



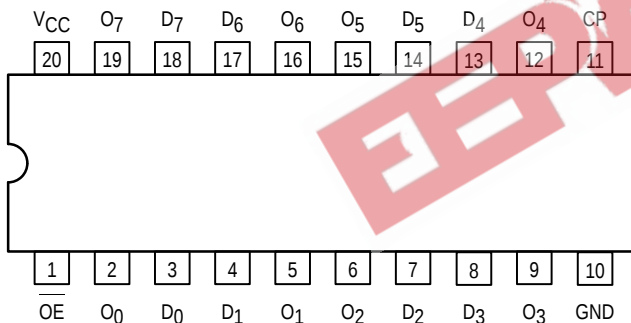
MOTOROLA

MC74AC374 MC74ACT374

Octal D-Type Flip-Flop with 3-State Outputs

The MC74AC374/74ACT374 is a high-speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and 3-state outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable (OE) are common to all flip-flops.

- Buffered Positive Edge-Triggered Clock
- 3-State Outputs for Bus-Oriented Applications
- Outputs Source/Sink 24 mA
- See MC74AC273 for Reset Version
- See MC74AC377 for Clock Enable Version
- See MC74AC373 for Transparent Latch Version
- See MC74AC574 for Broadside Pinout Version
- See MC74AC564 for Broadside Pinout Version with Inverted Outputs
- 'ACT374 Has TTL Compatible Inputs



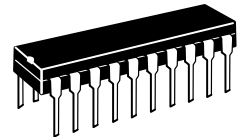
PIN NAMES

D₀–D₇ Data Inputs
CP Clock Pulse Input
OE 3-State Output Enable Input
O₀–O₇ 3-State Outputs

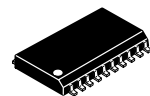
TRUTH TABLE

Inputs			Outputs
D _n	CP	OE	O _n
H	⌋	L	H
L	⌋	L	L
X	X	H	Z

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance
⌋ = LOW-to-HIGH Transition

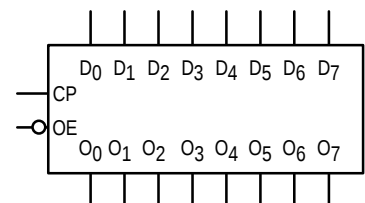


N SUFFIX
CASE 738-03
PLASTIC



DW SUFFIX
CASE 751D-04
PLASTIC

LOGIC SYMBOL



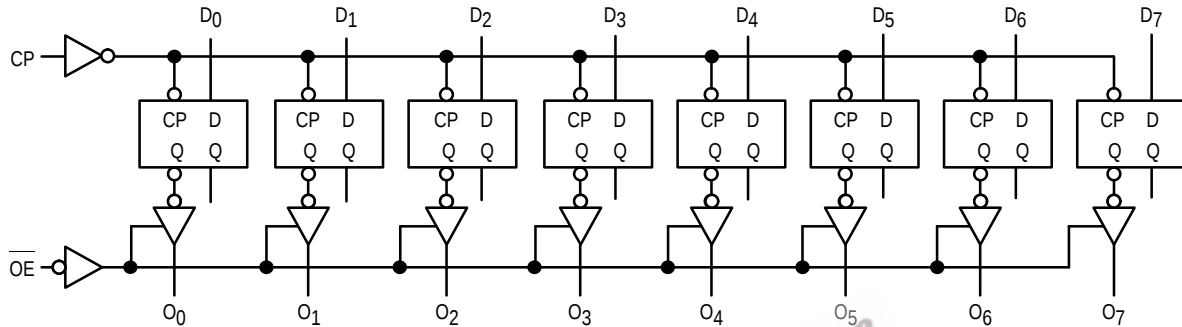
MC74AC374 MC74ACT374

FUNCTIONAL DESCRIPTION

The MC74AC374/74ACT374 consists of eight edge-triggered flip-flops with individual D-type inputs and 3-state true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold

time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable (OE) LOW, the contents of the eight flip-flops are available at the outputs. When the OE is HIGH, the outputs go to the high impedance state. Operation of the OE input does not affect the state of the flip-flops.

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	$^{\circ}\text{C}$

* 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	V
		'ACT	4.5	5.0	
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	$V_{CC} @ 3.0 \text{ V}$	150		ns/V
		$V_{CC} @ 4.5 \text{ V}$	40		
		$V_{CC} @ 5.5 \text{ V}$	25		
t_r, t_f	Input Rise and Fall Time (Note 2) 'ACT Devices except Schmitt Inputs	$V_{CC} @ 4.5 \text{ V}$	10		ns/V
		$V_{CC} @ 5.5 \text{ V}$	8.0		
T_J	Junction Temperature (PDIP)			140	$^{\circ}\text{C}$
T_A	Operating Ambient Temperature Range	-40	25	85	$^{\circ}\text{C}$
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.

FACT DATA

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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 _{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 _{OZ}	Maximum 3-State Current	5.5		±0.5	±5.0	μA	V _I (OE) = V _{IL} , V _{IH} V _I = V _{CC} , GND V _O = 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}.

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

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	60 100	110 155		60 100		MHz	3-3
t _{PLH}	Propagation Delay CP to O _n	3.3 5.0	3.0 2.5	11 8.0	13.5 9.5	1.5 1.5	15.5 10.5	ns	3-6
t _{PHL}	Propagation Delay CP to O _n	3.3 5.0	2.5 2.0	10 7.0	12.5 9.0	2.0 1.5	14 10	ns	3-6
t _{PZH}	Output Enable Time	3.3 5.0	3.0 2.0	9.5 7.0	11.5 8.5	1.5 1.0	13 9.5	ns	3-7
t _{PZL}	Output Enable Time	3.3 5.0	2.5 2.0	9.0 6.5	11.5 8.5	1.5 1.0	13 9.5	ns	3-8
t _{PHZ}	Output Disable Time	3.3 5.0	3.0 2.0	10.5 8.0	12.5 11	2.0 2.0	14.5 12.5	ns	3-7
t _{PLZ}	Output Disable Time	3.3 5.0	2.0 1.5	8.0 6.5	11.5 8.5	1.0 1.0	12.5 10	ns	3-8

* Voltage Range 3.3 V is 3.3 V ±0.3 V.
Voltage Range 5.0 V is 5.0 V ±0.5 V.

AC OPERATING REQUIREMENTS

Symbol	Parameter	VCC* (V)	74AC		74AC	Unit	Fig. No.
			TA = +25°C CL = 50 pF		TA = -40°C to +85°C CL = 50 pF		
			Typ	Guaranteed Minimum			
ts	Setup Time, HIGH or LOW Dn to CP	3.3	2.0	5.5	6.0	ns	3-9
		5.0	1.0	4.0	4.5		
th	Hold Time, HIGH or LOW Dn to CP	3.3	-1.0	1.0	1.0	ns	3-9
		5.0	0	1.5	1.5		
tw	CP Pulse Width HIGH or LOW	3.3	4.0	5.5	6.0	ns	3-6
		5.0	2.5	4.0	4.5		

* 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 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} –24 mA I _{OH} –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} 24 mA I _{OL} 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 _{OZ}	Maximum 3-State Current	5.5		±0.5	±5.0	μA	V _I (OE) = V _{IL} , V _{IH} V _I = V _{CC} , GND V _O = 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.

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	100	160		90		MHz	3-3
t _{PLH}	Propagation Delay CP to O _N	5.0	2.0	8.5	10	2.0	11.5	ns	3-6
t _{PHL}	Propagation Delay CP to O _N	5.0	2.0	8.0	9.5	1.5	11	ns	3-6
t _{PZH}	Output Enable Time	5.0	2.0	8.0	9.5	1.5	10.5	ns	3-7
t _{PZL}	Output Enable Time	5.0	1.5	8.0	9.0	1.5	10.5	ns	3-8
t _{PHZ}	Output Disable Time	5.0	1.5	8.5	11.5	1.0	12.5	ns	3-7
t _{PLZ}	Output Disable Time	5.0	1.5	7.0	8.5	1.0	10	ns	3-8

* 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		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	Setup Time, HIGH or LOW D _n to CP	5.0	1.0	5.0	5.5	ns	3-9
t _h	Hold Time, HIGH or LOW D _n to CP	5.0	0	1.5	1.5	ns	3-9
t _w	CP Pulse Width HIGH or LOW	5.0	2.5	5.0	5.0	ns	3-6

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

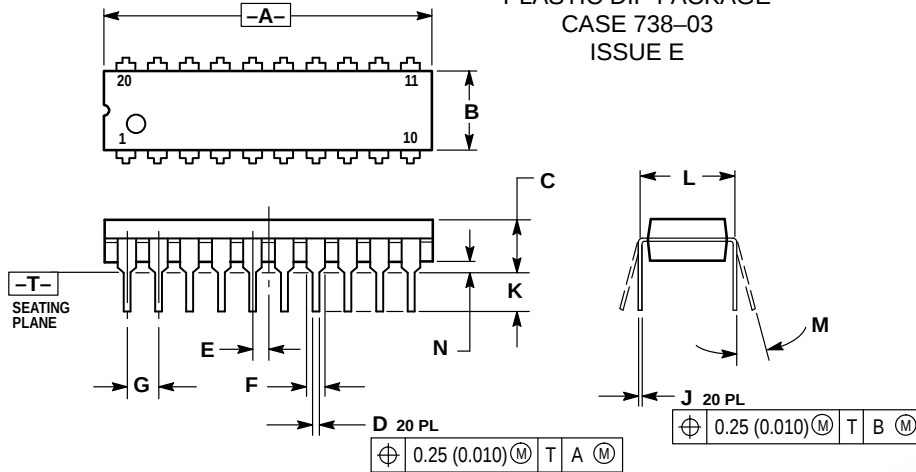
CAPACITANCE

Symbol	Parameter	Value Typ	Unit	Test Conditions
C _{IN}	Input Capacitance	4.5	pF	V _{CC} = 5.0 V
C _{PD}	Power Dissipation Capacitance	80	pF	V _{CC} = 5.0 V

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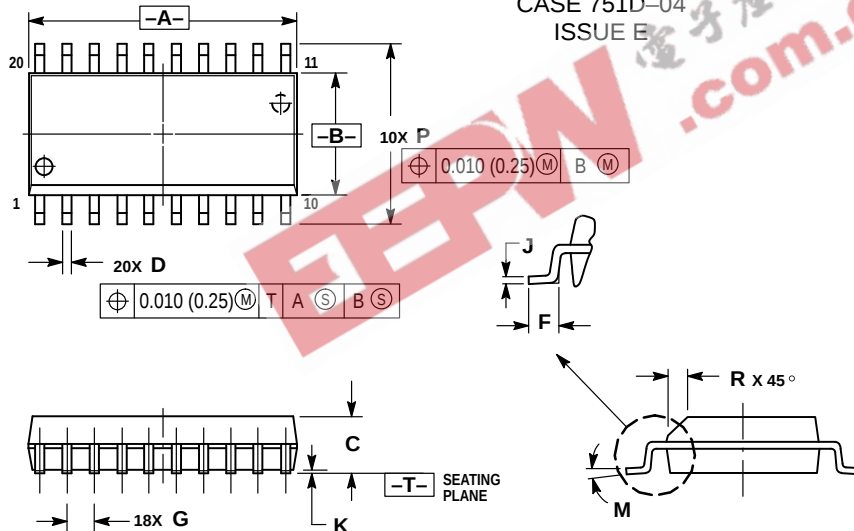
OUTLINE DIMENSIONS

N SUFFIX PLASTIC DIP PACKAGE CASE 738-03 ISSUE E



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

DW SUFFIX PLASTIC SOIC PACKAGE CASE 751D-04 ISSUE E



- 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 0.150 (0.006) PER SIDE.
 5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

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MC74AC374/D

