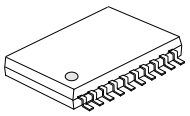
# U74HCT374

**CMOS IC**

# OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS



TSSOP-20

## ■ DESCRIPTION

The **U74HCT374** is a octal edge-triggered D-type flip-flops with 3-state outputs and it has 8 channels.

When the $\overline{OE}$ input is low, on the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels of the data (D) inputs.

When the $\overline{OE}$ input is high, the outputs are in the high-impedance.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to $V_{CC}$ through a pull-up resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

## ■ FEATURES

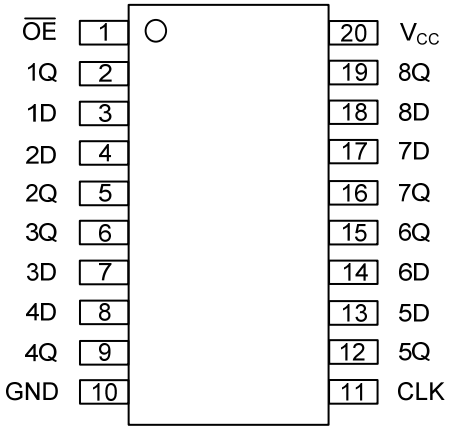
* Inputs are TTL-Voltage Compatible
* Operate from 4.5V to 5.5V
* Inputs Accept Voltages to 5.5V
* Max $t_{pd}$ of 25ns at $V_{CC}$=5.5V, $C_L$=50pF
* Typ $V_{OL}$< 0.26V at $V_{CC}$=4.5V, $I_{OL}$=6mA, $T_A$=25°C
* Typ $V_{OH}$> 3.98V at $V_{CC}$=4.5V, $I_{OH}$=-6mA, $T_A$=25°C

## ■ ORDERING INFORMATION

| Ordering Number | | Package | Packing |
|---|---|---|---|
| Lead Free | Halogen Free | | |
| U74HCT374L-P20-R | U74HCT374G-P20-R | TSSOP-20 | Tape Reel |
| U74HCT374L-P20-T | U74HCT374G-P20-T | TSSOP-20 | Tube |

| | |
|---|---|
| U74AHCT374L-P20-R<br>(1)Packing Type<br>(2)Package Type<br>(3)Lead Free | (1) R: Tape Reel, T: Tube<br>(2) P20: TSSOP-20<br>(3) G: Halogen Free, L: Lead Free |

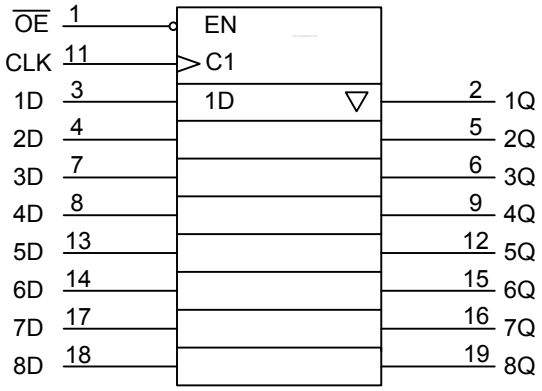
## ■ PIN CONFIGURATION



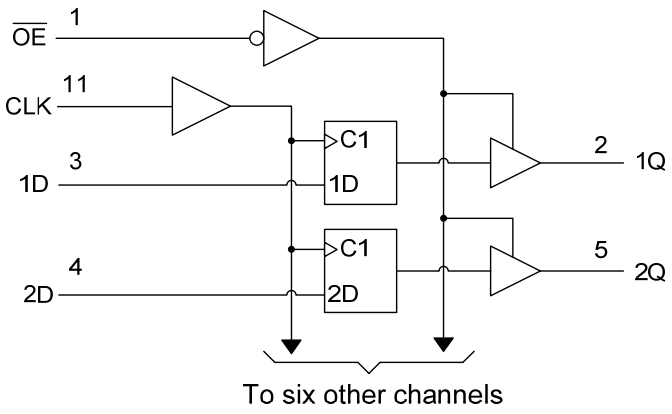

## ■ FUNCTION TABLE

| INPUTS( $\overline{OE}$ ) | INPUTS(CLK) | INPUTS(D) | OUTPUT(Q) |
|---|---|---|---|
| L | ↑ | H | H |
| L | ↑ | L | L |
| L | H or L | X | $Q_0$ |
| H | X | X | Z |

## ■ LOGIC SYMBOL




## ■ LOGIC DIAGRAM



## ■ ABSOLUTE MAXIMUM RATING

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | -0.5 ~ 7 | V |
| Input Voltage | $V_{IN}$ | -0.5 ~ 7 | V |
| Output Voltage | $V_{OUT}$ | -0.5 ~ $V_{CC}$ +0.5 | V |
| $V_{CC}$ or GND Current | $I_{CC}$ | ±70 | mA |
| Output Current | $I_{OUT}$ | ±35 | mA |
| Input Clamp Current | $I_{IK}$ | -20 | mA |
| Output Clamp Current | $I_{OK}$ | ±20 | mA |
| Operating Temperature | $T_{OPR}$ | -40 ~ + 85 | ℃ |
| Storage Temperature | $T_{STG}$ | -65 ~ + 150 | ℃ |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

## ■ RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 4.5 ~ 5.5 | V |
| High-level Input Voltage | $V_{IH}$ | 2 | V |
| Low-level Input Voltage | $V_{IL}$ | 0.8 | V |
| Input Voltage | $V_{IN}$ | 0 ~ $V_{CC}$ | V |
| Output Voltage | $V_{OUT}$ | 0 ~ $V_{CC}$ | V |
| High-level Output Current | $I_{OH}$ | -8 | mA |
| Low-level Output Current | $I_{OL}$ | 8 | mA |
| Input Rise or Fall Times | $t_R$, $t_F$ | 500 | ns/V |
| Operating temperature | $T_A$ | -40 ~ 85 | ℃ |

## ■ ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage High-Level | $V_{OH}$ | $V_{CC}$=4.5V, $I_{OH}$=-20μA | 4.4 | 4.499 | | V |
| | | $V_{CC}$=4.5V, $I_{OH}$=-6mA | 3.98 | 4.3 | | |
| Output Voltage Low-Level | $V_{OL}$ | $V_{CC}$=4.5V, $I_{OL}$=20μA | | 0.001 | 0.1 | V |
| | | $V_{CC}$=4.5V, $I_{OL}$=6mA | | 0.17 | 0.26 | |
| Input Leakage Current | $I_{I(LEAK)}$ | $V_{CC}$=5.5V, $V_{IN}$=0 or 5.5V | | ±0.1 | ±100 | nA |
| Leakage Current (For output in high-impedance state) | $I_{OZ}$ | $V_{CC}$=5.5V, $V_{IN}$=$V_{IH}$ or $V_{IH}$, $V_{OUT}$=0 or 5.5V | | ±0.01 | ±0.5 | μA |
| Quiescent Supply Current | $I_{CC}$ | $V_{CC}$=5.5V, $V_{IN}$=$V_{CC}$ or GND, $I_{OUT}$=0 | | | 8 | μA |
| Additional quiescent supply current | $\Delta I_{CC}$ | $V_{CC}$=5.5V, one input at 0.5V or 3.4V, Other inputs at $V_{CC}$ or GND | | 1.4 | 2.4 | mA |
| Input Capacitance | $C_I$ | $V_{CC}$=4.5V to 5V | | 3 | 10 | pF |

## ■ TIMING REQUIREMENTS

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Clock Frequency | $f_{CLOCK}$ | $V_{CC}$=4.5V | | | 31 | MHz |
| | | $V_{CC}$=5.5V | | | 36 | |
| Pulse Width, CLK High or Low | $t_W$ | $V_{CC}$=4.5V | 16 | | | ns |
| | | $V_{CC}$=5.5V | 14 | | | |
| Setup Time, Data Before CLK↑ | $t_{SU}$ | $V_{CC}$=4.5V | 20 | | | ns |
| | | $V_{CC}$=5.5V | 17 | | | |
| Hold Time, Data After CLK↑ | $t_H$ | $V_{CC}$=4.5V | 10 | | | ns |
| | | $V_{CC}$=5.5V | 10 | | | |

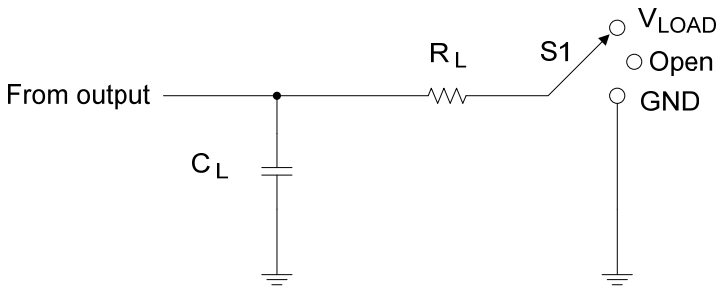
## ■ SWITCHING CHARACTERISTICS (See TEST CIRCUIT AND WAVEFORMS)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Maximum Clock Frequency | $f_{(MAX)}$ | $V_{CC}$=4.5V, $C_L$=50pF | 31 | 36 | | MHz |
| | | $V_{CC}$=5.5V, $C_L$=50pF | 36 | 40 | | |
| From CLK to Q | $t_{PD}$ ($t_{PLH}/t_{PHL}$) | $V_{CC}$=4.5V, $C_L$=50pF | | 30 | 36 | ns |
| | | $V_{CC}$=5.5V, $C_L$=50pF | | 25 | 32 | |
| | | $V_{CC}$=4.5V, $C_L$=150pF | | 40 | 46 | |
| | | $V_{CC}$=5.5V, $C_L$=150pF | | 35 | 41 | |
| From $\overline{OE}$ to Q | $t_{EN}$ ($t_{PZL}/t_{PZH}$) | $V_{CC}$=4.5V, $C_L$=50pF | | 26 | 30 | ns |
| | | $V_{CC}$=5.5V, $C_L$=50pF | | 23 | 27 | |
| | | $V_{CC}$=4.5V, $C_L$=150pF | | 34 | 40 | |
| | | $V_{CC}$=5.5V, $C_L$=150pF | | 29 | 36 | |
| From $\overline{OE}$ to Q | $t_{DIS}$ ($t_{PLZ}/t_{PHZ}$) | $V_{CC}$=4.5V, $C_L$=50pF | | 23 | 30 | ns |
| | | $V_{CC}$=5.5V, $C_L$=50pF | | 22 | 27 | |
| Output transition rise/fall time | $t_T$ ($t_R/t_F$) | $V_{CC}$=4.5V, $C_L$=50pF | | 10 | 12 | ns |
| | | $V_{CC}$=5.5V, $C_L$=50pF | | 9 | 11 | |
| | | $V_{CC}$=4.5V, $C_L$=150pF | | 18 | 42 | |
| | | $V_{CC}$=5.5V, $C_L$=150pF | | 16 | 38 | |

## ■ OPERATING CHARACTERISTICS($T_a$=25°C)

| PARAMETER | SYMBOL | TEST CONDITIONS | RATINGS | UNIT |
|---|---|---|---|---|
| Power Dissipation Capacitance | $C_{PD}$ | No load, $V_{CC}$ = 5 V, f=1MHz | 85 | pF |

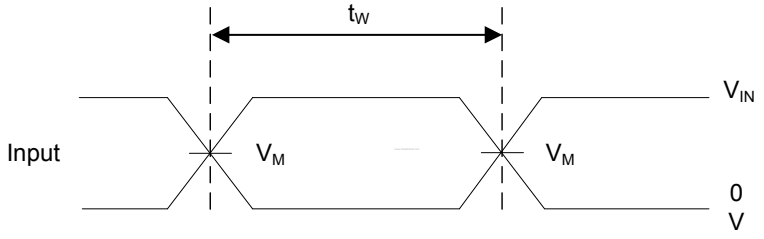
## ■ TEST CIRCUIT AND WAVEFORMS



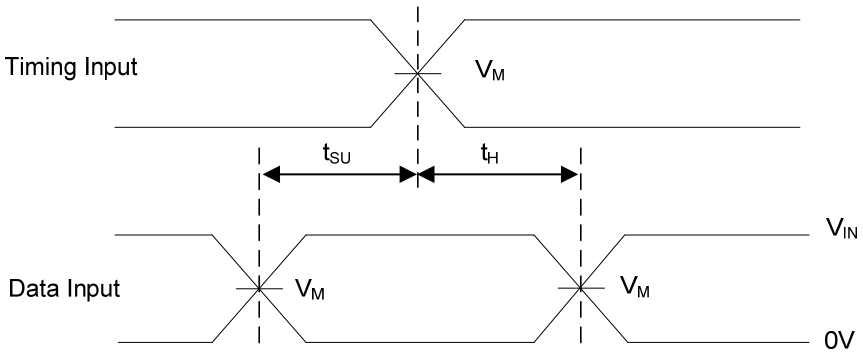

Test Circuit

| TEST | S1 |
|---|---|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | $V_{LOAD}$ |
| $t_{PHZ}/t_{PZH}$ | GND |

| $V_{CC}$ | Input | | $V_M$ | $V_{LOAD}$ | $C_L$ | $R_L$ | $V_\Delta$ |
|---|---|---|---|---|---|---|---|
| | $V_{IN}$ | $t_R$, $t_F$ | | | | | |
| 5V±0.5V | $V_{CC}$ | ≤3ns | $V_{CC}/2$ | $V_{CC}$ | 15pF<br>50pF | 1kΩ | 0.5V |

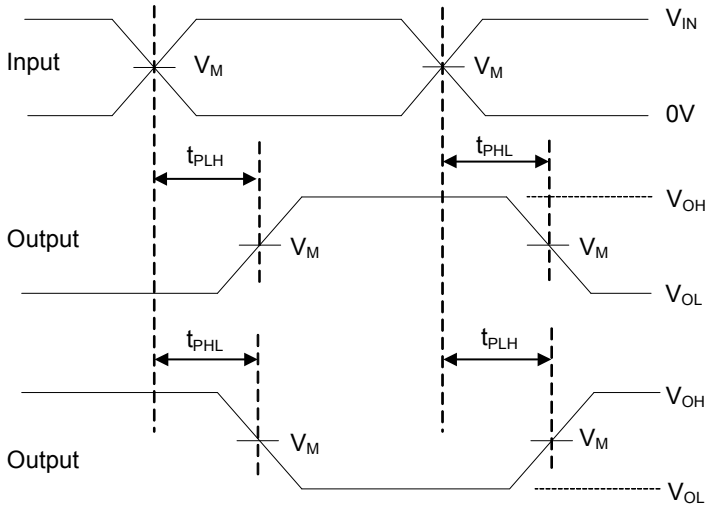



Pulse Duration

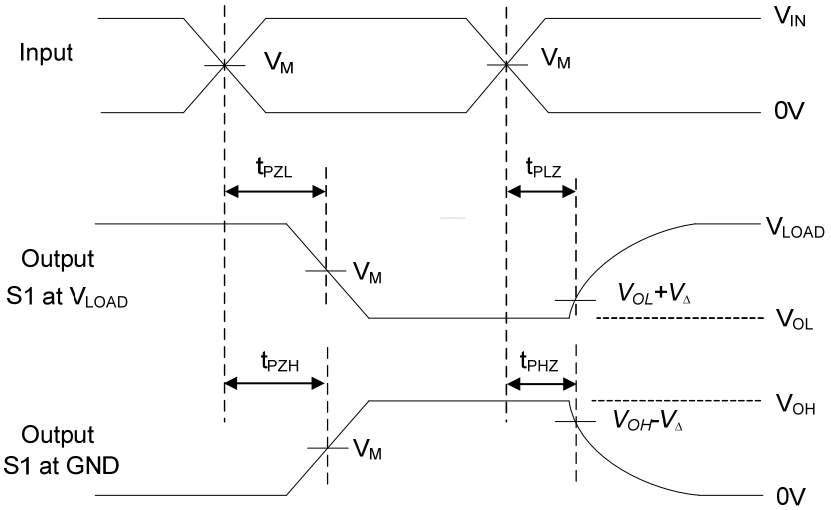



Setup and Hold Times

■ TEST CIRCUIT AND WAVEFORMS(Cont.)




Voltage Waveforms Propagation Delay Times




Voltage Waveforms Enble and Disable Times

Note: A. $C_L$ includes probe and jig capacitance.

B. $P_{RR} \leqslant 1MHz$, $Z_O = 50\Omega$, $t_R \leqslant 3ns$, $t_F \leqslant 3ns$.