

## 74AC174 • 74ACT174 Hex D-Type Flip-Flop with Master Reset

### General Description

The AC/ACT174 is a high-speed hex D-type flip-flop. The device is used primarily as a 6-bit edge-triggered storage register. The information on the D inputs is transferred to storage during the LOW-to-HIGH clock transition. The device has a Master Reset to simultaneously clear all flip-flops.

### Features

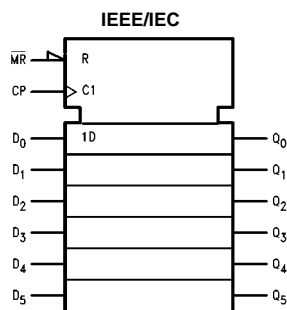
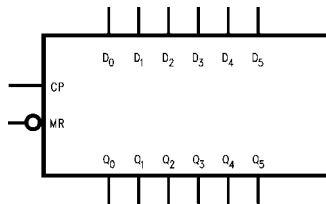
- $I_{CC}$  reduced by 50%
- Outputs source/sink 24 mA
- ACT174 has TTL-compatible inputs

### Ordering Code:

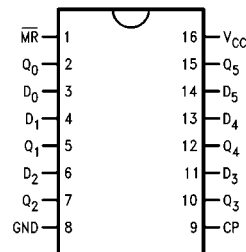
Order Number	Package Number	Package Description
74AC174SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
74AC174SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74AC174MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74AC174PC	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide
74ACT174SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
74ACT174SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74ACT174MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ACT174PC	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

### Logic Symbols



### Connection Diagram



### Pin Descriptions

Pin Names	Description
D <sub>0</sub> -D <sub>5</sub>	Data Inputs
CP	Clock Pulse Input
$\overline{MR}$	Master Reset Input
Q <sub>0</sub> -Q <sub>5</sub>	Outputs

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### Functional Description

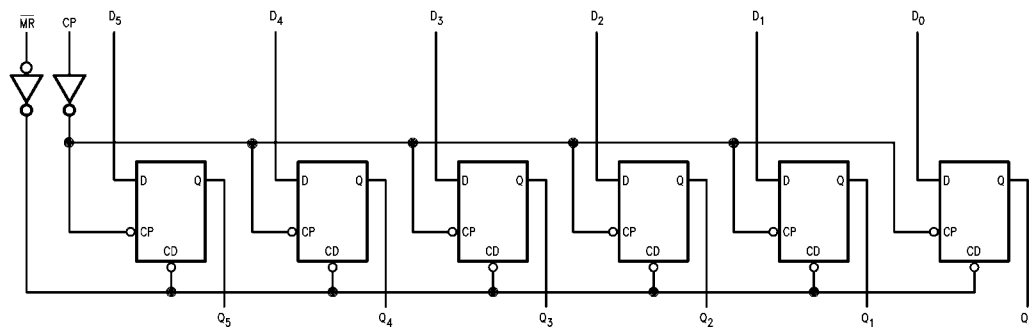
The AC/ACT174 consists of six edge-triggered D-type flip-flops with individual D inputs and Q outputs. The Clock (CP) and Master Reset (MR) are common to all flip-flops. Each D input's state is transferred to the corresponding flip-flop's output following the LOW-to-HIGH Clock (CP) transition. A LOW input to the Master Reset ( $\overline{MR}$ ) will force all outputs LOW independent of Clock or Data inputs. The AC/ACT174 is useful for applications where the true output only is required and the Clock and Master Reset are common to all storage elements.

### Truth Table

Inputs			Output
$\overline{MR}$	CP	D	Q
L	X	X	L
H	↗	H	H
H	↗	L	L
H	L	X	Q

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 ↗ = LOW-to-HIGH Transition  
 X = Immaterial

### Logic Diagram



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 Ratings**(Note 1)

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
$V = V_{CC} + 0.5V$	+20 mA
DC Output Voltage ( $V_O$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Source or Sink Current ( $I_O$ )	$\pm 50$ mA
DC $V_{CC}$ or Ground Current per Output Pin ( $I_{CC}$ or $I_{GND}$ )	$\pm 50$ mA
Storage Temperature ( $T_{STG}$ )	-65°C to +150°C
Junction Temperature ( $T_J$ )	
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 ( $T_A$ )	-40°C to +85°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. Fairchild does not recommend operation of FACT™ circuits outside databook specifications.

**DC Electrical Characteristics for AC**

Symbol	Parameter	$V_{CC}$ (V)	$T_A = +25^\circ\text{C}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		Units	Conditions
			Typ	Guaranteed Limits				
$V_{IH}$	Minimum HIGH Level Input Voltage	3.0	1.5	2.1	2.1	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	2.25	3.15	3.15			
		5.5	2.75	3.85	3.85			
$V_{IL}$	Maximum LOW Level Input Voltage	3.0	1.5	0.9	0.9	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	2.25	1.35	1.35			
		5.5	2.75	1.65	1.65			
$V_{OH}$	Minimum HIGH Level Output Voltage	3.0	2.99	2.9	2.9	V	$I_{OUT} = -50 \mu\text{A}$	
		4.5	4.49	4.4	4.4			
		5.5	5.49	5.4	5.4			
			3.0		2.56	2.46	V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OH} = -12 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ $I_{OH} = -24 \text{ mA (Note 2)}$
			4.5		3.86	3.76		
			5.5		4.86	4.76		
$V_{OL}$	Maximum LOW Level Output Voltage	3.0	0.002	0.1	0.1	V	$I_{OUT} = 50 \mu\text{A}$	
		4.5	0.001	0.1	0.1			
		5.5	0.001	0.1	0.1			
			3.0		0.36	0.44	V	$V_{IN} = V_{IL}$ or $V_{IH}$ $I_{OL} = 12 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ $I_{OL} = 24 \text{ mA (Note 2)}$
			4.5		0.36	0.44		
			5.5		0.36	0.44		
$I_{IN}$ (Note 4)	Maximum Input Leakage Current	5.5		$\pm 0.1$	$\pm 1.0$	$\mu\text{A}$	$V_I = V_{CC}$ or GND	
$I_{OLD}$	Minimum Dynamic	5.5			75	mA	$V_{OLD} = 1.65V$ Max	
$I_{OHD}$	Output Current (Note 3)	5.5			-75	mA	$V_{OHD} = 3.85V$ Min	
$I_{CC}$ (Note 4)	Maximum Quiescent Supply Current	5.5		4.0	40.0	$\mu\text{A}$	$V_{IN} = V_{CC}$ or GND	

**Note 2:** All outputs loaded; thresholds on input associated with output under test.

**Note 3:** Maximum test duration 2.0 ms, one output loaded at a time.

**Note 4:**  $I_{IN}$  and  $I_{CC}$  @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V  $V_{CC}$ .

## DC Electrical Characteristics for ACT

Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C		Units	Conditions
			Typ	Guaranteed Limits				
V <sub>IH</sub>	Minimum HIGH Level Input Voltage	4.5	1.5	2.0	2.0	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V	
		5.5	1.5	2.0	2.0			
V <sub>IL</sub>	Maximum LOW Level Input Voltage	4.5	1.5	0.8	0.8	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V	
		5.5	1.5	0.8	0.8			
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	4.5	4.49	4.4	4.4	V	I <sub>OUT</sub> = -50 μA	
		5.5	5.49	5.4	5.4			
		4.5		3.86	3.76	V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OH</sub> = -24 mA I <sub>OH</sub> = -24 mA (Note 5)	
		5.5		4.86	4.76			
V <sub>OL</sub>	Maximum LOW Level Output Voltage	4.5	0.001	0.1	0.1	V	I <sub>OUT</sub> = 50 μA	
		5.5	0.001	0.1	0.1			
		4.5		0.36	0.44	V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 24 mA (Note 5)	
		5.5		0.36	0.44			
I <sub>IN</sub>	Maximum Input Leakage Current	5.5		±0.1	±1.0	μA	V <sub>I</sub> = V <sub>CC</sub> , GND	
I <sub>CCT</sub>	Maximum I <sub>CC</sub> /Input	5.5	0.6		1.5	mA	V <sub>I</sub> = V <sub>CC</sub> - 2.1V	
I <sub>OLD</sub>	Minimum Dynamic Output Current (Note 6)	5.5			75	mA	V <sub>OLD</sub> = 1.65V Max	
I <sub>OHD</sub>	Output Current (Note 6)	5.5			-75	mA	V <sub>OHD</sub> = 3.85V Min	
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5		4.0	40.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND	

**Note 5:** All outputs loaded; thresholds on input associated with output under test.

**Note 6:** Maximum test duration 2.0 ms, one output loaded at a time.

## AC Electrical Characteristics for AC

Symbol	Parameter	V <sub>CC</sub> (V) (Note 7)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum Clock Frequency	3.3	90	100		70	MHz	
		5.0	100	125		100		
t <sub>PLH</sub>	Propagation Delay CP to Q <sub>n</sub>	3.3	2.0	9.0	11.5	1.5	12.5	ns
		5.0	1.5	6.0	8.5	1.0	9.5	
t <sub>PHL</sub>	Propagation Delay CP to Q <sub>n</sub>	3.3	2.0	8.5	11.0	1.5	12.0	ns
		5.0	1.5	6.0	8.0	1.0	9.0	
t <sub>PHL</sub>	Propagation Delay MR to Q <sub>n</sub>	3.3	2.5	9.0	11.5	2.0	12.5	ns
		5.0	1.5	7.0	9.0	1.5	10.5	

**Note 7:** Voltage Range 3.3 is 3.3V ± 0.3V  
Voltage Range 5.0 is 5.0V ± 0.5V

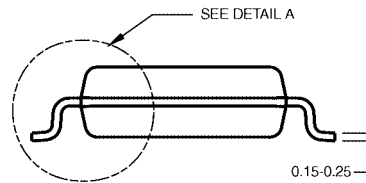
AC Operating Requirements for AC								
Symbol	Parameter	V <sub>CC</sub> (V) (Note 8)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units	
			Typ	Guaranteed Minimum				
t <sub>S</sub>	Setup Time, HIGH or LOW	3.3	2.5	6.5	7.0		ns	
	D <sub>n</sub> to CP	5.0	2.0	5.0	5.5			
t <sub>H</sub>	Hold Time, HIGH or LOW	3.3	1.0	3.0	3.0		ns	
	D <sub>n</sub> to CP	5.0	0.5	3.0	3.0			
t <sub>W</sub>	MR Pulse Width, LOW	3.3	1.0	5.5	7.0		ns	
		5.0	1.0	5.0	5.0			
t <sub>W</sub>	CP Pulse Width	3.3	1.0	5.5	7.0		ns	
		5.0	1.0	5.0	5.0			
t <sub>REC</sub>	Recovery Time	3.3	0	2.5	2.5		ns	
	MR to CP	5.0	0	2.0	2.0			
<b>Note 8:</b> Voltage Range 3.3 is 3.3V ± 0.3V Voltage Range 5.0 is 5.0V ± 0.5V								
AC Electrical Characteristics for ACT								
Symbol	Parameter	V <sub>CC</sub> (V) (Note 9)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units
			Min	Typ	Max	Min	Max	
f <sub>MAX</sub>	Maximum Clock Frequency	5.0	165	200		140		MHz
t <sub>PLH</sub>	Propagation Delay CP to Q <sub>n</sub>	5.0	1.5	7.0	10.5	1.5	11.5	ns
t <sub>PHL</sub>	Propagation Delay CP to Q <sub>n</sub>	5.0	1.5	7.0	10.5	1.5	11.5	ns
t <sub>PHL</sub>	Propagation Delay MR to Q <sub>n</sub>	5.0	1.5	6.5	9.5	1.5	11.0	ns
<b>Note 9:</b> Voltage Range 5.0 is 5.0V ± 0.5V								
AC Operating Requirements for ACT								
Symbol	Parameter	V <sub>CC</sub> (V) (Note 10)	T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		Units	
			Typ	Guaranteed Minimum				
t <sub>S</sub>	Setup Time, HIGH or LOW D <sub>n</sub> to CP	5.0	0.5	1.5	1.5		ns	
t <sub>H</sub>	Hold Time, HIGH or LOW D <sub>n</sub> to CP	5.0	1.0	2.0	2.0		ns	
t <sub>W</sub>	MR Pulse Width, LOW	5.0	1.5	3.0	3.5		ns	
t <sub>W</sub>	CP Pulse Width, HIGH or LOW	5.0	1.5	3.0	3.5		ns	
t <sub>rec</sub>	Recovery Time MR to CP	5.0	-1.0	0.5	0.5		ns	
<b>Note 10:</b> Voltage Range 5.0 is 5.0V ± 0.5V								
Capacitance								
Symbol	Parameter	Typ	Units	Conditions				
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = OPEN				
C <sub>PD</sub>	Power Dissipation Capacitance	85.0	pF	V <sub>CC</sub> = 5.0V				

**Physical Dimensions** inches (millimeters) unless otherwise noted



**16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow  
Package Number M16A**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

- NOTES:  
 A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.  
 B. DIMENSIONS ARE IN MILLIMETERS.  
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

M16DRevB1



**16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide  
 Package Number M16D**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC16**



**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide Package Number N16E**

N16E (REV F)

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