

# SN54ALS174, SN54ALS175, SN54AS174, SN54AS175A SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

SDAS207C – APRIL 1982 – REVISED OCTOBER 1995

- 'ALS174 and 'AS174 Contain Six Flip-Flops With Single-Rail Outputs
- 'ALS175, SN54AS175A, and SN74AS175B Contain Four Flip-Flops With Double-Rail Outputs
- Buffered Clock and Direct-Clear Inputs
- Applications Include:
  - Buffer/Storage Registers
  - Shift Registers
  - Pattern Generators
- Fully Buffered Outputs for Maximum Isolation From External Disturbances ('AS Only)
- Package Options Include Plastic Small-Outline (D) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

## description

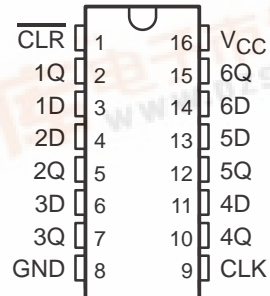
These positive-edge-triggered flip-flops utilize TTL circuitry to implement D-type flip-flop logic. All have a direct-clear (CLR) input, and the 'ALS175, SN54AS175A, and SN74AS175B feature complementary outputs from each flip-flop.

Information at the data (D) inputs meeting the setup-time requirements is transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse. When the clock (CLK) input is at either the high or low level, the D-input signal has no effect at the output.

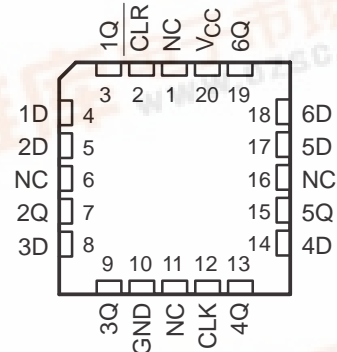
These circuits are fully compatible for use with most TTL circuits.

The SN54ALS174, SN54ALS175, SN54AS174, and SN54AS175A are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS174, SN74ALS175, SN74AS174, and SN74AS175B are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

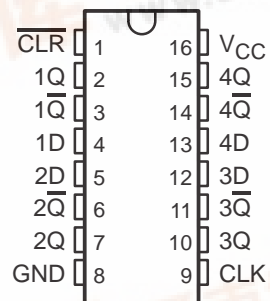
SN54ALS174, SN54AS174 ... J PACKAGE  
SN74ALS174, SN74AS174 ... D OR N PACKAGE  
(TOP VIEW)



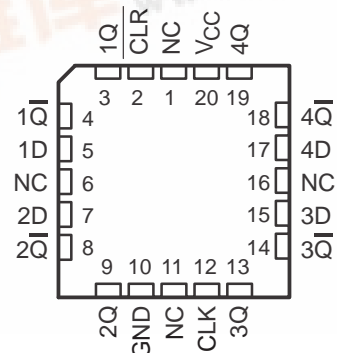
SN54ALS174, SN54AS174 ... FK PACKAGE  
(TOP VIEW)



SN54ALS175, SN54AS175A ... J PACKAGE  
SN74ALS175, SN74AS175B ... D OR N PACKAGE  
(TOP VIEW)



SN54ALS175A, SN54AS175A ... FK PACKAGE  
(TOP VIEW)



NC – No internal connection



# SN54ALS174, SN54ALS175, SN54AS174, SN54AS175A SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

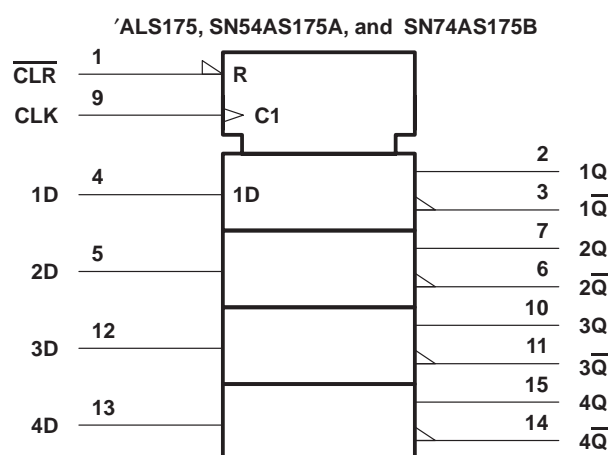
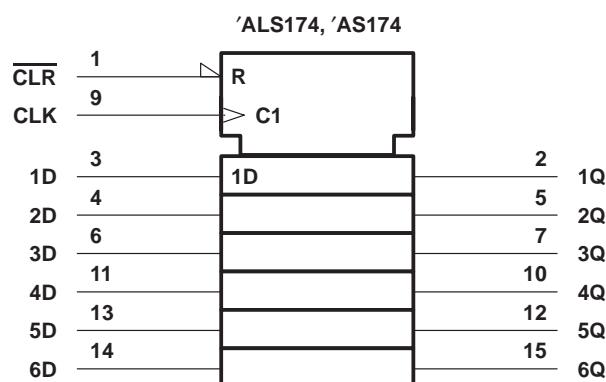
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FUNCTION TABLE  
 (each flip-flop)

INPUTS			OUTPUTS	
$\overline{\text{CLR}}$	CLK	D	Q	$\overline{\text{Q}}^\dagger$
L	X	X	L	H
H	$\uparrow$	H	H	L
H	$\uparrow$	L	L	H
H	L	X	$\text{Q}_0$	$\overline{\text{Q}}_0$

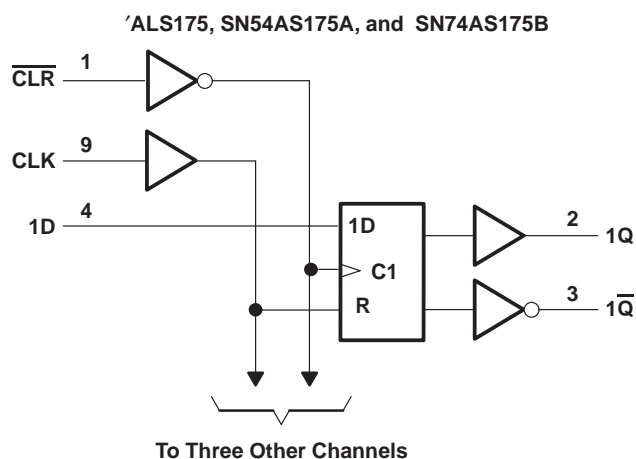
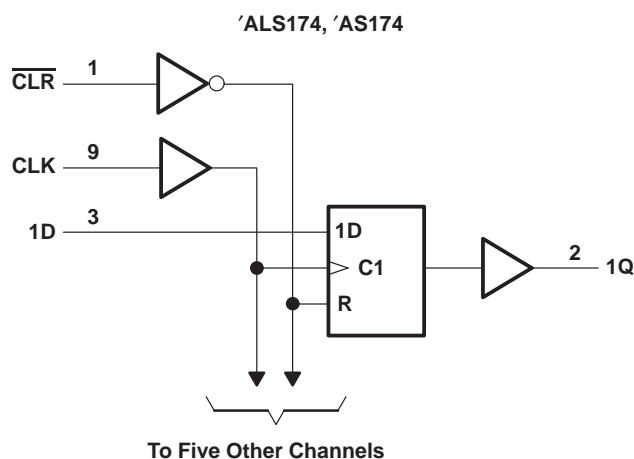
$^\dagger$  'ALS175, SN54AS175A, and SN74AS175B only

## logic symbols $^\ddagger$



$^\ddagger$  These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
 Pin numbers shown are for the D, J, and N packages.

## logic diagrams (positive logic)



Pin numbers shown are for the D, J, and N packages.

**SN54ALS174, SN54ALS175, SN54AS174, SN54AS175A  
SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B  
HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR**

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**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>**

Supply voltage, $V_{CC}$	7 V
Input voltage, $V_I$	7 V
Operating free-air temperature range, $T_A$ : SN54ALS174, SN54ALS175	–55°C to 125°C
SN74ALS174, SN74ALS175	0°C to 70°C
Storage temperature range	–65°C to 150°C

<sup>†</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**

			SN54ALS174 SN54ALS175			SN74ALS174 SN74ALS175			UNIT	
			MIN	NOM	MAX	MIN	NOM	MAX		
V <sub>CC</sub>	Supply voltage		4.5	5	5.5	4.5	5	5.5	V	
V <sub>IH</sub>	High-level input voltage		2			2			V	
V <sub>IL</sub>	Low-level input voltage		0.8			0.8			V	
I <sub>OH</sub>	High-level output current		−0.4			−0.4			mA	
I <sub>OL</sub>	Low-level output current		4			8			mA	
f <sub>clock</sub>	Clock frequency		0	40		0	50		MHz	
t <sub>w</sub>	Pulse duration	$\overline{\text{CLR}}$ low	15			10			ns	
		CLK high	12.5			10				
		CLK low	12.5			10				
t <sub>su</sub>	Setup time before CLK↑	Data	15			10			ns	
		$\overline{\text{CLR}}$ inactive	8			6				
t <sub>h</sub>	Hold time, data after CLK↑		0			0			ns	
T <sub>A</sub>	Operating free-air temperature		−55			125		0	70	°C

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

PARAMETER		TEST CONDITIONS		SN54ALS174 SN54ALS175			SN74ALS174 SN74ALS175			UNIT
				MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	
$V_{IK}$		$V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$				–1.5			–1.5	V
$V_{OH}$		$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ , $I_{OH} = -0.4\text{ mA}$		$V_{CC} - 2$			$V_{CC} - 2$			V
$V_{OL}$		$V_{CC} = 4.5\text{ V}$ , $I_{OL} = 4\text{ mA}$			0.25	0.4		0.25	0.4	V
		$I_{OL} = 8\text{ mA}$						0.35	0.5	
$I_I$		$V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$				0.1			0.1	mA
$I_{IH}$		$V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$				20			20	μA
$I_{IL}$	All others	$V_{CC} = 5.5\text{ V}$ , $V_I = 0.4\text{ V}$				–0.1			–0.1	mA
	CLK					–0.15				
$I_{O}^{\S}$		$V_{CC} = 5.5\text{ V}$ , $V_O = 2.25\text{ V}$		–20		–112	–30		–112	mA
$I_{CC}$	'ALS174	$V_{CC} = 5.5\text{ V}$ , See Note 1			11	19		11	19	mA
	'ALS175				8	14		9	14	

<sup>‡</sup> All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

<sup>\S</sup> The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

NOTE 1:  $I_{CC}$  is measured with D inputs and CLR grounded, and CLK at 4.5 V.

# SN54ALS174, SN54ALS175, SN54AS174, SN54AS175A SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

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## switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX†				UNIT
			SN54ALS174 SN54ALS175		SN74ALS174 SN74ALS175		
			MIN	MAX	MIN	MAX	
f <sub>max</sub>			40		50		MHz
t <sub>PLH</sub>	$\overline{\text{CLR}}$	Any $\overline{\text{Q}}$ ('ALS175) Any Q	3	20	5	18	ns
t <sub>PHL</sub>			5	30	8	23	
t <sub>PLH</sub>	CLK	Any Q (or Q, 'ALS175)	3	20	3	15	ns
t <sub>PHL</sub>			5	24	5	17	

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

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

Supply voltage, V <sub>CC</sub>	7 V
Input voltage, V <sub>I</sub>	7 V
Operating free-air temperature range, T <sub>A</sub> : SN54AS174, SN54AS175A	–55°C to 125°C
SN74AS174, SN74AS175B	0°C to 70°C
Storage temperature range	–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.

## recommended operating conditions

			SN54AS174 SN54AS175A			SN74AS174 SN74AS175B			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage		4.5	5	5.5	4.5	5	5.5	V
V <sub>IH</sub>	High-level input voltage		2			2			V
V <sub>IL</sub>	Low-level input voltage				0.8			0.8	V
I <sub>OH</sub>	High-level output current				–2			–2	mA
I <sub>OL</sub>	Low-level output current				20			20	mA
f <sub>clock</sub> *	Clock frequency		0		100	0		100	MHz
t <sub>w</sub> *	Pulse duration	CLR low	5.5			5			ns
		CLK high	4			4			
		CLK low	'AS174		6	6			
			SN54AS175A, SN74AS175B		5	5			
t <sub>su</sub> *	Setup time before CLK↑	Data	'AS174		4	4			ns
			SN54AS175A, SN74AS175B		3	3			
		CLR inactive			6	6			
t <sub>h</sub> *	Hold time, data after CLK↑		1			1			ns
T <sub>A</sub>	Operating free-air temperature		–55		125	0		70	°C

\* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.

**SN54ALS174, SN54ALS175, SN54AS174, SN54AS175A  
SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B  
HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR**

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

PARAMETER		TEST CONDITIONS	SN54AS174 SN54AS175A			SN74AS174 SN74AS175B			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
$V_{IK}$		$V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$			-1.2			-1.2	V
$V_{OH}$		$V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$ , $I_{OH} = -2\text{ mA}$	$V_{CC} - 2$			$V_{CC} - 2$			V
$V_{OL}$		$V_{CC} = 4.5\text{ V}$ , $I_{OL} = 20\text{ mA}$		0.35	0.5		0.35	0.5	V
$I_I$		$V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$			0.1			0.1	mA
$I_{IH}$		$V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$			20			20	$\mu\text{A}$
$I_{IL}$		$V_{CC} = 5.5\text{ V}$ , $V_I = 0.4\text{ V}$			-0.5			-0.5	mA
$I_{O\ddagger}$		$V_{CC} = 5.5\text{ V}$ , $V_O = 2.25\text{ V}$	-30		-112	-30		-112	mA
$I_{CC}$	'AS174	$V_{CC} = 5.5\text{ V}$ , See Note 2		30	45		30	45	mA
	SN54AS175A, SN74AS175B			22.5	34		22.5	34	

† All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

NOTE 2:  $I_{CC}$  is measured with D inputs, CLR, and CLK grounded.

**switching characteristics (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX§				UNIT
			SN54AS174		SN74AS174		
			MIN	MAX	MIN	MAX	
f <sub>max</sub> *			100		100		MHz
t <sub>PHL</sub>	$\overline{\text{CLR}}$	Any Q	5	15	5	14	ns
t <sub>PLH</sub>	CLK	Any Q	3.5	9.5	3.5	8	ns
t <sub>PHL</sub>			4.5	11.5	4.5	10	

\* On products compliant to MIL-STD-883, Class B, these parameters are based on characterization data but are not production tested.

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

**switching characteristics (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX§				UNIT
			SN54AS175A		SN74AS175B		
			MIN	MAX	MIN	MAX	
f <sub>max</sub> *			100		100		MHz
t <sub>PLH</sub>	CLR	Any Q or Q̄	4	10	4	9	ns
t <sub>PHL</sub>			4.5	15	4.5	13	
t <sub>PLH</sub>	CLK	Any Q or Q̄	4	8.5	3	7.5	ns
t <sub>PHL</sub>			4	11	3	10	

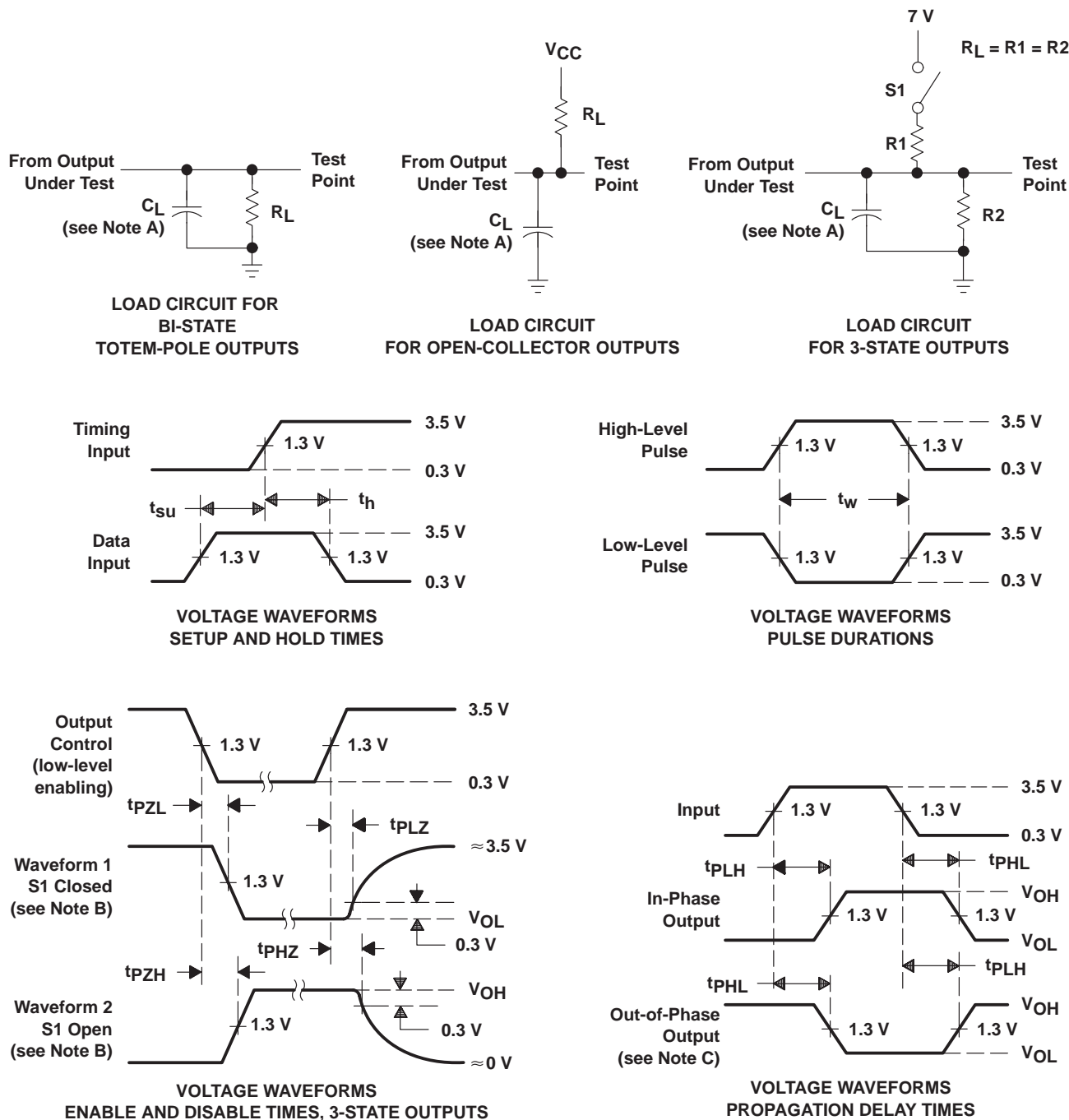
\* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.

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

SN54ALS174, SN54ALS175, SN54AS174, SN54AS175A  
 SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B  
 HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

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PARAMETER MEASUREMENT INFORMATION  
 SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- 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. When measuring propagation delay items of 3-state outputs, switch S1 is open.  
 D. All input pulses have the following characteristics:  $PRR \leq 1$  MHz,  $t_r = t_f = 2$  ns, duty cycle = 50%.  
 E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

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