

54AC174/54ACT174

Hex D Flip-Flop with Master Reset

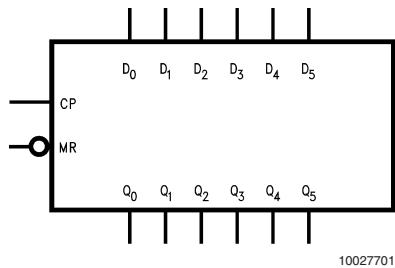
General Description

The 'AC/ACT174 is a high-speed hex D 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

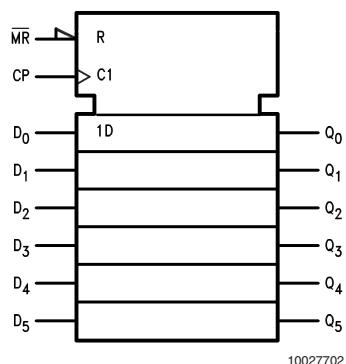
- I_{CC} reduced by 50%
- Outputs source/sink 24 mA

Logic Symbols



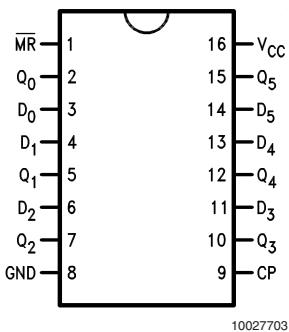
Pin Names	Description
D ₀ -D ₅	Data Inputs
CP	Clock Pulse Input
MR	Master Reset Input
Q ₀ -Q ₅	Outputs

IEEE/IEC

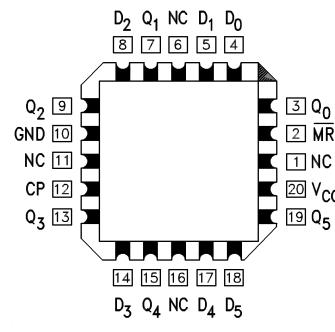


Connection Diagrams

Pin Assignment
for DIP and Flatpak



Pin Assignment
for LCC



Functional Description

The 'AC/ACT174 consists of six edge-triggered D 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 (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
MR	CP	D	Q
L	X	X	L
H	✓	H	H
H	✓	L	L
H	L	X	Q

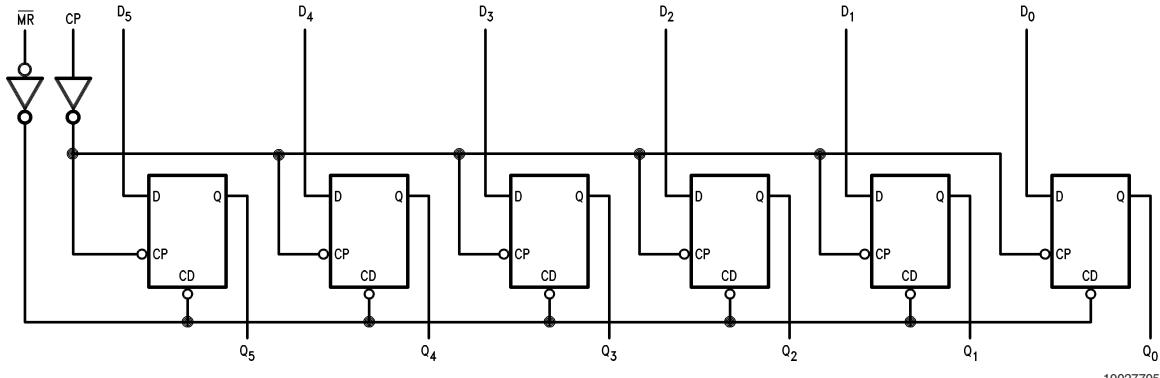
H = HIGH Voltage Level

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)

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

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)	
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
'ACT Devices	
V_{IN} from 0.8V to 2.0V	
V_{CC} @ 4.5V, 5.5V	125 mV/ns
Minimum Input Edge Rate ($\Delta V/\Delta t$)	

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)	54AC	Units	Conditions
			$T_A =$ -55°C to +125°C		
			Guaranteed Limits		
V_{IH}	Minimum High Level Input Voltage	3.0	2.1	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		4.5	3.15		
		5.5	3.85		
V_{IL}	Maximum Low Level Input Voltage	3.0	0.9	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		4.5	1.35		
		5.5	1.65		
V_{OH}	Minimum High Level Output Voltage	3.0	2.9	V	$I_{OUT} = -50 \mu A$
		4.5	4.4		
		5.5	5.4		
		3.0	2.4	V	(Note 2) $V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = -12 mA$ $I_{OH} = -24 mA$ $I_{OH} = -24 mA$
		4.5	3.7		
		5.5	4.7		
V_{OL}	Maximum Low Level Output Voltage	3.0	0.1	V	$I_{OUT} = 50 \mu A$
		4.5	0.1		
		5.5	0.1		
		3.0	0.50	V	(Note 2) $V_{IN} = V_{IL}$ or V_{IH} $I_{OL} = 12 mA$ $I_{OL} = 24 mA$ $I_{OL} = 24 mA$
		4.5	0.50		
		5.5	0.50		
I_{IN}	Maximum Input Leakage Current	5.5	± 1.0	μA	$V_I = V_{CC}, GND$

DC Characteristics for 'AC Family Devices (Continued)

Symbol	Parameter	V _{CC} (V)	54AC	Units	Conditions
			T _A = −55°C to +125°C		
			Guaranteed Limits		
I _{OLD}	Minimum Dynamic Output Current (Note 3)	5.5	50	mA	V _{OLD} = 1.65V Max
I _{OHD}		5.5	−50	mA	V _{OHD} = 3.85V Min
I _{CC}	Maximum Quiescent Supply Current	5.5	80.0	μA	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}.

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

DC Characteristics for 'ACT Family Devices

Symbol	Parameter	V _{CC} (V)	54ACT	Units	Conditions
			T _A = −55°C to +125°C		
			Guaranteed Limits		
V _{IH}	Minimum High Level Input Voltage	4.5	2.0	V	V _{OUT} = 0.1V or V _{CC} − 0.1V
		5.5	2.0		
V _{IL}	Maximum Low Level Input Voltage	4.5	0.8	V	V _{OUT} = 0.1V or V _{CC} − 0.1V
		5.5	0.8		
V _{OH}	Minimum High Level Output Voltage	4.5	4.4	V	I _{OUT} = −50 μA
		5.5	5.4		
		4.5	3.70	V	(Note 5) V _{IN} = V _{IL} or V _{IH} I _{OH} = −24 mA I _{OH} = −24 mA
		5.5	4.70		
V _{OL}	Maximum Low Level Output Voltage	4.5	0.1	V	I _{OUT} = 50 μA
		5.5	0.1		
		4.5	0.50	V	(Note 5) V _{IN} = V _{IL} or V _{IH} I _{OL} = 24 mA I _{OL} = 24 mA
		5.5	0.50		
I _{IN}	Maximum Input Leakage Current	5.5	±1.0	μA	V _I = V _{CC} , GND
I _{CCT}	Maximum I _{CC} /Input	5.5	1.6	mA	V _I = V _{CC} − 2.1V
I _{OLD}	Minimum Dynamic Output Current (Note 6)	5.5	50	mA	V _{OLD} = 1.65V Max
I _{OHD}		5.5	−50	mA	V _{OHD} = 3.85V Min
I _{CC}	Maximum Quiescent Supply Current	5.5	80.0	μA	V _{IN} = V _{CC} 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.

Note 7: I_{CC} for 54ACT @ 25°C is identical to 74ACT @ 25°C.

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V) (Note 8)	54AC		Units	Fig. No.		
			$T_A = -55^{\circ}C$ to $+125^{\circ}C$ $C_L = 50$ pF					
			Min	Max				
f_{max}	Maximum Clock Frequency	3.3	65		MHz			
		5.0	90					
t_{PLH}	Propagation Delay CP to Q_n	3.3	1.0	14.0	ns			
		5.0	1.5	10.5				
t_{PHL}	Propagation Delay CP to Q_n	3.3	1.0	13.0	ns			
		5.0	1.5	10.0				
t_{PHL}	Propagation Delay \overline{MR} to Q_n	3.3	1.0	13.5	ns			
		5.0	1.5	11.0				

Note 8: Voltage Range 3.3 is $3.3V \pm 0.3V$

Voltage Range 5.0 is $5.0V \pm 0.5V$

AC Operating Requirements

Symbol	Parameter	V_{CC} (V) (Note 9)	54AC		Units	Fig. No.		
			$T_A = -55^{\circ}C$ to $+125^{\circ}C$ $C_L = 50$ pF					
			Guaranteed Minimum					
t_s	Setup Time, HIGH or LOW D_n to CP	3.3	7.5		ns			
		5.0	5.5					
t_h	Hold Time, HIGH or LOW D_n to CP	3.3	3.0		ns			
		5.0	3.0					
t_w	\overline{MR} Pulse Width, LOW	3.3	7.0		ns			
		5.0	5.0					
t_w	CP Pulse Width	3.3	7.0		ns			
		5.0	5.0					
t_{rec}	Recovery Time \overline{MR} to CP	3.3	3.0		ns			
		5.0	2.0					

Note 9: Voltage Range 3.3 is $3.3V \pm 0.3V$

Voltage Range 5.0 is $5.0V \pm 0.5V$

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V) (Note 10)	54ACT		Units	Fig. No.		
			$T_A = -55^{\circ}C$ to $+125^{\circ}C$ $C_L = 50$ pF					
			Min	Max				
f_{max}	Maximum Clock Frequency	5.0	95		MHz			
t_{PLH}	Propagation Delay CP to Q_n	5.0	1.5	12.5	ns			
t_{PHL}	Propagation Delay CP to Q_n	5.0	1.5	13.0	ns			
t_{PHL}	Propagation Delay \overline{MR} to Q_n	5.0	1.5	12.0	ns			

Note 10: Voltage Range 5.0 is $5.0V \pm 0.5V$

AC Operating Requirements

Symbol	Parameter	V _{CC} (V) (Note 11)	54ACT	Units	Fig. No.
			T _A = -55°C to +125°C		
			C _L = 50 pF		
t _s	Setup Time, HIGH or LOW D _n to CP	5.0	3.0	ns	
t _h	Hold Time, HIGH or LOW D _n to CP	5.0	2.0	ns	
t _w	MR Pulse Width, LOW	5.0	5.0	ns	
t _w	CP Pulse Width, HIGH OR LOW	5.0	5.0	ns	
t _{rec}	Recovery Time MR to CP	5.0	1.0	ns	

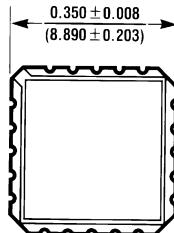
Note 11: Voltage Range 5.0 is 5.0V ±0.5V

Capacitance

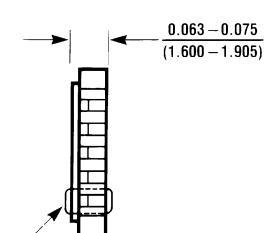
Symbol	Parameter	Typ	Units	Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = OPEN
C _{PD}	Power Dissipation Capacitance	85.0	pF	V _{CC} = 5.0V

Physical Dimensions

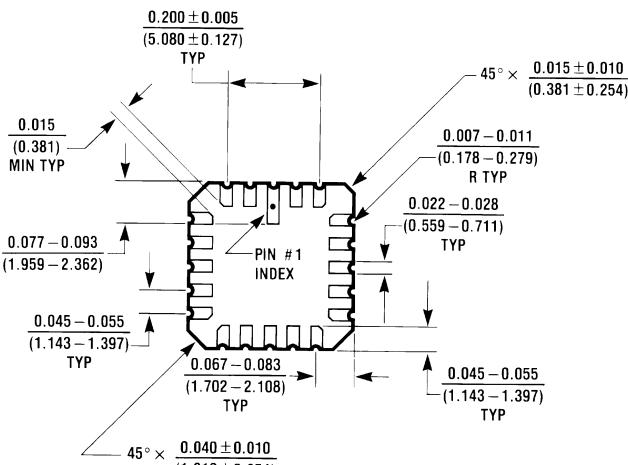
inches (millimeters) unless otherwise noted



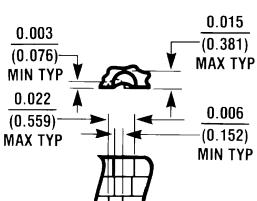
Top View



Side View



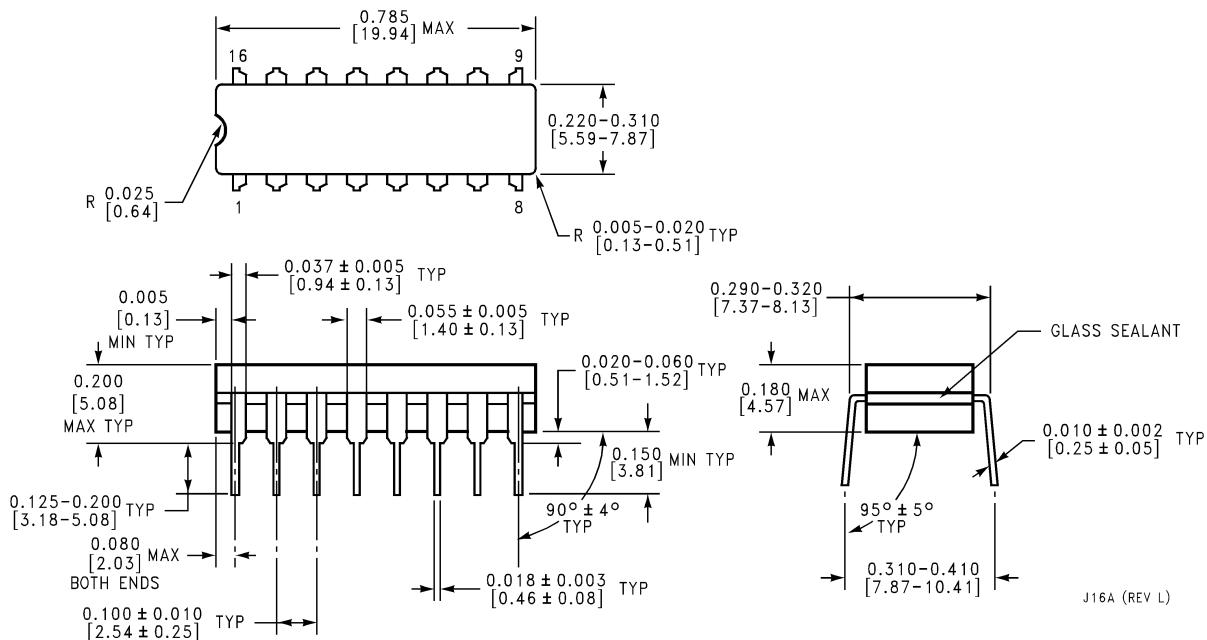
Bottom View



Detail A

E20A (REV D)

**20-Terminal Ceramic Leadless Chip Carrier (L)
NS Package Number E20A**



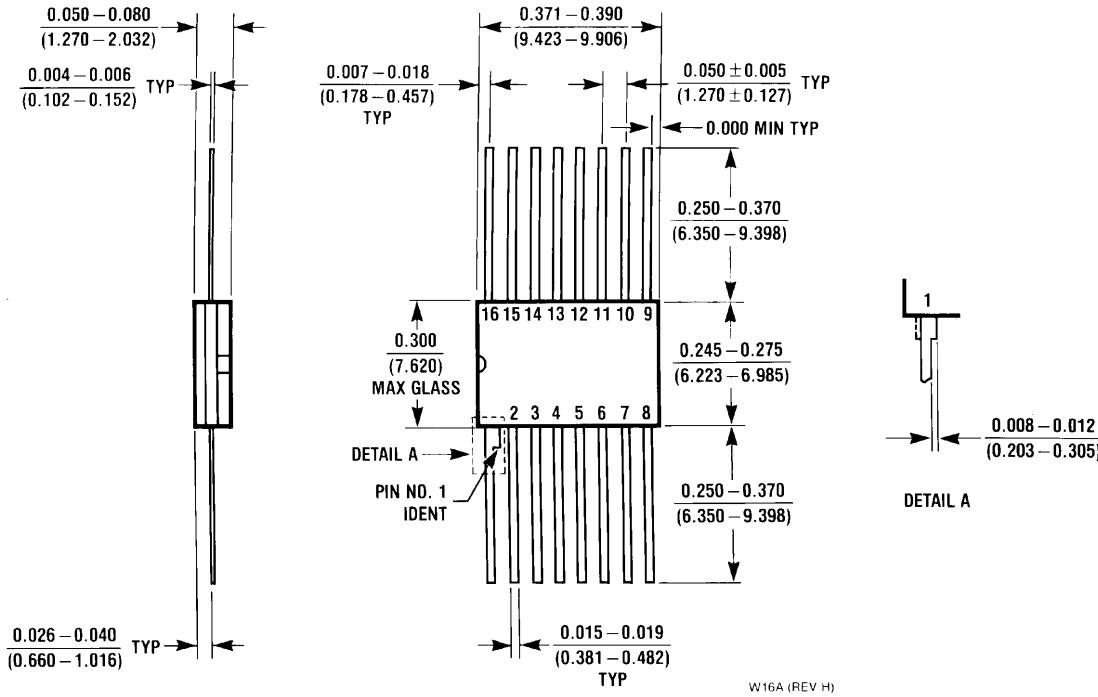
J16A (REV L)

**16-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J16A**

54AC174/54ACT174 Hex D Flip-Flop with Master Reset

Physical Dimensions

inches (millimeters) unless otherwise noted (Continued)



16-Lead Ceramic Flatpak (F)
NS Package Number W16A

W16A (REV H)

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