

CD74AC74, CD74ACT74

Dual D-Type Flip-Flop with Set and Reset Positive-Edge-Triggered

Features

- Buffered Inputs
- Typical Propagation Delay (AC00)
 - 4.9ns at $V_{CC} = 5V$, $T_A = 25^{\circ}C$, $C_L = 50pF$
- Exceeds 2kV ESD Protection MIL-STD-883, Method 3015
- SCR-Latchup-Resistant CMOS Process and Circuit Design
- Speed of Bipolar FAST™/AS/S with Significantly Reduced Power Consumption
- Balanced Propagation Delays
- AC Types Feature 1.5V to 5.5V Operation and Balanced Noise Immunity at 30% of the Supply
- $\pm 24mA$ Output Drive Current
 - Fanout to 15 FAST™ ICs
 - Drives 50 Ω Transmission Lines

Description

The Harris CD74AC74 and CD74ACT74 dual D-type, positive edge triggered flip-flops use the Harris ADVANCED CMOS technology. These flip-flops have independent DATA, SET, RESET, and CLOCK inputs and Q and Q outputs. The logic level present at the data input is transferred to the output during the positive going transition of the clock pulse. SET and RESET are independent of the clock and are accomplished by a low level at the appropriate input.

Ordering Information

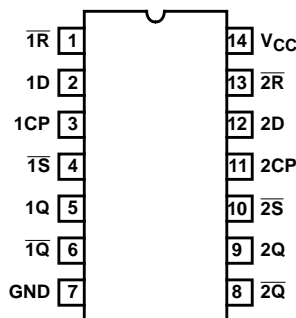
| PART NUMBER | TEMP. RANGE (°C) | PACKAGE | PKG. NO. |
|-------------|----------------------------------|------------|----------|
| CD74AC74E | 0 to 70, -40 to 85 -55 to 125 | 14 Ld PDIP | E14.3 |
| CD74ACT74E | 0 to 70, -40 to 85 -55 to 125 | 14 Ld PDIP | E14.3 |
| CD74AC74EX | 0 to 70, -40 to 85 -55 to 125 | 14 Ld PDIP | E14.3 |
| CD74ACT74EX | 0 to 70, -40 to 85 -55 to 125 | 14 Ld PDIP | E14.3 |
| CD74AC74M | 0 to 70, -40 to 85 -55 to 125 | 14 Ld SOIC | M14.15 |
| CD74ACT74M | 0 to 70, -40 to 85 -55 to 125 | 14 Ld SOIC | M14.15 |

NOTES:

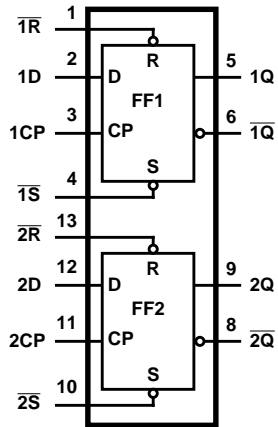
1. When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.
2. Wafer and die for this part number is available which meets all electrical specifications. Please contact your local sales office or Harris customer service for ordering information.

Pinout

CD74AC74, CD74ACT74
(PDIP, SOIC)
TOP VIEW



Functional Diagram



TRUTH TABLE

| INPUTS | | | | OUTPUTS | |
|--------|-------|----|---|------------|------------|
| SET | RESET | CP | D | Q | Q̄ |
| L | H | X | X | H | L |
| H | L | X | X | L | H |
| L | L | X | X | H (Note 5) | H (Note 5) |
| H | H | ↑ | H | H | L |
| H | H | ↑ | L | L | H |
| H | H | L | X | Q0 | Q̄0 |

NOTES:

- H = High level (steady state), L = Low level (steady state), X = Don't care, ↑ = Transition from Low to High level.
- Q0 = the level of Q before the indicated input conditions were established.
- This configuration is nonstable, that is, it will not persist when set and reset inputs return to their inactive (high) level.

CD74AC74, CD74ACT74

Absolute Maximum Ratings

| | |
|---|-------------|
| DC Supply Voltage, V_{CC} | -0.5V to 6V |
| DC Input Diode Current, I_{IK} | |
| For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$ | $\pm 20mA$ |
| DC Output Diode Current, I_{OK} | |
| For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$ | $\pm 50mA$ |
| DC Output Source or Sink Current per Output Pin, I_O | |
| For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$ | $\pm 50mA$ |
| DC V_{CC} or Ground Current, I_{CC} or I_{GND} (Note 6) | $\pm 100mA$ |

Thermal Information

| | |
|--|----------------------|
| Thermal Resistance (Typical, Note 8) | θ_{JA} (°C/W) |
| PDIP Package | 90 |
| SOIC Package | 175 |
| Maximum Junction Temperature (Plastic Package) | 150°C |
| Maximum Storage Temperature Range | -65°C to 150°C |
| Maximum Lead Temperature (Soldering 10s) | 300°C |

Operating Conditions

| | |
|---|----------------|
| Temperature Range, T_A | -55°C to 125°C |
| Supply Voltage Range, V_{CC} (Note 7) | |
| AC Types | 1.5V to 5.5V |
| ACT Types | 4.5V to 5.5V |
| DC Input or Output Voltage, V_I , V_O | 0V to V_{CC} |
| Input Rise and Fall Slew Rate, dt/dv | |
| AC Types, 1.5V to 3V | 50ns (Max) |
| AC Types, 3.6V to 5.5V | 20ns (Max) |
| ACT Types, 4.5V to 5.5V | 10ns (Max) |

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTES:

6. For up to 4 outputs per device, add $\pm 25mA$ for each additional output.
7. Unless otherwise specified, all voltages are referenced to ground.
8. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

DC Electrical Specifications

| PARAMETER | SYMBOL | TEST CONDITIONS | | V_{CC} (V) | 25°C | | -40°C TO 85°C | | -55°C TO 125°C | | UNITS | |
|---------------------------|----------|----------------------|---------------------|-----------------|------|------|------------------|------|-------------------|------|-------|---|
| | | V_I (V) | I_O (mA) | | MIN | MAX | MIN | MAX | MIN | MAX | | |
| AC TYPES | | | | | | | | | | | | |
| High Level Input Voltage | V_{IH} | - | - | 1.5 | 1.2 | - | 1.2 | - | 1.2 | - | V | |
| | | | | 3 | 2.1 | - | 2.1 | - | 2.1 | - | V | |
| | | | | 5.5 | 3.85 | - | 3.85 | - | 3.85 | - | V | |
| Low Level Input Voltage | V_{IL} | - | - | 1.5 | - | 0.3 | - | 0.3 | - | 0.3 | V | |
| | | | | 3 | - | 0.9 | - | 0.9 | - | 0.9 | V | |
| | | | | 5.5 | - | 1.65 | - | 1.65 | - | 1.65 | V | |
| High Level Output Voltage | V_{OH} | V_{IH} or V_{IL} | -0.05 | -0.05 | 1.5 | 1.4 | - | 1.4 | - | 1.4 | - | V |
| | | | -0.05 | -0.05 | 3 | 2.9 | - | 2.9 | - | 2.9 | - | V |
| | | | -0.05 | -0.05 | 4.5 | 4.4 | - | 4.4 | - | 4.4 | - | V |
| | | | -4 | -4 | 3 | 2.58 | - | 2.48 | - | 2.4 | - | V |
| | | | -24 | -24 | 4.5 | 3.94 | - | 3.8 | - | 3.7 | - | V |
| | | | -75 (Note 9, 10) | -75 | 5.5 | - | - | 3.85 | - | - | - | V |
| | | | -50 (Note 9, 10) | -50 | 5.5 | - | - | - | - | 3.85 | - | V |

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DC Electrical Specifications (Continued)

| PARAMETER | SYMBOL | TEST CONDITIONS | | V _{CC} (V) | 25°C | | -40°C TO 85°C | | -55°C TO 125°C | | UNITS |
|---|------------------|------------------------------------|---------------------|---------------------|------|------|---------------|------|----------------|------|-------|
| | | V _I (V) | I _O (mA) | | MIN | MAX | MIN | MAX | MIN | MAX | |
| Low Level Output Voltage | V _{OL} | V _{IH} or V _{IL} | 0.05 | 1.5 | - | 0.1 | - | 0.1 | - | 0.1 | V |
| | | | 0.05 | 3 | - | 0.1 | - | 0.1 | - | 0.1 | V |
| | | | 0.05 | 4.5 | - | 0.1 | - | 0.1 | - | 0.1 | V |
| | | | 12 | 3 | - | 0.36 | - | 0.44 | - | 0.5 | V |
| | | | 24 | 4.5 | - | 0.36 | - | 0.44 | - | 0.5 | V |
| | | | 75 (Note 9, 10) | 5.5 | - | - | - | 1.65 | - | - | V |
| | | | 50 (Note 9, 10) | 5.5 | - | - | - | - | - | 1.65 | V |
| Input Leakage Current | I _I | V _{CC} or GND | - | 5.5 | - | ±0.1 | - | ±1 | - | ±1 | μA |
| Quiescent Supply Current, FF | I _{CC} | V _{CC} or GND | 0 | 5.5 | - | 4 | - | 40 | - | 80 | μA |
| ACT TYPES | | | | | | | | | | | |
| High Level Input Voltage | V _{IH} | - | - | 4.5 to 5.5 | 2 | - | 2 | - | 2 | - | V |
| Low Level Input Voltage | V _{IL} | - | - | 4.5 to 5.5 | - | 0.8 | - | 0.8 | - | 0.8 | V |
| High Level Output Voltage | V _{OH} | V _{IH} or V _{IL} | -0.05 | 4.5 | 4.4 | - | 4.4 | - | 4.4 | - | V |
| | | | -24 | 4.5 | 3.94 | - | 3.8 | - | 3.7 | - | V |
| | | | -75 (Note 9, 10) | 5.5 | - | - | 3.85 | - | - | - | V |
| | | | -50 (Note 9, 10) | 5.5 | - | - | - | - | 3.85 | - | V |
| Low Level Output Voltage | V _{OL} | V _{IH} or V _{IL} | 0.05 | 4.5 | - | 0.1 | - | 0.1 | - | 0.1 | V |
| | | | 24 | 4.5 | - | 0.36 | - | 0.44 | - | 0.5 | V |
| | | | 75 (Note 9, 10) | 5.5 | - | - | - | 1.65 | - | - | V |
| | | | 50 (Note 9, 10) | 5.5 | - | - | - | - | - | 1.65 | V |
| Input Leakage Current | I _I | V _{CC} or GND | - | 5.5 | - | ±0.1 | - | ±1 | - | ±1 | μA |
| Quiescent Supply Current, FF | I _{CC} | V _{CC} or GND | 0 | 5.5 | - | 4 | - | 40 | - | 80 | μA |
| Additional Supply Current per Input Pin TTL Inputs High 1 Unit Load | ΔI _{CC} | V _{CC} -2.1 | - | 4.5 to 5.5 | - | 2.4 | - | 2.8 | - | 3 | mA |

NOTES:

9. Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.
10. Test verifies a minimum 50Ω transmission-line-drive capability at 85°C, 75Ω at 125°C.

ACT Input Load Table

| INPUT | UNIT LOAD |
|--------------------|-----------|
| D | 0.53 |
| \bar{R}, \bar{S} | 0.58 |
| CP | 1 |

NOTE: Unit load is ΔI_{CC} limit specified in DC Electrical Specifications Table, e.g., 2.4mA max at 25°C.

CD74AC74, CD74ACT74

Prerequisite For Switching Function

| PARAMETER | SYMBOL | V _{CC} (V) | -40°C TO 85°C | | -55°C TO 125°C | | UNITS |
|---|------------------|---------------------|---------------|-----|----------------|-----|-------|
| | | | MIN | MAX | MIN | MAX | |
| AC TYPES | | | | | | | |
| Data to CP Setup Time | t _{SU} | 1.5 | 39 | - | 44 | - | ns |
| | | 3.3 (Note 11) | 4.3 | - | 4.9 | - | ns |
| | | 5 (Note 12) | 3.1 | - | 3.5 | - | ns |
| Hold Time | t _H | 1.5 | 0 | - | 0 | - | ns |
| | | 3.3 | 0 | - | 0 | - | ns |
| | | 5 | 0 | - | 0 | - | ns |
| Removal Time, \bar{R} , \bar{S} to CP | t _{REM} | 1.5 | 30 | - | 34 | - | ns |
| | | 3.3 | 4.1 | - | 4.7 | - | ns |
| | | 5 | 2.4 | - | 2.7 | - | ns |
| Pulse Width, \bar{R} , \bar{S} | t _W | 1.5 | 44 | - | 50 | - | ns |
| | | 3.3 | 4.9 | - | 5.6 | - | ns |
| | | 5 | 3.5 | - | 4 | - | ns |
| Pulse Width, CP | t _W | 1.5 | 49 | - | 56 | - | ns |
| | | 3.3 | 5.5 | - | 6.3 | - | ns |
| | | 5 | 3.9 | - | 4.5 | - | ns |
| CP Frequency | f _{MAX} | 1.5 | 10 | - | 9 | - | MHz |
| | | 3.3 | 90 | - | 79 | - | MHz |
| | | 5 | 125 | - | 110 | - | MHz |
| ACT TYPES | | | | | | | |
| Data to CP Setup Time | t _{SU} | 5 (Note 12) | 3.5 | - | 4 | - | ns |
| Hold Time | t _H | 5 | 0 | - | 0 | - | ns |
| Removal Time, \bar{R} , \bar{S} to CP | t _{REM} | 5 | 2.4 | - | 2.7 | - | ns |
| Pulse Width, \bar{R} , \bar{S} | t _W | 5 | 4.4 | - | 5 | - | ns |
| Pulse Width, CP | t _W | 5 | 5 | - | 5.7 | - | ns |
| CP Frequency | f _{MAX} | 5 | 97 | - | 85 | - | MHz |

NOTES:

11. 3.3V Min at 3.6V.

12. 5V Min at 4.5V.

Switching Specifications Input t_p, t_f = 3ns, C_L = 50pF (Worst Case)

| PARAMETER | SYMBOL | V _{CC} (V) | -40°C TO 85°C | | | -55°C TO 125°C | | | UNITS |
|---------------------------------------|-------------------------------------|---------------------|---------------|-----|------|----------------|-----|-----|-------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| AC TYPES | | | | | | | | | |
| Propagation Delay, CP to Q, \bar{Q} | t _{PLH} , t _{PHL} | 1.5 | - | - | 114 | - | - | 125 | ns |
| | | 3.3 (Note 14) | 3.6 | - | 12.7 | 3.5 | - | 14 | ns |
| | | 5 (Note 15) | 2.6 | - | 9.1 | 2.5 | - | 10 | ns |

CD74AC74, CD74ACT74

Switching Specifications Input t_r , $t_f = 3\text{ns}$, $C_L = 50\text{pF}$ (Worst Case) (Continued)

| PARAMETER | SYMBOL | V_{CC} (V) | -40°C TO 85°C | | | -55°C TO 125°C | | | UNITS |
|--|-----------------------|--------------|---------------|-----|------|----------------|-----|------|-------|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| Propagation Delay, \bar{R} , \bar{S} to Q, \bar{Q} | t_{PLH} | 1.5 | - | - | 120 | - | - | 132 | ns |
| | | 3.3 | 3.8 | - | 13.4 | 3.7 | - | 14.7 | ns |
| | | 5 | 2.7 | - | 9.5 | 2.6 | - | 10.5 | ns |
| | t_{PHL} | 1.5 | - | - | 131 | - | - | 144 | ns |
| | | 3.3 | 4.1 | - | 14.6 | 4 | - | 16.1 | ns |
| | | 5 | 3 | - | 10.4 | 2.9 | - | 11.5 | ns |
| Input Capacitance | C_I | - | - | - | 10 | - | - | 10 | pF |
| Power Dissipation Capacitance | C_{PD} (Note 16) | - | - | 55 | - | - | 55 | - | pF |
| ACT TYPES | | | | | | | | | |
| Propagation Delay, CP to Q, \bar{Q} | t_{PHL} | 5 | 2.5 | - | 8.6 | 2.4 | - | 9.5 | ns |
| | t_{PLH} | (Note 15) | | | | | | | |
| Propagation Delay, \bar{R} , \bar{S} to Q, \bar{Q} | t_{PLH} | 5 | 3 | - | 10.5 | 2.9 | - | 11.5 | ns |
| | t_{PHL} | 5 | 3.2 | - | 11.4 | 3.1 | - | 12.5 | ns |
| Input Capacitance | C_I | - | - | - | 10 | - | - | 10 | pF |
| Power Dissipation Capacitance | C_{PD} (Note 16) | - | - | 55 | - | - | 55 | - | pF |

NOTES:

13. Limits tested 100%.
14. 3.3V Min at 3.6V, Max at 3V.
15. 5V Min at 5.5V, Max at 4.5V.
16. C_{PD} is used to determine the dynamic power consumption per flip-flop.
 $P_D = C_{PD}V_{CC}^2 f_i + \Sigma (C_L V_{CC}^2 f_o) + V_{CC} \Delta I_{CC}$ where f_i = input frequency, f_o = output frequency, C_L = output load capacitance, V_{CC} = supply voltage.

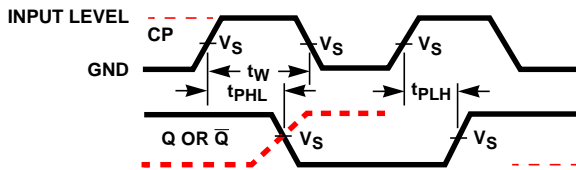


FIGURE 1.

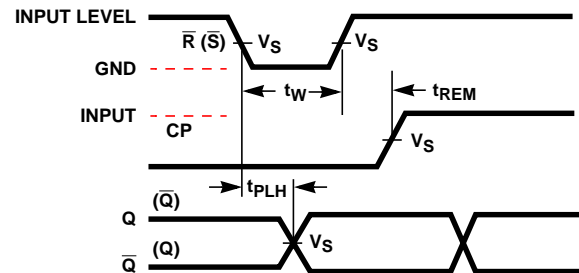


FIGURE 2.

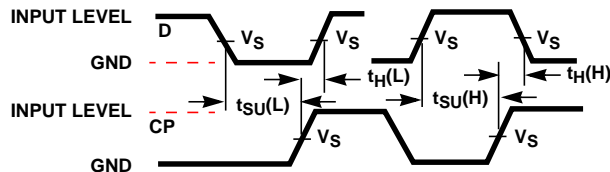
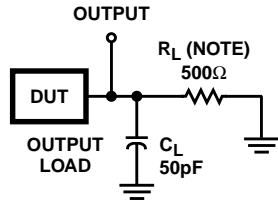


FIGURE 3.

CD74AC74, CD74ACT74



NOTE: For AC Series Only: When $V_{CC} = 1.5V$, $R_L = 1kΩ$.

| | CD74AC | CD74ACT |
|---------------------------------|--------------|--------------|
| Input Level | V_{CC} | 3V |
| Input Switching Voltage, V_S | $0.5 V_{CC}$ | 1.5V |
| Output Switching Voltage, V_S | $0.5 V_{CC}$ | $0.5 V_{CC}$ |

FIGURE 4. PROPAGATION DELAY TIMES

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