

SN54ALS874B, SN74ALS874B, SN74ALS876A SN74AS874, SN74AS876 DUAL 4-BIT D-TYPE EDGE-TRIGGERED FLIP-FLOPS

SDAS061C - APRIL 1982 - REVISED JANUARY 1995

- 3-State Buffer-Type Outputs Drive Bus Lines Directly
- Bus-Structured Pinout
- Choice of True or Inverting Logic
 - SN54ALS874B, SN74ALS874B, SN74AS874 Have True Outputs
 - SN74ALS876A, SN74AS876 Have Inverting Outputs
- Asynchronous Clear
- Package Options Include Plastic Small-Outline (DW) Packages, Plastic (FN) and Ceramic (FK) Chip Carriers, and Standard Plastic (NT) and Ceramic (JT) 300-mil DIPs

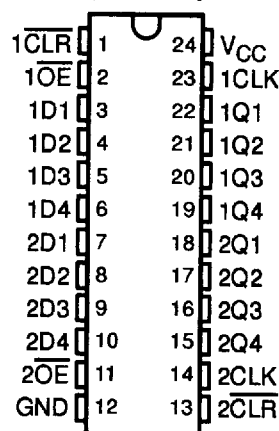
description

These dual 4-bit D-type edge-triggered flip-flops feature 3-state outputs designed specifically as bus drivers. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

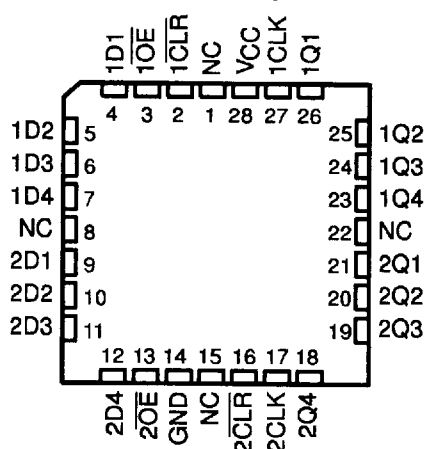
The edge-triggered flip-flops enter data on the low-to-high transition of the clock (CLK) input. The SN54ALS874B, SN74ALS874B, and SN74AS874 have clear ($\overline{\text{CLR}}$) inputs and noninverting Q outputs. The SN74ALS876A and SN74AS876 have preset ($\overline{\text{PRE}}$) inputs and inverting $\overline{\text{Q}}$ outputs; taking $\overline{\text{PRE}}$ low causes the four Q or $\overline{\text{Q}}$ outputs to go low independently of the clock.

The SN54ALS874B is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ALS874B, SN74ALS876A, SN74AS874, and SN74AS876 devices are characterized for operation from 0°C to 70°C .

**SN54ALS874B . . . JT PACKAGE
SN74ALS874B, SN74AS874 . . . DW OR NT PACKAGE
(TOP VIEW)**

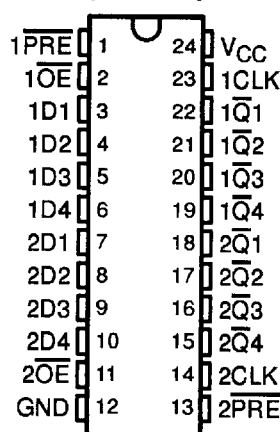


**SN54ALS874B . . . FK PACKAGE
(TOP VIEW)**



NC - No internal connection

**SN74ALS876A, SN74AS876 . . . DW OR NT PACKAGE
(TOP VIEW)**



**SN54ALS874B, SN74ALS874B, SN74ALS876A
SN74AS874, SN74AS876
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Function Tables

**SN54ALS874B, SN74ALS874B, SN74AS874
(each flip-flop)**

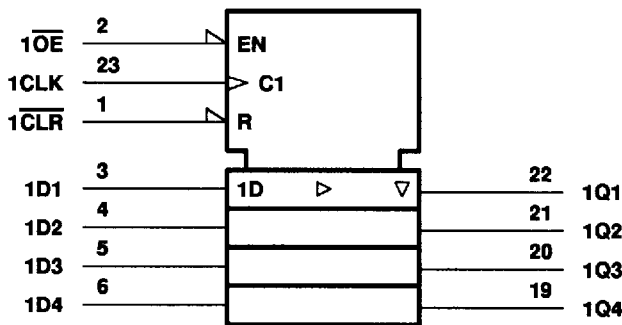
INPUTS				OUTPUT Q
OE	CLR	CLK	D	
L	L	X	X	L
L	H	↑	H	H
L	H	↑	L	L
L	H	L	X	Q ₀
H	X	X	X	Z

**SN74ALS876A, SN74AS876
(each flip-flop)**

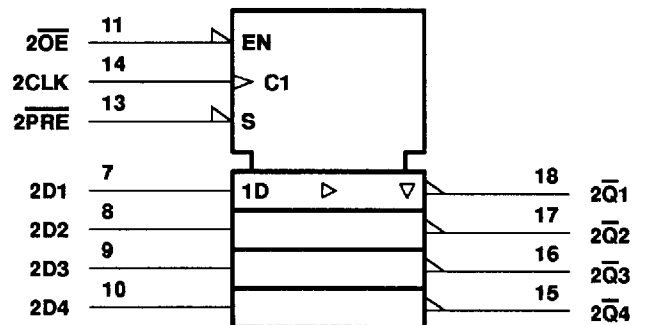
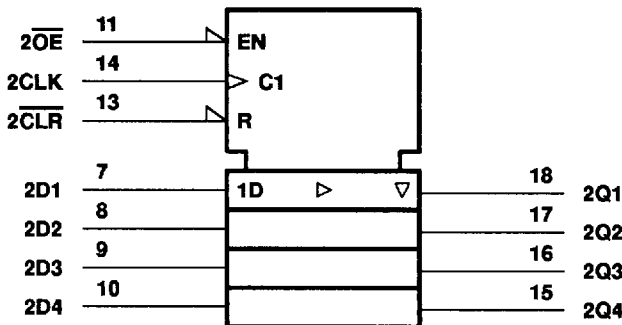
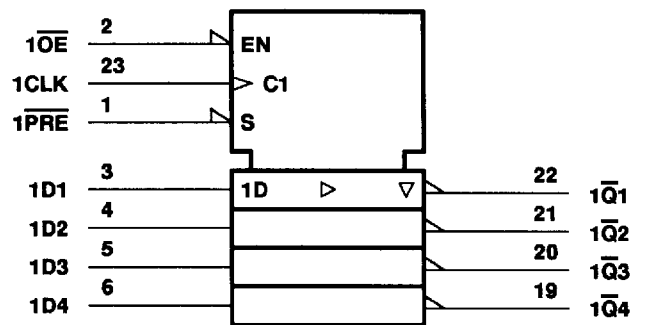
INPUTS				OUTPUT Q̄
OE	PRE	CLK	D	
L	L	X	X	L
L	H	↑	H	L
L	H	↑	L	H
L	H	L	X	Q̄ ₀
H	X	X	X	Z

logic symbols†

SN54ALS874B, SN74ALS874B, SN74AS874



SN74ALS876A, SN74AS876



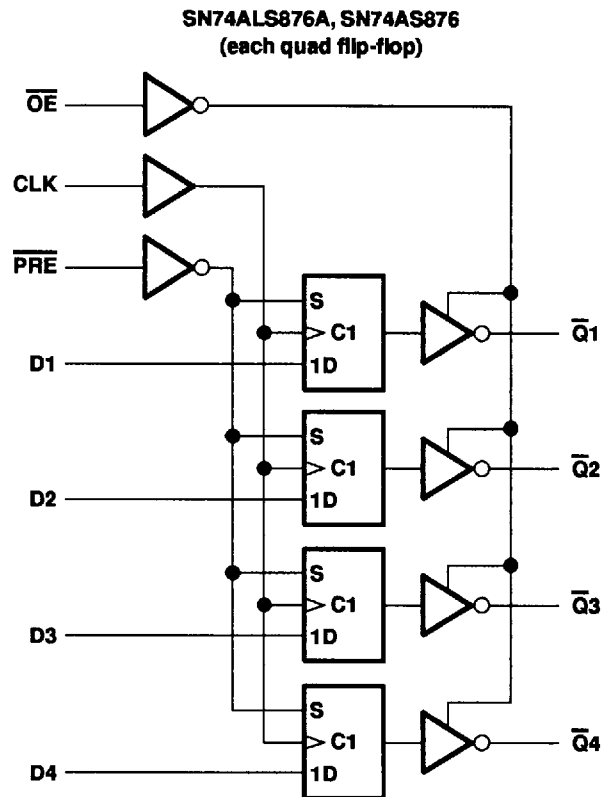
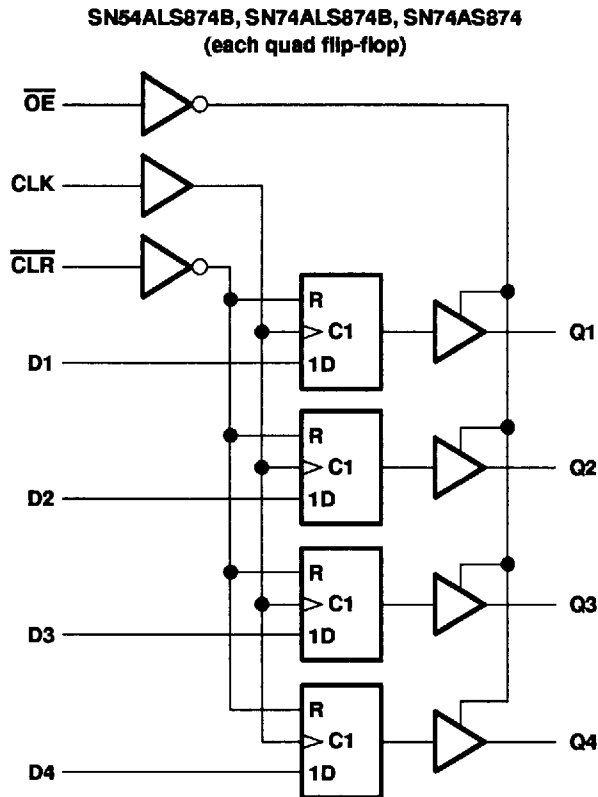
† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the DW, JT, and NT packages.



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logic diagrams (positive logic)



Pin numbers shown are for the DW, JT, and NT packages.

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

Supply voltage, V_{CC}	7 V
Input voltage, V_I	7 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, T_A : SN54ALS874B	-55°C to 125°C
SN74ALS874B, SN74ALS876A	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.



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SN54ALS874B, SN74ALS874B, SN74ALS876A
SN74AS874, SN74AS876
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recommended operating conditions

		SN54ALS874B			SN74ALS874B SN74ALS876A			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			0.7			0.8	V
I _{OH}	High-level output current			-1			-2.6	mA
I _{OL}	Low-level output current			12			24	mA
f _{clock}	Clock frequency	0		25	0		30	MHz
t _w	Pulse duration	PRE or CLR low		15		10		ns
		CLK high		20		16.5		
		CLK low		20		16.5		
t _{su}	Setup time before CLK↑	Data		15		15		ns
		PRE or CLR inactive		15		10		
t _h	Hold time, data after CLK↑	4			0			ns
T _A	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS		SN54ALS874B			SN74ALS874B SN74ALS876A			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} = -0.4 mA		V _{CC} - 2			V _{CC} - 2			V
		V _{CC} = 4.5 V		I _{OH} = -1 mA		2.4	3.3			
V _{OL}		V _{CC} = 4.5 V		I _{OH} = -2.6 mA			2.4	3.2		
				I _{OL} = 12 mA		0.25	0.4	0.25	0.4	
I _{OZ}		V _{CC} = 5.5 V, V _O = 2.7 V		I _{OL} = 24 mA			0.35	0.5		
				I _{OZ} H		V _{CC} = 5.5 V, V _O = 0.4 V		20		
I _{OZ} L		V _{CC} = 5.5 V, V _O = 0.4 V		-20			-20			μA
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		-0.2			-0.2			mA
I _{O‡}		V _{CC} = 5.5 V, V _O = 2.25 V		-20			-112			mA
I _{CC}	ALS874B	V _{CC} = 5.5 V		Outputs high		14	21	14	21	mA
				Outputs low		19	30	19	30	
				Outputs disabled		20	32	20	32	
	SN74ALS876A	V _{CC} = 5.5 V		Outputs high				14	21	
				Outputs low				18	29	
				Outputs disabled				20	31	

† All typical values are at V_{CC} = 5 V, T_A = 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_{OS}.



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switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX†				UNIT
			SN54ALS874B		SN74ALS874B		
			MIN	MAX	MIN	MAX	
f _{max}			25		30	MHz	
t _{PLH}	CLK	Any Q	4	18	4	14	ns
t _{PHL}			4	16	4	14	
t _{PHL}	$\overline{\text{CLR}}$	Any Q	5	23	5	17	ns
t _{PZH}	$\overline{\text{OE}}$	Any Q	4	24	4	18	ns
t _{PZL}			4	21	4	18	
t _{PHZ}	$\overline{\text{OE}}$	Any Q	2	15	2	10	ns
t _{PLZ}			3	22	3	12	

† 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 _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX†		UNIT
			SN74ALS876A		
			MIN	MAX	
f _{max}			30		MHz
t _{PLH}	CLK	Any $\overline{\text{Q}}$	4	14	ns
t _{PHL}			4	14	
t _{PHL}	$\overline{\text{PRE}}$	Any $\overline{\text{Q}}$	6	19	ns
t _{PZH}	$\overline{\text{OE}}$	Any $\overline{\text{Q}}$	4	18	ns
t _{PZL}			4	18	
t _{PHZ}	$\overline{\text{OE}}$	Any $\overline{\text{Q}}$	2	10	ns
t _{PLZ}			3	13	

† 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_{CC} 7 V
 Input voltage, V_I 7 V
 Operating free-air temperature range, T_A: SN74AS874, SN74AS876 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.



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recommended operating conditions

		SN74AS874			SN74AS876			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			-15			-15	mA	
I _{OL}	Low-level output current			48			48	mA	
f _{clock}	Clock frequency	0		125	0		80	MHz	
t _w	Pulse duration	PRE or CLR low		2	4.5		ns		
		CLK high		3	6.2				
		CLK low		4	6.2				
t _{su}	Setup time before CLK↑	Data		2	4.5		ns		
		PRE or CLR inactive		4	5				
t _h	Hold time, data after CLK↑			1	2		ns		
T _A	Operating free-air temperature			0	70		0	70	°C

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

PARAMETER		TEST CONDITIONS		SN74AS874 SN74AS876			UNIT
				MIN	TYP†	MAX	
V _{IK}		V _{CC} = 4.5 V,	I _I = -18 mA			-1.2	V
V _{OH}		V _{CC} = 4.5 V to 5.5 V,	I _{OH} = -2 mA	V _{CC} - 2		V	
		V _{CC} = 4.5 V,	I _{OH} = -15 mA	2.4	3.3		
V _{OL}		V _{CC} = 4.5 V,	I _{OL} = 48 mA	0.35	0.5	V	
I _{OZH}		V _{CC} = 5.5 V,	V _O = 2.7 V			50	μA
I _{OZL}		V _{CC} = 5.5 V,	V _O = 0.4 V			-50	μA
I _I		V _{CC} = 5.5 V,	V _I = 7 V			0.1	mA
I _{IH}		V _{CC} = 5.5 V,	V _I = 2.7 V			20	μA
I _{IL}	D	V _{CC} = 5.5 V,	V _I = 0.4 V			-2	mA
	All others					-0.5	
I _{O‡}		V _{CC} = 5.5 V,	V _O = 2.25 V	-30		-112	mA
I _{CC}	SN74AS874	V _{CC} = 5.5 V	Outputs high	82	133	mA	
			Outputs low	92	149		
			Outputs disabled	100	160		
	SN74AS876	V _{CC} = 5.5 V	Outputs high	88	142		
			Outputs low	94	150		
			Outputs disabled	100	160		

† All typical values are at V_{CC} = 5 V, T_A = 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_{OS}.



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switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX†		UNIT
			SN74AS874		
			MIN	MAX	
f _{max}			125		MHz
t _{PLH}	CLK	Any Q	3	8.5	ns
t _{PHL}			4	10.5	
t _{PHL}	$\overline{\text{CLR}}$	Any Q	4	9.5	ns
t _{PZH}	$\overline{\text{OE}}$	Any Q	2	7	ns
t _{PZL}			3	10.5	
t _{PHZ}	$\overline{\text{OE}}$	Any Q	2	6	ns
t _{PLZ}			2	7.5	

† 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 _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R ₁ = 500 Ω, R ₂ = 500 Ω, T _A = MIN to MAX†		UNIT
			SN74AS876		
			MIN	MAX	
f _{max}			80		MHz
t _{PLH}	CLK	Any $\overline{\text{Q}}$	3	8.5	ns
t _{PHL}			4	10.5	
t _{PHL}	$\overline{\text{PRE}}$	Any $\overline{\text{Q}}$	4	9.5	ns
t _{PZH}	$\overline{\text{OE}}$	Any $\overline{\text{Q}}$	2	7	ns
t _{PZL}			3	11	
t _{PHZ}	$\overline{\text{OE}}$	Any $\overline{\text{Q}}$	2	7	ns
t _{PLZ}			2	7	

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

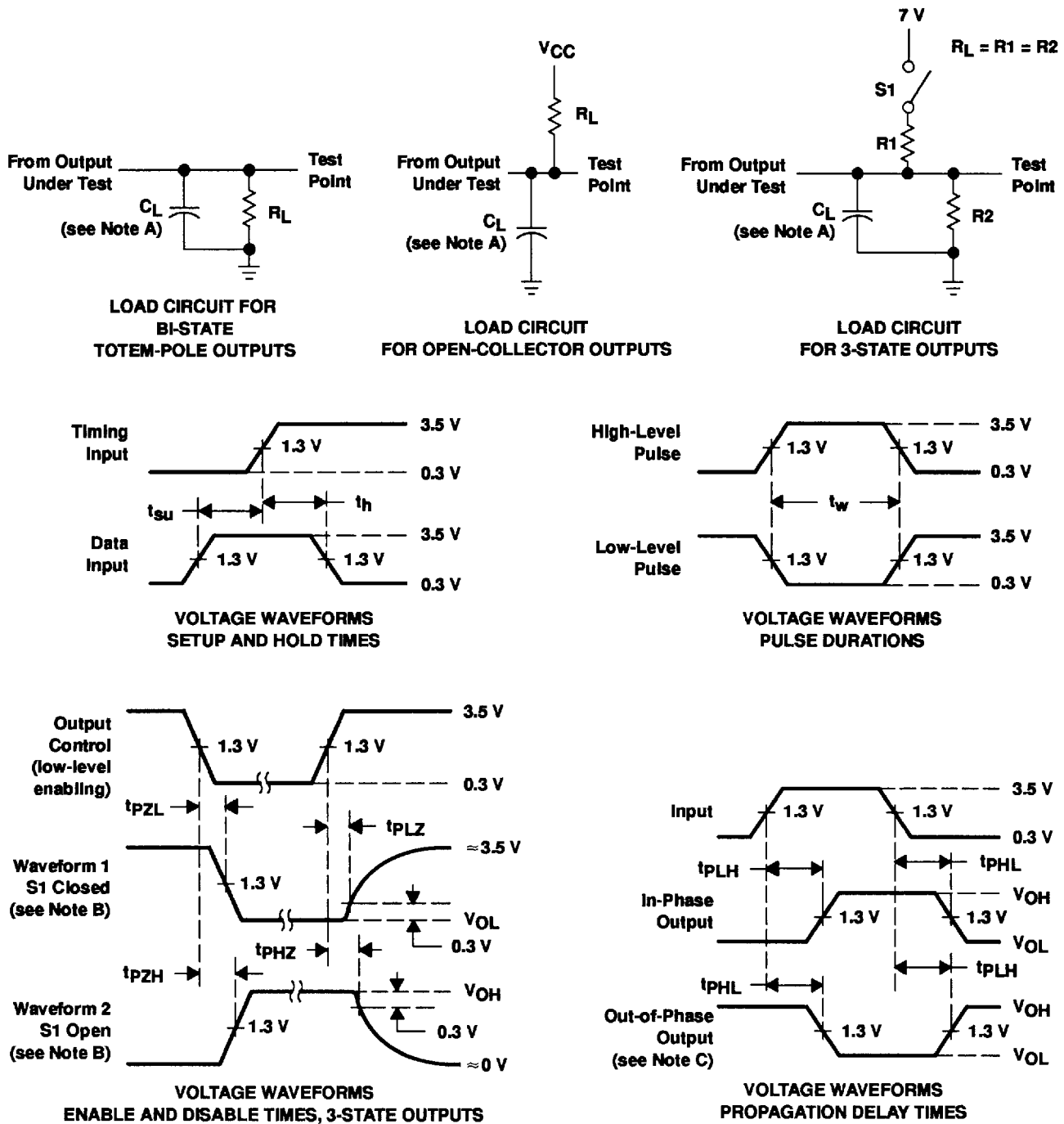


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PARAMETER MEASUREMENT INFORMATION
 SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- 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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