

Technical Data

**CD54/74AC74**  
**CD54/74ACT74**

**MAXIMUM RATINGS, Absolute-Maximum Values:**

DC SUPPLY-VOLTAGE ( $V_{CC}$ )	-0.5 to 6 V
DC INPUT DIODE CURRENT, $I_{IK}$ (for $V_i < -0.5$ V or $V_i > V_{CC} + 0.5$ V)	$\pm 20$ mA
DC OUTPUT DIODE CURRENT, $I_{OK}$ (for $V_o < -0.5$ V or $V_o > V_{CC} + 0.5$ V)	$\pm 50$ mA
DC OUTPUT SOURCE OR SINK CURRENT per Output Pin, $I_o$ (for $V_o > -0.5$ V or $V_o < V_{CC} + 0.5$ V)	$\pm 50$ mA
DC $V_{CC}$ or GROUND CURRENT ( $I_{CC}$ or $I_{GND}$ )	$\pm 100$ mA*
POWER DISSIPATION PER PACKAGE ( $P_D$ ):	
For $T_A = -55$ to $+100^\circ\text{C}$ (PACKAGE TYPE E)	500 mW
For $T_A = +100$ to $+125^\circ\text{C}$ (PACKAGE TYPE E)	Derate Linearly at 8 mW/ $^\circ\text{C}$ to 300 mW
For $T_A = -55$ to $+70^\circ\text{C}$ (PACKAGE TYPE M)	400 mW
For $T_A = +70$ to $+125^\circ\text{C}$ (PACKAGE TYPE M)	Derate Linearly at 6 mW/ $^\circ\text{C}$ to 70 mW
OPERATING-TEMPERATURE RANGE ( $T_A$ ):	$-55$ to $+120^\circ\text{C}$
STORAGE TEMPERATURE ( $T_{stg}$ )	$-65$ to $+150^\circ\text{C}$
LEAD TEMPERATURE (DURING SOLDERING):	
At distance $1/16 \pm 1/32$ in. ( $1.59 \pm 0.79$ mm) from case for 10 s maximum	$+265^\circ\text{C}$
Unit inserted into PC board min. thickness $1/16$ in. (1.59 mm) with solder contacting lead tips only	$+300^\circ\text{C}$

For up to 4 outputs per device; add  $\pm 25$  mA for each additional output.

**RECOMMENDED OPERATING CONDITIONS:**

For maximum reliability, normal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	LIMITS		UNITS
	MIN.	MAX.	
Supply-Voltage Range, $V_{CC}$ *: (For $T_A =$ Full Package-Temperature Range) AC Types ACT Types	1.5 4.5	5.5 5.5	V V
DC Input or Output Voltage, $V_i, V_o$	0	$V_{CC}$	V
Operating Temperature, $T_A$	-55	+125	$^\circ\text{C}$
Input Rise and Fall Slew Rate, $dt/dv$ at 1.5 V to 3 V (AC Types) at 3.6 V to 5.5 V (AC Types) at 4.5 V to 5.5 V (ACT Types)	0 0 0	50 20 10	ns/V ns/V ns/V

\*Unless otherwise specified, all voltages are referenced to ground.

# CD54/74AC74 CD54/74ACT74

## STATIC ELECTRICAL CHARACTERISTICS: AC Series

CHARACTERISTICS	TEST CONDITIONS		V <sub>CC</sub> (V)	AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C						UNITS	
				+25		-40 to +85		-55 to +125			
				MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
High-Level Input Voltage V <sub>IH</sub>			1.5	1.2	—	1.2	—	1.2	—	V	
			3	2.1	—	2.1	—	2.1	—		
			5.5	3.85	—	3.85	—	3.85	—		
Low-Level Input Voltage V <sub>IL</sub>			1.5	—	0.3	—	0.3	—	0.3	V	
			3	—	0.9	—	0.9	—	0.9		
			5.5	—	1.65	—	1.65	—	1.65		
High-Level Output Voltage V <sub>OH</sub>	V <sub>IH</sub> or V <sub>IL</sub>		-0.05	1.5	1.4	—	1.4	—	1.4	V	
			-0.05	3	2.9	—	2.9	—	2.9		
			-0.05	4.5	4.4	—	4.4	—	4.4		
			-4	3	2.58	—	2.48	—	2.4		
			-24	4.5	3.94	—	3.8	—	3.7		
	#, *	-75	5.5	—	—	3.85	—	—	—		
		-50	5.5	—	—	—	—	3.85	—		
Low-Level Output Voltage V <sub>OL</sub>	V <sub>IH</sub> or V <sub>IL</sub>		0.05	1.5	—	0.1	—	0.1	—	V	
			0.05	3	—	0.1	—	0.1	—		0.1
			0.05	4.5	—	0.1	—	0.1	—		0.1
			12	3	—	0.36	—	0.44	—		0.5
			24	4.5	—	0.36	—	0.44	—		0.5
	#, *	75	5.5	—	—	—	1.65	—	—		
		50	5.5	—	—	—	—	—	1.65		
Input Leakage Current I <sub>I</sub>	V <sub>CC</sub> or GND		5.5	—	±0.1	—	±1	—	±1	μA	
Quiescent Supply Current, FF I <sub>CC</sub>	V <sub>CC</sub> or GND	0	5.5	—	4	—	40	—	80	μA	

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

\*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at +125°C.

# CD54/74AC74

## CD54/74ACT74

STATIC ELECTRICAL CHARACTERISTICS: ACT Series

CHARACTERISTICS	TEST CONDITIONS	$V_{CC}$ (V)	AMBIENT TEMPERATURE ( $T_A$ ) - °C						UNITS		
			+25		-40 to +85		-55 to +125				
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.			
High-Level Input Voltage	$V_{IH}$		4.5 to 5.5	2	—	2	—	2	—	V	
Low-Level Input Voltage	$V_{IL}$		4.5 to 5.5	—	0.8	—	0.8	—	0.8	V	
High-Level Output Voltage	$V_{OH}$	$V_{IH}$ or $V_{IL}$ #, *	-0.05	4.5	4.4	—	4.4	—	4.4	—	V
			-24	4.5	3.94	—	3.8	—	3.7	—	
			-75	5.5	—	—	3.85	—	—	—	
			-50	5.5	—	—	—	—	3.85	—	
Low-Level Output Voltage	$V_{OL}$	$V_{IH}$ or $V_{IL}$ #, *	0.05	4.5	—	±0.1	—	±1	—	±1	V
			24	4.5	—	0.36	—	0.44	—	0.5	
			75	5.5	—	—	—	1.65	—	—	
			50	5.5	—	—	—	—	—	1.65	
Input Leakage Current	$I_I$	$V_{CC}$ or GND	5.5	—	±0.1	—	±1	—	±1	μA	
Quiescent Supply Current, FF	$I_{CC}$	$V_{CC}$ or GND	0	5.5	—	4	—	40	—	80	μA
Additional Quiescent Supply Current per Input Pin TTL Inputs High 1 Unit Load	$\Delta I_{CC}$	$V_{CC}-2.1$	4.5 to 5.5		2.4	—	2.8	—	3	mA	

#Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.

\*Test verifies a minimum 50-ohm transmission-line-drive capability at +85°C, 75 ohms at +125°C.

### ACT INPUT LOADING TABLE

INPUT	UNIT LOAD*
D	0.53
$\bar{R}, \bar{S}$	0.58
CP	1

\*Unit load is  $\Delta I_{CC}$  limit specified in Static Characteristics Chart, e.g., 2.4 mA max. @ 25°C.

# CD54/74AC74 CD54/74ACT74

PREREQUISITE FOR SWITCHING: AC Series

CHARACTERISTICS	SYMBOL	V <sub>CC</sub> (V)	AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Data to CP Setup Time	t <sub>SU</sub>	1.5 3.3* 5†	39 4.3 3.1	— — —	44 4.9 3.5	— — —	ns
Hold Time	t <sub>H</sub>	1.5 3.3 5	0 0 0	— — —	0 0 0	— — —	ns
Removal Time R, S to CP	t <sub>REM</sub>	1.5 3.3 5	30 4.1 2.4	— — —	34 4.7 2.7	— — —	ns
Pulse Width R, S	t <sub>W</sub>	1.5 3.3 5	44 4.9 3.5	— — —	50 5.6 4	— — —	ns
Pulse Width CP	t <sub>W</sub>	1.5 3.3 5	49 5.5 3.9	— — —	56 6.3 4.5	— — —	ns
CP Frequency	f <sub>MAX</sub>	1.5 3.3 5	10 90 125	— — —	9 79 110	— — —	MHz

\*3.3 V: min. is @ 3 V

†5 V: min. is @ 4.5 V

SWITCHING CHARACTERISTICS: AC Series, t<sub>r</sub> t<sub>f</sub> = 3 ns, C<sub>L</sub> = 50 pF

CHARACTERISTICS	SYMBOL	V <sub>CC</sub> (V)	AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Propagation Delays: CP to Q, Q̄	t <sub>PLH</sub> t <sub>PHL</sub>	1.5 3.3* 5†	— 3.6 2.6	114 12.7 9.1	— 3.5 2.5	125 14 10	ns
R, S̄ to Q, Q̄	t <sub>PLH</sub>	1.5 3.3 5	— 3.8 2.7	120 13.4 9.5	— 3.7 2.6	132 14.7 10.5	ns
	t <sub>PHL</sub>	1.5 3.3 5	— 4.1 3	131 14.6 10.4	— 4 2.9	144 16.1 11.5	ns
Power Dissipation Capacitance	C <sub>PD</sub> §	—	55 Typ.		55 Typ.		pF
Input Capacitance	C <sub>I</sub>	—	—	10	—	10	pF

\*3.3 V: min. is @ 3.6 V  
max. is @ 3 V

†5 V: min. is @ 5.5 V  
max. is @ 4.5 V

§C<sub>PD</sub> is used to determine the dynamic power consumption, per flip-flop.

$$P_D = C_{PD} V_{CC}^2 f_i + \sum (C_L V_{CC}^2 f_o) \text{ where } f_i = \text{input frequency}$$

$$f_o = \text{output frequency}$$

$$C_L = \text{output load capacitance}$$

$$V_{CC} = \text{supply voltage.}$$

# CD54/74AC74

## CD54/74ACT74

PREREQUISITE FOR SWITCHING: ACT Series

CHARACTERISTICS	SYMBOL	V <sub>CC</sub> (V)	AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Data to CP Setup Time	t <sub>SU</sub>	5*	3.5	—	4	—	ns
Hold Time	t <sub>H</sub>	5	0	—	0	—	ns
Removal Time R̄, S̄ to CP	t <sub>REM</sub>	5	2.4	—	2.7	—	ns
Pulse Width R̄, S̄	t <sub>w</sub>	5	4.4	—	5	—	ns
Pulse Width CP	t <sub>w</sub>	5	5	—	5.7	—	ns
CP Frequency	f <sub>MAX</sub>	5	97	—	85	—	MHz

\*Min. is @ 4.5 V

SWITCHING CHARACTERISTICS: ACT Series, t<sub>r</sub> = 3 ns, C<sub>L</sub> = 50 pF

CHARACTERISTICS	SYMBOL	V <sub>CC</sub> (V)	AMBIENT TEMPERATURE (T <sub>A</sub> ) - °C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Propagation Delays: CP to Q, Q̄	t <sub>PLH</sub> t <sub>PHL</sub>	5*	2.5	8.6	2.4	9.5	ns
R̄, S̄ to Q, Q̄	t <sub>PLH</sub>	5	3	10.5	2.9	11.5	ns
	t <sub>PHL</sub>	5	3.2	11.4	3.1	12.5	
Power Dissipation Capacitance	C <sub>PD</sub> †	—	55 Typ.		55 Typ.		pF
Input Capacitance	C <sub>I</sub>	—	—	10	10	—	pF

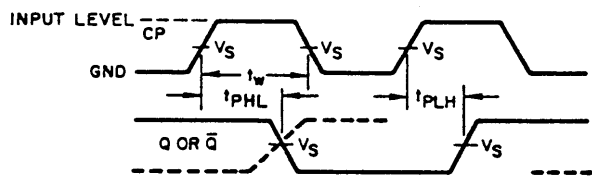
\*Min. is @ 5.5 V

Max. is @ 4.5 V.

†C<sub>PD</sub> is used to determine the dynamic power consumption, per flip-flop.

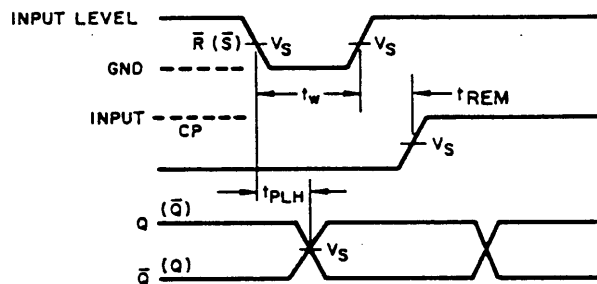
$$P_D = C_{PD}V_{CC}^2 f_i + \sum (C_L V_{CC}^2 f_o) + V_{CC} \Delta I_{CC}$$

where f<sub>i</sub> = input frequency  
f<sub>o</sub> = output frequency  
C<sub>L</sub> = output load capacitance  
V<sub>CC</sub> = supply voltage.



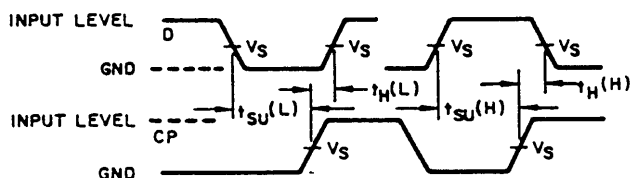
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Fig. 1 - Clock prerequisite and propagation delays.



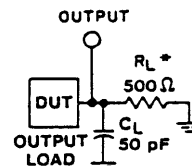
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Fig. 2 - Reset or Set prerequisite and propagation delays.



92CS-36969

Fig. 3 - Data prerequisite times.



\*FOR AC SERIES ONLY: WHEN  
V<sub>CC</sub> = 1.5 V, R<sub>L</sub> = 1 kΩ

92CS-42389

	CD54/74AC	CD54/74ACT
Input Level	V <sub>CC</sub>	3 V
Input Switching Voltage, V <sub>s</sub>	0.5 V <sub>CC</sub>	1.5 V
Output Switching Voltage, V <sub>s</sub>	0.5 V <sub>CC</sub>	0.5 V <sub>CC</sub>