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MM74HCT74

Dual D-Type Flip-Flop with Preset and Clear

Features

- Typical propagation delay: 20ns
- Low quiescent current: 40µA maximum (74HCT Series)
- Low input current: 1µA maximum
- Fanout of 10 LS-TTL loads
- Meta-stable hardened

General Description

The MM74HCT74 utilizes advanced silicon-gate CMOS technology to achieve operation speeds similar to the equivalent LS-TTL part. It possesses the high noise immunity and low power consumption of standard CMOS integrated circuits, along with the ability to drive 10 LS-TTL loads.

This flip-flop has independent data, preset, clear, and clock inputs and Q and \bar{Q} outputs. The logic level present at the data input is transferred to the output during the positive-going transition of the clock pulse. Preset and clear are independent of the clock and accomplished by a low level at the appropriate input.


The 74HCT logic family is functionally and pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug-in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

Ordering Information

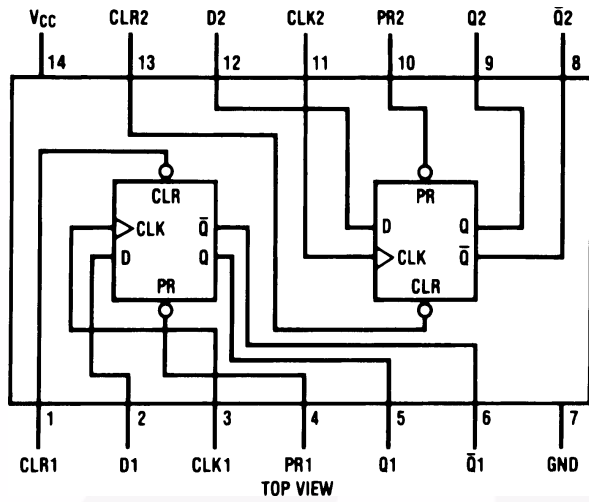
| Order Number | Package Number | Package Description |
|--------------|----------------|--|
| MM74HCT74M | M14A | 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| MM74HCT74SJ | M14D | 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide |
| MM74HCT74MTC | MTC14 | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |
| MM74HCT74N | N14A | 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.

 All packages are lead free per JEDEC: J-STD-020B standard.

Connection Diagram

Pin Assignments for DIP, SOIC, SOP and TSSOP



Truth Table

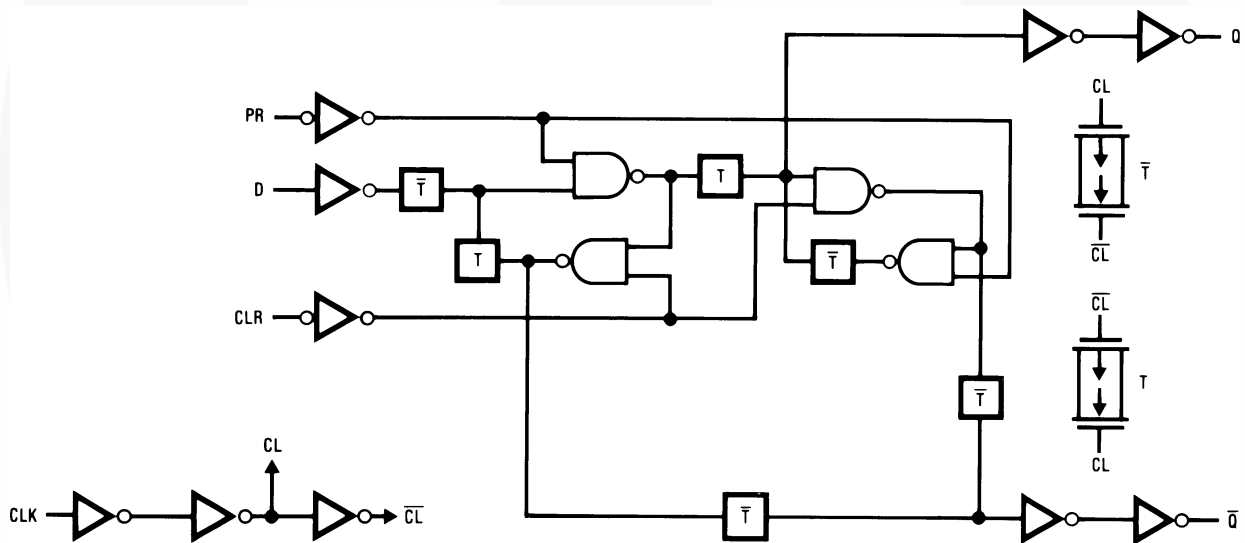
| Inputs | | | | Outputs | |
|--------|-----|-----|---|------------------|------------------|
| PR | CLR | CLK | D | Q | \bar{Q} |
| L | H | X | X | H | L |
| H | L | X | X | L | H |
| L | L | X | X | H ⁽¹⁾ | H ⁽¹⁾ |
| H | H | ↑ | H | H | L |
| H | H | ↑ | L | L | H |
| H | H | L | X | Q0 | $\bar{Q}0$ |

Q0 = the level of Q before the indicated input conditions were established.

Note:

1. This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (HIGH) level.

Logic Diagram



Absolute Maximum Ratings⁽²⁾

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol | Parameter | Rating |
|------------------|--|-------------------------|
| V_{CC} | Supply Voltage | -0.5 to +7.0V |
| V_{IN} | DC Input Voltage | -1.5 to $V_{CC} + 1.5V$ |
| V_{OUT} | DC Output Voltage | -0.5 to $V_{CC} + 0.5V$ |
| I_{IK}, I_{OK} | Clamp Diode Current | $\pm 20mA$ |
| I_{OUT} | DC Output Current, per pin | $\pm 25mA$ |
| I_{CC} | DC V_{CC} or GND Current, per pin | $\pm 50mA$ |
| T_{STG} | Storage Temperature Range | -65°C to +150°C |
| P_D | Power Dissipation Note 3 S.O. Package only | 600mW 500mW |
| T_L | Lead Temperature (Soldering 10 seconds) | 260°C |

Notes:

- Unless otherwise specified all voltages are referenced to ground.
- Power Dissipation temperature derating — plastic "N" package: -12 mW/°C from 65°C to 85°C.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

| Symbol | Parameter | Min. | Max. | Units |
|-------------------|-----------------------------|------|----------|-------|
| V_{CC} | Supply Voltage | 4.5 | 5.5 | V |
| V_{IN}, V_{OUT} | DC Input or Output Voltage | 0 | V_{CC} | V |
| T_A | Operating Temperature Range | -40 | +85 | °C |
| t_r, t_f | Input Rise or Fall Times | | 500 | ns |

DC Electrical Characteristics $V_{CC} = 5V \pm 10\%$ (unless otherwise specified).

| Symbol | Parameter | Conditions | $T_A =$ | | | | Units |
|----------|-----------------------------------|---|----------|-------------------|----------------|----------------|---------|
| | | | 25°C | | -40°C to 85°C | -55°C to 125°C | |
| | | | Typ. | Guaranteed Limits | | | |
| V_{IH} | Minimum HIGH Level Input Voltage | | | 2.0 | 2.0 | 2.0 | V |
| V_{IL} | Maximum LOW Level Input Voltage | | | 0.8 | 0.8 | 0.8 | V |
| V_{OH} | Minimum HIGH Level Output Voltage | $V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 20\mu A$ | V_{CC} | $V_{CC} - 0.1$ | $V_{CC} - 0.1$ | $V_{CC} - 0.1$ | V |
| | | $V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 4.0mA$, $V_{CC} = 4.5V$ | 4.2 | 3.98 | 3.84 | 3.7 | |
| | | $V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 4.8mA$, $V_{CC} = 5.5V$ | 5.2 | 4.98 | 4.84 | 4.7 | |
| V_{OL} | Maximum LOW Level Voltage | $V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 20\mu A$ | 0 | 0.1 | 0.1 | 0.1 | V |
| | | $V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 4.0mA$, $V_{CC} = 4.5V$ | 0.2 | 0.26 | 0.33 | 0.4 | |
| | | $V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 4.8mA$, $V_{CC} = 5.5V$ | 0.2 | 0.26 | 0.33 | 0.4 | |
| I_{IN} | Maximum Input Current | $V_{IN} = V_{CC}$ or GND, V_{IH} or V_{IL} | | ± 0.5 | ± 0.5 | ± 1.0 | μA |
| I_{CC} | Maximum Quiescent Supply Current | $V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0\mu A$ | | 2.0 | 20 | 80 | μA |
| | | $V_{IN} = 2.4V$ or $0.5V^{(4)}$ | | 0.3 | 0.4 | 0.5 | mA |

Note:4. This is measured per pin. All other inputs are held at V_{CC} Ground.**AC Electrical Characteristics** $V_{CC} = 5V$, $T_A = 25^\circ C$, $C_L = 15 pF$, $t_r = t_f = 6ns$.

| Symbol | Parameter | Conditions | Typ. | Guaranteed Limit | Units |
|-----------------------|--|------------|------|------------------|-------|
| f_{MAX} | Maximum Operating Frequency from Clock to Q or \bar{Q} | | 50 | 30 | MHz |
| t_{PHL} , t_{PLH} | Maximum Propagation Delay Clock to Q or \bar{Q} | | 18 | 30 | ns |
| t_{PHL} , t_{PLH} | Maximum Propagation Delay from Preset or Clear to Q or \bar{Q} | | 18 | 30 | ns |
| t_{REM} | Minimum Removal Time, Preset or Clear to Clock | | | 20 | ns |
| t_S | Minimum Setup Time Data to Clock | | | 20 | ns |
| t_H | Minimum Hold Time Clock to Data | | -3 | 0 | ns |
| t_W | Minimum Pulse Width Clock, Preset or Clear | | 8 | 16 | ns |

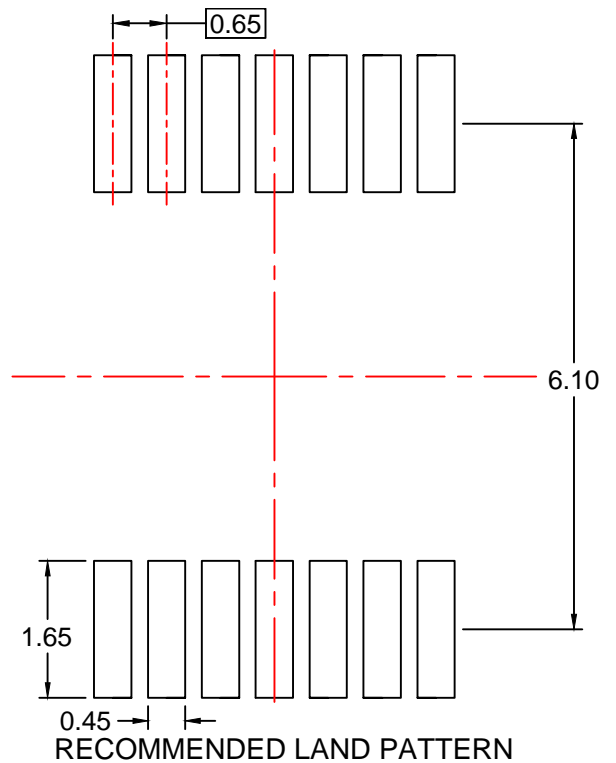
AC Electrical Characteristics

$V_{CC} = 5.0V \pm 10\%$, $C_L = 50 \text{ pF}$, $t_r = t_f = 6\text{ns}$ unless otherwise specified.

| Symbol | Parameter | Conditions | $T_A = 25^\circ\text{C}$ | | $T_A = -40^\circ \text{ to } +85^\circ\text{C}$ | | Units |
|--------------------|--|-----------------|--------------------------|-------------------|---|--|-------|
| | | | Typ. | Guaranteed Limits | | | |
| f_{MAX} | Maximum Operating Frequency | | | 27 | 21 | | MHz |
| t_{PHL}, t_{PLH} | Maximum Propagation Delay from Clock to Q or \bar{Q} | | 21 | 35 | 44 | | ns |
| t_{PHL}, t_{PLH} | Maximum Propagation Delay from Preset or Clear to Q or \bar{Q} | | 21 | 35 | 44 | | ns |
| t_{REM} | Minimum Removal Time Preset or Clear to Clock | | | 20 | 25 | | ns |
| t_S | Minimum Setup Time Data to Clock | | | 20 | 25 | | ns |
| t_H | Minimum Hold Time Clock to Data | | -3 | 0 | 0 | | ns |
| t_W | Minimum Pulse Width Clock, Preset or Clear | | 9 | 16 | 20 | | ns |
| t_r, t_f | Maximum Clock Input Rise and Fall Time | | | 500 | 500 | | ns |
| t_{THL}, t_{TLH} | Maximum Output Rise and Fall Time | | | 15 | 19 | | ns |
| C_{PD} | Power Dissipation Capacitance ⁽⁵⁾ | (per flip-flop) | 10 | | | | pF |
| C_{IN} | Maximum Input Capacitance | | 5 | 10 | 10 | | pF |

Note:

5. C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 2009.
- E. LANDPATTERN STANDARD: SOP65P640X110-14M.
- F. DRAWING FILE NAME: MKT-MTC14rev7.





NOTES:

- A. CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS
- D. LAND PATTERN STANDARD: SOIC127P600X145-14M
- E. CONFORMS TO ASME Y14.5M, 2009
- D. DRAWING FILENAME: MKT-M14Arev14



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