

SN54AHC574, SN74AHC574 OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCLS244B – OCTOBER 1995 – REVISED APRIL 1998

- Operating Range 2-V to 5.5-V V_{CC}
- 3-State Outputs Directly Drive Bus Lines
- EPIC™ (Enhanced-Performance Implanted CMOS) Process
- High Latch-Up Immunity Exceeds 250 mA Per JEDEC Standard JESD-17
- ESD Protection Exceeds 2000 V per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

description

The 'AHC574 are octal edge-triggered D-type flip-flops that feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. These devices are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

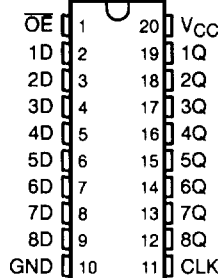
On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels of the data (D) inputs.

A buffered output-enable (\overline{OE}) input can be used to place the eight outputs in either a normal logic state (high or low) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and the increased drive provide the capability to drive bus lines without interface or pullup components.

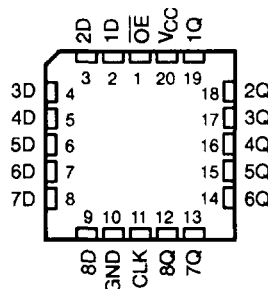
\overline{OE} does not affect internal operations of the flip-flop. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54AHC574 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74AHC574 is characterized for operation from -40°C to 85°C .

SN54AHC574 . . . J OR W PACKAGE
SN74AHC574 . . . DB, DW, N, OR PW PACKAGE
(TOP VIEW)



SN54AHC574 . . . FK PACKAGE
(TOP VIEW)



FUNCTION TABLE
(each flip-flop)

INPUTS			OUTPUT
\overline{OE}	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	H or L	X	Q_0
H	X	X	Z

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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.



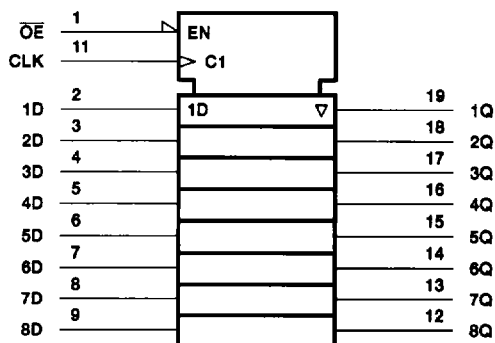
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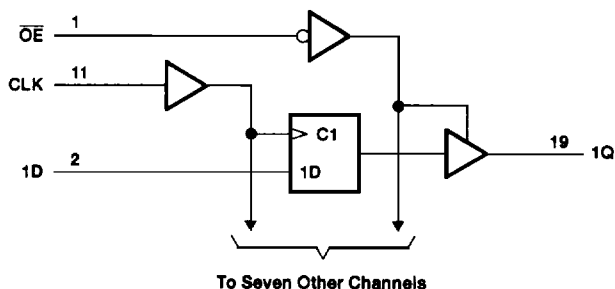
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



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

Supply voltage range, V_{CC}	-0.5 V to 7 V
Input voltage range, V_I (see Note 1)	-0.5 V to 7 V
Output voltage range, V_O (see Note 1)	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	-20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	± 20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	± 25 mA
Continuous current through V_{CC} or GND	± 75 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2):	
DB package	0.6 W
DW package	1.6 W
N package	1.3 W
PW package	0.7 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.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils, except for the N package, which has a trace length of zero.



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recommended operating conditions (see Note 3)

		SN54AHC574		SN74AHC574		UNIT
		MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage	2	5.5	2	5.5	V
V _{IH}	High-level input voltage	V _{CC} = 2 V		1.5		V
		V _{CC} = 3 V		2.1		
		V _{CC} = 5.5 V		3.85		
V _{IL}	Low-level input voltage	V _{CC} = 2 V		0.5		V
		V _{CC} = 3 V		0.9		
		V _{CC} = 5.5 V		1.65		
V _I	Input voltage	0	5.5	0	5.5	V
V _O	Output voltage	0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 2 V		-50		μA
		V _{CC} = 3.3 V ± 0.3 V		-4		
		V _{CC} = 5 V ± 0.5 V		-8		
I _{OL}	Low-level output current	V _{CC} = 2 V		50		μA
		V _{CC} = 3.3 V ± 0.3 V		4		
		V _{CC} = 5 V ± 0.5 V		8		
Δt/Δv	Input transition rise or fall rate	V _{CC} = 3.3 V ± 0.3 V		100		ns/V
		V _{CC} = 5 V ± 0.5 V		20		
T _A	Operating free-air temperature	-55	125	-40	85	°C

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			SN54AHC574		SN74AHC574		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V _{OH}	I _{OH} = -50 μA	2 V	1.9	2	1.9	1.9	V			
		3 V	2.9	3	2.9	2.9				
		4.5 V	4.4	4.5	4.4	4.4				
	I _{OH} = -4 mA	3 V	2.58		2.48	2.48				
		4.5 V	3.94		3.8	3.8				
V _{OL}	I _{OL} = 50 μA	2 V	0.1		0.1	0.1	V			
		3 V	0.1		0.1	0.1				
		4.5 V	0.1		0.1	0.1				
	I _{OL} = 4 mA	3 V	0.36		0.5	0.44				
		4.5 V	0.36		0.5	0.44				
I _I	V _I = V _{CC} or GND	5.5 V	±0.1		±1	±1	μA			
I _{OZ}	V _O = V _{CC} or GND	5.5 V	±0.25		±2.5	±2.5	μA			
I _{CC}	V _I = V _{CC} or GND, I _O = 0	5.5 V	4		40	40	μA			
C _i	V _I = V _{CC} or GND	5 V	3 10			10	pF			
C _o	V _O = V _{CC} or GND	5 V	3				pF			



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timing requirements over recommended operating free-air temperature range,
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see Figure 1)

		$T_A = 25^\circ\text{C}$		SN54AHC574		SN74AHC574		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration, CLK high or low	5		5		5		ns
t_{su}	Setup time, data before CLK \uparrow	3.5		3.5		3.5		ns
t_h	Hold time, data after CLK \uparrow	1.5		1.5		1.5		ns

timing requirements over recommended operating free-air temperature range,
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see Figure 1)

		$T_A = 25^\circ\text{C}$		SN54AHC574		SN74AHC574		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration, CLK high or low	5		5		5		ns
t_{su}	Setup time, data before CLK \uparrow	3		3		3		ns
t_h	Hold time, data after CLK \uparrow	1.5		1.5		1.5		ns

switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN54AHC574				UNIT	
				$T_A = 25^\circ\text{C}$			MIN		MAX
				MIN	TYP	MAX			
f_{max}			$C_L = 15\text{ pF}$	80	125	65		MHz	
			$C_L = 50\text{ pF}$	50	75	45			
t_{PLH}^*	CLK	Q	$C_L = 15\text{ pF}$	8.5	13.2	1	15.5	ns	
t_{PHL}^*				8.5	13.2	1	15.5		
t_{PZH}^*	\overline{OE}	Q	$C_L = 15\text{ pF}$	8.2	12.8	1	15	ns	
t_{PZL}^*				8.2	12.8	1	15		
t_{PHZ}^*	\overline{OE}	Q	$C_L = 15\text{ pF}$	8.5	13	1	15	ns	
t_{PLZ}^*				8.5	13	1	15		
t_{PLH}	CLK	Q	$C_L = 50\text{ pF}$	11	16.7	1	19	ns	
t_{PHL}				11	16.7	1	19		
t_{PZH}	\overline{OE}	Q	$C_L = 50\text{ pF}$	10.7	16.3	1	18.5	ns	
t_{PZL}				10.7	16.3	1	18.5		
t_{PHZ}	\overline{OE}	Q	$C_L = 50\text{ pF}$	11	15	1	17	ns	
t_{PLZ}				11	15	1	17		

* On products compliant to MIL-PRF-38535, this parameter is ensured but not production tested.



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**switching characteristics over recommended operating free-air temperature range,
V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN74AHC574				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
f _{max}			C _L = 15 pF	80	125	65	MHz		
			C _L = 50 pF	50	75	45			
t _{PLH}	CLK	Q	C _L = 15 pF	8.5	13.2	1	15.5	ns	
t _{PHL}				8.5	13.2	1	15.5		
t _{PZH}	OE	Q	C _L = 15 pF	8.2	12.8	1	15	ns	
t _{PZL}				8.2	12.8	1	15		
t _{PHZ}	OE	Q	C _L = 15 pF	8.5	13	1	15	ns	
t _{PLZ}				8.5	13	1	15		
t _{PLH}	CLK	Q	C _L = 50 pF	11	16.7	1	19	ns	
t _{PHL}				11	16.7	1	19		
t _{PZH}	OE	Q	C _L = 50 pF	10.7	16.3	1	18.5	ns	
t _{PZL}				10.7	16.3	1	18.5		
t _{PHZ}	OE	Q	C _L = 50 pF	11	15	1	17	ns	
t _{PLZ}				11	15	1	17		

**switching characteristics over recommended operating free-air temperature range,
V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN54AHC574				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
f _{max}			C _L = 15 pF	130	180	110	MHz		
			C _L = 50 pF	85	115	75			
t _{PLH} *	CLK	Q	C _L = 15 pF	5.6	8.6	1	10	ns	
t _{PHL} *				5.6	8.6	1	10		
t _{PZH} *	OE	Q	C _L = 15 pF	5.9	9	1	10.5	ns	
t _{PZL} *				5.9	9	1	10.5		
t _{PHZ} *	OE	Q	C _L = 15 pF	5.5	9	1	10.5	ns	
t _{PLZ} *				5.5	9	1	10.5		
t _{PLH}	CLK	Q	C _L = 50 pF	7.1	10.6	1	12	ns	
t _{PHL}				7.1	10.6	1	12		
t _{PZH}	OE	Q	C _L = 50 pF	7.4	11	1	12.5	ns	
t _{PZL}				7.4	11	1	12.5		
t _{PHZ}	OE	Q	C _L = 50 pF	7.1	10.1	1	11.5	ns	
t _{PLZ}				7.1	10.1	1	11.5		

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switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 5 V \pm 0.5 V$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	SN74AHC574				UNIT	
				$T_A = 25^\circ C$			MIN		MAX
				MIN	TYP	MAX			
f_{max}			$C_L = 15 \text{ pF}$	130	180		110	MHz	
			$C_L = 50 \text{ pF}$	85	115		75		
t_{PLH}	CLK	Q	$C_L = 15 \text{ pF}$		5.6	8.6	1	10	ns
t_{PHL}					5.6	8.6	1	10	
t_{PZH}	\overline{OE}	Q	$C_L = 15 \text{ pF}$		5.9	9	1	10.5	ns
t_{PZL}					5.9	9	1	10.5	
t_{PHZ}	\overline{OE}	Q	$C_L = 15 \text{ pF}$		5.5	9	1	10.5	ns
t_{PLZ}					5.5	9	1	10.5	
t_{PLH}	CLK	Q	$C_L = 50 \text{ pF}$		7.1	10.6	1	12	ns
t_{PHL}					7.1	10.6	1	12	
t_{PZH}	\overline{OE}	Q	$C_L = 50 \text{ pF}$		7.4	11	1	12.5	ns
t_{PZL}					7.4	11	1	12.5	
t_{PHZ}	\overline{OE}	Q	$C_L = 50 \text{ pF}$		7.1	10.1	1	11.5	ns
t_{PLZ}					7.1	10.1	1	11.5	

output-skew characteristics, $C_L = 50 \text{ pF}$ (see Note 4)

PARAMETER	V_{CC}	SN74AHC574		UNIT
		$T_A = 25^\circ C$		
		MIN	MAX	
$t_{sk(o)}$ Output skew	$3.3 V \pm 0.3 V$		1.5	ns
	$5 V \pm 0.5 V$	1	1	

NOTE 4: Characteristics are determined during product characterization and ensured by design.

noise characteristics, $V_{CC} = 5 V$, $C_L = 50 \text{ pF}$, $T_A = 25^\circ C$ (see Note 5)

PARAMETER	SN74AHC574		UNIT
	MIN	MAX	
$V_{OL(P)}$ Quiet output, maximum dynamic V_{OL}		0.8	V
$V_{OL(V)}$ Quiet output, minimum dynamic V_{OL}		-0.8	V
$V_{OH(V)}$ Quiet output, minimum dynamic V_{OH}	4.2		V
$V_{IH(D)}$ High-level dynamic input voltage	3.5		V
$V_{IL(D)}$ Low-level dynamic input voltage		1.5	V

NOTE 5: Characteristics are determined during product characterization and ensured by design for surface-mount packages only.

operating characteristics, $V_{CC} = 5 V$, $T_A = 25^\circ C$

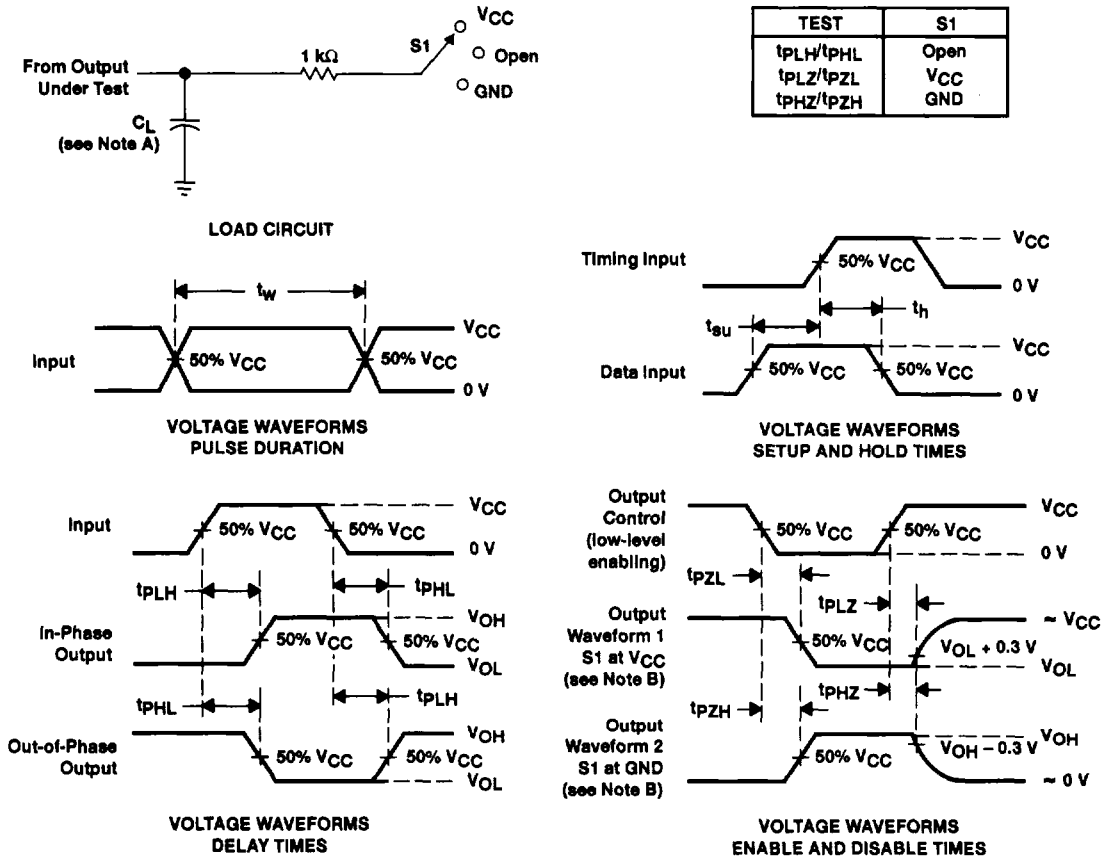
PARAMETER	TEST CONDITIONS	TYP	UNIT
C_{pd} Power dissipation capacitance	No load, $f = 1 \text{ MHz}$	28	pF



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PARAMETER MEASUREMENT INFORMATION



- 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. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, $Z_O = 50 \Omega$, $t_r = 3$ ns, $t_f = 3$ ns.
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

