MOTOROLA

MC74AC175
MC74ACT175

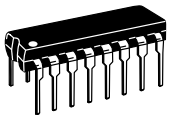
Quad D Flip-Flop With Master Reset

QUAD D FLIP-FLOP WITH MASTER RESET

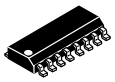
The MC74AC/ACT175 is a high-speed quad D flip-flop. The device is useful for general flip-flop requirements where clock and clear inputs are common. The information on the D inputs is transferred to storage during the LOW-to-HIGH clock transition. The device has a Master Reset to simultaneously clear all flip-flops, when MR is low.

The MC74AC/ACT175 consists of four edge-triggered D flip-flops with individual D inputs and Q 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 Q outputs LOW and 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

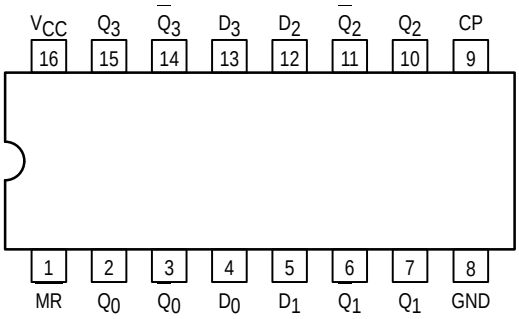


N SUFFIX
CASE 648-08
PLASTIC



D SUFFIX
CASE 751B-05
PLASTIC

Pinout: 16-Lead Packages (Top View)



PIN NAMES

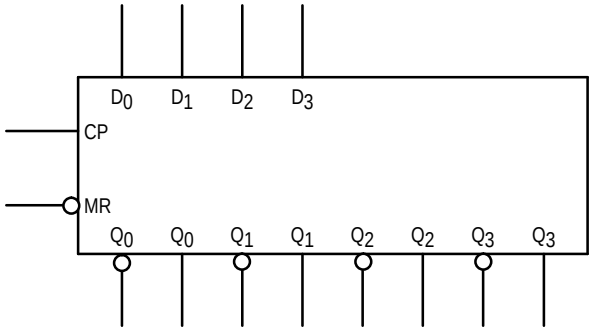
$D_0 – D_3$	Data Inputs
CP	Clock Pulse Input
MR	Master Reset Input
$Q_0 – Q_3$	Outputs
$Q_0 – Q_3$	Outputs

TRUTH TABLE

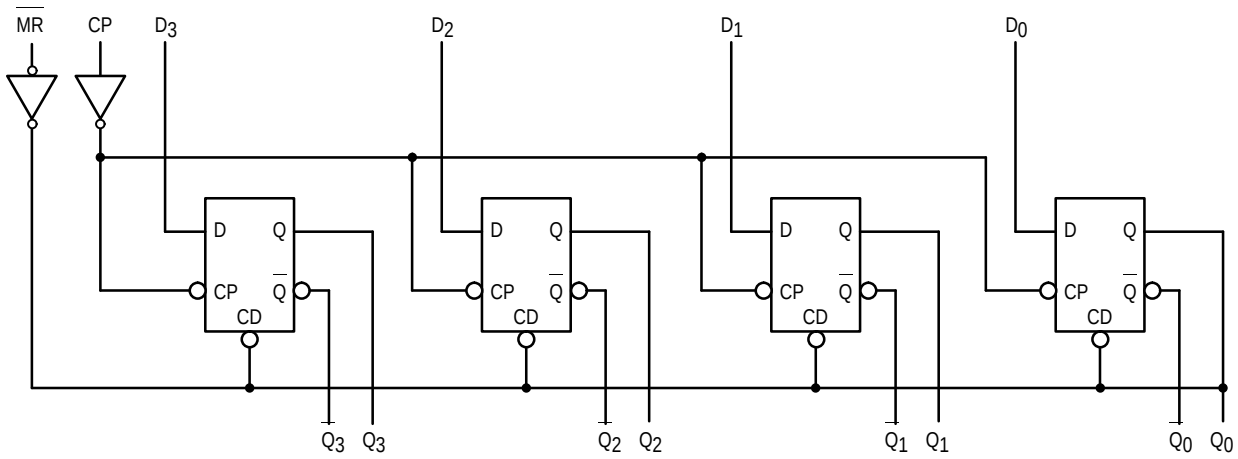
Inputs			Outputs	
MR	CP	D	Qn	Qn
L	X	X	L	H
H	⌡⌠	H	H	L
H	⌡⌠	L	L	H
H	L	X	Qn	Qn

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
⌡⌠ = LOW-to-HIGH Transition of Clock

LOGIC SYMBOL



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.

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.

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 T_A = +25°C	74AC T_A = –40°C to +85°C		Unit	Conditions
			Typ	Guaranteed Limits			
V_{IH}	Minimum High Level Input Voltage	3.0 4.5 5.5	1.5 2.25 2.75	2.1 3.15 3.85	2.1 3.15 3.85	V	V_{OUT} = 0.1 V or V_{CC} – 0.1 V
V_{IL}	Maximum Low Level Input Voltage	3.0 4.5 5.5	1.5 2.25 2.75	0.9 1.35 1.65	0.9 1.35 1.65	V	V_{OUT} = 0.1 V or V_{CC} – 0.1 V
V_{OH}	Minimum High Level Output Voltage	3.0 4.5 5.5	2.99 4.49 5.49	2.9 4.4 5.4	2.9 4.4 5.4	V	I_{OUT} = – 50 μA
		3.0 4.5 5.5		2.56 3.86 4.86	2.46 3.76 4.76	V	*V_{IN} = V_{IL} or V_{IH} – 12 mA I_{OH} – 24 mA – 24 mA
V_{OL}	Maximum Low Level Output Voltage	3.0 4.5 5.5	0.002 0.001 0.001	0.1 0.1 0.1	0.1 0.1 0.1	V	I_{OUT} = 50 μA
		3.0 4.5 5.5		0.36 0.36 0.36	0.44 0.44 0.44	V	*V_{IN} = V_{IL} or V_{IH} 12 mA I_{OH} 24 mA 24 mA
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
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 T_A = +25°C, C_L = 50 pF			74AC T_A = –40°C to +85°C, C_L = 50 pF		Unit	Fig. No.
			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 $\overline{Q}_n$	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 $\overline{Q}_n$	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 MR to 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 MR 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 T_A = +25°C, C_L = 50 pF		74AC T_A = –40°C to +85°C, C_L = 50 pF	Unit	Fig. No.
			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	MR 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 MR 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.

DC CHARACTERISTICS

Symbol	Parameter	V_{CC} (V)	74ACT T_A = +25°C		74ACT T_A = –40°C to +85°C	Unit	Conditions
			Typ	Guaranteed Limits			
V_{IH}	Minimum High Level Input Voltage	4.5 5.5	1.5 1.5	2.0 2.0	2.0 2.0	V	V_{OUT} = 0.1 V or V_{CC} – 0.1 V
V_{IL}	Maximum Low Level Input Voltage	4.5 5.5	1.5 1.5	0.8 0.8	0.8 0.8	V	V_{OUT} = 0.1 V or V_{CC} – 0.1 V
V_{OH}	Minimum High Level Output Voltage	4.5 5.5	4.49 5.49	4.4 5.4	4.4 5.4	V	I_{OUT} = – 50 μA
		4.5 5.5		3.86 4.86	3.76 4.76	V	*V_{IN} = V_{IL} or V_{IH} I_{OH} – 24 mA – 24 mA
V_{OL}	Maximum Low Level Output Voltage	4.5 5.5	0.001 0.001	0.1 0.1	0.1 0.1	V	I_{OUT} = 50 μA
		4.5 5.5		0.36 0.36	0.44 0.44	V	*V_{IN} = V_{IL} or V_{IH} I_{OH} 24 mA 24 mA
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	μA	V_I = V_{CC}, GND
ΔI_{CCT}	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 T_A = +25°C, C_L = 50 pF			74ACT T_A = –40°C to +85°C, C_L = 50 pF		Unit	Fig. No.
			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 $\overline{Q}_n$	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.

AC OPERATING REQUIREMENTS

Symbol	Parameter	V_{CC}* (V)	74ACT T_A = +25°C, C_L = 50 pF		74ACT T_A = –40°C to +85°C, C_L = 50 pF	Unit	Fig. No.
			Typ	Guaranteed Minimum			
t_s (H) (L)	Set-up Time, HIGH or LOW D_n to CP	5.0		2.0 2.5	2.0 2.5	ns	3-9
t_h	Hold Time, HIGH or LOW D_n to CP	5.0		1.0	1.0	ns	3-9
t_w	$\overline{MR}$ Pulse Width, LOW	5.0		3.0	4.0	ns	3-6
t_w	CP Pulse Width, HIGH or LOW	5.0		3.0	3.5	ns	3-6
t_{rec}	Recovery TIme $\overline{MR}$ to CP	5.0		0	0	ns	3-6

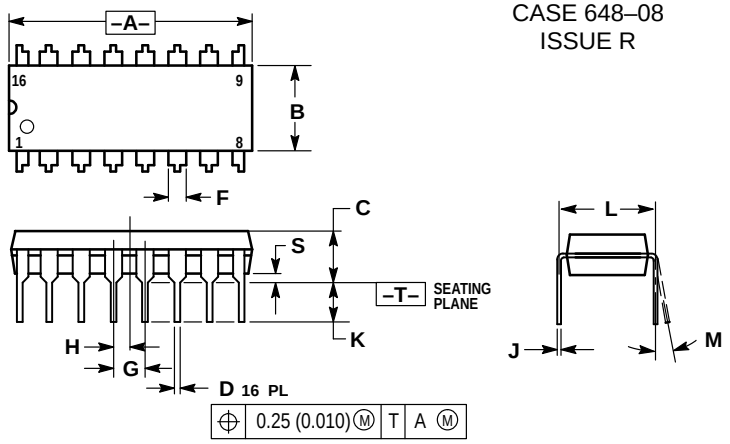
* Voltage Range 5.0 V is 5.0 V ±0.5 V.

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

OUTLINE DIMENSIONS

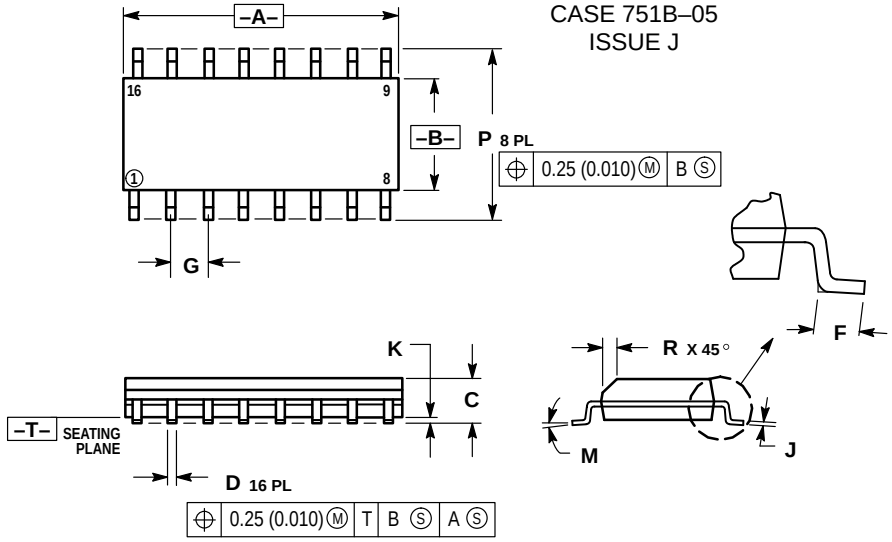
N SUFFIX
PLASTIC DIP PACKAGE
CASE 648–08
ISSUE R



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0 °	10 °	0 °	10 °
S	0.020	0.040	0.51	1.01

D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751B–05
ISSUE J



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0 °	7 °	0 °	7 °
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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