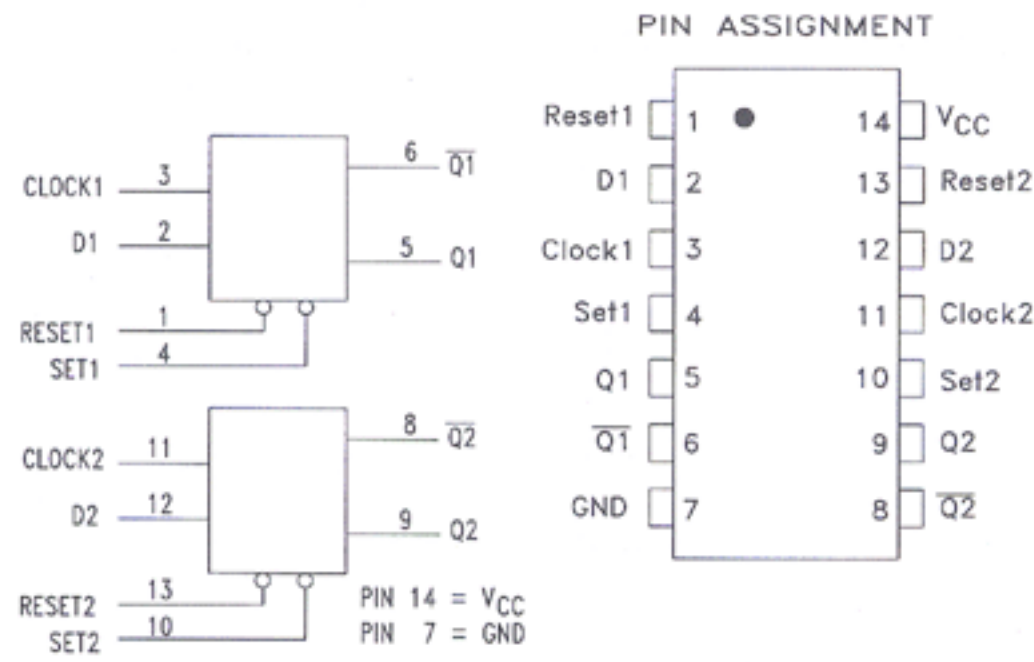
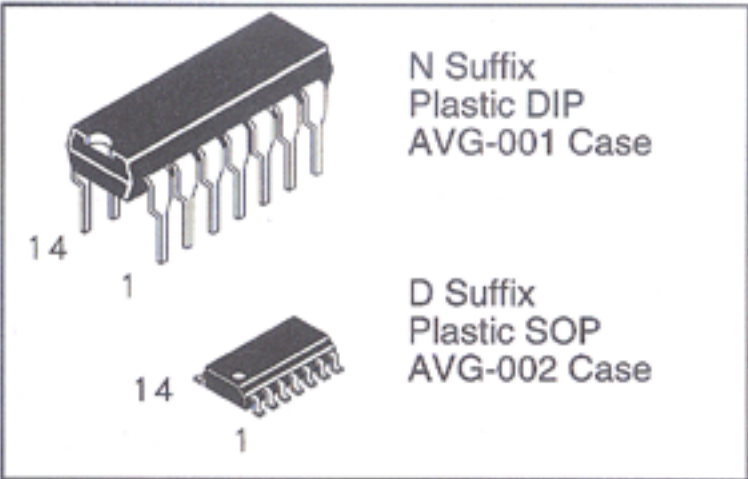


Dual D Flip-Flop with Set and Reset

This device consists of two D flip-flops with individual Set, Reset, and Clock inputs. Information at a D-input is transferred to the corresponding Q output on the next positive going edge of the clock input. Both Q and \bar{Q} outputs are available from each flip-flop. The Set and Reset inputs are asynchronous.

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2 to 6 V for HC devices
- Low Input Current: 1 μ A
- DC, AC parameters guaranteed from -55°C to 125°C

DV74HC74A
DV74HCT74A



TRUTH TABLE

| Inputs | | | | Outputs | |
|--------|-------|-------|------|-----------|-----------|
| Set | Reset | Clock | Data | Q | \bar{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 | No Change | No Change |
| H | H | H | X | No Change | No Change |
| H | H | ↓ | X | No Change | No Change |

*Both outputs will remain high as long as Set and Reset are low, but the output states are unpredictable if Set and Reset go high simultaneously
 H = High Logic Level
 L = Low Logic Level
 X = Don't Care
 ↑ = Low to High Transition
 ↓ = High to Low Transition

ABSOLUTE MAXIMUM RATINGS

Maximum ratings are those values beyond which damage to the device may occur.

| 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) | -1.5 to V _{CC} +1.5 | 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 | ± 25 | mA |
| I _{CC} | DC Supply Current, V _{CC} and GND Pins | ± 50 | mA |
| P _D | Power Dissipation in Still Air, Plastic DIP SOP Package | 750 500 | mW |
| T _{STG} | Storage Temperature Range | -65 to +150 | °C |
| TL | Lead Temperature, 1mm from Case for 10 Seconds (Plastic DIP or SOP Package) | 260 | °C |

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GUARANTEED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|------------------------------------|--|-------------|--------------------|------|
| V _{CC} | DC Supply Voltage, HC (HCT), Referenced to GND | 2.0 (4.5) | 6.0 (5.5) | V |
| V _{IN} , V _{OUT} | DC Input Voltage, Output Voltage, Referenced to GND | 0 | V _{CC} | V |
| T _A | Ambient Temperature | -55 | +125 | °C |
| t _r , t _f | Input Rise and Fall Time: HC: V _{CC} =2.0V HCT: V _{CC} =5.5V / HC: V _{CC} =4.5V HC: V _{CC} =6.0V | 0 0 0 | 1000 500 400 | ns |

HC-74A

DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Conditions | V _{CC} V | Guaranteed Limits | | | Unit |
|-----------------|-----------------------------------|---|----------------------|---------------------|-------|--------|------|
| | | | | 25°C to -55°C | ≤85°C | ≤125°C | |
| V _{IH} | Minimum High-Level Input Voltage | V _{OUT} = 0.1 V, I _{OUT} = 20 μA or V _{OUT} = V _{CC} - 0.1 V | 2.0 | 1.5 | 1.5 | 1.5 | V |
| | | | 4.5 | 3.15 | 3.15 | 3.15 | |
| | | | 6.0 | 4.2 | 4.2 | 4.2 | |
| V _{IL} | Maximum Low-Level Input Voltage | V _{OUT} = 0.1 V, I _{OUT} ≤ 20 μA or V _{OUT} = V _{CC} - 0.1 V | 2.0 | 0.5 | 0.5 | 0.5 | V |
| | | | 4.5 | 1.35 | 1.35 | 1.35 | |
| | | | 6.0 | 1.8 | 1.8 | 1.8 | |
| V _{OH} | Minimum High-Level Output Voltage | V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA | 2.0 | 1.9 | 1.9 | 1.9 | V |
| | | | 4.5 | 4.4 | 4.4 | 4.4 | |
| | | 6.0 | 5.9 | 5.9 | 5.9 | | |
| | | V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0 mA I _{OUT} ≤ 5.2 mA | 4.5 | 3.98 | 3.84 | 3.7 | |
| 6.0 | 5.48 | 5.34 | 5.2 | | | | |
| V _{OL} | Maximum Low Level Output Voltage | V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA | 2.0 | 0.1 | 0.1 | 0.1 | V |
| | | | 4.5 | 0.1 | 0.1 | 0.1 | |
| | | 6.0 | 0.1 | 0.1 | 0.1 | | |
| | | V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0 mA I _{OUT} ≤ 5.2 mA | 4.5 | 0.26 | 0.33 | 0.40 | |
| 6.0 | 0.26 | 0.33 | 0.40 | | | | |
| I _{IN} | Maximum Input Leakage Current | V _{IN} = V _{CC} or GND | 6.0 | ±0.1 | ±1.0 | ±1.0 | μA |
| I _{CC} | Maximum Quiescent Supply Current | V _{IN} = V _{CC} or GND, I _{OUT} ≤ 0 μA | 6.0 | 2.0 | 20 | 80 | μA |

AC ELECTRICAL CHARACTERISTICS over full operating conditions (C_L = 50 pF, Input t_f = t_r = 6 ns)

| Symbol | Parameter | V _{CC} V | Guaranteed Limit | | | Unit |
|--|---|----------------------|---------------------|-------|--------|------|
| | | | 25°C to -55°C | ≤85°C | ≤125°C | |
| f _{max} | Maximum Clock Frequency (50% Duty Cycle) | 2.0 | 6.0 | 4.8 | 4.0 | MHz |
| | | 4.5 | 30 | 24 | 20 | |
| | | 6.0 | 35 | 28 | 24 | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay Time, Clock to Q or \bar{Q} | 2.0 | 100 | 125 | 150 | ns |
| | | 4.5 | 20 | 25 | 30 | |
| | | 6.0 | 17 | 21 | 26 | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay Time, Set or Reset to Q or \bar{Q} | 2.0 | 105 | 130 | 160 | ns |
| | | 4.5 | 21 | 26 | 32 | |
| | | 6.0 | 18 | 22 | 27 | |
| t _{TLH} , t _{THL} | Maximum Output Transition Time Any Output | 2.0 | 75 | 95 | 110 | ns |
| | | 4.5 | 15 | 19 | 22 | |
| | | 6.0 | 13 | 16 | 19 | |
| C _{IN} | Maximum Input Capacitance | — | 10 | 10 | 10 | pF |

| | | | | | |
|-----------------|--|---------------------------------------|--|--|----|
| C _{PD} | Power Dissipation Capacitance (Per Flip-Flop) Used to determine the no-load dynamic power consumption, P _D = C _{PD} V _{CC} ² f + I _{CC} V _{CC} | Typical @ 25°C, V _{CC} = 5 V | | | pF |
| | | 39 | | | |

TIMING REQUIREMENTS (Input $t_r = t_f = 6.0$ ns)

| Symbol | Parameter | V _{CC} | Guaranteed Limit | | | Unit |
|---------------------------------|---|-----------------|------------------|--------|--------|------|
| | | | 25°C to -55°C | ≤85 °C | ≤125°C | |
| t _{SU} | Minimum Setup Time, Data to Clock | 2.0 | 80 | 100 | 120 | ns |
| | | 4.5 | 16 | 20 | 24 | |
| | | 6.0 | 14 | 17 | 20 | |
| t _H | Minimum Hold Time, Clock to Data | 2.0 | 3.0 | 3.0 | 3.0 | ns |
| | | 4.5 | 3.0 | 3.0 | 3.0 | |
| | | 6.0 | 3.0 | 3.0 | 3.0 | |
| t _{REC} | Minimum Recovery Time, Set or Reset Inactive to Clock | 2.0 | 8.0 | 8.0 | 8.0 | ns |
| | | 4.5 | 8.0 | 8.0 | 8.0 | |
| | | 6.0 | 8.0 | 8.0 | 8.0 | |
| t _W | Minimum Pulse Width, Clock | 2.0 | 60 | 75 | 90 | ns |
| | | 4.5 | 12 | 15 | 18 | |
| | | 6.0 | 10 | 13 | 15 | |
| t _W | Minimum Pulse Width, Set or Reset | 2.0 | 60 | 75 | 90 | ns |
| | | 4.5 | 12 | 15 | 18 | |
| | | 6.0 | 10 | 13 | 15 | |
| t _r , t _f | Maximum Input Rise and Fall Times | 2.0 | 1000 | 1000 | 1000 | ns |
| | | 4.5 | 500 | 500 | 500 | |
| | | 6.0 | 400 | 400 | 400 | |

HCT-74A
DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Conditions | V _{CC} V | Guaranteed Limits | | | Unit |
|------------------|--|---|----------------------|-------------------|---------------|--------|------|
| | | | | 25°C to -55°C | ≤85°C | ≤125°C | |
| V _{IH} | Minimum High-Level Input Voltage | V _{OUT} = 0.1 V, I _{OUT} ≤ 20 μA or V _{OUT} = V _{CC} - 0.1 V | 4.5 | 2.0 | 2.0 | 2.0 | V |
| | | | 5.5 | 2.0 | 2.0 | 2.0 | |
| V _{IL} | Maximum Low-Level Input Voltage | V _{OUT} = 0.1 V, I _{OUT} ≤ 20 μA or V _{OUT} = V _{CC} - 0.1 V | 4.5 | 0.8 | 0.8 | 0.8 | V |
| | | | 5.5 | 0.8 | 0.8 | 0.8 | |
| V _{OH} | Minimum High-Level Output Voltage | V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 20 μA | 4.5 | 4.4 | 4.4 | 4.4 | V |
| | | V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0 mA | 5.5 | 5.4 | 5.4 | 5.4 | |
| | | | 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 | 0.1 | 0.1 | 0.1 | V |
| | | V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0 mA | 5.5 | 0.1 | 0.1 | 0.1 | |
| | | | 4.5 | 0.26 | 0.33 | 0.40 | |
| I _{IN} | Maximum Input Leakage Current | V _{IN} = V _{CC} or GND | 5.5 | ± 0.1 | ± 1.0 | ± 1.0 | μA |
| I _{CC} | Maximum Quiescent Supply Current (Per Package) | V _{IN} = V _{CC} or GND I _{OUT} ≤ 0 μA | 5.5 | 1.0 | 10 | 40 | μA |
| 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 | ≥ -55°C | 25°C to 125°C | | mA |
| | | | | 2.9 | 2.4 | | |

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AC ELECTRICAL CHARACTERISTICS over full operating conditions ($C_L=50\text{pF}$, Input $t_f=t_r=6\text{ns}$)

| Symbol | Parameter | Vcc V | Guaranteed Limit | | | Unit |
|--------------------------|---|--------------|---------------------|-------|--------|------|
| | | | 25°C to -55°C | ≤85°C | ≤125°C | |
| f_{max} | Maximum Clock Frequency (50% Duty Cycle) | 5.0V ±10% | 30 | 24 | 20 | MHz |
| t_{PLH} , t_{PHL} | Maximum Propagation Delay Time, Clock to Q or \bar{Q} | | 24 | 30 | 36 | ns |
| t_{PLH} , t_{PHL} | Maximum Propagation Delay Time, Set or Reset to Q or \bar{Q} | | 24 | 30 | 36 | ns |
| t_{TLH} , t_{THL} | Maximum Output Transition Time Any Output | | 15 | 19 | 22 | ns |
| C_{IN} | Maximum Input Capacitance | — | 10 | 10 | 10 | pF |

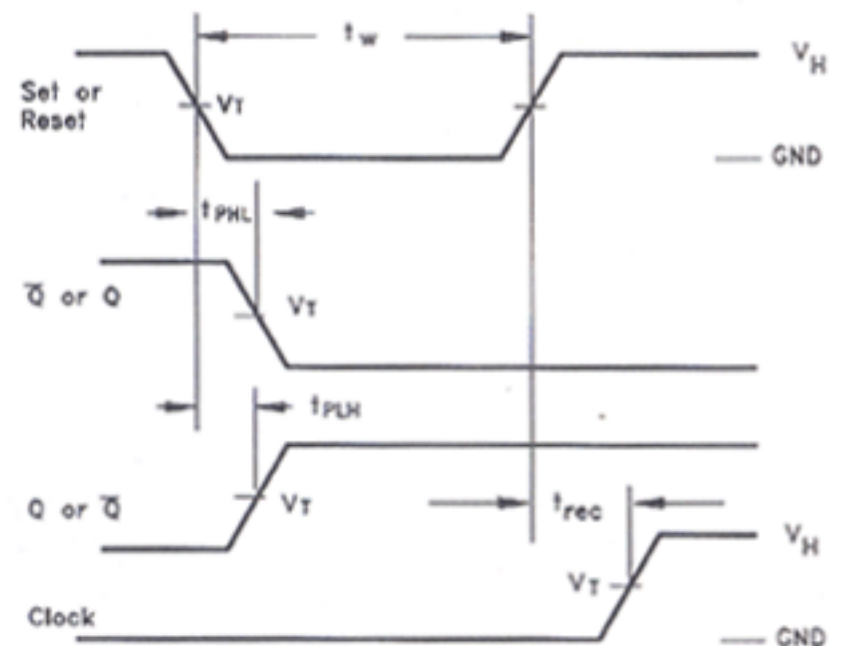
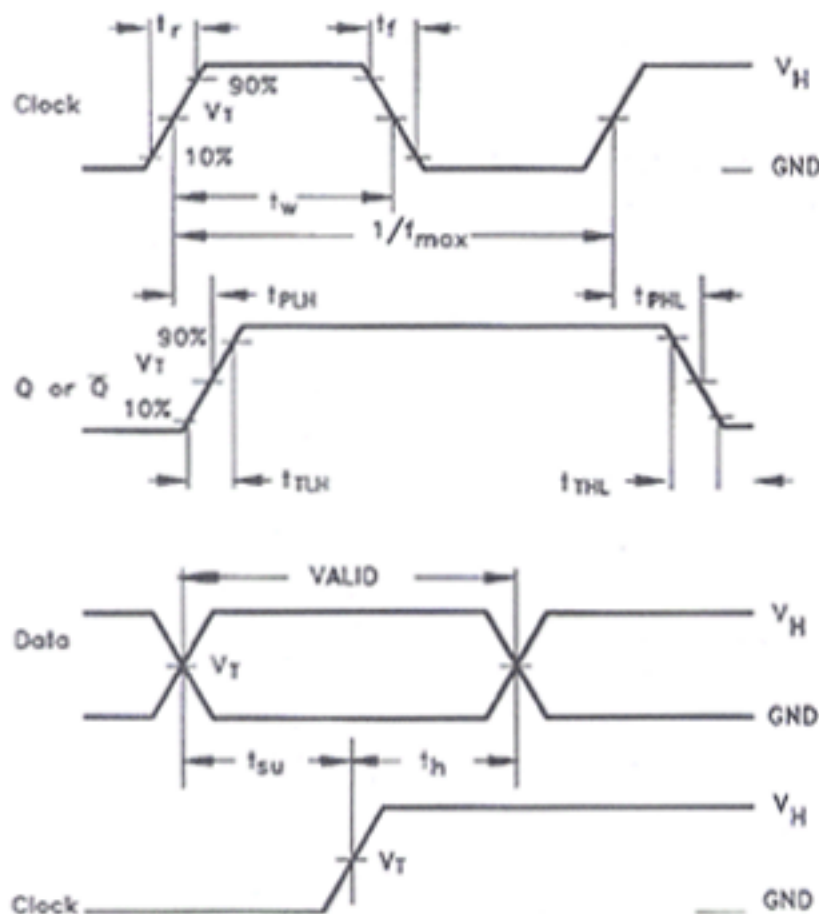
| | | | | |
|----------|--|--------------------------------------|--|----|
| C_{PD} | Power Dissipation Capacitance (Per Flip-Flop) Used to determine the no-load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ | Typical @ 25°C, $V_{CC} = 5\text{V}$ | | pF |
| | | 130 | | |

TIMING REQUIREMENTS ($C_L=50\text{pF}$, Input $t_f=t_r=6.0\text{ns}$)

| Symbol | Parameter | Vcc | Guaranteed Limit | | | | | | Unit |
|------------|---|--------------|------------------|-----|-------|-----|--------|-----|------|
| | | | 25°C to -55°C | | ≤85°C | | ≤125°C | | |
| | | | Min | Max | Min | Max | Min | Max | |
| t_{su} | Minimum Setup Time, Data to Clock | 5.0V ±10% | 15 | | 19 | | 22 | | ns |
| t_h | Minimum Hold Time, Clock to Data | | 3 | | 3 | | 3 | | ns |
| t_{rec} | Minimum Recovery Time, Set or Reset Inactive to Clock | | 6 | | 8 | | 9 | | ns |
| t_w | Minimum Pulse Width, Clock | | 15 | | 19 | | 22 | | ns |
| t_w | Minimum Pulse Width, Set or Reset | | 15 | | 19 | | 22 | | ns |
| t_r, t_f | Maximum Input Rise and Fall Times | | | 500 | | 500 | | 500 | |

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SWITCHING WAVEFORMS



Input and Output threshold voltage, $V_T=50\% V_{CC}$ for HC; 1.3V for HCT, $V_H=V_{CC}$ for HC, 3V for HCT