

# 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.

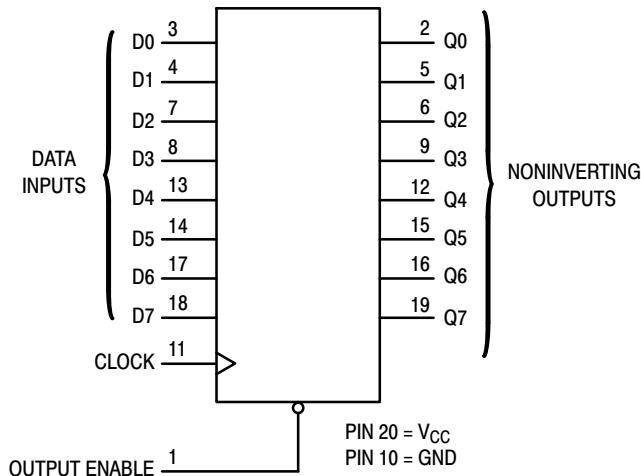
Data meeting the setup and hold time is clocked to the outputs with the rising edge of Clock. The Output Enable does not affect the state of the flip-flops, but when Output Enable is high, the outputs are forced to the high-impedance state. Thus, data may be stored even when the outputs are not enabled.

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

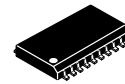
- Output Drive Capability: 15 LSTTL Loads
- TTL/NMOS-Compatible Input Levels
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 4.5 to 5.5 V
- Low Input Current: 1.0  $\mu$ A
- In Compliance With the JEDEC Standard No. 7.0 A Requirements
- Chip Complexity: 276 FETs or 69 Equivalent 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

#### LOGIC DIAGRAM

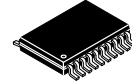


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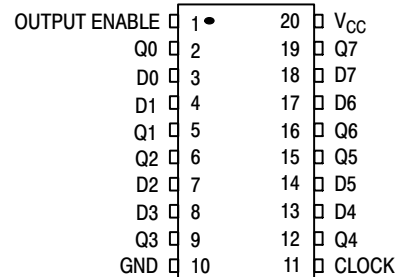


SOIC-20  
DW SUFFIX  
CASE 751D

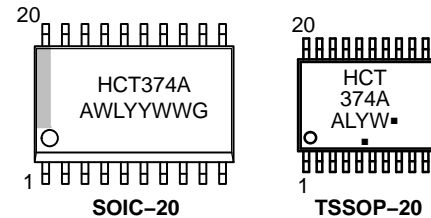


TSSOP-20  
DT SUFFIX  
CASE 948E

#### PIN ASSIGNMENT



#### MARKING DIAGRAMS



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)

#### FUNCTION TABLE

| Inputs        |       | Output |           |
|---------------|-------|--------|-----------|
| Output Enable | Clock | D      | Q         |
| L             |       | H      | H         |
| L             |       | L      | L         |
| L             | L,H,  | 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   | $\mu$ W |
| 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   | $\pm 20$               | mA           |
| $I_{out}$ | DC Output Current, per Pin  | $\pm 35$               | mA           |
| $I_{CC}$  | DC Supply Current, $V_{CC}$ and GND Pins                                | $\pm 75$               | mA           |
| $P_D$     | Power Dissipation in Still Air, SOIC Package†<br>TSSOP Package†         | 500<br>450             | mW           |
| $T_{stg}$ | Storage Temperature   | -65 to +150            | $^{\circ}$ C |
| $T_L$     | Lead Temperature, 1 mm from Case for 10 Seconds (SOIC or TSSOP Package) | 260                    | $^{\circ}$ 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  $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$ . 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/ $^{\circ}$ C from 65 $^{\circ}$  to 125 $^{\circ}$ C  
TSSOP Package: -6.1 mW/ $^{\circ}$ C from 65 $^{\circ}$  to 125 $^{\circ}$ 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     | $^{\circ}$ 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 <sub>CC</sub><br>V | Guaranteed Limit |               |            | Unit |
|------------------|--|---|----------------------|------------------|---------------|------------|------|
|                  |  |   |                      | -55 to 25°C      | ≤ 85°C        | ≤ 125°C    |      |
| V <sub>IH</sub>  | Minimum High-Level Input Voltage               | V <sub>out</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V<br>I <sub>out</sub> ≤ 20 μA   | 4.5<br>5.5           | 2.0<br>2.0       | 2.0<br>2.0    | 2.0<br>2.0 | V    |
| V <sub>IL</sub>  | Maximum Low-Level Input Voltage                | V <sub>out</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V<br>I <sub>out</sub> ≤ 20 μA   | 4.5<br>5.5           | 0.8<br>0.8       | 0.8<br>0.8    | 0.8<br>0.8 | V    |
| V <sub>OH</sub>  | Minimum High-Level Output Voltage              | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>out</sub> ≤ 20 μA  | 4.5<br>5.5           | 4.4<br>5.4       | 4.4<br>5.4    | 4.4<br>5.4 | V    |
|                  |  | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>out</sub> ≤ 6.0 mA   | 4.5                  | 3.98             | 3.84          | 3.7        |      |
| V <sub>OL</sub>  | Maximum Low-Level Output Voltage               | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>out</sub> ≤ 20 μA  | 4.5<br>5.5           | 0.1<br>0.1       | 0.1<br>0.1    | 0.1<br>0.1 | V    |
|                  |  | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>out</sub> ≤ 6.0 mA   | 4.5                  | 0.26             | 0.33          | 0.4        |      |
| I <sub>in</sub>  | Maximum Input Leakage Current                  | V <sub>in</sub> = V <sub>CC</sub> or GND  | 5.5                  | ±0.1             | ±1.0          | ±1.0       | μA   |
| I <sub>oz</sub>  | Maximum Three-State Leakage Current            | Output in High-Impedance State<br>V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>out</sub> = V <sub>CC</sub> or GND | 5.5                  | ±0.5             | ±5.0          | ±10        | μA   |
| I <sub>CC</sub>  | Maximum Quiescent Supply Current (per Package) | V <sub>in</sub> = V <sub>CC</sub> or GND<br>I <sub>out</sub> = 0 μA   | 5.5                  | 4.0              | 40            | 160        | μA   |
| ΔI <sub>CC</sub> | Additional Quiescent Supply Current            | V <sub>in</sub> = 2.4 V, Any One Input<br>V <sub>in</sub> = V <sub>CC</sub> or GND, Other Inputs<br>I <sub>out</sub> = 0 μA         | 5.5                  | ≥ -55°C          | 25°C to 125°C |            | mA   |
|                  |  |   |                      | 2.9              | 2.4           |            |      |

1. Total Supply Current = I<sub>CC</sub> + ΣΔI<sub>CC</sub>.

## AC ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 5.0 V ±10%, C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6.0 ns)

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

| C <sub>PD</sub> | Power Dissipation Capacitance (Per Flip-Flop)* | Typical @ 25°C, V <sub>CC</sub> = 5.0 V |  | pF |
|-----------------|--|---|--|----|
|                 |  | 65                                      |  |    |
|                 |  |   |  |    |

\* Used to determine the no-load dynamic power consumption: P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup>f + I<sub>CC</sub> V<sub>CC</sub>.

# MC74HCT374A

**TIMING REQUIREMENTS** ( $V_{CC} = 5.0\text{ V} \pm 10\%$ , Input  $t_r = t_f = 6.0\text{ ns}$ )

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

## SWITCHING WAVEFORMS

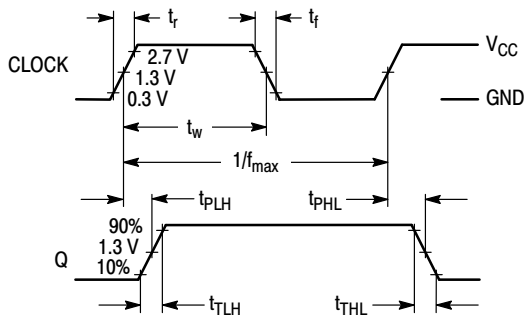


Figure 1.

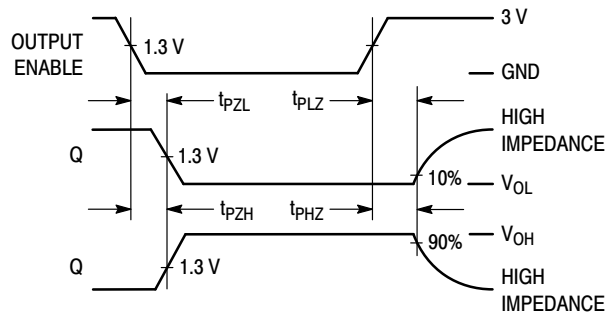


Figure 2.

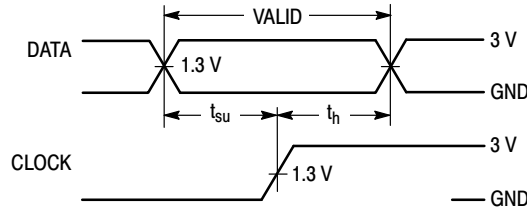
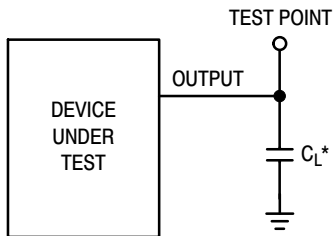


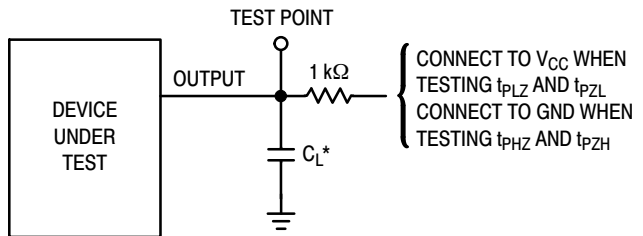
Figure 3.

## TEST CIRCUITS



\*Includes all probe and jig capacitance

Figure 4.

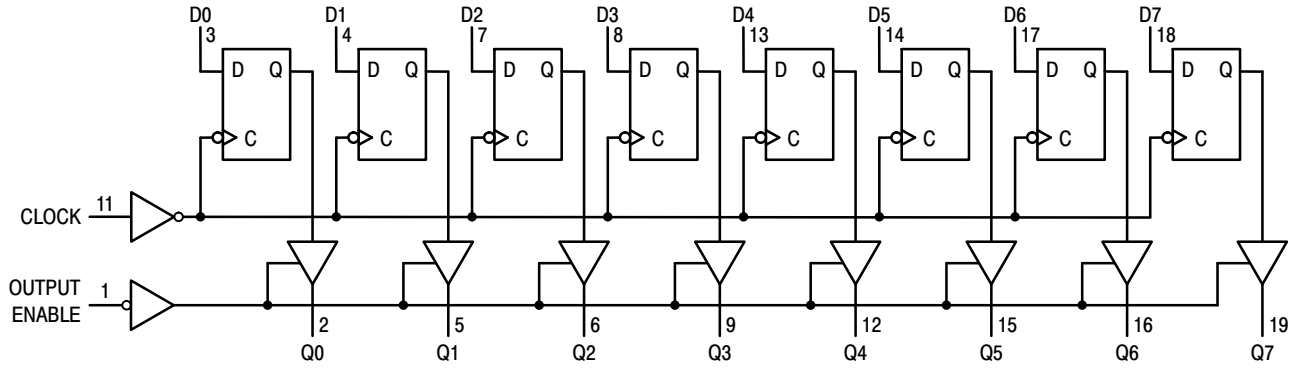


\*Includes all probe and jig capacitance

Figure 5.

# MC74HCT374A

## EXPANDED LOGIC DIAGRAM



### ORDERING INFORMATION

| Device           | Package               | Shipping†         |
|------------------|-----------------------|-------------------|
| MC74HCT374ADWG   | SOIC-20<br>(Pb-Free)  | 38 Units / Rail   |
| MC74HCT374ADWR2G | SOIC-20<br>(Pb-Free)  | 1000 Units / Reel |
| MC74HCT374ADTR2G | TSSOP-20<br>(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.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-20 WB  
CASE 751D-05  
ISSUE H

DATE 22 APR 2015



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\*



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\*



- XXXXXX = 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. Some products may not follow the Generic Marking.

|                  |             |  |
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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



TSSOP-20 WB  
CASE 948E  
ISSUE D

DATE 17 FEB 2016

SCALE 2:1



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



GENERIC MARKING DIAGRAM\*



- 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.

|                  |             |  |
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