MOTOROLA

MC74AC175
MC74ACT175

QUAD D FLIP-FLOP
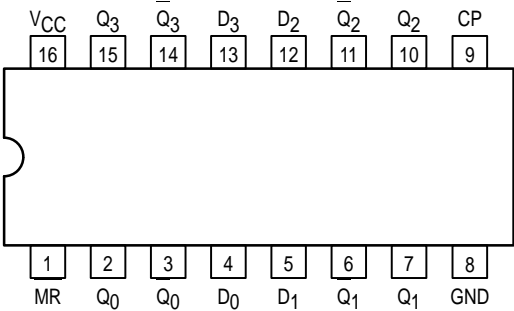WITH MASTER RESET

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
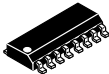
D SUFFIX
CASE 751B-05
PLASTIC

Pinout: 16-Lead Packages (Top View)

16	15	14	13	12	11	10	9
V_{CC}	Q_3	$\overline{Q_3}$	D_3	D_2	$\overline{Q_2}$	Q_2	CP

1	2	3	4	5	6	7	8
MR	Q_0	$\overline{Q_0}$	D_0	D_1	$\overline{Q_1}$	Q_1	GND

PIN NAMES

$D_0 - D_3$	Data Inputs
CP	Clock Pulse Input
MR	Master Reset Input
$\overline{Q_0} - \overline{Q_3}$	Outputs
$Q_0 - Q_3$	Outputs

TRUTH TABLE

Inputs			Outputs	
$\overline{MR}$	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	$\overline{Q_n}$

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

LOGIC SYMBOL

D_0 D_1 D_2 D_3
CP
MR
Q_0 $\overline{Q_0}$ Q_1 $\overline{Q_1}$ Q_2 $\overline{Q_2}$ Q_3 $\overline{Q_3}$
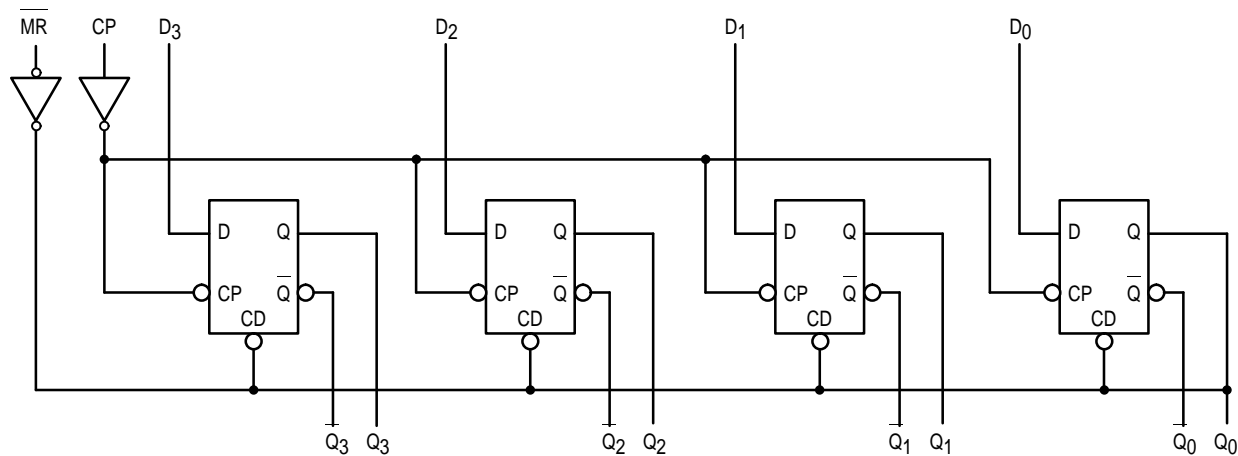
FACT DATA

MC74AC175 MC74ACT175

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 Typ	74AC T$_A$ = +25°C Guaranteed Limits	74AC T$_A$ = −40°C to +85°C Guaranteed Limits	Unit	Conditions
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$_{IH}$ I$_{OH}$ − 12 mA − 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$_{IH}$ I$_{OH}$ 12 mA 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 Min	74AC Typ	74AC Max	74AC T$_A$ = −40°C to +85°C C$_L$ = 50 pF Min	74AC Max	Unit	Fig. No.
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 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 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

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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	$\overline{MR}$ 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 $\overline{MR}$ 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.

FACT DATA

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	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 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

FACT DATA

MC74AC175 MC74ACT175

OUTLINE DIMENSIONS

N SUFFIX
PLASTIC DIP PACKAGE
CASE 648–08
ISSUE R
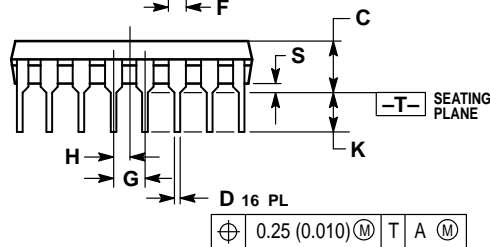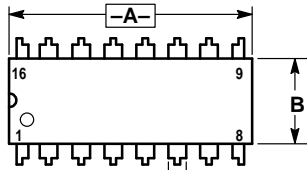
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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

⊕ | 0.25 (0.010) Ⓜ | T | A Ⓜ

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

⊕ | 0.25 (0.010) Ⓜ | B Ⓢ
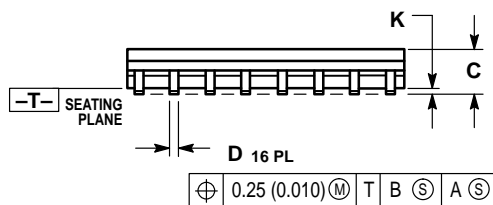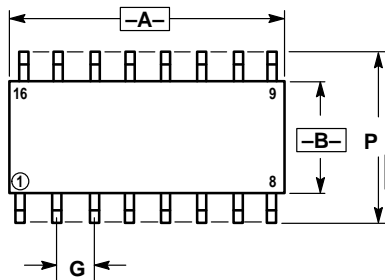
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES 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

⊕ | 0.25 (0.010) Ⓜ | T | B Ⓢ | A Ⓢ