



54AC/74AC374 • 54ACT/74ACT374

Octal D Flip-Flop with TRI-STATE® Outputs

General Description

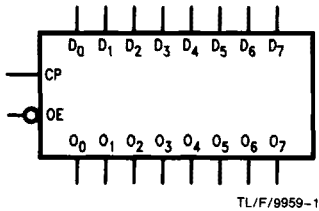
The 'AC/'ACT374 is a high-speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and TRI-STATE outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable (\overline{OE}) are common to all flip-flops.

Features

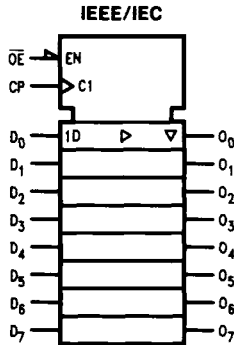
- I_{CC} and I_{OZ} reduced by 50%
- Buffered positive edge-triggered clock
- TRI-STATE outputs for bus-oriented applications
- Outputs source/sink 24 mA
- See '273 for reset version
- See '377 for clock enable version
- See '373 for transparent latch version
- See '574 for broadside pinout version
- See '564 for broadside pinout version with inverted outputs
- 'ACT374 has TTL-compatible inputs
- Standard Military Drawing (SMD)
 - 'AC374: 5962-87694
 - 'ACT374: 5962-87631

Ordering Code: See Section 8

Logic Symbols



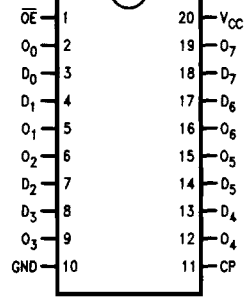
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Connection Diagrams

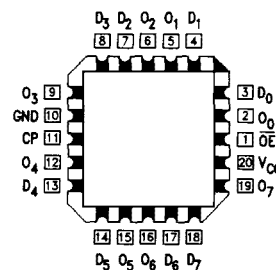
Pin Assignment for DIP, Flatpak, SSOP and SOIC



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Pin Names	Description
D ₀ -D ₇	Data Inputs
CP	Clock Pulse Input
\overline{OE}	TRI-STATE Output Enable Input
O ₀ -O ₇	TRI-STATE Outputs

Pin Assignment for LCC and PCC






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Functional Description

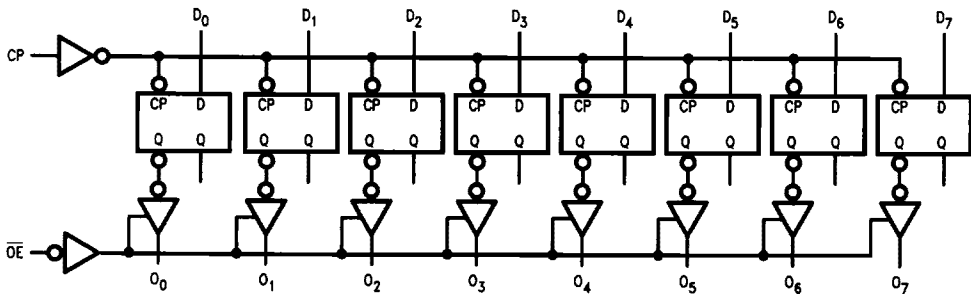
The 'AC/ACT374 consists of eight edge-triggered flip-flops with individual D-type inputs and TRI-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable (\overline{OE}) LOW, the contents of the eight flip-flops are available at the outputs. When the \overline{OE} is HIGH, the outputs go to the high impedance state. Operation of the \overline{OE} input does not affect the state of the flip-flops.

Truth Table

Inputs			Outputs
D_n	CP	\overline{OE}	O_n
H		L	H
L		L	L
X	X	H	Z

H = HIGH Voltage Level
 L = LOW Voltage Level
 X = Immaterial
 Z = High Impedance
 = LOW-to-HIGH Transition

Logic Diagram



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Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Rating (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC})	-0.5V to +7.0V
DC Input Diode Current (I_{IK})	
$V_I = -0.5V$	-20 mA
$V_I = V_{CC} + 0.5V$	+20 mA
DC Input Voltage (V_I)	-0.5V to $V_{CC} + 0.5V$
DC Output Diode Current (I_{OK})	
$V_O = -0.5V$	-20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage (V_O)	-0.5V to $V_{CC} + 0.5V$
DC Output Source or Sink Current (I_O)	±50 mA
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND})	±50 mA
Storage Temperature (T_{STG})	-65°C to +150°C
Junction Temperature (T_J)	
CDIP	175°C
PDIP	140°C

Recommended Operating Conditions

Supply Voltage (V_{CC})	
'AC	2.0V to 6.0V
'ACT	4.5V to 5.5V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A)	
74AC/ACT	-40°C to +85°C
54AC/ACT	-55°C to +125°C
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
'AC Devices	
V_{IN} from 30% to 70% of V_{CC}	
V_{CC} @ 3.3V, 4.5V, 5.5V	125 mV/ns
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
'ACT Devices	
V_{IN} from 0.8V to 2.0V	
V_{CC} @ 4.5V, 5.5V	125 mV/ns

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ circuits outside databook specifications.

DC Characteristics for 'AC Family Devices

Symbol	Parameter	V_{CC} (V)	74AC		54AC		74AC		Units	Conditions
			$T_A = +25^\circ\text{C}$		$T_A = -55^\circ\text{C to } +125^\circ\text{C}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$			
			Typ	Guaranteed Limits						
V_{IH}	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1	2.1	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$		
		4.5	2.25	3.15	3.15	3.15				
		5.5	2.75	3.85	3.85	3.85				
V_{IL}	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9	0.9	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$		
		4.5	2.25	1.35	1.35	1.35				
		5.5	2.75	1.65	1.65	1.65				
V_{OH}	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9	2.9	V	$I_{OUT} = -50 \mu\text{A}$		
		4.5	4.49	4.4	4.4	4.4				
		5.5	5.49	5.4	5.4	5.4				
V_{OL}	Maximum Low Level Output Voltage	3.0		2.56	2.4	2.46	V	* $V_{IN} = V_{IL}$ or V_{IH} -12 mA I_{OH} -24 mA -24 mA		
		4.5		3.86	3.7	3.76				
		5.5		4.86	4.7	4.76				
V_{OL}	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	0.1	V	$I_{OUT} = 50 \mu\text{A}$		
		4.5	0.001	0.1	0.1	0.1				
		5.5	0.001	0.1	0.1	0.1				
V_{OL}	Maximum Low Level Output Voltage	3.0		0.36	0.50	0.44	V	* $V_{IN} = V_{IL}$ or V_{IH} 12 mA I_{OL} 24 mA 24 mA		
		4.5		0.36	0.50	0.44				
		5.5		0.36	0.50	0.44				
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	±1.0	μA	$V_I = V_{CC}, \text{GND}$		

*All outputs loaded; thresholds on input associated with output under test.

DC Characteristics for 'AC Family Devices (Continued)

Symbol	Parameter	V _{CC} (V)	74AC		54AC		74AC		Units	Conditions
			T _A = +25°C		T _A = -55°C to +125°C		T _A = -40°C to +85°C			
			Typ	Guaranteed Limits						
I _{OZ}	Maximum TRI-STATE® Current	5.5		±0.25		±5.0		±2.5	μA	V _I (OE) = V _{IL} , V _{IH} V _I = V _{CC} , GND V _O = V _{CC} , GND
I _{OLD}	†Minimum Dynamic Output Current	5.5				50		75	mA	V _{OLD} = 1.65V Max
I _{OHD}		5.5				-50		-75	mA	V _{OHD} = 3.85V Min
I _{CC}	Maximum Quiescent Supply Current	5.5		4.0		80.0		40.0	μA	V _{IN} = V _{CC} or GND

†Maximum test duration 2.0 ms, one output loaded at a time.

Note: I_{IN} and I_{CC} @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V_{CC}.

I_{CC} for 54AC @ 25°C is identical to 74AC @ 25°C.

DC Characteristics for 'ACT Family Devices

Symbol	Parameter	V _{CC} (V)	74ACT		54ACT		74ACT		Units	Conditions	
			T _A = +25°C		T _A = -55°C to +125°C		T _A = -40°C to +85°C				
			Typ	Guaranteed Limits							
V _{IH}	Minimum High Level Input Voltage	4.5	1.5	2.0		2.0		2.0	V	V _{OUT} = 0.1V or V _{CC} - 0.1V	
		5.5	1.5	2.0		2.0		2.0			
V _{IL}	Maximum Low Level Input Voltage	4.5	1.5	0.8		0.8		0.8	V	V _{OUT} = 0.1V or V _{CC} - 0.1V	
		5.5	1.5	0.8		0.8		0.8			
V _{OH}	Minimum High Level Output Voltage	4.5	4.49	4.4		4.4		4.4	V	I _{OUT} = -50 μA	
		5.5	5.49	5.4		5.4		5.4			
			4.5		3.86		3.70		3.76	V	*V _{IN} = V _{IL} or V _{IH} -24 mA I _{OH} -24 mA
			5.5		4.86		4.70		4.76		
V _{OL}	Maximum Low Level Output Voltage	4.5	0.001	0.1		0.1		0.1	V	I _{OUT} = 50 μA	
		5.5	0.001	0.1		0.1		0.1			
			4.5		0.36		0.50		0.44	V	*V _{IN} = V _{IL} or V _{IH} 24 mA I _{OL} 24 mA
		5.5		0.36		0.50		0.44			
I _{IN}	Maximum Input Leakage Current	5.5		±0.1		±1.0		±1.0	μA	V _I = V _{CC} , GND	
I _{OZ}	Maximum TRI-STATE® Current	5.5		±0.25		±5.0		±2.5	μA	V _I = V _{IL} , V _{IH} V _O = V _{CC} , GND	
I _{CC} T	Maximum I _{CC} /Input	5.5	0.6			1.6		1.5	mA	V _I = V _{CC} - 2.1V	
I _{OLD}	†Minimum Dynamic Output Current	5.5				50		75	mA	V _{OLD} = 1.65V Max	
I _{OHD}		5.5				-50		-75	mA	V _{OHD} = 3.85V Min	
I _{CC}	Maximum Quiescent Supply Current	5.5		4.0		80.0		40.0	μA	V _{IN} = V _{CC} or GND	

*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

Note: I_{CC} for 54ACT @ 25°C is identical to 74ACT @ 25°C.

AC Electrical Characteristics: See Section 2 for waveforms

Symbol	Parameter	V _{CC} * (V)	74AC			54AC		74AC		Units	Fig. No.
			T _A = +25°C C _L = 50 pF			T _A = -55°C to +125°C C _L = 50 pF		T _A = -40°C to +85°C C _L = 50 pF			
			Min	Typ	Max	Min	Max	Min	Max		
f _{max}	Maximum Clock Frequency	3.3 5.0	60 100	110 155	60 95	60 100	60 100	60 100	MHz		
t _{PLH}	Propagation Delay CP to O _n	3.3 5.0	3.0 2.5	11.0 8.0	13.5 9.5	3.0 3.0	16.5 12.0	1.5 1.5	15.5 10.5	ns	2-3, 4
t _{PHL}	Propagation Delay CP to O _n	3.3 5.0	2.5 2.0	10.0 7.0	12.5 9.0	3.0 3.0	15.0 11.0	2.0 1.5	14.0 10.0	ns	2-3, 4
t _{PZH}	Output Enable Time	3.3 5.0	3.0 2.0	9.5 7.0	11.5 8.5	1.0 1.5	14.0 10.5	1.5 1.0	13.0 9.5	ns	2-5
t _{PZL}	Output Enable Time	3.3 5.0	2.5 2.0	9.0 6.5	11.5 8.5	1.0 1.5	14.0 10.5	1.5 1.0	13.0 9.5	ns	2-6
t _{PHZ}	Output Disable Time	3.3 5.0	3.0 2.0	10.5 8.0	12.5 11.0	1.0 1.5	16.0 12.5	2.0 2.0	14.5 12.5	ns	2-5
t _{PLZ}	Output Disable Time	3.3 5.0	2.0 1.5	8.0 6.5	11.5 8.5	1.0 1.5	13.0 10.5	1.0 1.0	12.5 10.0	ns	2-6

*Voltage Range 3.3 is 3.3V ±0.3V

Voltage Range 5.0 is 5.0V ±0.5V

AC Operating Requirements: See Section 2 for waveforms

Symbol	Parameter	V _{CC} * (V)	74AC		54AC	74AC	Units	Fig. No.
			T _A = +25°C C _L = 50 pF		T _A = -55°C to +125°C C _L = 50 pF	T _A = -40°C to +85°C C _L = 50 pF		
			Typ	Guaranteed Minimum				
t _s	Setup Time, HIGH or LOW D _n to CP	3.3 5.0	2.0 1.0	5.5 4.0	6.5 5.0	6.0 4.5	ns	2-7
t _h	Hold Time, HIGH or LOW D _n to CP	3.3 5.0	-1.0 0	1.0 1.5	1.0 1.5	1.0 1.5	ns	2-7
t _w	CP Pulse Width, HIGH or LOW	3.3 5.0	4.0 2.5	5.5 4.0	6.5 5.0	6.0 4.5	ns	2-4

*Voltage Range 3.3 is 3.3V ±0.3V

Voltage Range 5.0 is 5.0V ±0.5V

AC Electrical Characteristics: See Section 2 for waveforms

Symbol	Parameter	V _{CC} * (V)	74ACT			54ACT		74ACT		Units	Fig. No.
			T _A = +25°C C _L = 50 pF			T _A = -55°C to +125°C C _L = 50 pF		T _A = -40°C to +85°C C _L = 50 pF			
			Min	Typ	Max	Min	Max	Min	Max		
t _{max}	Maximum Clock Frequency	5.0	100	160		70		90	MHz		
t _{PLH}	Propagation Delay CP to O _n	5.0	2.0	8.5	10.0	1.5	12.0	2.0	11.5	ns	2-3, 4
t _{PHL}	Propagation Delay CP to O _n	5.0	2.0	8.0	9.5	1.5	11.5	1.5	11.0	ns	2-3, 4
t _{pZH}	Output Enable Time	5.0	2.0	8.0	9.5	1.5	11.5	1.5	10.5	ns	2-5
t _{pZL}	Output Enable Time	5.0	1.5	8.0	9.0	1.5	11.5	1.5	10.5	ns	2-6
t _{PHZ}	Output Disable Time	5.0	1.5	8.5	11.5	1.5	13.0	1.0	12.5	ns	2-5
t _{PLZ}	Output Disable Time	5.0	1.5	7.0	8.5	1.5	11.0	1.0	10.0	ns	2-6

*Voltage Range 5.0 is 5.0V ±0.5V

AC Operating Requirements: See Section 2 for waveforms

Symbol	Parameter	V _{CC} * (V)	74ACT		54ACT		74ACT		Units	Fig. No.
			T _A = +25°C C _L = 50 pF		T _A = -55°C to +125°C C _L = 50 pF		T _A = -40°C to +85°C C _L = 50 pF			
			Typ	Guaranteed Minimum						
t _s	Setup Time, HIGH or LOW D _n to CP	5.0	1.0	5.0	5.5	5.5	ns	2-7		
t _h	Hold Time, HIGH or LOW D _n to CP	5.0	0	1.5	1.5	1.5	ns	2-7		
t _w	CP Pulse Width, HIGH or LOW	5.0	2.5	5.0	5.0	5.0	ns	2-4		

*Voltage Range 5.0 is 5.0V ±0.5V

Capacitance

Symbol	Parameter	Typ	Units	Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = OPEN
C _{PD}	Power Dissipation Capacitance	40	pF	V _{CC} = 5.0V