

MC74AC175, MC74ACT175

Quad D Flip-Flop With Master Reset

The MC74AC/ACT175 is a high-speed quad D flip-flop. The device is useful for general flip-flop requirements where clock and clear inputs are common. 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, when \overline{MR} is low.

The MC74AC/ACT175 consists of four edge-triggered D flip-flops with individual D inputs and Q and \overline{Q} outputs. The Clock (CP) and Master Reset (\overline{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 Q outputs LOW and \overline{Q} outputs HIGH independent of Clock or Data inputs. The MC74AC/ACT175 is useful for applications where the Clock and Master Reset are common to all storage elements.

- Outputs Source/Sink 24 mA
- 'ACT175 Has TTL Compatible Inputs

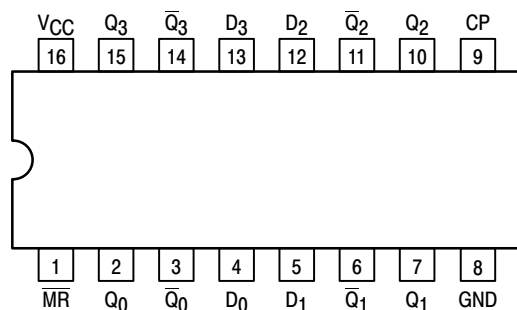


Figure 1. Pinout: 16-Lead Packages
(Top View)

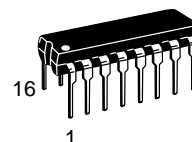
PIN ASSIGNMENT

PIN	FUNCTION
D ₀ – D ₃	Data Inputs
CP	Clock Pulse Input
\overline{MR}	Master Reset Input
Q ₀ – Q ₃	Outputs
\overline{Q}_0 – \overline{Q}_3	Outputs

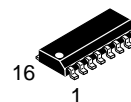


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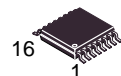
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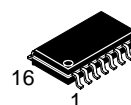
DIP-16
N SUFFIX
CASE 648



SO-16
D SUFFIX
CASE 751B



TSSOP-16
DT SUFFIX
CASE 948F



EIAJ-16
M SUFFIX
CASE 966

ORDERING INFORMATION

Device	Package	Shipping
MC74AC175N	PDIP-16	25 Units/Rail
MC74ACT175N	PDIP-16	25 Units/Rail
MC74AC175D	SOIC-16	48 Units/Rail
MC74ACT175D	SOIC-16	48 Units/Rail
MC74AC175DR2	SOIC-16	2500 Tape & Reel
MC74ACT175DR2	SOIC-16	2500 Tape & Reel
MC74AC175DT	TSSOP-16	96 Units/Rail
MC74ACT175DT	TSSOP-16	96 Units/Rail
MC74AC175DTR2	TSSOP-16	2500 Tape & Reel
MC74ACT175DTR2	TSSOP-16	2500 Tape & Reel
MC74AC175M	EIAJ-16	50 Units/Rail

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 176 of this data sheet.

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TRUTH TABLE

Inputs			Outputs	
MR	CP	D	Q _n	\overline{Q}_n
L	X	X	L	H
H	┐	H	H	L
H	┐	L	L	H
H	L	X	Q _n	\overline{Q}_n

NOTE: H = HIGH Voltage Level,
 L = LOW Voltage Level
 X = Immaterial
 ┐ = LOW-to-HIGH Transition of Clock

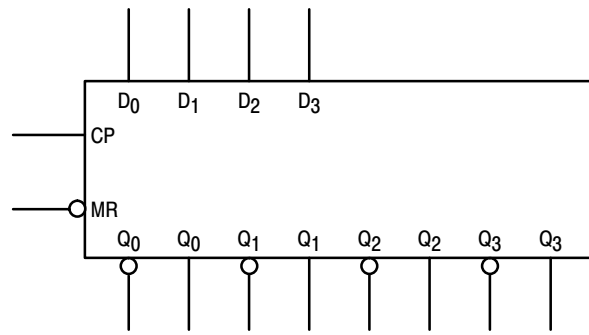
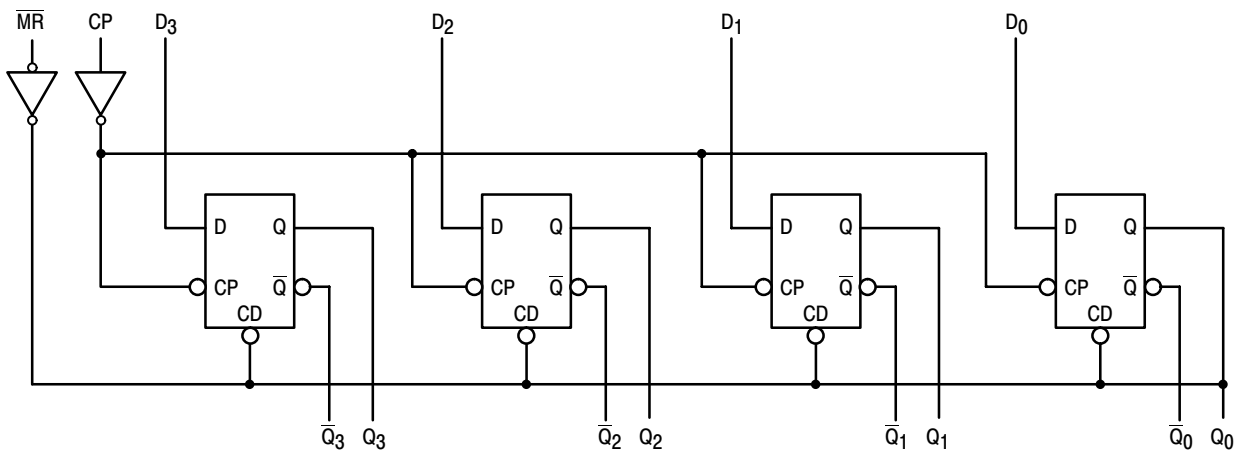


Figure 2. Logic Symbol



NOTE: This diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Figure 3. Logic Diagram

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V _{CC}	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
V _{IN}	DC Input Voltage (Referenced to GND)	-0.5 to V _{CC} + 0.5	V
V _{OUT}	DC Output Voltage (Referenced to GND)	-0.5 to V _{CC} + 0.5	V
I _{IN}	DC Input Current, per Pin	± 20	mA
I _{OUT}	DC Output Sink/Source Current, per Pin	± 50	mA
I _{CC}	DC V _{CC} or GND Current per Output Pin	± 50	mA
T _{stg}	Storage Temperature	-65 to +150	°C

*Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

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RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Min	Unit	
V _{CC}	Supply Voltage	'AC	2.0	5.0	6.0	V
		'ACT	4.5	5.0	5.5	
V _{in} , V _{out}	DC Input Voltage, Output Voltage (Ref. to GND)	0	–	V _{CC}	V	
t _r , t _f	Input Rise and Fall Time (Note 1) 'AC Devices except Schmitt Inputs	V _{CC} @ 3.0 V	–	150	–	ns/V
		V _{CC} @ 4.5 V	–	40	–	
		V _{CC} @ 5.5 V	–	25	–	
t _r , t _f	Input Rise and Fall Time (Note 2) 'ACT Devices except Schmitt Inputs	V _{CC} @ 4.5 V	–	10	–	ns/V
		V _{CC} @ 5.5 V	–	8.0	–	
T _J	Junction Temperature (PDIP)	–	–	140	°C	
T _A	Operating Ambient Temperature Range	–40	25	85	°C	
I _{OH}	Output Current – HIGH	–	–	–24	mA	
I _{OL}	Output Current – LOW	–	–	24	mA	

1. V_{IN} from 30% to 70% V_{CC}; see individual Data Sheets for devices that differ from the typical input rise and fall times.
2. V_{IN} from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

DC CHARACTERISTICS

Symbol	Parameter	V _{CC} (V)	74AC		74AC	Unit	Conditions
			T _A = +25°C		T _A = –40°C to +85°C		
			Typ	Guaranteed Limits			
V _{IH}	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1	V	V _{OUT} = 0.1 V or V _{CC} – 0.1 V
		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} = 0.1 V or V _{CC} – 0.1 V
		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 μA
		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} – 12 mA I _{OH} – 24 mA – 24 mA
		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 μA
		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} 12 mA I _{OH} 24 mA 24 mA
		4.5	–	0.36	0.44		
		5.5	–	0.36	0.44		
I _{IN}	Maximum Input Leakage Current	5.5	–	±0.1	±1.0	μA	V _I = V _{CC} , GND
I _{OLD}	†Minimum Dynamic Output Current	5.5	–	–	75	mA	V _{OLD} = 1.65 V Max
I _{OHD}		5.5	–	–	–75	mA	V _{OHD} = 3.85 V Min

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

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DC CHARACTERISTICS (continued)

Symbol	Parameter	V _{CC} (V)	74AC		74AC		Unit	Conditions
			T _A = +25°C		T _A = -40°C to +85°C			
			Typ	Guaranteed Limits				
I _{CC}	Maximum Quiescent Supply Current	5.5	–	8.0	80	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_{IN} and I_{CC} @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V_{CC}.

AC CHARACTERISTICS

Symbol	Parameter	V _{CC} * (V)	74AC			74AC		Unit	Fig. No.
			T _A = +25°C C _L = 50 pF			T _A = -40°C to +85°C C _L = 50 pF			
			Min	Typ	Max	Min	Max		
f _{max}	Maximum Clock Frequency	3.3 5.0	149 187	– –	– –	139 187	– –	MHz	3–3
t _{PLH}	Propagation Delay CP to Q _n or \bar{Q}_n	3.3 5.0	2.0 1.5	– –	12.0 9.0	2.0 1.0	13.5 9.5	ns	3–6
t _{PHL}	Propagation Delay CP to Q _n or \bar{Q}_n	3.3 5.0	2.5 1.5	– –	13.0 9.5	2.0 1.5	14.5 10.5	ns	3–6
t _{PLH}	Propagation Delay $\bar{M}\bar{R}$ to \bar{Q}_n	3.3 5.0	3.0 2.0	– –	12.5 9.0	2.5 1.5	13.5 10.0	ns	3–6
t _{PHL}	Propagation Delay $\bar{M}\bar{R}$ to Q _n	3.3 5.0	3.0 2.0	– –	11.0 8.5	2.5 1.5	12.5 9.0	ns	3–6

AC OPERATING REQUIREMENTS

Symbol	Parameter	V _{CC} * (V)	74AC		74AC		Unit	Fig. No.
			T _A = +25°C C _L = 50 pF		T _A = -40°C to +85°C C _L = 50 pF			
			Typ	Guaranteed Minimum				
t _s	Set-up Time, HIGH or LOW D _n to CP	3.3 5.0	– –	4.5 3.0	4.5 3.0	ns	3–9	
t _h	Hold Time, HIGH or LOW D _n to CP	3.3 5.0	– –	1.0 1.0	1.0 1.0	ns	3–9	
t _w	$\bar{M}\bar{R}$ Pulse Width Low	3.3 5.0	– –	4.5 3.5	4.5 3.5	ns	3–6	
t _w	CP Pulse Width	3.3 5.0	– –	4.5 3.5	5.0 3.5	ns	3–6	
t _{rec}	Recovery Time $\bar{M}\bar{R}$ to CP	3.3 5.0	– –	0 0	0 0	ns	3–6	

*Voltage Range 3.3 V is 3.3 V ±0.3 V.

*Voltage Range 5.0 V is 5.0 V ±0.5 V.

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DC CHARACTERISTICS

Symbol	Parameter	V _{CC} (V)	74ACT		74ACT		Unit	Conditions
			T _A = +25°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	V	V _{OUT} = 0.1 V or V _{CC} - 0.1 V	
		5.5	1.5	2.0	2.0			
V _{IL}	Maximum Low Level Input Voltage	4.5	1.5	0.8	0.8	V	V _{OUT} = 0.1 V or V _{CC} - 0.1 V	
		5.5	1.5	0.8	0.8			
V _{OH}	Minimum High Level Output Voltage	4.5	4.49	4.4	4.4	V	I _{OUT} = - 50 μA	
		5.5	5.49	5.4	5.4			
		4.5	-	3.86	3.76	V	*V _{IN} = V _{IL} or V _{IH} - 24 mA	
		5.5	-	4.86	4.76			- 24 mA
V _{OL}	Maximum Low Level Output Voltage	4.5	0.001	0.1	0.1	V	I _{OUT} = 50 μA	
		5.5	0.001	0.1	0.1			
		4.5	-	0.36	0.44	V	*V _{IN} = V _{IL} or V _{IH} 24 mA	
		5.5	-	0.36	0.44			24 mA
I _{IN}	Maximum Input Leakage Current	5.5	-	±0.1	±1.0	μA	V _I = V _{CC} , GND	
ΔI _{CCCT}	Additional Max. I _{CC} /Input	5.5	0.6	-	1.5	mA	V _I = V _{CC} - 2.1 V	
I _{OLD}	†Minimum Dynamic Output Current	5.5	-	-	75	mA	V _{OLD} = 1.65 V Max	
I _{OHD}		5.5	-	-	-75	mA	V _{OHD} = 3.85 V Min	
I _{CC}	Maximum Quiescent Supply Current	5.5	-	8.0	80	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.

AC CHARACTERISTICS

Symbol	Parameter	V _{CC} * (V)	74ACT			74ACT		Unit	Fig. No.
			T _A = +25°C C _L = 50 pF			T _A = -40°C to +85°C C _L = 50 pF			
			Min	Typ	Max	Min	Max		
f _{max}	Maximum Clock Frequency	5.0	175	-	-	145	-	MHz	3-3
t _{PLH}	Propagation Delay CP to Q _n	5.0	2.0	-	10.0	1.5	11.0	ns	3-6
t _{PHL}	Propagation Delay CP to Q _n	5.0	2.0	-	11.0	1.5	12.0	ns	3-6
t _{PHL}	Propagation Delay MR to Q _n or Q _n	5.0	2.0	-	9.5	1.5	10.5	ns	3-6

*Voltage Range 5.0 V is 5.0 V ±0.5 V.

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AC OPERATING REQUIREMENTS

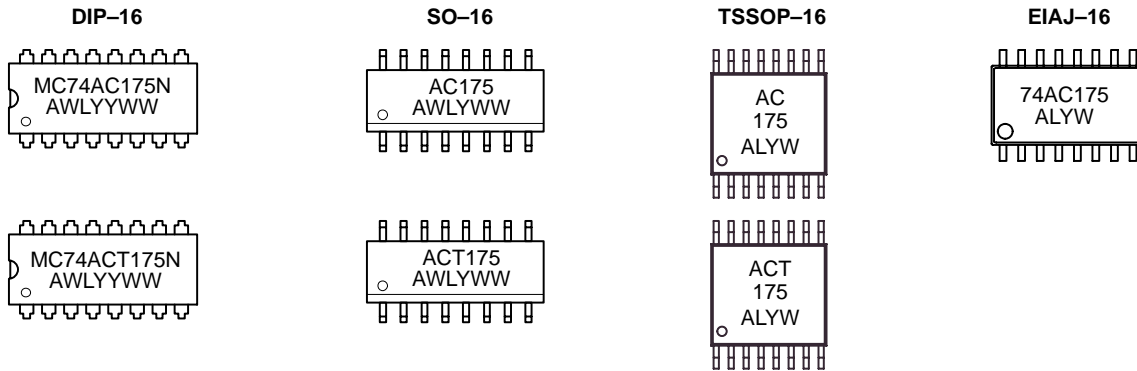
Symbol	Parameter	V _{CC} * (V)	74ACT		Unit	Fig. No.
			T _A = +25°C C _L = 50 pF			
			Typ	Guaranteed Minimum		
t _s	(H) Set-up Time, HIGH or LOW	5.0	–	2.0	ns	3–9
	(L) D _N to CP		–	2.5		
t _h	Hold Time, HIGH or LOW D _N to CP	5.0	–	1.0	ns	3–9
t _w	MR Pulse Width, LOW	5.0	–	3.0	ns	3–6
t _w	CP Pulse Width, HIGH or LOW	5.0	–	3.0	ns	3–6
t _{rec}	Recovery Time MR to CP	5.0	–	0	ns	3–6

*Voltage Range 5.0 V is 5.0 V ±0.5 V.

CAPACITANCE

Symbol	Parameter	Value Typ	Unit	Test Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = 5.0 V
C _{PD}	Power Dissipation Capacitance	45.0	pF	V _{CC} = 5.0 V

MARKING DIAGRAMS



A = Assembly Location
 WL, L = Wafer Lot
 YY, Y = Year
 WW, W = Work Week