
FUNCTIONAL DIAGRAM

Octal D-Type Flip-Flop, 3-State Positive-Edge-Triggered

CD54/74AC/ACT564 - Inverting
 CD54/74AC/ACT574 - Non-Inverting

Type Features:

- Buffered inputs
- Typical propagation delay:
6.5 ns @ $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$

The RCA-CD54/74AC564 and CD54/74AC574 and the CD54/74ACT564 and CD54/74ACT574 octal D-type, 3-state, positive-edge-triggered flip-flops use the RCA ADVANCED CMOS technology. The eight flip-flops enter data into their registers on the LOW-to-HIGH transition of the clock (CP). The Output Enable (\overline{OE}) controls the 3-state outputs and is independent of the register operation. When the Output Enable (\overline{OE}) is HIGH, the outputs are in the high-impedance state. The CD54/74AC/ACT564 and CD54/74AC/ACT574 share the same pin configurations; the CD54/74AC/ACT564, however, has inverted outputs and the CD54/74AC/ACT574 has non-inverted outputs.

The CD74AC/ACT564 and CD74AC/ACT574 are supplied in 20-lead dual-in-line plastic packages (E suffix) and in 20-lead dual-in-line small-outline plastic packages (M suffix). Both package types are operable over the following temperature ranges: Commercial (0 to 70°C); Industrial (-40 to $+85^\circ\text{C}$); and Extended Industrial/Military (-55 to $+125^\circ\text{C}$).

The CD54AC/ACT564 and CD54AC/ACT574, available in chip form (H suffix), are operable over the -55 to $+125^\circ\text{C}$ temperature range.

Family Features:

- Exceeds 2-kV ESD Protection - MIL-STD-883, Method 3015
- SCR-Latchup-resistant CMOS process and circuit design
- Speed of bipolar FAST*/AS/S with significantly reduced power consumption
- Balanced propagation delays
- AC types feature 1.5-V to 5.5-V operation and balanced noise immunity at 30% of the supply
- $\pm 24\text{-mA}$ output drive current
 - Fanout to 15 FAST* ICs
 - Drives 50-ohm transmission lines

*FAST is a Registered Trademark of Fairchild Semiconductor Corp.

TRUTH TABLE

INPUTS			OUTPUTS	
			564	574
\overline{OE}	CP	D_n	$\overline{Q_n}$	Q_n
L		H	L	H
L		L	H	L
L	L	X	\overline{QO}	QO
H	X	X	Z	Z

H = High level (steady state)

L = Low level (steady state)

X = Don't care

= Transition from low to high level

QO = The level of Q before the indicated steady-state input conditions were established

\overline{QO} = The level of \overline{Q} before the indicated steady-state input conditions were established.

Z = High impedance

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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)	± 20 mA
DC OUTPUT DIODE CURRENT, I_{OK} (for $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V)	± 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)	± 50 mA
DC V_{CC} or GROUND CURRENT (I_{CC} or I_{GND})	± 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 $+125^\circ\text{C}$
STORAGE TEMPERATURE (T_{stg})	-65 to $+150^\circ\text{C}$
LEAD TEMPERATURE (DURING SOLDERING):	
At distance $1/16 \pm 1/32$ in. (1.59 ± 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 ± 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.

TERMINAL ASSIGNMENT DIAGRAMS



CD54/74AC/ACT564



CD54/74AC/ACT574

Technical Data

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STATIC ELECTRICAL CHARACTERISTICS: AC 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}			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 _{IL}			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 _{OH}	V _{IH} or V _{IL}	#, *	-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	—	—	—	
Low-Level Output Voltage V _{OL}	V _{IH} or V _{IL}	#, *	0.05	1.5	—	0.1	—	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	—	—	
Input Leakage Current I _I	V _{CC} or GND		5.5	—	±0.1	—	±1	—	±1	μA	
3-State Leakage Current I _{OZ}	V _{IH} or V _{IL} V _O = V _{CC} or GND		5.5	—	±0.5	—	±5	—	±10	μA	
Quiescent Supply Current, MSI I _{CC}	V _{CC} or GND	0	5.5	—	8	—	80	—	160	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.

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STATIC ELECTRICAL CHARACTERISTICS: ACT Series

CHARACTERISTICS	TEST CONDITIONS		V _{CC} (V)	AMBIENT TEMPERATURE (T _A) - °C						UNITS	
				+25		-40 to +85		-55 to +125			
	V _I (V)	I _O (mA)		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	
3-State Leakage Current	I _{OZ}	V _{IH} or V _{IL} , V _O = V _{CC} or GND	5.5	—	±0.5	—	±5	—	±10	μA	
Quiescent Supply Current, MSI	I _{CC}	V _{CC} or GND	0	5.5	—	8	—	80	—	160	μA
Additional Quiescent Supply Current per Input Pin TTL Inputs High 1 Unit Load	ΔI _{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 LOADS*
D, OE	0.7
CP	1.17

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

CD54/74AC564, CD54/74AC574 CD54/74ACT564, CD54/74ACT574

PREREQUISITE FOR SWITCHING: AC Series

CHARACTERISTICS	SYMBOL	V _{CC} (V)	AMBIENT TEMPERATURE (T _A) -°C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Clock Pulse Width	t _w	1.5	44	—	50	—	ns
		3.3*	4.9	—	5.6	—	
		5†	3.5	—	4	—	
Setup Time Data to Clock	t _{su}	1.5	2	—	2	—	ns
		3.3	2	—	2	—	
		5	2	—	2	—	
Hold Time Data to Clock	t _h	1.5	2	—	2	—	ns
		3.3	2	—	2	—	
		5	2	—	2	—	
Maximum Clock Frequency	f _{MAX}	1.5	11	—	10	—	MHz
		3.3	101	—	89	—	
		5	143	—	125	—	

*3.3 V: min. is @ 3 V

†5 V: min. is @ 4.5 V

SWITCHING CHARACTERISTICS: AC Series; t_r, t_f = 3 ns, C_L = 50 pF

CHARACTERISTICS	SYMBOL	V _{CC} (V)	AMBIENT TEMPERATURE (T _A) -°C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Propagation Delays: Clock to Q AC574	t _{PLH} t _{PHL}	1.5	—	123	—	135	ns
		3.3*	4	13.7	3.8	15.1	
		5†	2.9	9.8	2.7	10.8	
Clock to \bar{Q} AC564	t _{PLH} t _{PHL}	1.5	—	128	—	141	ns
		3.3	4.1	14.4	4	15.8	
		5	2.9	10.3	2.8	11.3	
Output Enable to Q, \bar{Q}	t _{PZL} t _{PZH}	1.5	—	165	—	181	ns
		3.3	5.6	19.2	5.5	21.8	
		5	3.7	13.2	3.6	14.5	
Output Disable to Q, \bar{Q}	t _{PLZ} t _{PHZ}	1.5	—	165	—	181	ns
		3.3	4.7	16.5	4.5	18.1	
		5	3.7	13.2	3.6	14.5	
Power Dissipation Capacitance	C _{PD} §	—	67 Typ.		67 Typ.		pF
Min. (Valley) V _{OH} During Switching of Other Outputs (Output Under Test Not Switching)	V _{OHV} See Fig. 1	5	4 Typ. @ 25°C				V
Max. (Peak) V _{OL} During Switching of Other Outputs (Output Under Test Not Switching)	V _{OLP} See Fig. 1	5	1 Typ. @ 25°C				V
Input Capacitance	C _I	—	—	10	—	10	pF
3-State Output Capacitance	C _O	—	—	15	—	15	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_{PD} is used to determine the dynamic power consumption, per flip flop.

P_D = C_{PD} V_{CC}² f_i + Σ V_{CC}² f_o C_L where f_i = input frequency

f_o = output frequency

C_L = output load capacitance

V_{CC} = supply voltage.

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PREREQUISITE FOR SWITCHING: ACT Series

CHARACTERISTICS	SYMBOL	V _{CC} (V)	AMBIENT TEMPERATURE (T _A) -°C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Clock Pulse Width	t _w	5†	3.9	—	4.5	—	ns
Setup Time Data to Clock	t _{SU}	5	2	—	2	—	ns
Hold Time Data to Clock	t _H	5	2.6	—	3	—	ns
Maximum Clock Frequency	f _{MAX}	5	125	—	110	—	MHz

†5 V: min. is @ 4.5 V

SWITCHING CHARACTERISTICS: ACT Series; t_r, t_f = 3 ns, C_L = 50 pF

CHARACTERISTICS	SYMBOL	V _{CC} (V)	AMBIENT TEMPERATURE (T _A) -°C				UNITS
			-40 to +85		-55 to +125		
			MIN.	MAX.	MIN.	MAX.	
Propagation Delays: Clock to Q ACT574	t _{PLH} t _{PHL}	5†	2.9	10.2	2.8	11.2	ns
Clock to \bar{Q} ACT564	t _{PLH} t _{PHL}	5	3	10.6	2.9	11.7	ns
Output Enable and Disable to Q ACT574	t _{PLZ} t _{PHZ} t _{PZL} t _{PZH}	5	3.7	13.2	3.6	14.5	ns
Output Enable and Disable to \bar{Q} ACT564	t _{PLZ} t _{PHZ} t _{PZL} t _{PZH}	5	3.7	13.2	3.6	14.5	ns
Power Dissipation Capacitance	C _{PD} §	—	67 Typ.		67 Typ.		pF
Min. (Valley) V _{OH} During Switching of Other Outputs (Output Under Test Not Switching)	V _{OHV} See Fig. 1	5	4 Typ. @ 25°C				V
Max. (Peak) V _{OL} During Switching of Other Outputs (Output Under Test Not Switching)	V _{OLP} See Fig. 1	5	1 Typ. @ 25°C				V
Input Capacitance	C _I	—	—	10	—	10	pF
3-State Output Capacitance	C _O	—	—	15	—	15	pF

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

§C_{PD} is used to determine the dynamic power consumption, per flip flop.

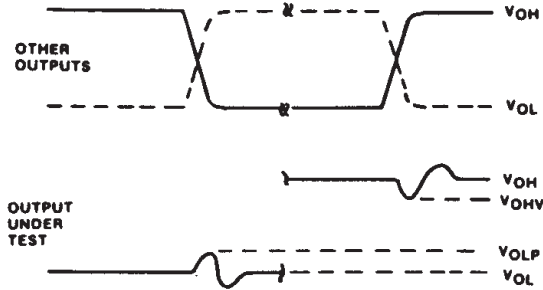
$$P_D = C_{PD} V_{CC}^2 f_i + \sum V_{CC}^2 f_o C_L + V_{CC} \Delta I_{CC}$$

where f_i = input frequency
 f_o = output frequency
 C_L = output load capacitance
 V_{CC} = supply voltage.

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PARAMETER MEASUREMENT INFORMATION



- NOTES:**
1. V_{OHV} and V_{OLP} ARE MEASURED WITH RESPECT TO A GROUND REFERENCE NEAR THE OUTPUT UNDER TEST.
 2. INPUT PULSES HAVE THE FOLLOWING CHARACTERISTICS:
 $PRR \leq 1$ MHz, $t_r = 3$ ns, $t_f = 3$ ns, SKEW 1 ns.
 3. R.F. FIXTURE WITH 700-MHz DESIGN RULES REQUIRED.
 IC SHOULD BE SOLDERED INTO TEST BOARD AND BYPASSED WITH 0.1 μ F CAPACITOR. SCOPE AND PROBES REQUIRE 700-MHz BANDWIDTH.

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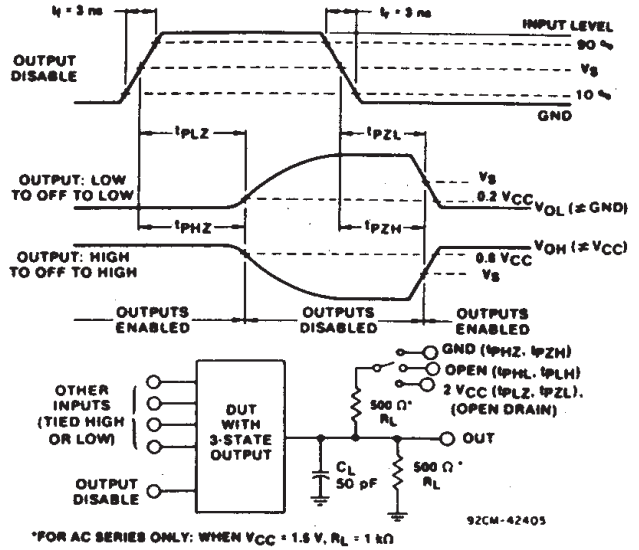
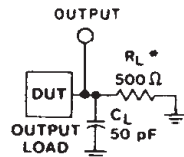
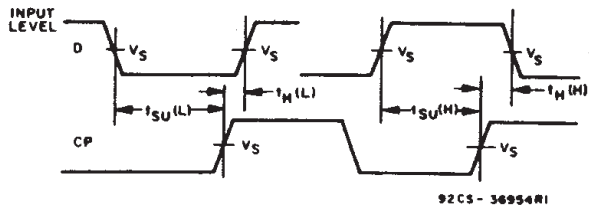
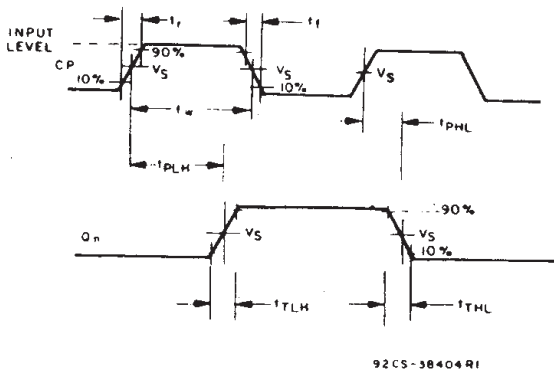


Fig. 1 - Simultaneous switching transient waveforms.

Fig. 2 - Three-state propagation delay waveforms and test circuit.



*FOR AC SERIES ONLY: WHEN
 $V_{CC} = 1.5$ V, $R_L = 1$ k Ω

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	CD54/74AC	CD54/74ACT
Input Level	V_{CC}	3 V
Input Switching Voltage, V_S	$0.5 V_{CC}$	1.5 V
Output Switching Voltage, V_S	$0.5 V_{CC}$	$0.5 V_{CC}$

Fig. 3 - Propagation delays times and test circuit.

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