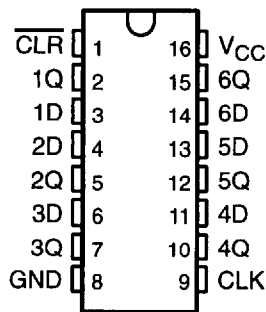


# SN54ALS174, SN54ALS175, SN54AS174, SN54AS175B SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

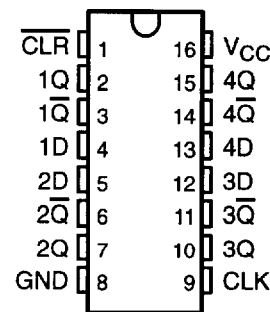
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- 'ALS174 and 'AS174 Contain Six Flip-Flops With Single-Rail Outputs
- 'ALS175 and 'AS175B Contain Four Flip-Flops With Double-Rail Outputs
- Buffered Clock and Direct-Clear Inputs
- Applications Include:
  - Buffer/Storage Registers
  - Shift Registers
  - 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

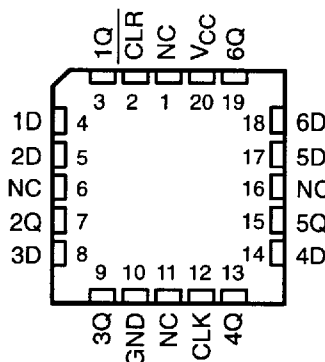
SN54ALS174, SN54AS174 . . . J PACKAGE  
SN74ALS174, SN74AS174 . . . D OR N PACKAGE  
(TOP VIEW)



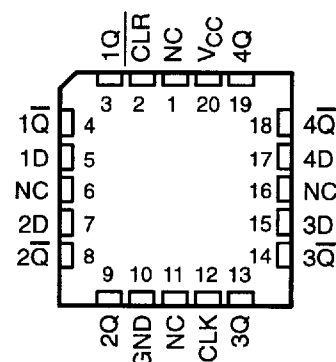
SN54ALS175, SN54AS175B . . . J PACKAGE  
SN74ALS175, SN74AS175B . . . D OR N PACKAGE  
(TOP VIEW)



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



SN54ALS175A, SN54AS175B . . . FK PACKAGE  
(TOP VIEW)



NC - No internal connection

## description

These positive-edge-triggered flip-flops utilize TTL circuitry to implement D-type flip-flop logic. All have a direct-clear ( $\overline{\text{CLR}}$ ) input. The 'ALS175 and 'AS175B 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.



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.

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.

 **TEXAS  
INSTRUMENTS**

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**SN54ALS174, SN54ALS175, SN54AS174, SN54AS175B  
SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B  
HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR**

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**description (continued)**

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

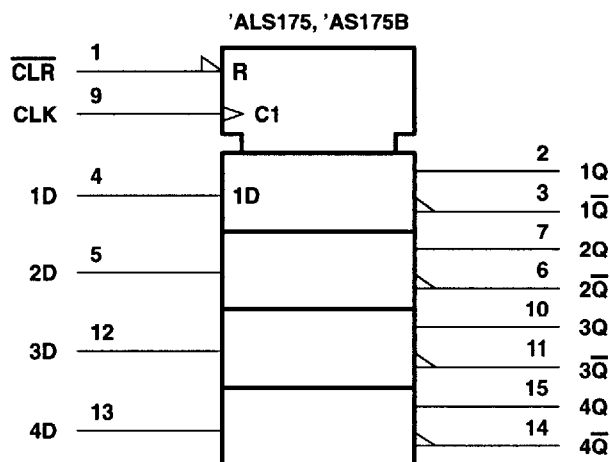
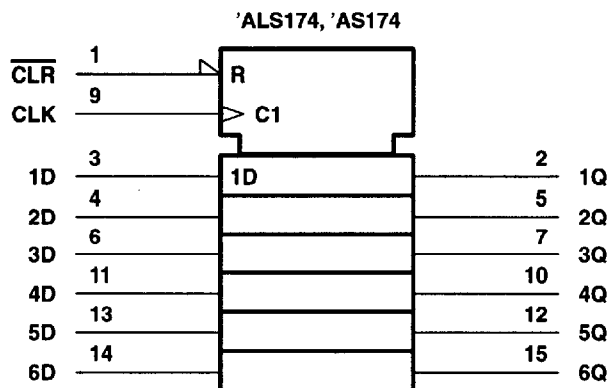
The SN54ALS174, SN54ALS175, SN54AS174, and SN54AS175B are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS174, SN74ALS175, SN74AS174, and SN74AS175B are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**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 and 'AS175B only

**logic symbols $\ddagger$**

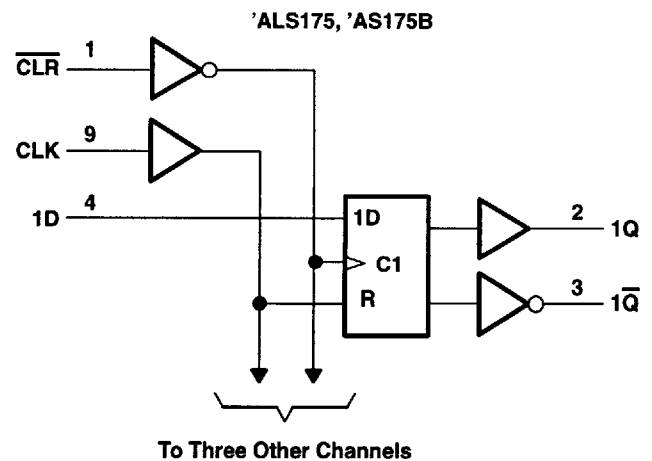
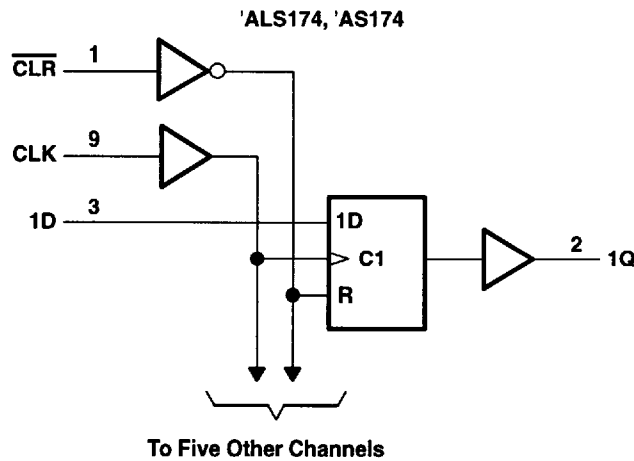


$\ddagger$  These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
 $\supset$  Pin numbers shown are for the D, J, and N packages.

# SN54ALS174, SN54ALS175, SN54AS174, SN54AS175B SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

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## logic diagrams (positive logic)



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

## 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, $T_{stg}$	-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	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.8			0.8	V
$I_{OH}$	High-level output current			-0.4			-0.4	mA
$I_{OL}$	Low-level output current			4			8	mA
$f_{clock}$	Clock frequency	0		40	0		50	MHz
$t_w$	Pulse duration	CLR low	15		10			ns
		CLK high	12.5		10			
		CLK low	12.5		10			
$t_{su}$	Setup time before CLK $\uparrow$	Data	15		10		ns	
		CLR inactive	8		6			
$t_h$	Hold time, data after CLK $\uparrow$	0			0			ns
$T_A$	Operating free-air temperature	-55		125	0		70	°C



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**SN54ALS174, SN54ALS175, SN54AS174, SN54AS175B  
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		SN54ALS174 SN54ALS175			SN74ALS174 SN74ALS175			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = -18 mA		-1.5			-1.5			V
V <sub>OH</sub>	V <sub>CC</sub> = 4.5 V to 5.5 V, I <sub>OH</sub> = -0.4 mA		V <sub>CC</sub> -2			V <sub>CC</sub> -2			V
V <sub>OL</sub>	V <sub>CC</sub> = 4.5 V	I <sub>OL</sub> = 4 mA	0.25 0.4		0.25 0.4				V
		I <sub>OL</sub> = 8 mA			0.35 0.5				
I <sub>I</sub>	V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 7 V		0.1			0.1			mA
I <sub>IH</sub>	V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 2.7 V		20			20			μA
I <sub>IL</sub>	All others	V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0.4 V	-0.1			-0.1			mA
	CLK		-0.15						
I <sub>O</sub> ‡	V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.25 V		-20	-112		-30	-112		mA
I <sub>CC</sub>	'ALS174	V <sub>CC</sub> = 5.5 V, See Note 1	11 19		11 19				mA
	'ALS175		8 14		9 14				

† All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I<sub>OS</sub>.

NOTE 1: I<sub>CC</sub> is measured with D inputs and CLR grounded, and CLK at 4.5 V.

**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>	CLR	Any Q̄ ('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.



**SN54ALS174, SN54ALS175, SN54AS174, SN54AS175B  
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)†**

Supply voltage, $V_{CC}$ .....	7 V
Input voltage, $V_I$ .....	7 V
Operating free-air temperature range, $T_A$ : SN54AS174, SN54AS175B .....	-55°C to 125°C
SN74AS174, SN74AS175B .....	0°C to 70°C
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.

**recommended operating conditions**

		SN54AS174 SN54AS175B			SN74AS174 SN74AS175B			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.8			0.8	V
$I_{OH}$	High-level output current			-2			-2	mA
$I_{OL}$	Low-level output current			20			20	mA
$f_{clock}^*$	Clock frequency	0		100	0		100	MHz
$t_w^*$	Pulse duration	CLR low		5.5		5		ns
		CLK high		4		4		
		CLK low	'AS174	6		6		
'AS175B	5			5				
$t_{su}^*$	Setup time before CLK↑	Data	'AS174	4		4		ns
			'AS175B	3		3		
		CLR inactive		6		6		
$t_h^*$	Hold time, data after CLK↑	1			1			ns
$T_A$	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, SN54AS175B  
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 SN54AS175B		SN74AS174 SN74AS175B		UNIT	
		MIN	TYP†	MAX	MIN		TYP†
V <sub>IK</sub>	V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = -18 mA			-1.2		-1.2	V
V <sub>OH</sub>	V <sub>CC</sub> = 4.5 V to 5.5 V, I <sub>OH</sub> = -2 mA	V <sub>CC</sub> -2		V <sub>CC</sub> -2		V	
V <sub>OL</sub>	V <sub>CC</sub> = 4.5 V, I <sub>OL</sub> = 20 mA	0.35	0.5	0.35	0.5	V	
I <sub>I</sub>	V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 7 V		0.1		0.1	mA	
I <sub>IH</sub>	V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 2.7 V		20		20	μA	
I <sub>IL</sub>	V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0.4 V		-0.5		-0.5	mA	
I <sub>O</sub> ‡	V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.25 V	-30	-112	-30	-112	mA	
I <sub>CC</sub>	V <sub>CC</sub> = 5.5 V, See Note 2	'AS174		'AS174		mA	
		'AS175B		'AS175B			
		30	45	30	45		
		22.5	34	22.5	34		

† All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I<sub>OS</sub>.

NOTE 2: I<sub>CC</sub> is measured with D inputs,  $\overline{\text{CLR}}$ , 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
			SN54AS175B		SN74AS175B		
			MIN	MAX	MIN	MAX	
f <sub>max</sub> *			100		100	MHz	
t <sub>PLH</sub>	$\overline{\text{CLR}}$	Any Q or $\overline{\text{Q}}$	4	10	4	9	ns
t <sub>PHL</sub>			4.5	15	4.5	13	
t <sub>PLH</sub>	CLK	Any Q or $\overline{\text{Q}}$	3	8.5	3	7.5	ns
t <sub>PHL</sub>			3	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.

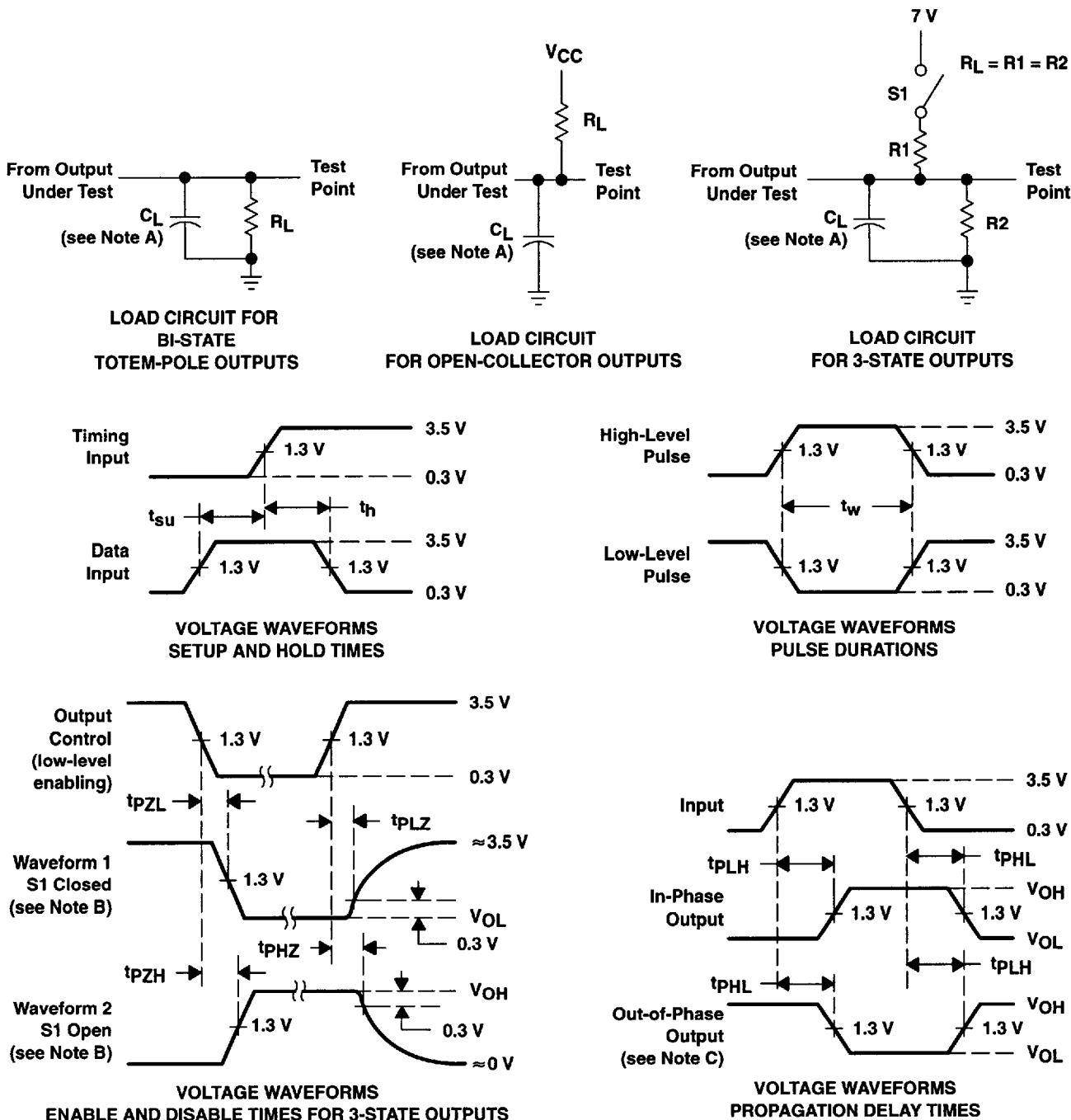


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SN54ALS174, SN54ALS175, SN54AS174, SN54AS175B  
 SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B  
 HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

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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