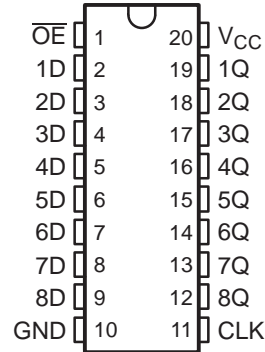


## OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH 3-STATE OUTPUTS

### 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)
- Operates From 2 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 7 ns at 3.3 V
- Typical  $V_{OLP}$  (Output Ground Bounce) < 0.8 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot) > 2 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V  $V_{CC}$ )
- $I_{off}$  Supports Partial-Power-Down Mode Operation

DW OR PW PACKAGE  
(TOP VIEW)



### DESCRIPTION/ORDERING INFORMATION

The SN74LVC574A octal edge-triggered D-type flip-flop is designed for 2.7-V to 3.6-V  $V_{CC}$  operation.

This device features 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. It is particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels at the data (D) inputs.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without interface or pullup components.

$\overline{OE}$  does not affect the internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

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.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of this device as a translator in a mixed 3.3-V/5-V system environment.



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.

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

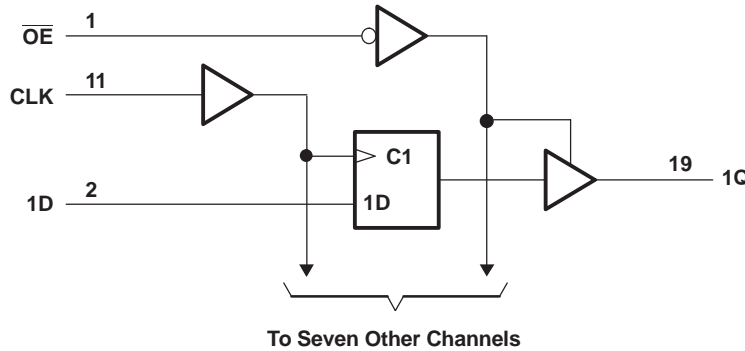
T <sub>A</sub>	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 125°C	SOIC – DW	Reel of 2000	SN74LVC574AQDWRQ1	L574AQ1
	TSSOP – PW	Reel of 2000	SN74LVC574AQPWRQ1	L574AQ1

- (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).

**FUNCTION TABLE  
(EACH FLIP-FLOP)**

INPUTS			OUTPUT Q
$\overline{OE}$	CLK	D	
L	↑	H	H
L	↑	L	L
L	L	X	Q <sub>0</sub>
H	X	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	6.5	V
V <sub>I</sub>	Input voltage range <sup>(2)</sup>	-0.5	6.5	V
V <sub>O</sub>	Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup>	-0.5	6.5	V
V <sub>O</sub>	Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>	-0.5	V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> < 0		-50 mA
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0		-50 mA
I <sub>O</sub>	Continuous output current			±50 mA
	Continuous current through V <sub>CC</sub> or GND			±100 mA
θ <sub>JA</sub>	Package thermal impedance <sup>(4)</sup>	DW package		58 °C/W
		PW package		83 °C/W
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 current ratings are observed.
- (3) The value of V<sub>CC</sub> is provided in the recommended operating conditions table.
- (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	Operating	2	3.6	V
		Data retention only	1.5		
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2.7 V to 3.6 V	2		V
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2.7 V to 3.6 V		0.8	V
V <sub>I</sub>	Input voltage		0	5.5	V
V <sub>O</sub>	Output voltage	High or low state	0	V <sub>CC</sub>	V
		3-state	0	5.5	
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 2.7 V		-12	mA
		V <sub>CC</sub> = 3 V		-24	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 2.7 V		12	mA
		V <sub>CC</sub> = 3 V		24	
Δt/Δv	Input transition rise or fall rate			6	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		V <sub>CC</sub>	MIN	TYP <sup>(1)</sup>	MAX	UNIT
V <sub>OH</sub>	I <sub>OH</sub> = -100 μA		2.7 V to 3.6 V	V <sub>CC</sub> - 0.2			V
	I <sub>OH</sub> = -12 mA		2.7 V	2.2			
			3 V	2.4			
	I <sub>OH</sub> = -24 mA		3 V	2.2			
V <sub>OL</sub>	I <sub>OL</sub> = 100 μA		2.7 V to 3.6 V			0.2	V
	I <sub>OL</sub> = 12 mA		2.7 V			0.4	
	I <sub>OL</sub> = 24 mA		3 V			0.55	
I <sub>I</sub>	V <sub>I</sub> = 0 to 5.5 V		3.6 V			±5	μA
I <sub>OZ</sub>	V <sub>O</sub> = 0 to 5.5 V		3.6 V			±15	μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND		3.6 V	I <sub>O</sub> = 0		10	μA
	3.6 V ≤ V <sub>I</sub> ≤ 5.5 V <sup>(2)</sup>					10	
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> - 0.6 V, Other inputs at V <sub>CC</sub> or GND		2.7 V to 3.6 V			500	μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND		3.3 V			4	pF
C <sub>o</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND		3.3 V			5.5	pF

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

(2) This applies in the disabled state only.

**Timing Requirements**

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 1](#))

		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		UNIT
		MIN	MAX	MIN	MAX	
f <sub>clock</sub>	Clock frequency	150		150		MHz
t <sub>w</sub>	Pulse duration, CLK high or low	3.3		3.3		ns
t <sub>su</sub>	Setup time, data before CLK↑	2		2		ns
t <sub>h</sub>	Hold time, data after CLK↑	2		2		ns

## Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 1](#))

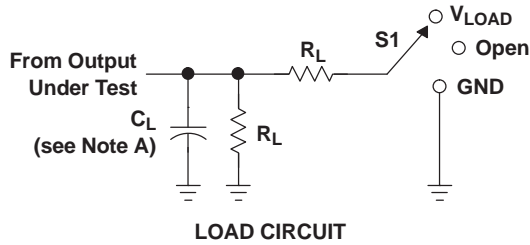
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		UNIT
			MIN	MAX	MIN	MAX	
f <sub>max</sub>			150		150		MHz
t <sub>pd</sub>	CLK	Q		8	1	7	ns
t <sub>en</sub>	$\overline{OE}$	Q		9	1	7.5	ns
t <sub>dis</sub>	$\overline{OE}$	Q		7	0.5	6.4	ns

## Operating Characteristics

T<sub>A</sub> = 25°C

PARAMETER		TEST CONDITIONS	V <sub>CC</sub> = 2.5 V	V <sub>CC</sub> = 3.3 V	UNIT
			TYP	TYP	
C <sub>pd</sub> Power dissipation capacitance per flip-flop	Outputs enabled	f = 10 MHz	60	43	pF
	Outputs disabled		9	15	

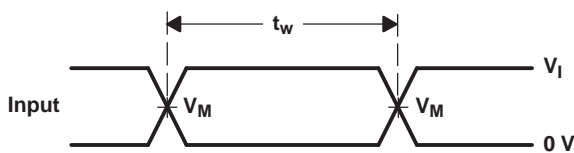
PARAMETER MEASUREMENT INFORMATION



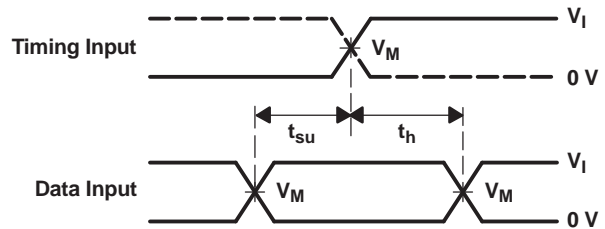
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND

LOAD CIRCUIT

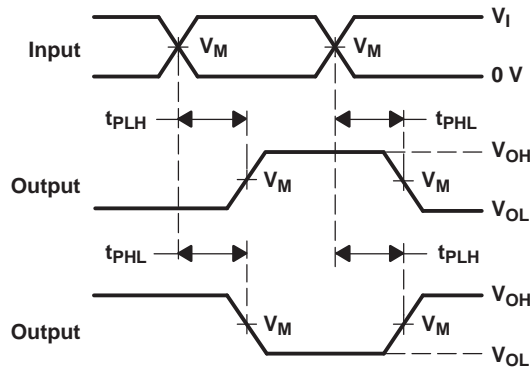
$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
	$V_I$	$t_r/t_f$					
2.7 V	2.7 V	$\leq 2.5$ ns	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V
$3.3 \text{ V} \pm 0.3 \text{ V}$	2.7 V	$\leq 2.5$ ns	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V



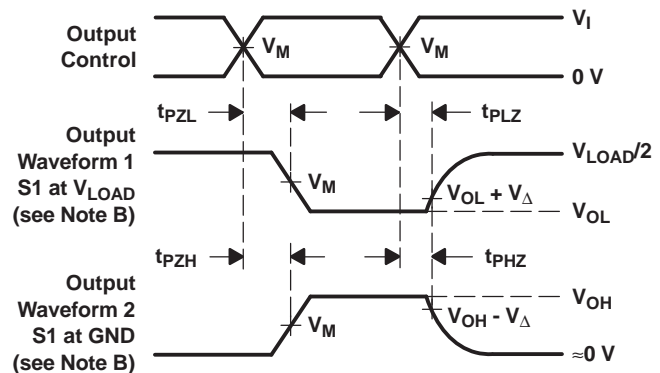
VOLTAGE WAVEFORMS PULSE DURATION



VOLTAGE WAVEFORMS SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES LOW- AND HIGH-LEVEL ENABLING

- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
  - C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ .
  - D. The outputs are measured one at a time, with one transition per measurement.
  - E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
CLVC574AQDWRG4Q1	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CLVC574AQPWRG4Q1	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LVC574AQDWRQ1	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
SN74LVC574AQPWRQ1	ACTIVE	TSSOP	PW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM

<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.

<sup>(2)</sup> 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)

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

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**OTHER QUALIFIED VERSIONS OF SN74LVC574A-Q1 :**

- Catalog: [SN74LVC574A](#)
- Enhanced Product: [SN74LVC574A-EP](#)
- Military: [SN54LVC574A](#)

NOTE: Qualified Version Definitions:

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

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AC.



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