

SN54LVC74A, SN74LVC74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SCAS287H – JANUARY 1993 – REVISED JUNE 1998

- **EPIC™ (Enhanced-Performance Implanted CMOS) Submicron Process**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)**
- **Latch-Up Performance Exceeds 250 mA Per JESD 17**
- **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, $T_A = 25^\circ\text{C}$**
- **Inputs Accept Voltages to 5.5 V**
- **Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and DIPs (J)**

description

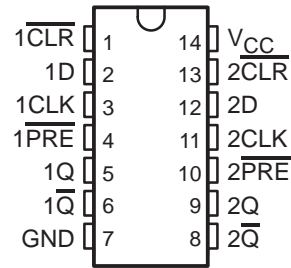
The SN54LVC74A dual positive-edge-triggered D-type flip-flop is designed for 2.7-V to 3.6-V V_{CC} operation and the SN74LVC74A dual positive-edge-triggered D-type flip-flop is designed for 1.65-V to 3.6-V V_{CC} operation.

A low level at the preset ($\overline{\text{PRE}}$) or clear ($\overline{\text{CLR}}$) inputs sets or resets the outputs, regardless of the levels of the other inputs. When $\overline{\text{PRE}}$ and $\overline{\text{CLR}}$ are inactive (high), data at the data (D) input meeting the setup time requirements is transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of the clock pulse. Following the hold-time interval, data at the D input can be changed without affecting the levels at the outputs.

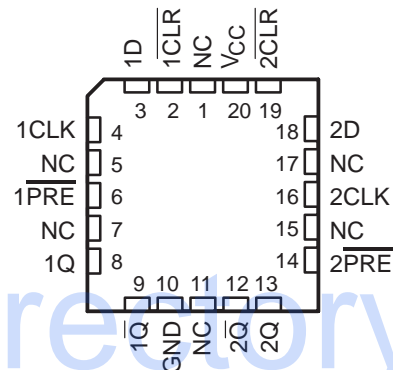
Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment.

The SN54LVC74A is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74LVC74A is characterized for operation from -40°C to 85°C .

SN54LVC74A . . . J OR W PACKAGE
SN74LVC74A . . . D, DB, OR PW PACKAGE
(TOP VIEW)



SN54LVC74A . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection



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.

EPIC is a trademark of Texas Instruments Incorporated.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1998, Texas Instruments Incorporated
On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54LVC74A, SN74LVC74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

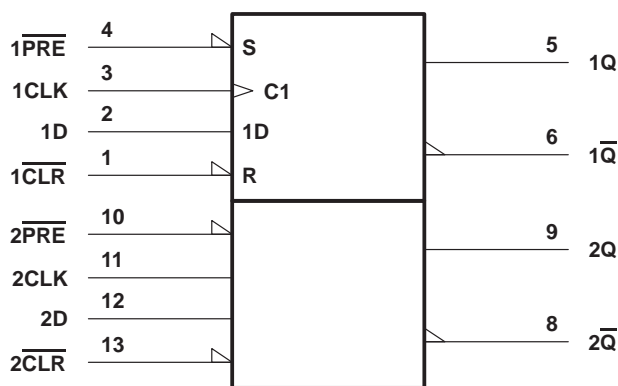
SCAS287H – JANUARY 1993 – REVISED JUNE 1998

FUNCTION TABLE

INPUTS				OUTPUTS	
$\overline{\text{PRE}}$	$\overline{\text{CLR}}$	CLK	D	Q	$\overline{\text{Q}}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H [†]	H [†]
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q ₀	$\overline{\text{Q}}_0$

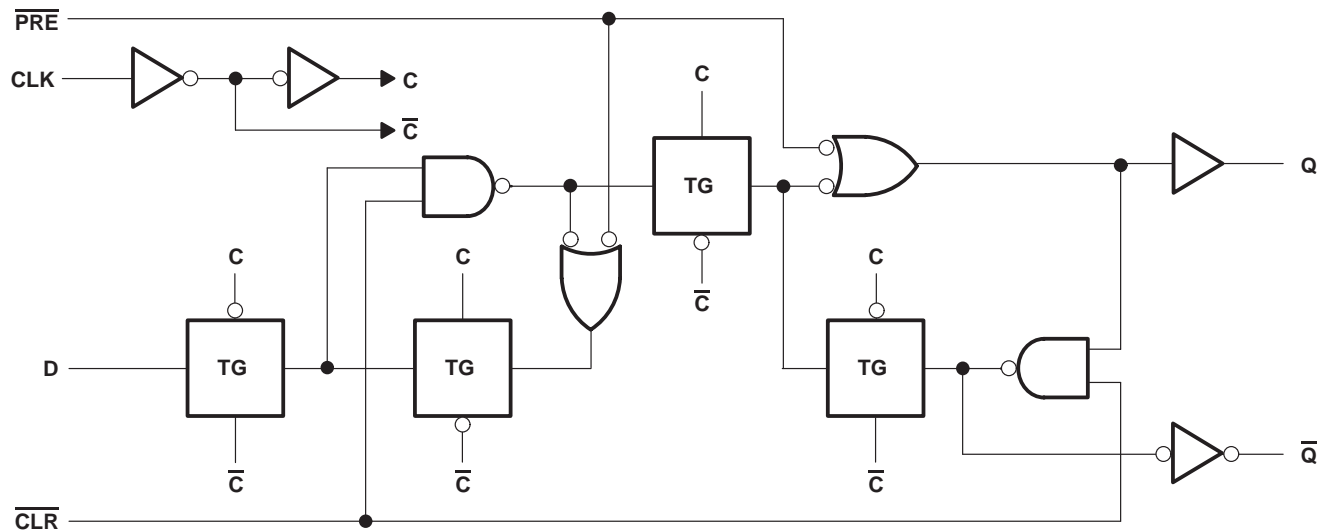
[†] This configuration is unstable; that is, it does not persist when $\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ returns to its inactive (high) level.

logic symbol[‡]



[‡] This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the D, DB, J, PW, and W packages.

logic diagram, each flip-flop (positive logic)



SN54LVC74A, SN74LVC74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SCAS287H – JANUARY 1993 – REVISED JUNE 1998

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply-voltage range, V_{CC}	–0.5 V to 6.5 V
Input-voltage range, V_I (see Note 1)	–0.5 V to 6.5 V
Output-voltage range, V_O (see Notes 1 and 2)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	–50 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Continuous output current, I_O	±50 mA
Continuous current through V_{CC} or GND	±100 mA
Package thermal impedance, θ_{JA} (see Note 3): D package	127°C/W
DB package	158°C/W
PW package	170°C/W
Storage temperature range, T_{stg}	–65°C to 150°C

† 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.

- NOTES: 1. The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
 2. The value of V_{CC} is provided in the recommended operating conditions table.
 3. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions (see Note 4)

		SN54LVC74A		SN74LVC74A		UNIT
		MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage	Operating		2	3.6	V
		Data retention only		1.5	1.5	
V_{IH}	High-level input voltage	$V_{CC} = 1.65$ V to 1.95 V		$0.65 \times V_{CC}$		V
		$V_{CC} = 2.3$ V to 2.7 V		1.7		
		$V_{CC} = 2.7$ V to 3.6 V		2	2	
V_{IL}	Low-level input voltage	$V_{CC} = 1.65$ V to 1.95 V		$0.35 \times V_{CC}$		V
		$V_{CC} = 2.3$ V to 2.7 V		0.7		
		$V_{CC} = 2.7$ V to 3.6 V		0.8	0.8	
V_I	Input voltage	0	5.5	0	5.5	V
V_O	Output voltage	0	V_{CC}	0	V_{CC}	V
I_{OH}	High-level output current	$V_{CC} = 1.65$ V		–4		mA
		$V_{CC} = 2.3$ V		–8		
		$V_{CC} = 2.7$ V		–12	–12	
		$V_{CC} = 3$ V		–24	–24	
I_{OL}	Low-level output current	$V_{CC} = 1.65$ V		4		mA
		$V_{CC} = 2.3$ V		8		
		$V_{CC} = 2.7$ V		12	12	
		$V_{CC} = 3$ V		24	24	
$\Delta t/\Delta v$	Input transition rise or fall rate	0	10	0	10	ns/V
T_A	Operating free-air temperature	–55	125	–40	85	°C

NOTE 4: 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.



SN54LVC74A, SN74LVC74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SCAS287H – JANUARY 1993 – REVISED JUNE 1998

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

PARAMETER	TEST CONDITIONS	V _{CC}	SN54LVC74A			SN74LVC74A			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
V _{OH}	I _{OH} = -100 μA	1.65 V to 3.6 V				V _{CC} -0.2			V
		2.7 V to 3.6 V	V _{CC} -0.2						
	I _{OH} = -4 mA	1.65 V			1.2				
	I _{OH} = -8 mA	2.3 V			1.7				
	I _{OH} = -12 mA	2.7 V	2.2		2.2				
		3 V	2.4		2.4				
I _{OH} = -24 mA	3 V	2.2		2.2					
V _{OL}	I _{OL} = 100 μA	1.65 V to 3.6 V				0.2			V
		2.7 V to 3.6 V			0.2				
	I _{OL} = 4 mA	1.65 V				0.45			
	I _{OL} = 8 mA	2.3 V				0.7			
	I _{OL} = 12 mA	2.7 V			0.4		0.4		
3 V				0.55		0.55			
I _I	V _I = 5.5 V or GND	3.6 V			±5			±5	μA
I _{CC}	V _I = V _{CC} or GND, I _O = 0	3.6 V			10			10	μA
ΔI _{CC}	One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND	2.7 V to 3.6 V			500			500	μA
C _i	V _I = V _{CC} or GND	3.3 V			5			5	pF

† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

		SN54LVC74A				UNIT
		V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V		
		MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency		83		100	MHz
t _w	Pulse duration	PRE or CLR low		3.3	3.3	ns
		CLK high or low		3.3	3.3	
t _{su}	Setup time before CLK↑	Data		3.4	3	ns
		PRE or CLR inactive		2.2	2	
t _h	Hold time, data after CLK↑		1		1	ns



SN54LVC74A, SN74LVC74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SCAS287H – JANUARY 1993 – REVISED JUNE 1998

timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figures 1 through 3)

			SN74LVC74A								UNIT
			V _{CC} = 1.8 V ± 0.15 V		V _{CC} = 2.5 V ± 0.2 V		V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency		†		†		83		100		MHz
t _w	Pulse duration	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ low	†		†		3.3		3.3		ns
		CLK high or low	†		†		3.3		3.3		
t _{su}	Setup time before CLK↑	Data	†		†		3.4		3		ns
		$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ inactive	†		†		2.2		2		
t _h	Hold time, data after CLK↑		†		†		1		0		ns

† This information was not available at the time of publication.

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVC74A				UNIT
			V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	
f _{max}			83		100		MHz
t _{pd}	CLK	Q or $\overline{\text{Q}}$	6		1	5.2	ns
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$		6.4		1	5.4	

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figures 1 through 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74LVC74A								UNIT
			V _{CC} = 1.8 V ± 0.15 V		V _{CC} = 2.5 V ± 0.2 V		V _{CC} = 2.7 V		V _{CC} = 3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f _{max}			†		†		83		100		MHz
t _{pd}	CLK	Q or $\overline{\text{Q}}$	†		†		6		1	5.2	ns
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$		†		†		6.4		1	5.4	
t _{sk(o)} †									1	ns	

† This information was not available at the time of publication.

‡ Skew between any two outputs of the same package switching in the same direction

operating characteristics, T_A = 25°C

PARAMETER	TEST CONDITIONS	V _{CC} = 1.8 V ± 0.15 V	V _{CC} = 2.5 V ± 0.2 V	V _{CC} = 3.3 V ± 0.3 V	UNIT	
		TYP	TYP	TYP		
C _{pd}	Power dissipation capacitance per flip-flop	f = 10 MHz	†	†	27	pF

† This information was not available at the time of publication.

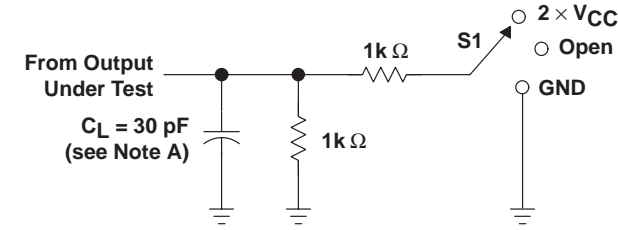


SN54LVC74A, SN74LVC74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SCAS287H – JANUARY 1993 – REVISED JUNE 1998

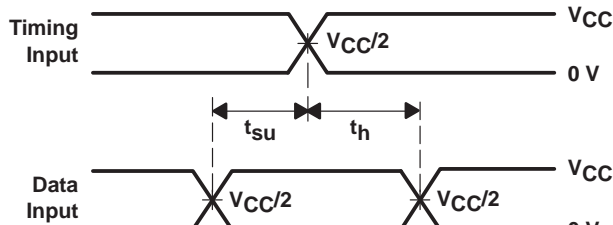
PARAMETER MEASUREMENT INFORMATION

$$V_{CC} = 1.8 \text{ V} \pm 0.15 \text{ V}$$

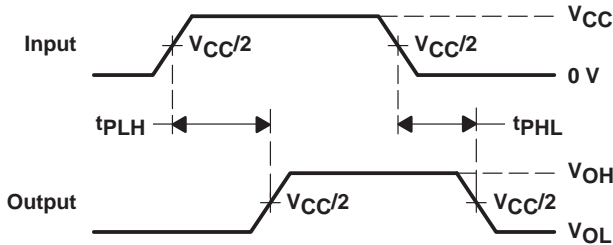


LOAD CIRCUIT

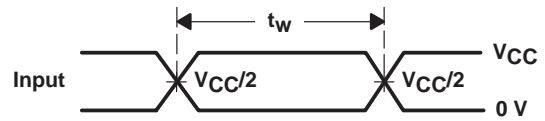
TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	2 \times V_{CC}
t_{PHZ}/t_{PZH}	Open



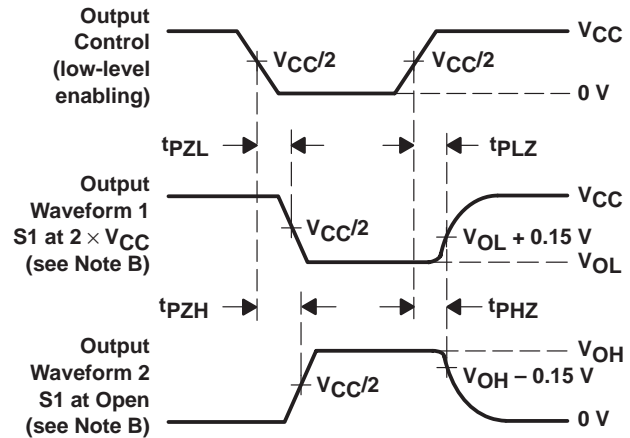
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

- NOTES:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2 \text{ ns}$, $t_f \leq 2 \text{ ns}$.
 - The outputs are measured one at a time with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .

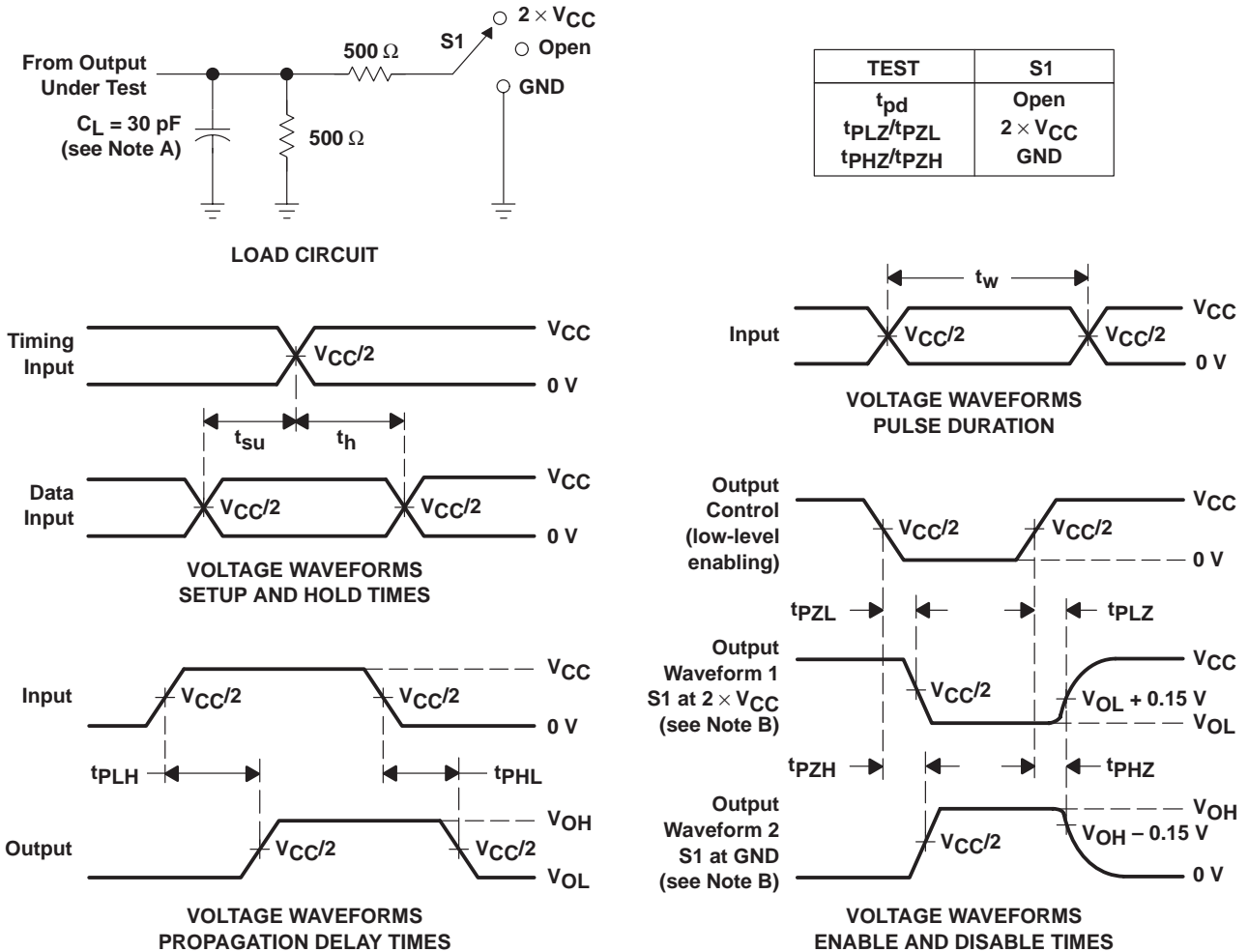
Figure 1. Load Circuit and Voltage Waveforms

SN54LVC74A, SN74LVC74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SCAS287H – JANUARY 1993 – REVISED JUNE 1998

PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$



- 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, $Z_O = 50\ \Omega$, $t_r \leq 2\text{ ns}$, $t_f \leq 2\text{ ns}$.
 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} .

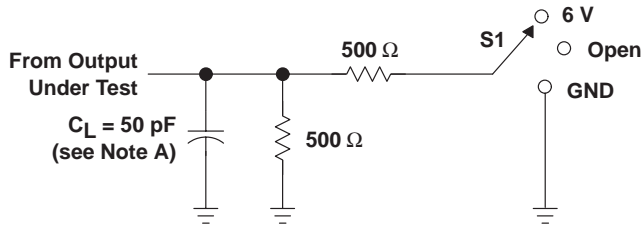
Figure 2. Load Circuit and Voltage Waveforms

SN54LVC74A, SN74LVC74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SCAS287H – JANUARY 1993 – REVISED JUNE 1998

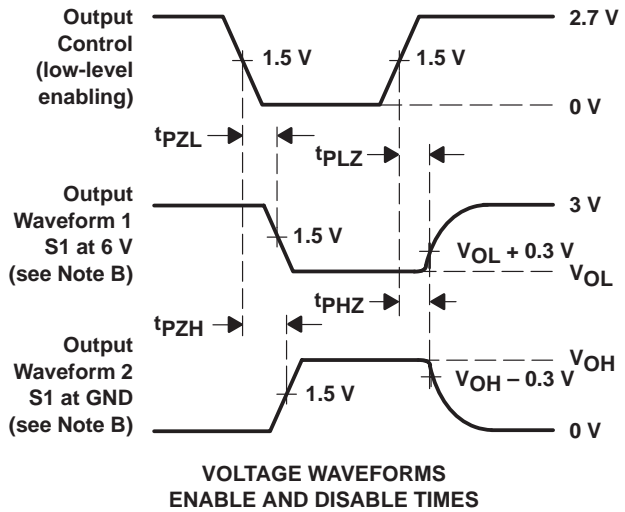
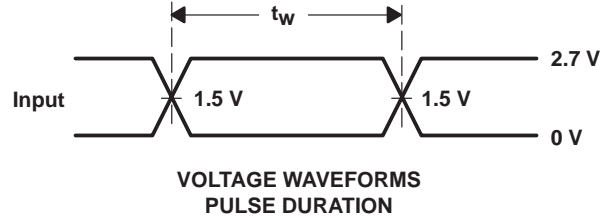
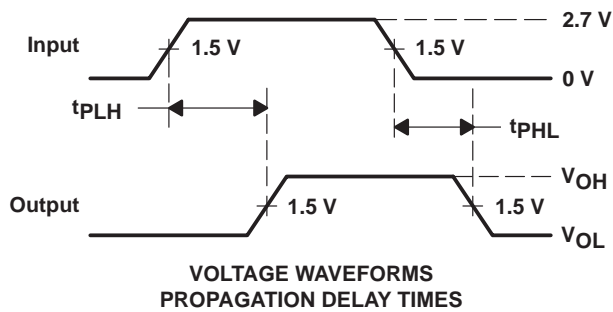
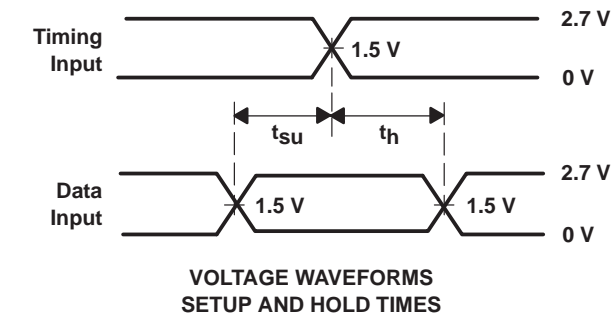
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.7\text{ V AND } 3.3\text{ V} \pm 0.3\text{ V}$



LOAD CIRCUIT

TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND



- NOTES:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 2.5\text{ ns}$, $t_f \leq 2.5\text{ ns}$.
 - The outputs are measured one at a time with one transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 3. Load Circuit and Voltage Waveforms

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

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

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.