



MOTOROLA

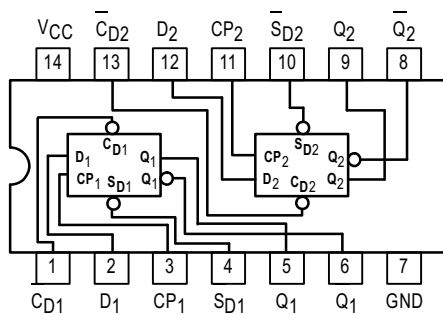
Dual D-Type Positive Edge-Triggered Flip-Flop

The MC74AC74/74ACT74 is a dual D-type flip-flop with Asynchronous Clear and Set inputs and complementary (Q,Q) outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. After the Clock Pulse input threshold voltage has been passed, the Data input is locked out and information present will not be transferred to the outputs until the next rising edge of the Clock Pulse input.

Asynchronous Inputs:

- LOW input to \overline{S}_D (Set) sets Q to HIGH level
- LOW input to \overline{C}_D (Clear) sets Q to LOW level
- Clear and Set are independent of clock
- Simultaneous LOW on \overline{C}_D and \overline{S}_D makes both Q and \overline{Q} HIGH

- Outputs Source/Sink 24 mA
- 'ACT74 Has TTL Compatible Inputs



PIN NAMES

- D₁, D₂ Data Inputs
- CP₁, CP₂ Clock Pulse Inputs
- \overline{C}_D ₁, \overline{C}_D ₂ Direct Clear Inputs
- \overline{S}_D ₁, \overline{S}_D ₂ Direct Set Inputs
- Q₁, Q₁, Q₂, Q₂ Outputs

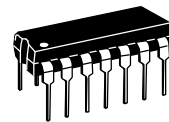
TRUTH TABLE (Each Half)

Inputs				Outputs	
\overline{S}_D	\overline{C}_D	CP	D	Q	\overline{Q}
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H	H
H	H	┐	H	H	L
H	H	┐	L	L	H
H	H	L	X	Q ₀	\overline{Q}_0

- H = HIGH Voltage Level
- L = LOW Voltage Level
- X = Immaterial
- ┐ = LOW-to-HIGH Clock Transition
- Q₀(Q₀) = Previous Q(Q) before LOW-to-HIGH Transition of Clock

MC74AC74
MC74ACT74

DUAL D-TYPE POSITIVE
EDGE-TRIGGERED
FLIP-FLOP

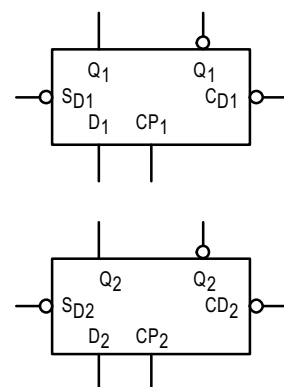


N SUFFIX
CASE 646-06
PLASTIC



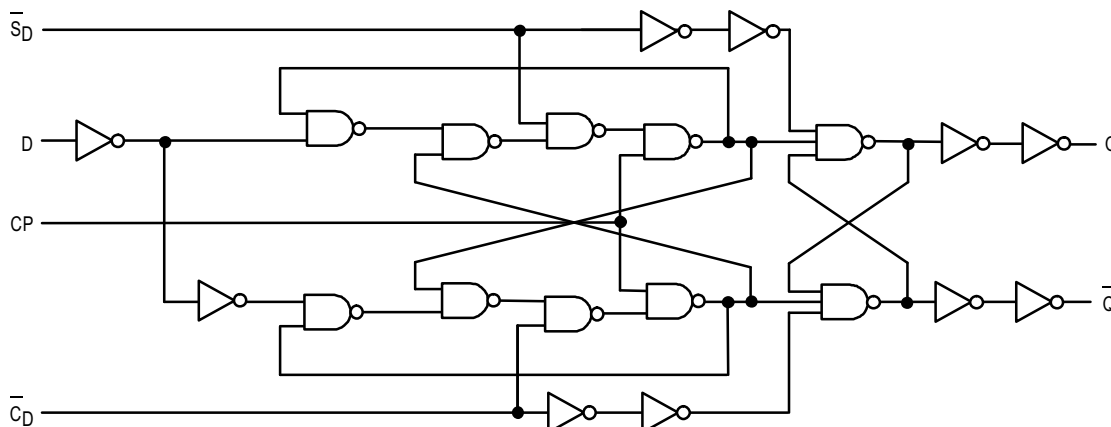
D SUFFIX
CASE 751A-03
PLASTIC

LOGIC SYMBOL



MC74AC74 MC74ACT74

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	$^{\circ}C$

* 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	Max	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	$^{\circ}C$	
T_A	Operating Ambient Temperature Range	-40	25	85	$^{\circ}C$	
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.

MC74AC74 MC74ACT74

DC CHARACTERISTICS

Symbol	Parameter	V _{CC} (V)	74AC		74ACT		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 _{OL} 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	
I _{CC}	Maximum Quiescent Supply Current	5.5		4.0	40		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 (For Figures and Waveforms — See Section 3)

Symbol	Parameter	V _{CC} * (V)	74AC			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	3.3 5.0	100 140	125 160		95 125		MHz	3-3
t _{PLH}	Propagation Delay — C _{DN} or S _{DN} to Q _N or Q _N	3.3 5.0	5.0 3.5	8.0 6.0	12.5 9.0	4.0 3.0	13.0 10.0	ns	3-6
t _{PHL}	Propagation Delay — C _{DN} or S _{DN} to Q _N or Q _N	3.3 5.0	4.0 3.0	10.5 8.0	12.0 9.5	3.5 2.5	13.5 10.5	ns	3-6
t _{PLH}	Propagation Delay C _{PN} to Q _N or Q _N	3.3 5.0	4.5 3.5	8.0 6.0	13.5 10.0	4.0 3.0	16.0 10.5	ns	3-6
t _{PHL}	Propagation Delay C _{PN} to Q _N or Q _N	3.3 5.0	3.5 2.5	8.0 6.0	14.0 10.0	3.5 2.5	14.5 10.5	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.

MC74AC74 MC74ACT74

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 _n	3.3 5.0	1.5	4.0	4.5	ns	3-9	
			1.0	3.0	3.0			
t _h	Hold Time, HIGH or LOW D _n to CP _n	3.3 5.0	-2.0	0.5	0.5	ns	3-9	
			-1.5	0.5	0.5			
t _w	CP _n or CD _n or SD _n Pulse Width	3.3 5.0	3.0	5.5	7.0	ns	3-6	
			2.5	4.5	5.0			
t _{rec}	Recovery Time CD _n or SD _n to CP	3.3 5.0	-2.5	0	0	ns	3-9	
			-2.0	0	0			

* 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		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 5.5	1.5	2.0	2.0	V	V _{OUT} = 0.1 V or V _{CC} - 0.1 V	
			1.5	2.0	2.0			
V _{IL}	Maximum Low Level Input Voltage	4.5 5.5	1.5	0.8	0.8	V	V _{OUT} = 0.1 V or V _{CC} - 0.1 V	
			1.5	0.8	0.8			
V _{OH}	Minimum High Level Output Voltage	4.5 5.5	4.49	4.4	4.4	V	I _{OUT} = -50 μA	
			5.49	5.4	5.4			
		4.5 5.5		3.86	3.76	V	*V _{IN} = V _{IL} or V _{IH} -24 mA I _{OH} -24 mA	
				4.86	4.76			
V _{OL}	Maximum Low Level Output Voltage	4.5 5.5	0.001	0.1	0.1	V	I _{OUT} = 50 μA	
			0.001	0.1	0.1			
		4.5 5.5		0.36	0.44	V	*V _{IN} = V _{IL} or V _{IH} 24 mA I _{OL} 24 mA	
				0.36	0.44			
I _{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	μA	V _I = V _{CC} , GND	
ΔI _{CC} T	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		4.0	40	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.

MC74AC74 MC74ACT74

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

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	145	210		125		MHz	3-3
t _{PLH}	Propagation Delay — C _{Dn} or S _{Dn} to Q _n or Q _n	5.0	3.0	5.5	9.5	2.5	10.5	ns	3-6
t _{PHL}	Propagation Delay — C _{Dn} or S _{Dn} to Q _n or Q _n	5.0	3.0	6.0	10.0	3.0	11.5	ns	3-6
t _{PLH}	Propagation Delay C _{Pn} to Q _n or Q _n	5.0	4.0	7.5	11.0	4.0	13.0	ns	3-6
t _{PHL}	Propagation Delay C _{Pn} to Q _n or Q _n	5.0	3.5	6.0	10.0	3.0	11.5	ns	3-6

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

AC OPERATING REQUIREMENTS

Symbol	Parameter	V _{CC} * (V)	74ACT		74ACT		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 _n	5.0	1.0	3.0	3.5	ns	3-9	
t _h	Hold Time, HIGH or LOW D _n to CP _n	5.0	-0.5	1.0	1.0	ns	3-9	
t _w	CP _n or C _{Dn} or S _{Dn} Pulse Width	5.0	3.0	5.0	6.0	ns	3-6	
t _{rec}	Recovery Time C _{Dn} or S _{Dn} to CP	5.0	-2.5	0	0	ns	3-9	

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

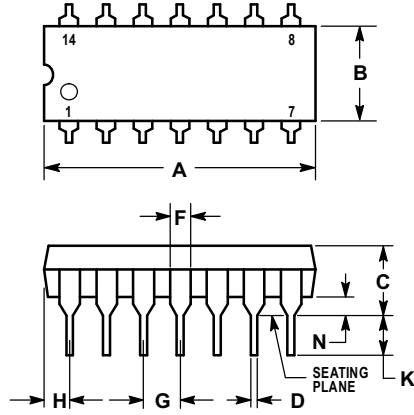
CAPACITANCE

Symbol	Parameter	Value Typ	Unit	Test Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = 5.0 V
C _{PD}	Power Dissipation Capacitance	35	pF	V _{CC} = 5.0 V

MC74AC74 MC74ACT74

OUTLINE DIMENSIONS

N SUFFIX PLASTIC DIP PACKAGE CASE 646-06 ISSUE L

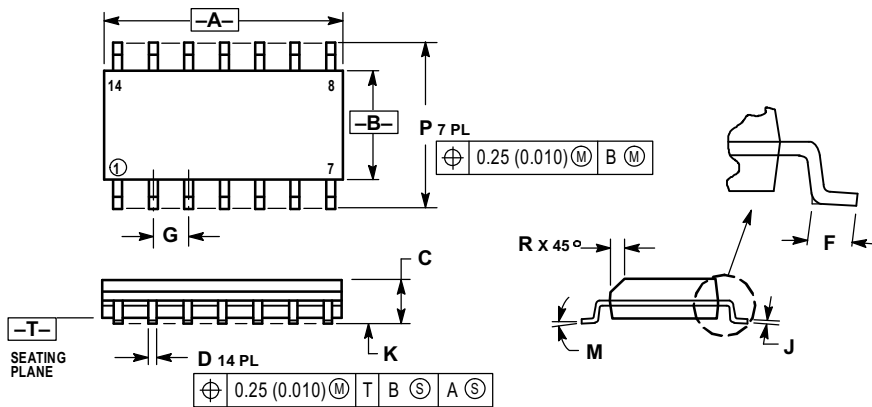


NOTES:

- LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
- DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
- DIMENSION B DOES NOT INCLUDE MOLD FLASH.
- ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	19.56
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.300 BSC		7.62 BSC	
M	0°	10°	0°	10°
N	0.015	0.039	0.39	1.01


D SUFFIX PLASTIC SOIC PACKAGE CASE 751A-03 ISSUE F



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
- MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
- 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		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
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	0.228	0.244
R	0.25	0.50	0.010	0.019

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MC74AC74/D

