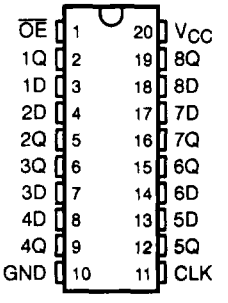
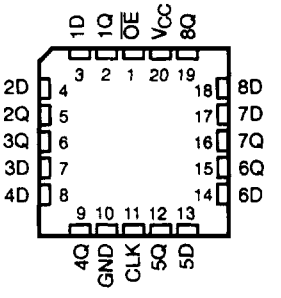
- **Operating Range 2-V to 5.5-V V_{CC}**
- **3-State Outputs Drive Bus Lines Directly**
- ***EPIC*™ (Enhanced-Performance Implanted CMOS) Process**
- **High Latch-Up Immunity Exceeds 250 mA Per JEDEC Standard JESD-17**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using 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**

SN54AHC374 . . . J OR W PACKAGE
SN74AHC374 . . . DB, DW, N, OR PW PACKAGE
(TOP VIEW)



SN54AHC374 . . . FK PACKAGE
(TOP VIEW)



description

The 'AHC374 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.

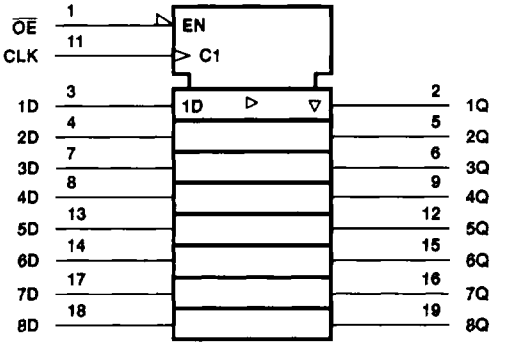
The SN54AHC374 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74AHC374 is characterized for operation from –40°C to 85°C.

EPIC is a trademark of Texas Instruments Incorporated.

FUNCTION TABLE
(each flip-flop)

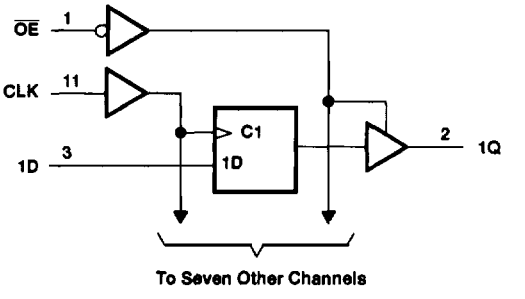
INPUTS			OUTPUT
$\overline{OE}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	H or L	X	Q_0
H	X	X	Z

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°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.

recommended operating conditions (see Note 3)

			SN54AHC374		SN74AHC374		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		1.5		V
		V_{CC} = 3 V	2.1		2.1		
		V_{CC} = 5.5 V	3.85		3.85		
V_{IL}	Low-level input voltage	V_{CC} = 2 V		0.5		0.5	V
		V_{CC} = 3 V		0.9		0.9	
		V_{CC} = 5.5 V		1.65		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		–50	μA
		V_{CC} = 3.3 V ± 0.3 V		–4		–4	mA
		V_{CC} = 5 V ± 0.5 V		–8		–8	
I_{OL}	Low-level output current	V_{CC} = 2 V		50		50	μA
		V_{CC} = 3.3 V ± 0.3 V		4		4	mA
		V_{CC} = 5 V ± 0.5 V		8		8	
$\Delta t/\Delta v$	Input transition rise or fall rate	V_{CC} = 3.3 V ± 0.3 V		100		100	ns/V
		V_{CC} = 5 V ± 0.5 V		20		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			SN54AHC374		SN74AHC374		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		
	I_{OH} = –8 mA	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	
	I_{OL} = 8 mA	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		4	10				10	pF
C_o	V_O = V_{CC} or GND	5 V		6						pF

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

		T_A = 25°C		SN54AHC374		SN74AHC374		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration, CLK high or low	5		5.5		5.5		ns
t_{su}	Setup time, data before CLK↑	4.5		4		4		ns
t_h	Hold time, data after CLK↑	2		2		2		ns

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

		T_A = 25°C		SN54AHC374		SN74AHC374		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↑	3		3		3		ns
t_h	Hold time, data after CLK↑	2		2		2		ns

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)	OUTPUT CAPACITANCE	SN54AHC374					UNIT
				T_A = 25°C			MIN	MAX	
				MIN	TYP	MAX			
f_{max}			C_L = 15 pF	80	130		70		MHz
			C_L = 50 pF	55	85		50		
t_{PLH}*	CLK	Q	C_L = 15 pF		8.1	12.7	1	15	ns
t_{PHL}*					8.1	12.7	1	15	
t_{PZH}*	$\overline{OE}$	Q	C_L = 15 pF		7.1	11	1	13	ns
t_{PZL}*					7.1	11	1	13	
t_{PHZ}*	$\overline{OE}$	Q	C_L = 15 pF		7.5	10.5	1	12.5	ns
t_{PLZ}*					7.5	10.5	1	12.5	
t_{PLH}	CLK	Q	C_L = 50 pF		10.6	16.2	1	18.5	ns
t_{PHL}					10.6	16.2	1	18.5	
t_{PZH}	$\overline{OE}$	Q	C_L = 50 pF		9.6	14.5	1	16.5	ns
t_{PZL}					9.6	14.5	1	16.5	
t_{PHZ}	$\overline{OE}$	Q	C_L = 50 pF		10.2	14	1	16	ns
t_{PLZ}					10.2	14	1	16	

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

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)	OUTPUT CAPACITANCE	SN74AHC374					UNIT
				T_A = 25°C			MIN	MAX	
				MIN	TYP	MAX			
f_{max}			C_L = 15 pF	80	130		70		MHz
			C_L = 50 pF	55	85		50		
t_{PLH}	CLK	Q	C_L = 15 pF		8.1	12.7	1	15	ns
t_{PHL}					8.1	12.7	1	15	
t_{PZH}	$\overline{OE}$	Q	C_L = 15 pF		7.1	11	1	13	ns
t_{PZL}					7.1	11	1	13	
t_{PHZ}	$\overline{OE}$	Q	C_L = 15 pF		7.5	10.5	1	12.5	ns
t_{PLZ}					7.5	10.5	1	12.5	
t_{PLH}	CLK	Q	C_L = 50 pF		10.6	16.2	1	18.5	ns
t_{PHL}					10.6	16.2	1	18.5	
t_{PZH}	$\overline{OE}$	Q	C_L = 50 pF		9.6	14.5	1	16.5	ns
t_{PZL}					9.6	14.5	1	16.5	
t_{PHZ}	$\overline{OE}$	Q	C_L = 50 pF		10.2	14	1	16	ns
t_{PLZ}					10.2	14	1	16	

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)	OUTPUT CAPACITANCE	SN54AHC374					UNIT
				T_A = 25°C			MIN	MAX	
				MIN	TYP	MAX			
f_{max}			C_L = 15 pF	130	185		110		MHz
			C_L = 50 pF	85	120		75		
t_{PLH}*	CLK	Q	C_L = 15 pF		5.4	8.1	1	9.5	ns
t_{PHL}*					5.4	8.1	1	9.5	
t_{PZH}*	$\overline{OE}$	Q	C_L = 15 pF		5.1	7.6	1	9	ns
t_{PZL}*					5.1	7.6	1	9	
t_{PHZ}*	$\overline{OE}$	Q	C_L = 15 pF		4.6	6.8	1	8	ns
t_{PLZ}*					4.6	6.8	1	8	
t_{PLH}	CLK	Q	C_L = 50 pF		6.9	10.1	1	11.5	ns
t_{PHL}					6.9	10.1	1	11.5	
t_{PZH}	$\overline{OE}$	Q	C_L = 50 pF		6.6	9.6	1	11	ns
t_{PZL}					6.6	9.6	1	11	
t_{PHZ}	$\overline{OE}$	Q	C_L = 50 pF		6.1	8.8	1	10	ns
t_{PLZ}					6.1	8.8	1	10	

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

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)	OUTPUT CAPACITANCE	SN74AHC374					UNIT
				T_A = 25°C			MIN	MAX	
				MIN	TYP	MAX			
f_{max}			C_L = 15 pF	130	185		110		MHz
			C_L = 50 pF	85	120		75		
t_{PLH}	CLK	Q	C_L = 15 pF		5.4	8.1	1	9.5	ns
t_{PHL}					5.4	8.1	1	9.5	
t_{PZH}	$\overline{OE}$	Q	C_L = 15 pF		5.1	7.6	1	9	ns
t_{PZL}					5.1	7.6	1	9	
t_{PHZ}	$\overline{OE}$	Q	C_L = 15 pF		4.6	6.8	1	8	ns
t_{PLZ}					4.6	6.8	1	8	
t_{PLH}	CLK	Q	C_L = 50 pF		6.9	10.1	1	11.5	ns
t_{PHL}					6.9	10.1	1	11.5	
t_{PZH}	$\overline{OE}$	Q	C_L = 50 pF		6.6	9.6	1	11	ns
t_{PZL}					6.6	9.6	1	11	
t_{PHZ}	$\overline{OE}$	Q	C_L = 50 pF		6.1	8.8	1	10	ns
t_{PLZ}					6.1	8.8	1	10	

output-skew characteristics, C_L = 50 pF (see Note 4)

PARAMETER		V_{CC}	SN74AHC374				UNIT
			T_A = 25°C		MIN	MAX	
			MIN	MAX			
$t_{sk(o)}$	Output skew	3.3 V ± 0.3 V		1.5		1.5	ns
		5 V ± 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 pF, T_A = 25°C (see Note 5)

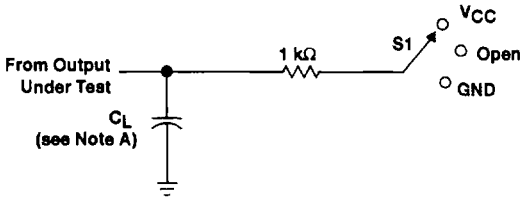
PARAMETER		SN74AHC374			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.5	1	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		–0.5	–0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}	4			V
$V_{IH(D)}$	High-level dynamic input voltage	3.5			V
$V_{IL(D)}$	Low-level dynamic 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°C

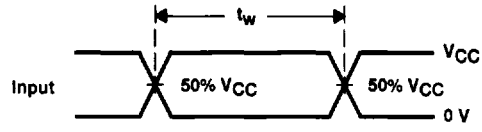
PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance	No load,	f = 1 MHz	32	pF

PARAMETER MEASUREMENT INFORMATION

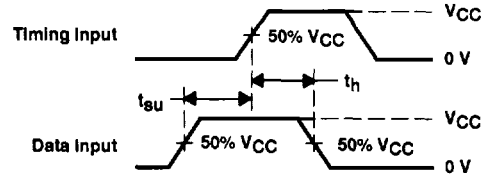


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND

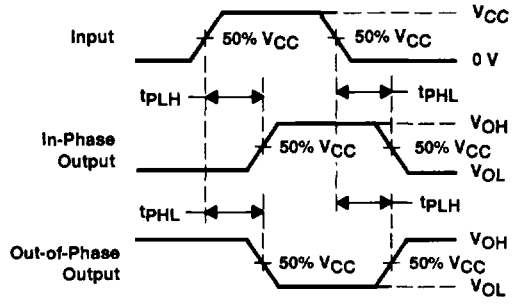
LOAD CIRCUIT



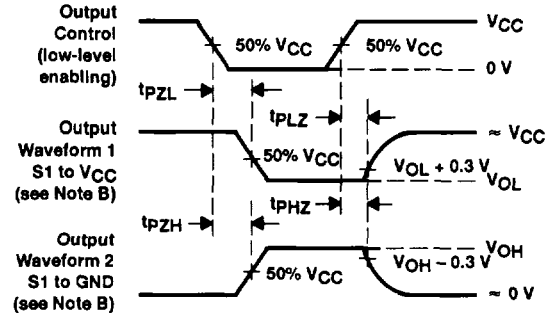
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
DELAY TIMES



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

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 Ω, 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