

SN54ALS74A, SN54AS74A, SN74ALS74A, SN74AS74A DUAL POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH CLEAR AND PRESET

SDAS143C – APRIL 1982 – REVISED AUGUST 1995

- Package Options Include Plastic Small-Outline (D) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

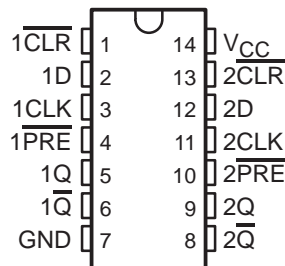
TYPE	TYPICAL MAXIMUM CLOCK FREQUENCY ($C_L = 50$ pF) (MHz)	TYPICAL POWER DISSIPATION PER FLIP-FLOP (mW)
'ALS74A	50	6
'AS74A	134	26

description

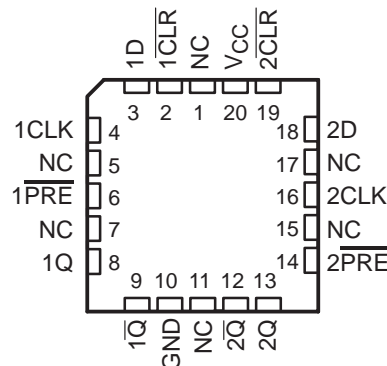
These devices contain two independent positive-edge-triggered D-type flip-flops. A low level at the preset (PRE) or clear (CLR) inputs sets or resets the outputs regardless of the levels of the other inputs. When PRE and CLR are inactive (high), data at the data (D) input meeting the setup-time requirements are transferred to the outputs on the positive-going edge of the clock (CLK) pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of CLK. Following the hold-time interval, data at the D input can be changed without affecting the levels at the outputs.

The SN54ALS74A and SN54AS74A are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ALS74A and SN74AS74A are characterized for operation from 0°C to 70°C .

SN54ALS74A, SN54AS74A . . . J PACKAGE
SN74ALS74A, SN74AS74A . . . D OR N PACKAGE
(TOP VIEW)



SN54ALS74A, SN54AS74A . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE

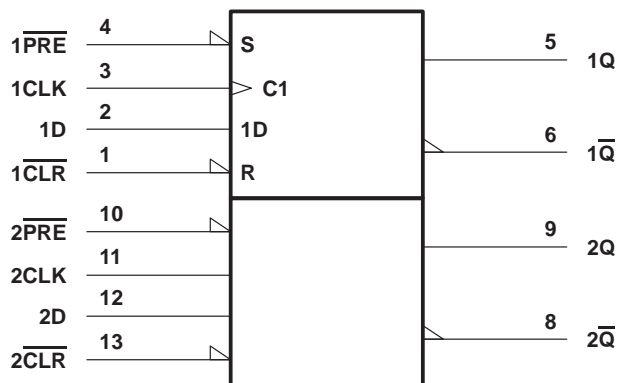
INPUTS				OUTPUTS	
PRE	CLR	CLK	D	Q	Q-bar
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H [†]	H [†]
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q ₀	Q ₀ -bar

[†]The output levels in this configuration are not specified to meet the minimum levels for V_{OH} if the lows at PRE and CLR are near V_{IL} maximum. Furthermore, this configuration is nonstable; that is, it does not persist when PRE or CLR returns to its inactive (high) level.

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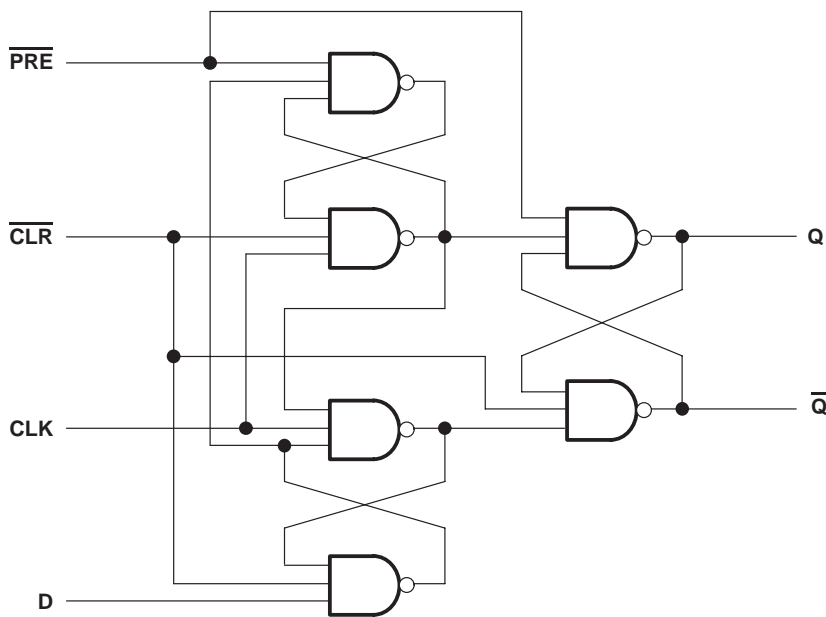
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the D, J, and N packages.

logic diagram (positive logic)



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 : SN54ALS74A	-55°C to 125°C
SN74ALS74A	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

		SN54ALS74A			SN74ALS74A			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			-0.4			-0.4	mA
I_{OL}	Low-level output current			4			8	mA
f_{clock}	Clock frequency	0		25	0		34	MHz
t_w	Pulse duration	\overline{PRE} or \overline{CLR} low		15	15		ns	
		CLK high		17.5	14.5			
		CLK low		17.5	14.5			
t_{su}	Setup time before CLK \uparrow	Data		16	15		ns	
		\overline{PRE} or \overline{CLR} inactive		10	10			
t_h	Hold time after CLK \uparrow	Data		2	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		SN54ALS74A		SN74ALS74A		UNIT
				MIN	TYP \dagger	MAX	MIN	
V_{IK}		$V_{CC} = 4.5\text{ V}$,	$I_I = -18\text{ mA}$		-1.5		-1.5	V
V_{OH}		$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$,	$I_{OH} = -2\text{ mA}$	$V_{CC}-2$		$V_{CC}-2$		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	CLK or D	$V_{CC} = 4.5\text{ V}$,	$V_I = 7\text{ V}$		0.1		0.1	mA
	\overline{PRE} or \overline{CLR}				0.2		0.2	
I_{IH}	CLK or D	$V_{CC} = 4.5\text{ V}$,	$V_I = 2.7\text{ V}$		20		20	μA
	\overline{PRE} or \overline{CLR}				40		40	
I_{IL}	CLK or D	$V_{CC} = 4.5\text{ V}$,	$V_I = 0.4\text{ V}$		-0.2		-0.2	mA
	\overline{PRE} or \overline{CLR}				-0.4		-0.4	
$I_{O\ddagger}$		$V_{CC} = 5.5\text{ V}$,	$V_O = 2.25\text{ V}$	-20	-112	-30	-112	mA
I_{CC}		$V_{CC} = 5.5\text{ V}$,	See Note 1	2.4	4	2.4	4	mA

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

\ddagger 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, CLK, and \overline{PRE} grounded, then with D, CLK, and \overline{CLR} grounded.

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switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5\text{ V to }5.5\text{ V},$ $C_L = 50\text{ pF},$ $R_L = 500\ \Omega,$ $T_A = \text{MIN to MAX}^\dagger$				UNIT
			SN54ALS74A		SN74ALS74A		
			MIN	MAX	MIN	MAX	
f_{max}			25		34		MHz
t_{PLH}	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or $\overline{\text{Q}}$	3	18	3	13	ns
t_{PHL}			5	17	5	15	
t_{PLH}	CLK	Q or Q	5	23	5	16	ns
t_{PHL}			5	20	5	18	

[†] 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 : SN54AS74A	-55°C to 125°C
SN74AS74A	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

		SN54AS74A			SN74AS74A			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		90	0		105	MHz
t_w^*	Pulse duration	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ low		4		4		ns
		CLK high		4		4		
		CLK low		5.5		5.5		
t_{su}^*	Setup time before CLK \uparrow	Data		4.5		4.5	ns	
		$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ inactive		2		2		
t_h^*	Hold time after CLK \uparrow	Data		0		0	ns	
T_A	Operating free-air temperature	-55		125	0		70	°C

* On products compliant to MIL-STD-833, Class B, this parameter is based on characterization data but is not production tested.



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

PARAMETER	TEST CONDITIONS	SN54AS74A		SN74AS74A		UNIT	
		MIN	TYP†	MAX	MIN		TYP†
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}	$V_{CC} = 4.5\text{ V}$, $I_{OL} = 20\text{ mA}$	0.25	0.5	0.25	0.5		V
I_I	$V_{CC} = 5.5\text{ V}$, $V_I = 7\text{ V}$		0.1		0.1		mA
I_{IH}	CLK or D			20	20		μA
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$			40	40		
I_{IL}	CLK or D			-0.5	-0.5		mA
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$			-1.8	-1.8		
$I_{O\ddagger}$	$V_{CC} = 5.5\text{ V}$, $V_O = 2.25\text{ V}$	-30	-112	-30	-112		mA
I_{CC}	$V_{CC} = 5.5\text{ V}$, See Note 1	10.5	16	10.5	16		mA

† 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 1: I_{CC} is measured with D, CLK, and $\overline{\text{PRE}}$ grounded, then with D, CLK, and $\overline{\text{CLR}}$ grounded.

switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$, $C_L = 50\text{ pF}$, $R_L = 500\ \Omega$, $T_A = \text{MIN to MAX}\S$				UNIT
			SN54AS74A		SN74AS74A		
			MIN	MAX	MIN	MAX	
f_{max}^*			90		105	MHz	
t_{PLH}	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or $\overline{\text{Q}}$	2	9	2	7.5	ns
t_{PHL}			2.5	11.5	2.5	10.5	
t_{PLH}	CLK	Q or Q	2.5	10	3	8	ns
t_{PHL}			3.5	10.5	3	9	

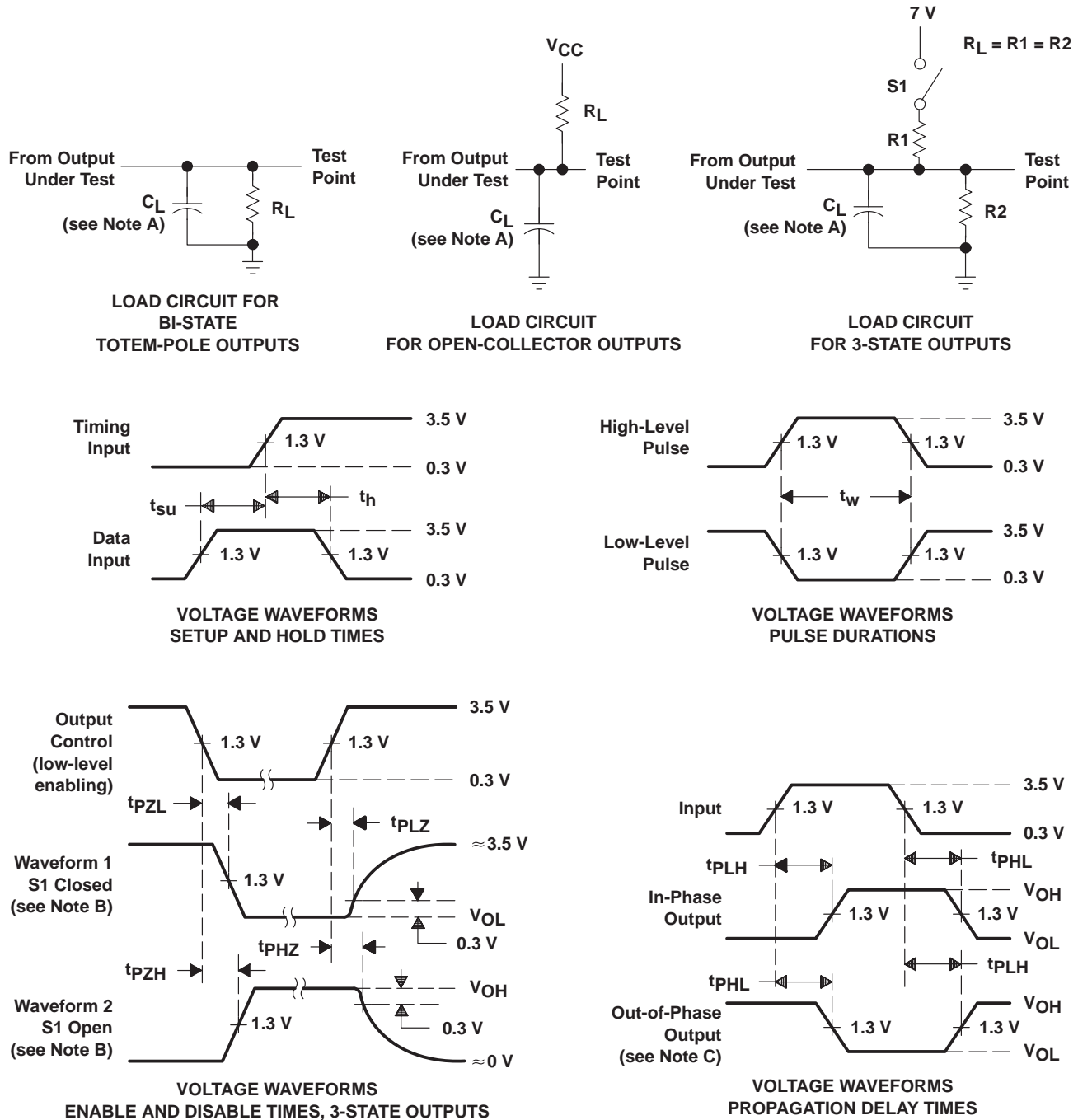
* On products compliant to MIL-STD-833, Class B, this parameter is based on characterization data but is not production tested.

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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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