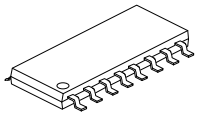
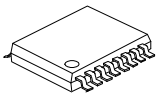
# U74HC4060

**CMOS IC**

## 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS



SOP-16



TSSOP-16

## ■ DESCRIPTION

The **U74HC4060** are high-speed Si-gate CMOS device.

The **U74HC4060** devices consist of an oscillator section and 14 ripple-carry binary counter stages. The oscillator configuration allows design of either RC or crystal oscillator circuits with three oscillator terminals (CLKI, $\overline{CLKO}$, CLKO) , ten buffered outputs ($Q_D$ to $Q_J$ and $Q_L$ to $Q_M$) and an overriding asynchronous master reset (CLR) . The oscillator may be replaced by an external clock signal at input CLKI. In this case keep the other oscillator pins ($\overline{CLKO}$, CLKO) floating. The counter advances on the negative-going transition of CLKI. A high level at the clear (CLR) input disables the oscillator and resets the counter to zero (all Q output low).

## ■ FEATURES

* Operate from 2.0V to 6.0V
* Low Input Current:1.0uA
* Outputs Can Drive Up To 10 LSTTL Loads
* Low Power Consumption ,80uA Max $I_{CC}$
* 4mA Output Drive at 5V
* Typical $t_{PD}$=14ns
* Allow Design of Either RC or Crystal Oscillator Circuits

## ■ ORDERING INFORMATION

| Ordering Number | | Package | Packing |
|---|---|---|---|
| Lead Free | Halogen Free | | |
| U74HC4060L-S16-R | U74HC4060G-S16-R | SOP-16 | Tape Reel |
| U74HC4060L-P16-R | U74HC4060G-P16-R | TSSOP-16 | Tape Reel |

| | |
|---|---|
| U74HC4060G-S16-R<br>(1)Packing Type<br>(2)Package Type<br>(3)Green Package | (1) R: Tape Reel<br>(2) S16: SOP-16, P16: TSSOP-16<br>(3) G: Halogen Free and Lead Free, L: Lead Free |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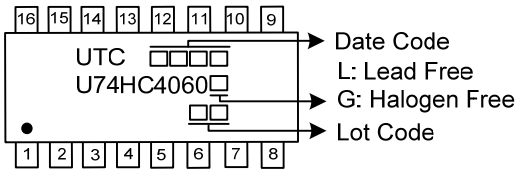
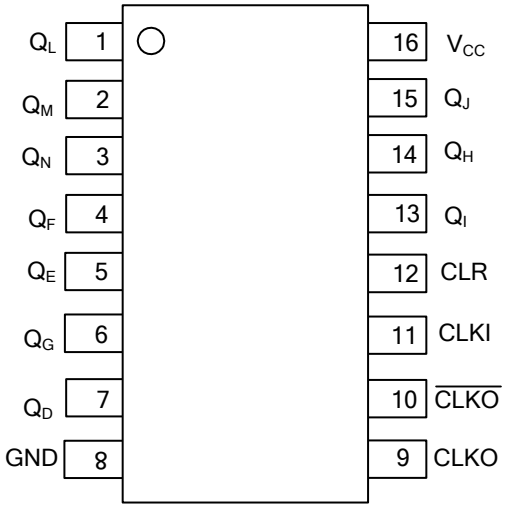
## ■ MARKING




## ■ PIN CONFIGURATION

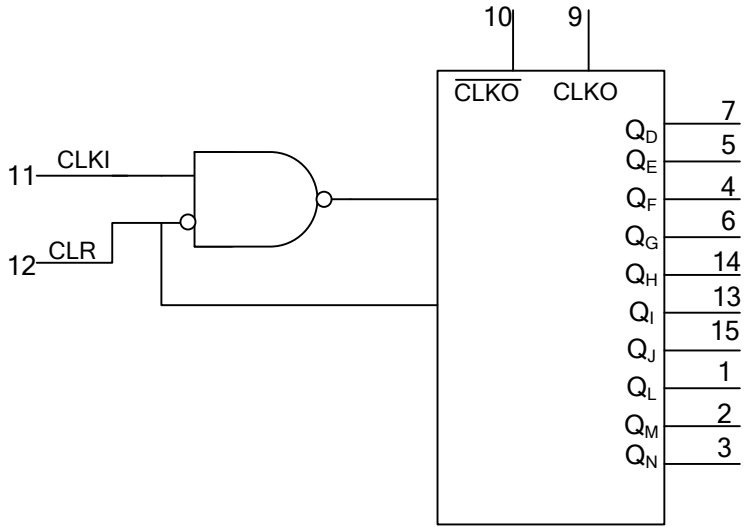



## ■ FUNCTION TABLE

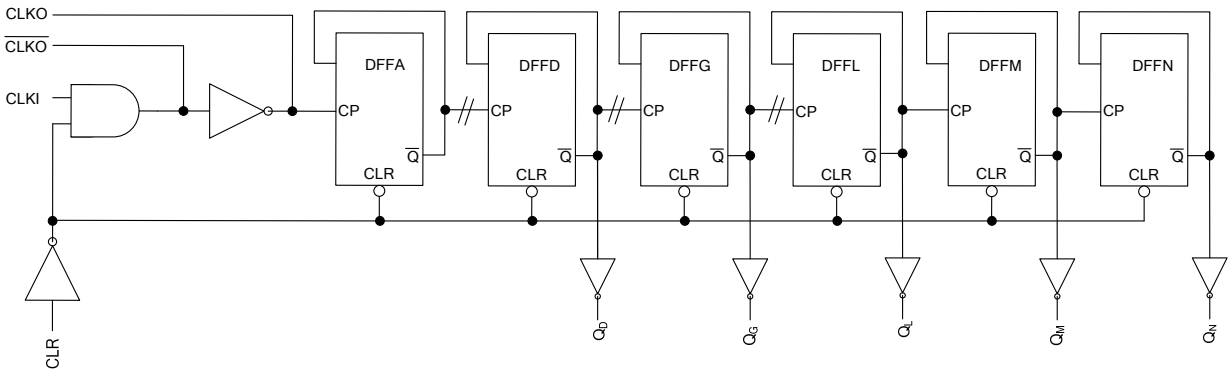
| INPUTS | | FUNCTION |
|---|---|---|
| CLK | CLR | |
| ↑ | L | No change |
| ↓ | L | Advance to next stage |
| X | H | All outputs L |

Note: H: HIGH voltage level
L: LOW voltage level
X: Don't care. High impedance OFF-state
↑: Low-to-High CP transition
↓: High-to-Low CP transition

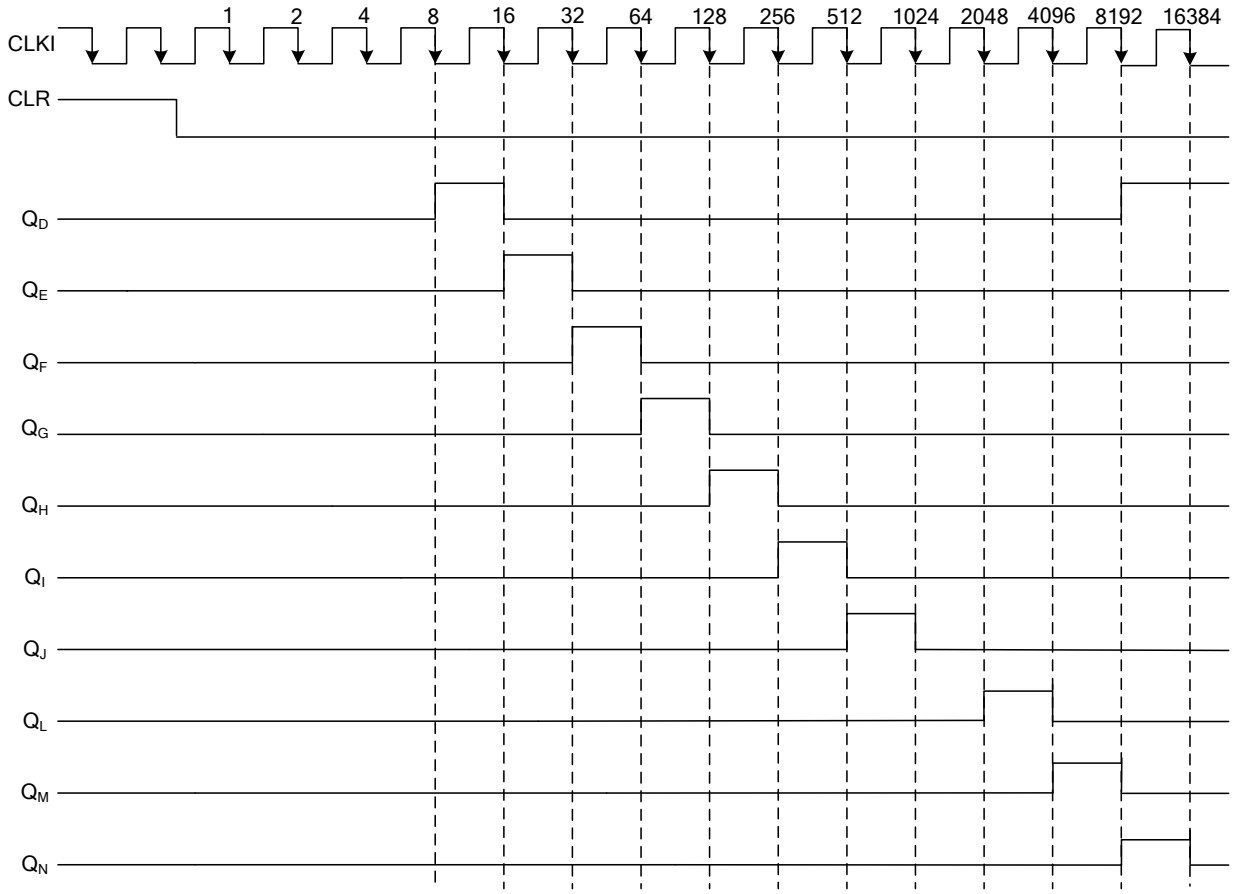
## ■ LOGIC SYMBOL




## ■ LOGIC DIAGRAM



## ■ TIMING DIAGRAM



## ■ ABSOLUTE MAXIMUM RATING (Unless otherwise specified)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | -0.5 ~ 7.0 | V |
| Input Clamp Current ($V_I$<0 or $V_I$>$V_{CC}$) | $I_{IK}$ | ±20 | mA |
| Output Clamp Current ($V_O$<0 or $V_O$>$V_{CC}$) | $I_{OK}$ | ±20 | mA |
| $V_{CC}$ or GND Current | $I_{CC}$ | ±50 | mA |
| Continuous Output Current($V_O$=0 to $V_{CC}$) | $I_{OUT}$ | ±25 | mA |
| Storage Temperature | $T_{STG}$ | -65 ~ + 150 | °C |

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 (Unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | Operating | 2.0 | | 6.0 | V |
| Input Voltage | $V_{IN}$ | | 0 | | $V_{CC}$ | V |
| Output Voltage | $V_{OUT}$ | | 0 | | $V_{CC}$ | V |
| Input Rise or Fall Times | $t_R$, $t_F$ | $V_{CC}$=2.0V | | | 1000 | ns |
| | | $V_{CC}$=4.5V | | | 500 | ns |
| | | $V_{CC}$=6.0V | | | 400 | ns |
| Operating Temperature | $T_A$ | | -40 | | +125 | °C |

## ■ ELECTRICAL CHARACTERISTICS (Unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| High-Level Input Voltage | $V_{IH}$ | $V_{CC}$=2V | 1.5 | | | V |
| | | $V_{CC}$=4.5V | 3.15 | | | V |
| | | $V_{CC}$=6V | 4.2 | | | V |
| Low-Lever Input Voltage | $V_{IL}$ | $V_{CC}$=2V | | | 0.5 | V |
| | | $V_{CC}$=4.5V | | | 1.35 | V |
| | | $V_{CC}$=6V | | | 1.8 | V |
| High-Level Output Voltage | $V_{OH}$ | $V_{CC}$=2V, $I_{OH}$=-20μA | 1.9 | 1.998 | | V |
| | | $V_{CC}$=4.5V, $I_{OH}$=-20μA | 4.4 | 4.499 | | V |
| | | $V_{CC}$=6V, $I_{OH}$=-20μA | 5.9 | 5.999 | | V |
| | | $V_{CC}$=4.5V, $I_{OH}$=-4.0mA | 3.98 | 4.3 | | V |
| | | $V_{CC}$=6V, $I_{OH}$=-5.2mA | 5.48 | 5.8 | | V |
| Low-Level Output Voltage | $V_{OL}$ | $V_{CC}$=2V, $I_{OL}$=20μA | | 0.002 | 0.1 | V |
| | | $V_{CC}$=4.5V, $I_{OL}$=20μA | | 0.001 | 0.1 | V |
| | | $V_{CC}$=6V, $I_{OL}$=20μA | | 0.001 | 0.1 | V |
| | | $V_{CC}$=4.5V, $I_{OL}$=4mA | | 0.17 | 0.26 | V |
| | | $V_{CC}$=6V, $I_{OL}$=5.2mA | | 0.15 | 0.26 | V |
| Input Leakage Current | $I_{I(LEAK)}$ | $V_{CC}$=6V, $V_{IN}$= $V_{CC}$ or GND | | | ±100 | nA |
| Quiescent Supply Current | $I_{CC}$ | $V_{CC}$=6V, $V_{IN}$=$V_{CC}$ or GND, $I_{OUT}$=0 | | | 8 | μA |

## ■ TIMING REQUIREMENTS

(over recommended operating free-air temperature range, unless otherwise specified)

| PARAMETER | | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Clock Frequency | | $f_{clock}$ | $V_{CC}$=2V | | | 4.3 | MHz |
| | | | $V_{CC}$=4.5V | | | 22 | MHz |
| | | | $V_{CC}$=6V | | | 25 | MHz |
| Pulse Duration | $C_{LKI}$ high or low | $t_W$ | $V_{CC}$=2V | 115 | | | ns |
| | | | $V_{CC}$=4.5V | 23 | | | ns |
| | | | $V_{CC}$=6V | 20 | | | ns |
| | $C_{LR}$ high | | $V_{CC}$=2v | 115 | | | ns |
| | | | $V_{CC}$=4.5V | 23 | | | ns |
| | | | $V_{CC}$=6V | 20 | | | ns |
| Setup time, $C_{LR}$ Inactive Before $C_{LKI}$ High To Low | | tsu | $V_{CC}$=2V | 200 | | | ns |
| | | | $V_{CC}$=4.5V | 40 | | | ns |
| | | | $V_{CC}$=6V | 34 | | | ns |

## ■ SWITCHING CHARACTERISTICS

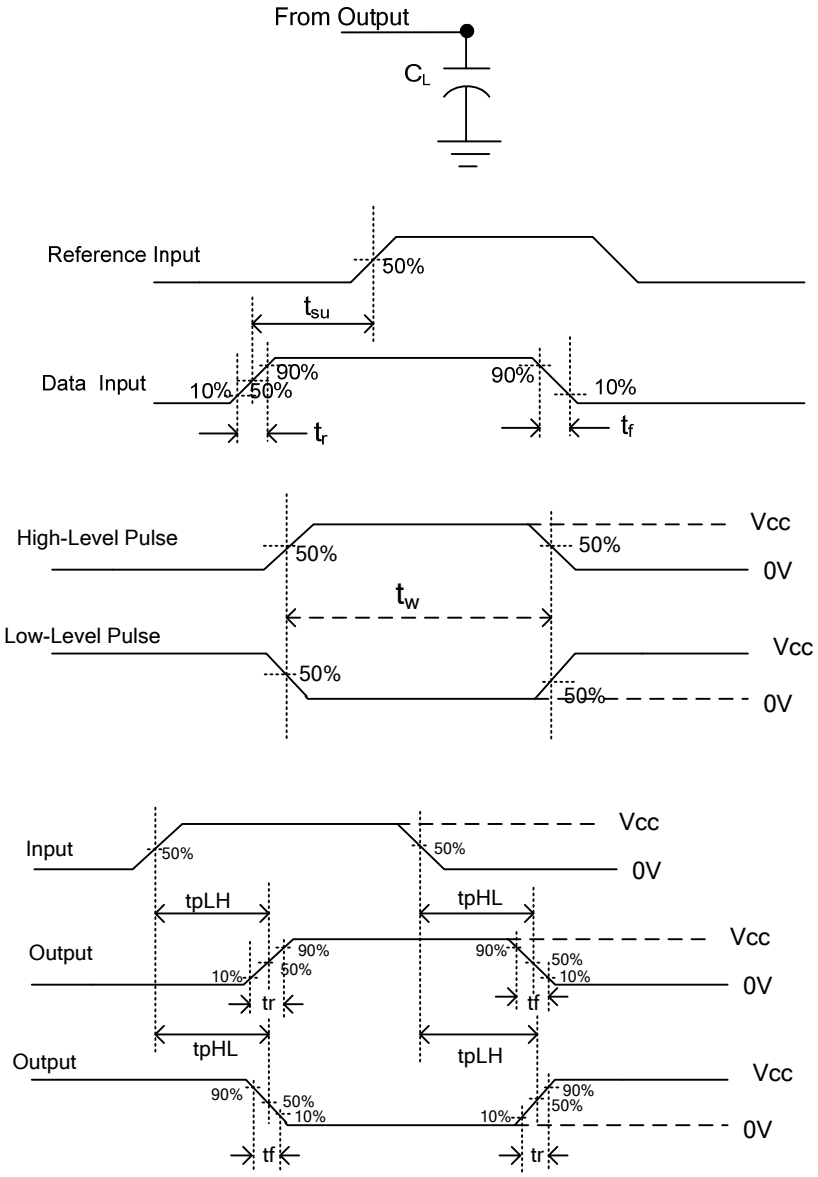
(over recommended operating free-air temperature range, $C_L$=50pF, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Maximum Clock Pulse Frequency | $f_{MAX}$ | $V_{CC}$=2V | 4.3 | | | MHz |
| | | $V_{CC}$=4.5V | 22 | | | MHz |
| | | $V_{CC}$=6V | 25 | | | MHz |
| Propagation delay from CLKI to $Q_D$ | $t_{PD}$ | $V_{CC}$=2V | | | 615 | ns |
| | | $V_{CC}$=4.5V | | | 123 | ns |
| | | $V_{CC}$=6V | | | 105 | ns |
| Propagation delay from CLR to Any Q | $t_{PHL}$ | $V_{CC}$=2V | | | 175 | ns |
| | | $V_{CC}$=4.5V | | | 35 | ns |
| | | $V_{CC}$=6V | | | 30 | ns |
| Output rise or fall time | $t_t$ | $V_{CC}$=2V | | | 95 | ns |
| | | $V_{CC}$=4.5V | | | 19 | ns |
| | | $V_{CC}$=6V | | | 16 | ns |

## ■ OPERATING CHARACTERISTICS (Unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Power Dissipation Capacitance | $C_{PD}$ | No load | | 88 | | pF |

## ■ TEST CIRCUIT AND WAVEFORMS




Note: A. CL =50pF ,CL includes probe and jig capacitance.

B. All input pulses are supplied by generators having the following characteristics : PRR ≤1MHz, Zo = 50Ω, tr ≤6ns, tf ≤6ns.

C. For clock inputs ,$f_{max}$ is measured when the input duty cycle is 50%.

D. tpLH and tpHL are the same as tpd.

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