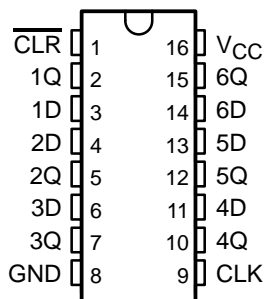


# SN54ALS174, SN54ALS175, SN54AS174, SN54AS175B SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

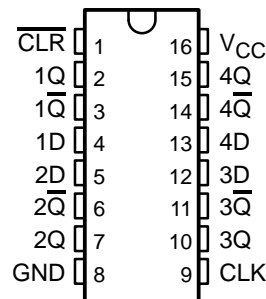
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- 'ALS174 and 'AS174 Contain Six Flip-Flops With Single-Rail Outputs
- 'ALS175 and 'AS175B Contain Four Flip-Flops With Double-Rail Outputs
- Buffered Clock and Direct-Clear Inputs
- Applications Include:
  - Buffer/Storage Registers
  - Shift Registers
  - Pattern Generators
- Fully Buffered Outputs for Maximum Isolation From External Disturbances ('AS Only)

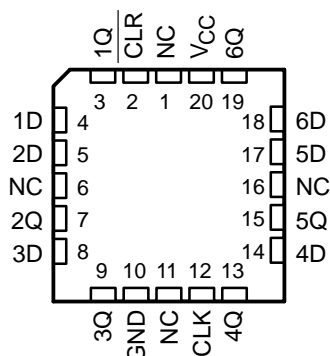
SN54ALS174 . . . J OR W PACKAGE  
SN54AS174 . . . J PACKAGE  
SN74ALS174, SN74AS174 . . . D, N, OR NS PACKAGE  
(TOP VIEW)



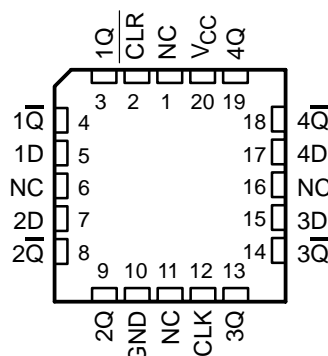
SN54ALS175 . . . J OR W PACKAGE  
SN54AS175B . . . J PACKAGE  
SN74ALS175, SN74AS175B . . . D, N, OR NS PACKAGE  
(TOP VIEW)



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



SN54ALS175 . . . 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.

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



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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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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.

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

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**ORDERING INFORMATION**

T <sub>A</sub>	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP – N	Tube	SN74ALS174N	SN74ALS174N
			SN74AS174N	SN74AS174N
			SN74ALS175N	SN74ALS175N
			SN74AS175BN	SN74AS175BN
	SOIC – D	Tube	SN74ALS174D	ALS174
		Tape and reel	SN74ALS174DR	
		Tube	SN74AS174D	AS174
		Tape and reel	SN74AS174DR	
		Tube	SN74ALS175D	ALS175
		Tape and reel	SN74ALS175DR	
		Tube	SN74AS175BD	AS175B
		Tape and reel	SN74AS175BDR	
	SOP – NS	Tape and reel	SN74ALS174NSR	ALS174
			SN74AS174NSR	74AS174
			SN74ALS175NSR	ALS175
			SN74AS175BNSR	74AS175B
–55°C to 125°C	CDIP – J	Tube	SNJ54ALS174J	SNJ54ALS174J
			SNJ54AS174J	SNJ54AS174J
			SNJ54ALS175J	SNJ54ALS175J
			SNJ54AS175BJ	SNJ54AS175BJ
	CFP – W	Tube	SNJ54ALS174W	SNJ54ALS174W
			SNJ54ALS175W	SNJ54ALS175W
	LCCC – FK	Tube	SNJ54ALS174FK	SNJ54ALS174FK
			SNJ54ALS175FK	SNJ54ALS175FK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

‡ This orderable is not recommended for new designs.

**FUNCTION TABLE**  
(each flip-flop)

INPUTS			OUTPUTS	
$\overline{\text{CLR}}$	CLK	D	Q	$\overline{\text{Q}}^{\S}$
L	X	X	L	H
H	↑	H	H	L
H	↑	L	L	H
H	L	X	Q <sub>0</sub>	$\overline{\text{Q}}_0$

<sup>§</sup>ALS175 and AS175B only

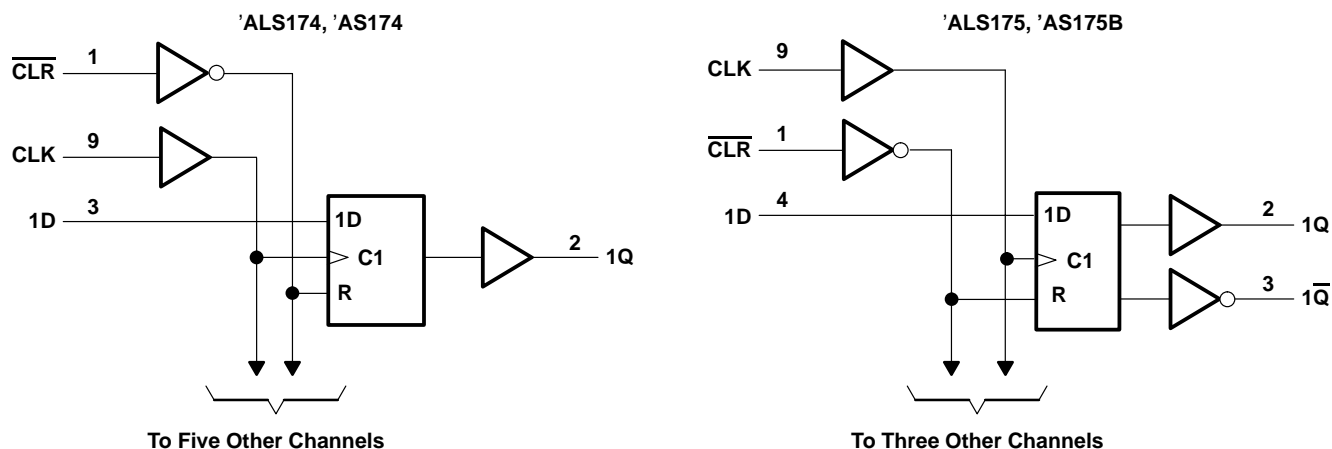


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# SN54ALS174, SN54ALS175, SN54AS174, SN54AS175B SN74ALS174, SN74ALS175, SN74AS174, SN74AS175B HEX/QUADRUPLE D-TYPE FLIP-FLOPS WITH CLEAR

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## logic diagrams (positive logic)



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

## absolute maximum ratings over operating free-air temperature range, SN54/74ALS174, SN54/74ALS175 (unless otherwise noted)<sup>†</sup>

Supply voltage, $V_{CC}$	7 V
Input voltage, $V_I$	7 V
Package thermal impedance, $\theta_{JA}$ (see Note 1): D package	73°C/W
N package	67°C/W
NS package	64°C/W
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.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.

## recommended operating conditions (see Note 2)

		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
$T_A$	Operating free-air temperature	–55		125	0		70	°C

NOTE 2: 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.

**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	
$V_{IK}$	$V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$				-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	$\mu\text{A}$
$I_{IL}$	All others	$V_{CC} = 5.5\text{ V}$ , $V_I = 0.4\text{ V}$			-0.1			-0.1	mA
	CLK				-0.15				
$I_{O\ddagger}$	$V_{CC} = 5.5\text{ V}$ , $V_O = 2.25\text{ V}$		-20		-112	-30		-112	mA
$I_{CC}$	'ALS174	$V_{CC} = 5.5\text{ V}$ , See Note 3			11			11	mA
	'ALS175				8			9	

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

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

			SN54ALS174 SN54ALS175		SN74ALS174 SN74ALS175		UNIT
			MIN	MAX	MIN	MAX	
$f_{\text{clock}}$	Clock frequency			40		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↑	Data		15		10	ns
		CLR inactive		8		6	
$t_h$	Hold time, data after CLK↑			0		0	ns

**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 Q (or $\overline{\text{Q}}$ , 'ALS175)	3	20	5	18	ns
t <sub>PHL</sub>			5	30	8	23	
t <sub>PLH</sub>	CLK	Any Q (or $\overline{\text{Q}}$ , '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, SN54/74AS174, SN54/74AS175B (unless otherwise noted)†**

Supply voltage, $V_{CC}$	7 V
Input voltage, $V_I$	7 V
Package thermal impedance, $\theta_{JA}$ (see Note 1): D package	73°C/W
N package	67°C/W
NS package	64°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.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.

## recommended operating conditions (see Note 2)

		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
$T_A$	Operating free-air temperature	–55		125	0		70	°C

NOTE 2: 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.

## 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‡	MAX	
$V_{IK}$	$V_{CC} = 4.5$ V, $I_I = -18$ mA			–1.2			–1.2	V
$V_{OH}$	$V_{CC} = 4.5$ V to 5.5 V, $I_{OH} = -2$ mA	$V_{CC}-2$			$V_{CC}-2$			V
$V_{OL}$	$V_{CC} = 4.5$ V, $I_{OL} = 20$ mA	0.35	0.5		0.35	0.5		V
$I_I$	$V_{CC} = 5.5$ V, $V_I = 7$ V		0.1			0.1		mA
$I_{IH}$	$V_{CC} = 5.5$ V, $V_I = 2.7$ V		20			20		µA
$I_{IL}$	$V_{CC} = 5.5$ V, $V_I = 0.4$ V		–0.5			–0.5		mA
$I_{O}^{\S}$	$V_{CC} = 5.5$ V, $V_O = 2.25$ V	–30		–112	–30		–112	mA
$I_{CC}$	'AS174		30	45		30	45	mA
	'AS175B		22.5	34		22.5	34	

‡ All typical values are at  $V_{CC} = 5$  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 4:  $I_{CC}$  is measured with D inputs, CLR, and CLK grounded.



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

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

				SN54AS174 SN54AS175B		SN74AS174 SN74AS175B		UNIT
				MIN	MAX	MIN	MAX	
f <sub>clock</sub> *	Clock frequency			100		100		MHz
t <sub>w</sub> *	Pulse duration	CLR low		5.5		5		ns
		CLK high		4		4		
		CLK low	'AS174	6		6		
		CLK low	'AS175B	5		5		
t <sub>su</sub> *	Setup time before CLK↑	Data	'AS174	4		4		ns
			'AS175B	3		3		
		CLR inactive		6		6		
t <sub>h</sub> *	Hold time, data after CLK↑			1		1		ns

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

**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>	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, 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.

**switching characteristics (see Figure 1)**

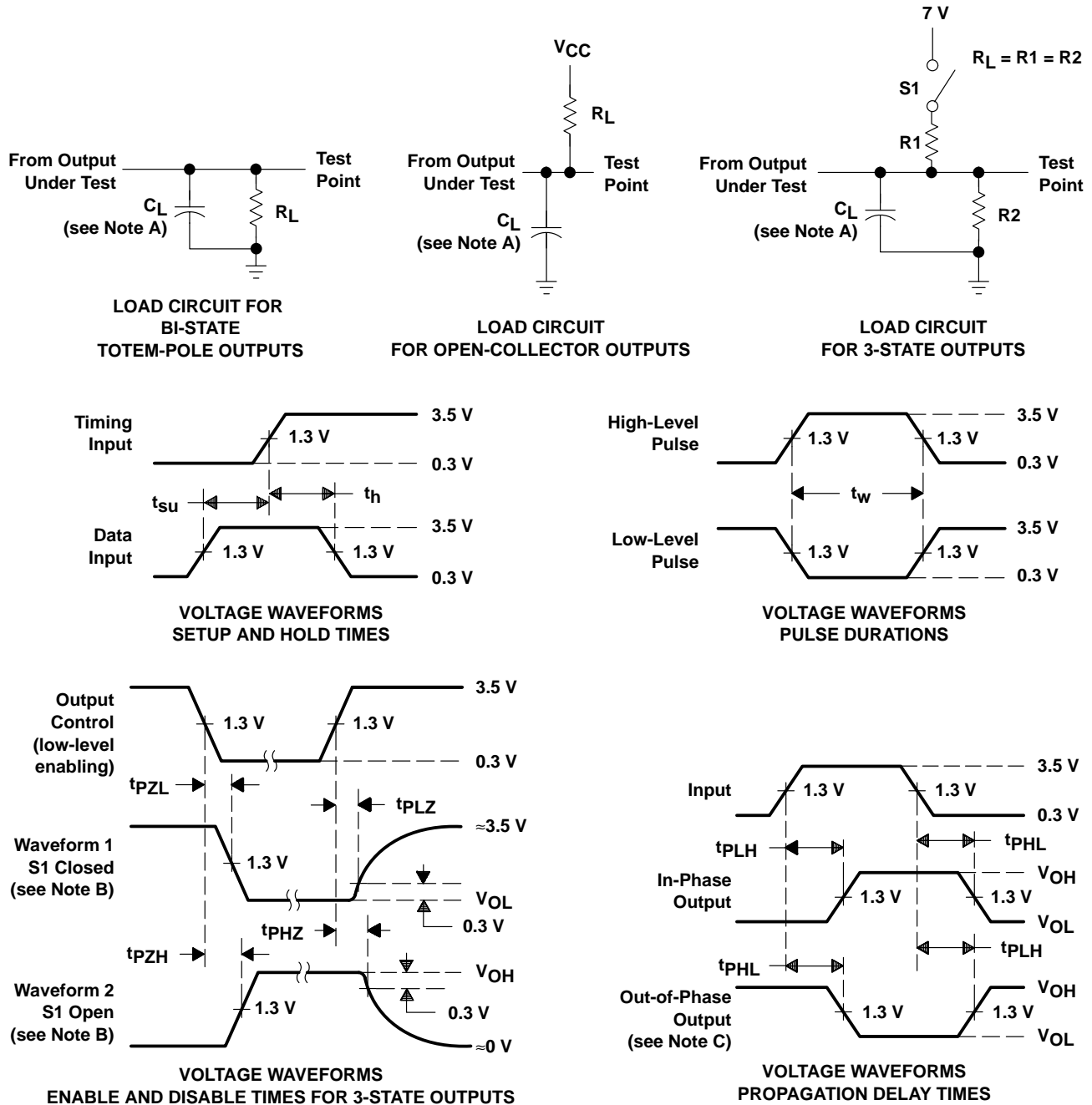
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX†				UNIT
			SN54AS175B		SN74AS175B		
			MIN	MAX	MIN	MAX	
f <sub>max</sub> *			100		100		MHz
t <sub>PLH</sub>	CLR	Any Q or Q̄	4	10	4	9	ns
t <sub>PHL</sub>			4.5	15	4.5	13	
t <sub>PLH</sub>	CLK	Any Q or Q̄	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.



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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