MC74HCT374A

Octal 3-State Noninverting D Flip-Flop with LSTTL-Compatible Inputs

High−Performance Silicon−Gate CMOS

The MC74HCT374A may be used as a level converter for interfacing TTL or NMOS outputs to High−Speed CMOS inputs.
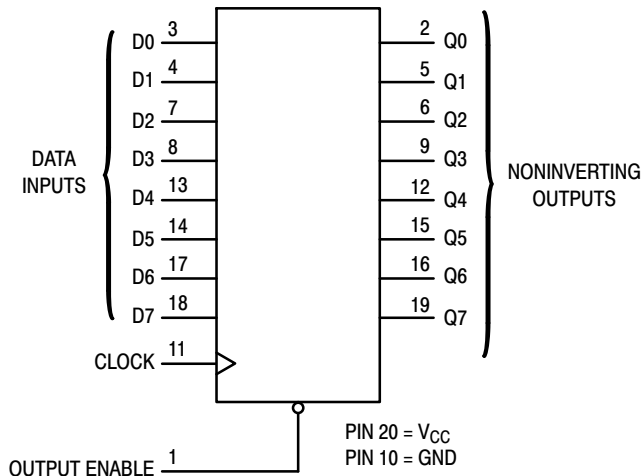
The HCT374A is identical in pinout to the LS374.

Data meeting the setup and hold time is clocked to the outputs with the rising edge of Clock. The Output Enable does not affect the state of the flip−flops, but when Output Enable is high, the outputs are forced to the high−impedance state. Thus, data may be stored even when the outputs are not enabled.

The HCT374A is identical in function to the HCT574A, which has the input pins on the opposite side of the package from the output pins. This device is similar in function to the HCT534A, which has inverting outputs.
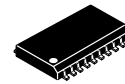
Features

- Output Drive Capability: 15 LSTTL Loads
- TTL/NMOS−Compatible Input Levels
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 4.5 to 5.5 V
- Low Input Current: 1.0 μA
- In Compliance With the JEDEC Standard No. 7.0 A Requirements
- Chip Complexity: 276 FETs or 69 Equivalent Gates
- Improvements over HCT374
  - Improved Propagation Delays
  - 50% Lower Quiescent Power
  - Improved Input Noise and Latchup Immunity
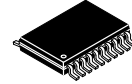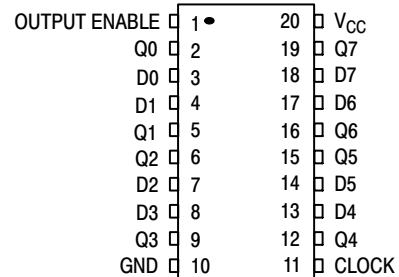- These Devices are Pb−Free and are RoHS Compliant

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SOIC−20
DW SUFFIX
CASE 751D

TSSOP−20
DT SUFFIX
CASE 948E

PIN ASSIGNMENT

OUTPUT ENABLE	1	20	V_{CC}
Q0	2	19	Q7
D0	3	18	D7
D1	4	17	D6
Q1	5	16	Q6
Q2	6	15	Q5
D2	7	14	D5
D3	8	13	D4
Q3	9	12	Q4
GND	10	11	CLOCK

MARKING DIAGRAMS

SOIC−20

HCT374A
AWLYYWWG

TSSOP−20

HCT
374A
ALYW■
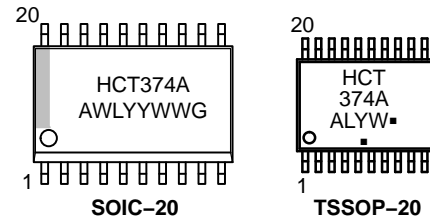
A	=	Assembly Location
WL, L	=	Wafer Lot
YY, Y	=	Year
WW, W	=	Work Week
G or ■	=	Pb−Free Package

(Note: Microdot may be in either location)

LOGIC DIAGRAM

DATA INPUTS: D0 (3), D1 (4), D2 (7), D3 (8), D4 (13), D5 (14), D6 (17), D7 (18)

NONINVERTING OUTPUTS: Q0 (2), Q1 (5), Q2 (6), Q3 (9), Q4 (12), Q5 (15), Q6 (16), Q7 (19)

CLOCK (11)

OUTPUT ENABLE (1)

PIN 20 = V_{CC}
PIN 10 = GND

FUNCTION TABLE

Inputs			Output
Output Enable	Clock	D	Q
L	⌐ (rising)	H	H
L	⌐ (rising)	L	L
L	L,H,⌐ (falling)	X	No Change
H	X	X	Z

X = don't care
Z = high impedance

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

MC74HCT374A

Design Criteria	Value	Units
Internal Gate Count*	69	ea.
Internal Gate Propagation Delay	1.5	ns
Internal Gate Power Dissipation	5.0	μW
Speed Power Product	.0075	pJ

*Equivalent to a two−input NAND gate.

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 Current, per Pin	±35	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	±75	mA
P_D	Power Dissipation in Still Air, SOIC Package† TSSOP Package†	500 450	mW
T_{stg}	Storage Temperature	−65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds (SOIC or TSSOP Package)	260	°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high−impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range GND $\leq$ (V_{in} or V_{out}) $\leq V_{CC}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

†Derating: SOIC Package: −7 mW/°C from 65° to 125°C
            TSSOP Package: −6.1 mW/°C from 65° to 125°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	4.5	5.5	V
V_{in}, V_{out}	DC Input Voltage, Output Voltage (Referenced to GND)	0	V_{CC}	V
T_A	Operating Temperature, All Package Types	−55	+125	°C
t_r, t_f	Input Rise and Fall Time (Figure 1)	0	500	ns

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

MC74HCT374A

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V$_{CC}$ V	Guaranteed Limit			Unit
				−55 to 25°C	≤ 85°C	≤ 125°C	
V$_{IH}$	Minimum High−Level Input Voltage	V$_{out}$ = 0.1 V or V$_{CC}$ − 0.1 V |I$_{out}$| ≤ 20 µA	4.5 5.5	2.0 2.0	2.0 2.0	2.0 2.0	V
V$_{IL}$	Maximum Low−Level Input Voltage	V$_{out}$ = 0.1 V or V$_{CC}$ − 0.1 V |I$_{out}$| ≤ 20 µA	4.5 5.5	0.8 0.8	0.8 0.8	0.8 0.8	V
V$_{OH}$	Minimum High−Level Output Voltage	V$_{in}$ = V$_{IH}$ or V$_{IL}$ |I$_{out}$| ≤ 20 µA	4.5 5.5	4.4 5.4	4.4 5.4	4.4 5.4	V
		V$_{in}$ = V$_{IH}$ or V$_{IL}$ |I$_{out}$| ≤ 6.0 mA	4.5	3.98	3.84	3.7	
V$_{OL}$	Maximum Low−Level Output Voltage	V$_{in}$ = V$_{IH}$ or V$_{IL}$ |I$_{out}$| ≤ 20 µA	4.5 5.5	0.1 0.1	0.1 0.1	0.1 0.1	V
		V$_{in}$ = V$_{IH}$ or V$_{IL}$ |I$_{out}$| ≤ 6.0 mA	4.5	0.26	0.33	0.4	
I$_{in}$	Maximum Input Leakage Current	V$_{in}$ = V$_{CC}$ or GND	5.5	±0.1	±1.0	±1.0	µA
I$_{OZ}$	Maximum Three−State Leakage Current	Output in High−Impedance State V$_{in}$ = V$_{IL}$ or V$_{IH}$ V$_{out}$ = V$_{CC}$ or GND	5.5	±0.5	±5.0	±10	µA
I$_{CC}$	Maximum Quiescent Supply Current (per Package)	V$_{in}$ = V$_{CC}$ or GND I$_{out}$ = 0 µA	5.5	4.0	40	160	µA

Symbol	Parameter	Test Conditions		≥ −55°C		25°C to 125°C	
ΔI$_{CC}$	Additional Quiescent Supply Current	V$_{in}$ = 2.4 V, Any One Input V$_{in}$ = V$_{CC}$ or GND, Other Inputs I$_{out}$ = 0 µA	5.5	2.9		2.4	mA

1. Total Supply Current = I$_{CC}$ + ΣΔI$_{CC}$.

AC ELECTRICAL CHARACTERISTICS (V$_{CC}$ = 5.0 V ±10%, C$_L$ = 50 pF, Input t$_r$ = t$_f$ = 6.0 ns)

Symbol	Parameter	Guaranteed Limit			Unit
		−55 to 25°C	≤ 85°C	≤ 125°C	
f$_{max}$	Maximum Clock Frequency (50% Duty Cycle) (Figures 1 and 4)	30	24	20	MHz
t$_{PLH}$, t$_{PHL}$	Maximum Propagation Delay, Clock to Q (Figures 1 and 4)	31	39	47	ns
t$_{PLZ}$, t$_{PHZ}$	Maximum Propagation Delay, Output Enable to Q (Figures 2 and 5)	30	38	45	ns
t$_{PZL}$, t$_{PZH}$	Maximum Propagation Delay, Output Enable to Q (Figures 2 and 5)	30	38	45	ns
t$_{TLH}$, t$_{THL}$	Maximum Output Transition Time, Any Output (Figures 1 and 4)	12	15	18	ns
C$_{in}$	Maximum Input Capacitance	10	10	10	pF
C$_{out}$	Maximum Three−State Output Capacitance (Output in High−Impedance State)	15	15	15	pF

		Typical @ 25°C, V$_{CC}$ = 5.0 V	
C$_{PD}$	Power Dissipation Capacitance (Per Flip−Flop)*	65	pF

* Used to determine the no−load dynamic power consumption: P$_D$ = C$_{PD}$ V$_{CC}$^{2}f + I$_{CC}$ V$_{CC}$.

MC74HCT374A

TIMING REQUIREMENTS (V_{CC} = 5.0 V ± 10%, Input t_r = t_f = 6.0 ns)

Symbol	Parameter	Guaranteed Limit			Unit
		−55 to 25°C	≤ 85°C	≤ 125°C	
t_{su}	Minimum Setup Time, Data to Clock (Figure 3)	12	15	18	ns
t_h	Minimum Hold Time, Clock to Data (Figure 3)	5.0	5.0	5.0	ns
t_w	Minimum Pulse Width, Clock (Figure 1)	12	15	18	ns
t_r, t_f	Maximum Input Rise and Fall Times (Figure 1)	500	500	500	ns

SWITCHING WAVEFORMS
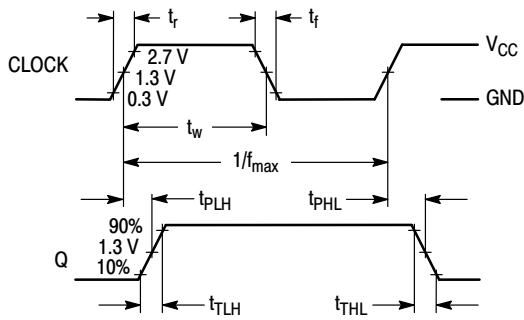
Figure 1.
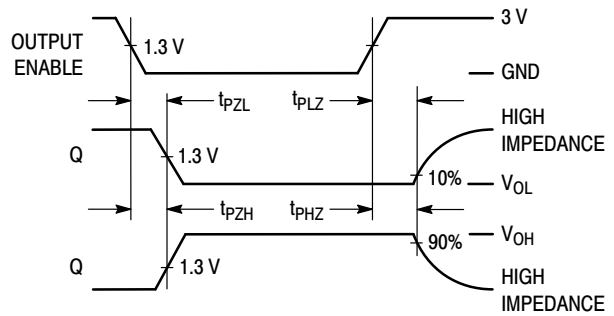
Figure 2.
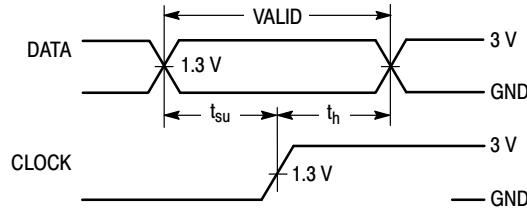
Figure 3.

TEST CIRCUITS
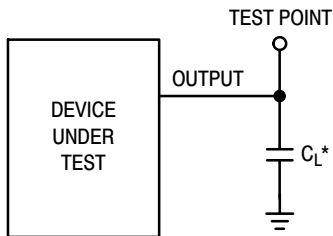
*Includes all probe and jig capacitance

Figure 4.
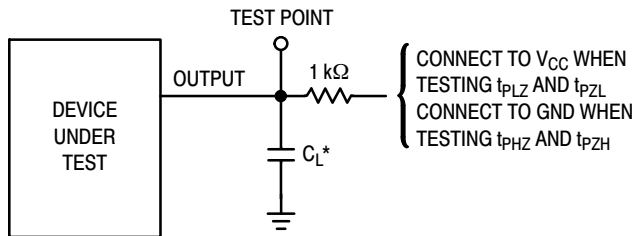
*Includes all probe and jig capacitance

Figure 5.

MC74HCT374A

EXPANDED LOGIC DIAGRAM
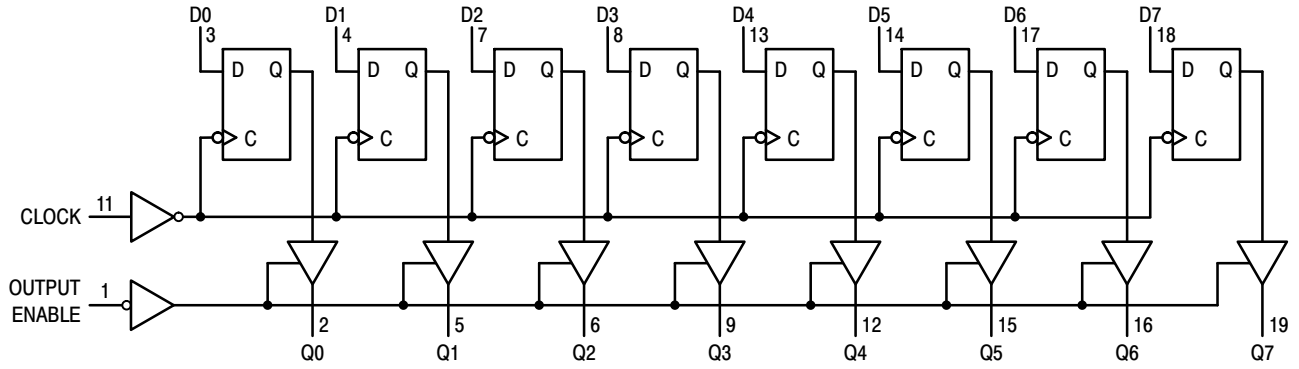
ORDERING INFORMATION

Device	Package	Shipping†
MC74HCT374ADWG	SOIC−20 (Pb−Free)	38 Units / Rail
MC74HCT374ADWR2G	SOIC−20 (Pb−Free)	1000 Units / Reel
MC74HCT374ADTR2G	TSSOP−20 (Pb−Free)	2500 Units / Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
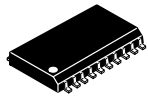
SOIC−20 WB
CASE 751D−05
ISSUE H

DATE 22 APR 2015

SCALE 1:1

D

A

20   11

H   0.25 (M) B (M)

E

1   10

B

20X b

⊕ 0.25 (M) T A (S) B (S)

θ

h X 45°

A

SEATING
PLANE

18X e

A1   T

L

c

NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS	
	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
b	0.35	0.49
c	0.23	0.32
D	12.65	12.95
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
θ	0°	7°

**RECOMMENDED
SOLDERING FOOTPRINT***

20X
0.52

20X
1.30

20   11

11.00

1   10

1.27
PITCH
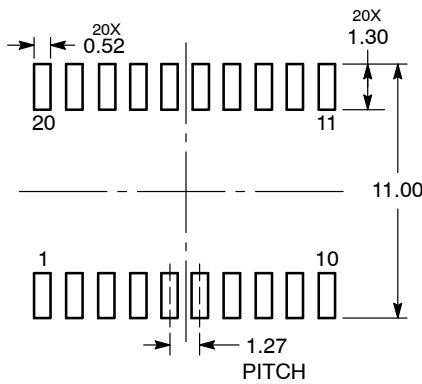
DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**GENERIC
MARKING DIAGRAM***

20

XXXXXXXXXXX
XXXXXXXXXXX
AWLYYWWG

1
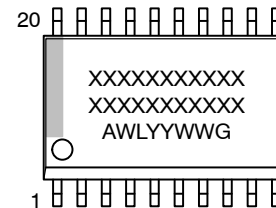
XXXXX = Specific Device Code
A   = Assembly Location
WL   = Wafer Lot
YY   = Year
WW   = Work Week
G   = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot " ▪ ", may or may not be present.

DOCUMENT NUMBER:	98ASB42343B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	SOIC−20 WB		PAGE 1 OF 1

TSSOP–20 WB
CASE 948E
ISSUE D

DATE 17 FEB 2016

SCALE 2:1

20X **K** REF

⊕ | 0.15 (0.006) | T | U | Ⓢ

⊕ | 0.10 (0.004) | Ⓜ | T | U | Ⓢ | V | Ⓢ

2X **L/2**

L

20
11

PIN 1
IDENT

10

B

A

–**V**–

–**U**–

⊕ | 0.15 (0.006) | T | U | Ⓢ

SECTION N–N

K
K1
J **J1**

0.25 (0.010)

N

M

N

F

DETAIL E

C

D ←→ **G** ←→ **H**

⌓ | 0.100 (0.004)

–**T**– **SEATING PLANE**

–**W**–

DETAIL E

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE –W–.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.40	6.60	0.252	0.260
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

SOLDERING FOOTPRINT

7.06

1

0.65
PITCH

16X
0.36

16X
1.26

DIMENSIONS: MILLIMETERS

**GENERIC
MARKING DIAGRAM***

XXXX
XXXX
ALYW▪

▪

A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb–Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb–Free indicator, "G" or microdot " ▪", may or may not be present.

DOCUMENT NUMBER:	98ASH70169A	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	TSSOP–20 WB		PAGE 1 OF 1

PUBLICATION ORDERING INFORMATION

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