - D. The outputs are measured one at a time, with one transition per measurement.
  - E. Since this device has open-drain outputs,  $t_{PLZ}$  and  $t_{PZL}$  are the same as  $t_{pd}$ .
  - F. tpzl is measured at V<sub>CC</sub>/2.
  - G.  $t_{PLZ}$  is measured at  $V_{OL}$  + 0.3 V.
  - H. All parameters and waveforms are not applicable to all devices.

Figure 4. Load Circuit and Voltage Waveforms



### **REVISION HISTORY**

Cł	hanges from Revision C (December, 2007) to Revision D	Page
•	Changed from "Operates From 1.65 V to 3.6 V" to "Operates From 1.65 V to 5 V"	1
•	Changed from "This hex buffer/driver is designed for 1.65-V to 3.6-V $V_{CC}$ operation" to "This hex buffer/driver is designed for 1.65-V to 5.5-V $V_{CC}$ operation"	1
•	Changed supply voltage max value from 3.6 to 5.5	<mark>2</mark>
•	Added 4th PMI image	<mark>7</mark>





11-Apr-2013

#### PACKAGING INFORMATION

Orderable Device	Status	Package Type	_	Pins		Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Top-Side Markings	Samples
	(1)		Drawing		Qty	(2)		(3)		(4)	
SN74LVC07AQPWRG4Q1	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC07AQ	Samples
SN74LVC07AQPWRQ1	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC07AQ	Samples

(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)

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#### OTHER QUALIFIED VERSIONS OF SN74LVC07A-Q1:

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

<sup>(4)</sup> Multiple Top-Side Markings will be inside parentheses. Only one Top-Side 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 Top-Side Marking for that device.





11-Apr-2013

• Catalog: SN74LVC07A

● Enhanced Product: SN74LVC07A-EP

NOTE: Qualified Version Definitions:

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

## PACKAGE MATERIALS INFORMATION

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### TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
	Dimension designed to accommodate the component length
	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)	W (mm)	Pin1 Quadrant
SN74LVC07AQPWRG4Q 1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LVC07AQPWRQ1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

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#### \*All dimensions are nominal

Device	Package Type	Package Drawing		SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVC07AQPWRG4Q1	TSSOP	PW	14	2000	367.0	367.0	35.0
SN74LVC07AQPWRQ1	TSSOP	PW	14	2000	367.0	367.0	35.0

PW (R-PDSO-G14)

### PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M—1994.
- B. This drawing is subject to change without notice.
  - Sody length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
- E. Falls within JEDEC MO-153



## PW (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.



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