



## U74HC4060

CMOS IC

### 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

#### DESCRIPTION

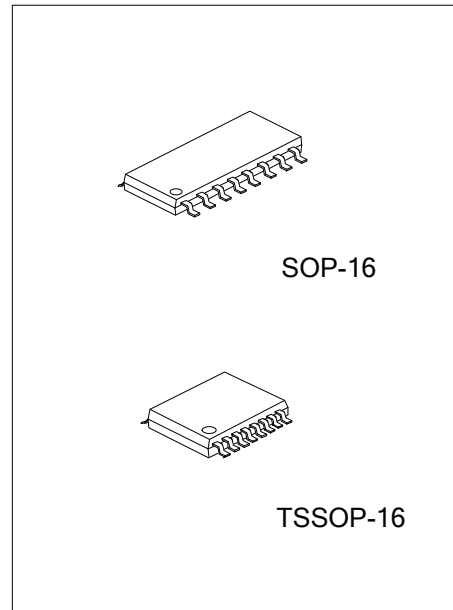
The **U74HC4060** are high-speed Si-gate CMOS device. The **U74HC4060** devices consist of an oscillator section and 14 ripple-carry binary counter stages. The oscillator configuration allows design of either RC or crystal oscillator circuits with three oscillator terminals (CLKI,  $\overline{\text{CLKO}}$ , 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 ( $\overline{\text{CLKO}}$ , 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

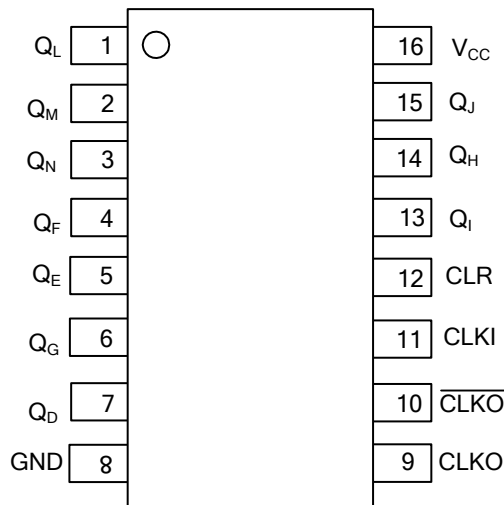
#### ORDERING INFORMATION

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



<p>U74HC4060L-S16-R</p> <p>(1) Packing Type (2) Package Type (3) Lead Free</p>	<p>(1) R: Tape Reel, T: Tube (2) S16: SOP-16, P16: TSSOP-16 (3) G: Halogen Free, L: Lead Free</p>
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■ 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

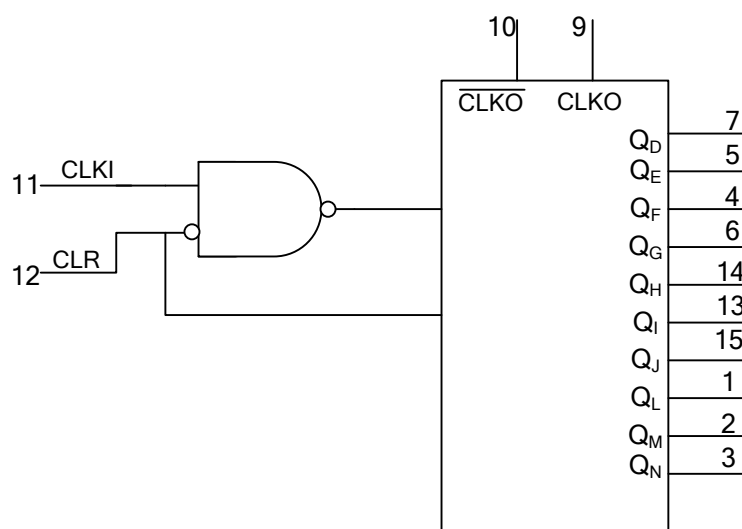
L: LOW voltage level

X: Don't care. High impedance OFF-state

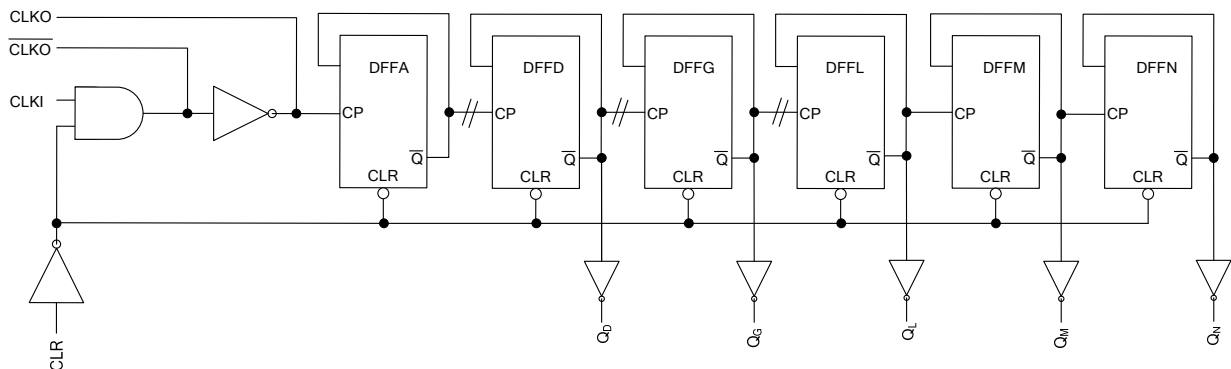
↑: Low-to-High CP transition

↓: High-to-Low CP transition

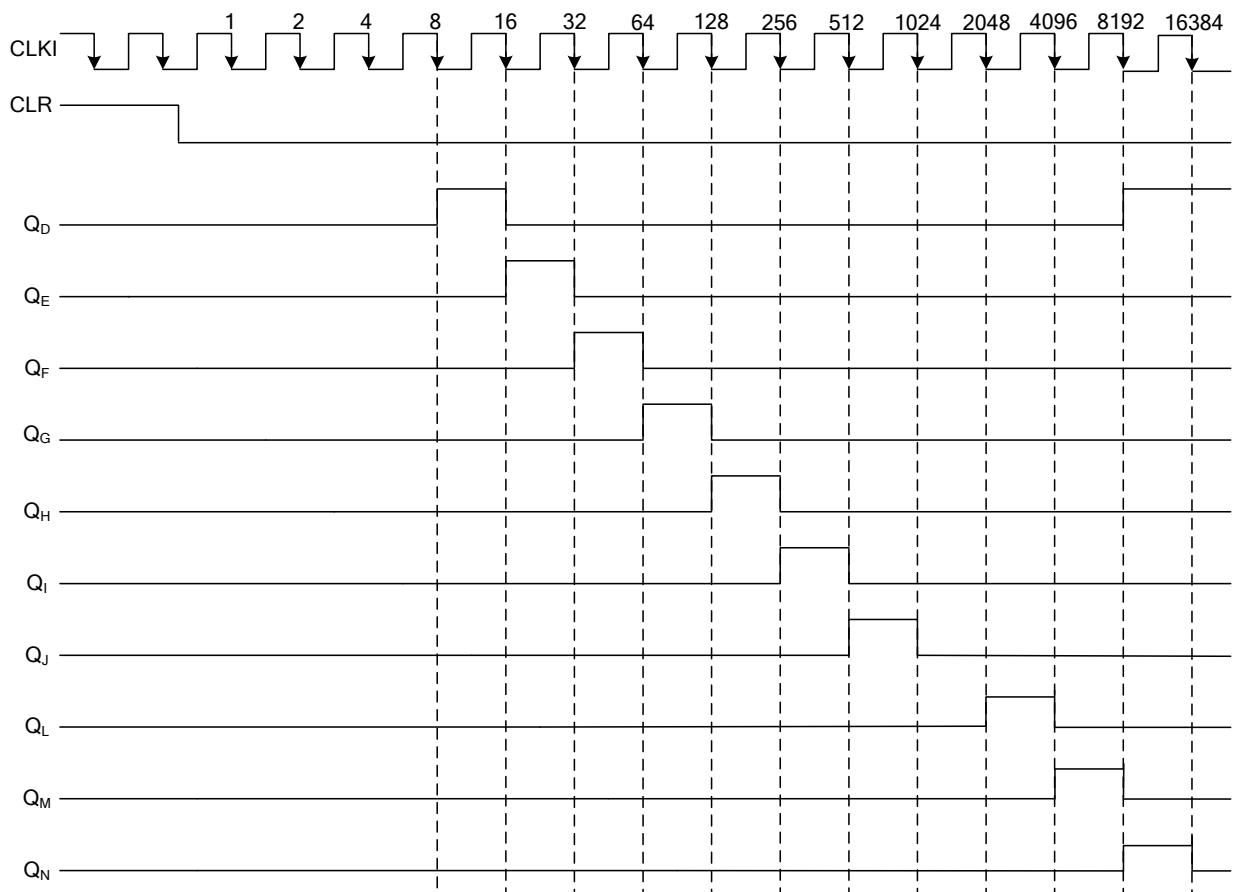
■ LOGIC SYMBOL



## LOGIC DIAGRAM



## TIMING DIAGRAM



### ■ ABSOLUTE MAXIMUM RATING

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

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
Operating Temperature	$T_A$		-40		+85	°C
Input Rise or Fall Times	$t_R, t_F$	$V_{CC}=2.0V$			1000	ns
		$V_{CC}=4.5V$			500	
		$V_{CC}=6.0V$			400	

### ■ ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , 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-Level 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	$V_{OH}$	$V_{CC}=2V, I_{OH}=-20\mu A$	1.9	1.998		V
		$V_{CC}=4.5V, I_{OH}=-20\mu A$	4.4	4.499		V
		$V_{CC}=6V, I_{OH}=-20\mu A$	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	$V_{OL}$	$V_{CC}=2V, I_{OL}=20\mu A$		0.002	0.1	V
		$V_{CC}=4.5V, I_{OL}=20\mu A$		0.001	0.1	V
		$V_{CC}=6V, I_{OL}=20\mu A$		0.001	0.1	V
		$V_{CC}=4.5V, I_{OH}=4mA$		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 noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
F <sub>COLCK</sub> Clock Frequency		V <sub>CC</sub> =2V			4.3	MHz
		V <sub>CC</sub> =4.5V			22	
		V <sub>CC</sub> =6V			25	
t <sub>w</sub> Pulse Duration	C <sub>LKI</sub> high or low	V <sub>CC</sub> =2V	115			ns
		V <sub>CC</sub> =4.5V	23			
		V <sub>CC</sub> =6V	20			
	C <sub>LR</sub> high	V <sub>CC</sub> =2V	115			
		V <sub>CC</sub> =4.5V	23			
		V <sub>CC</sub> =6V	20			
t <sub>su</sub> , Setup time, C <sub>LR</sub> Inactive Before C <sub>LKI</sub> High To Low		V <sub>CC</sub> =2V	200			ns
		V <sub>CC</sub> =4.5V	40			
		V <sub>CC</sub> =6V	34			

### ■ SWITCHING CHARACTERISTICS

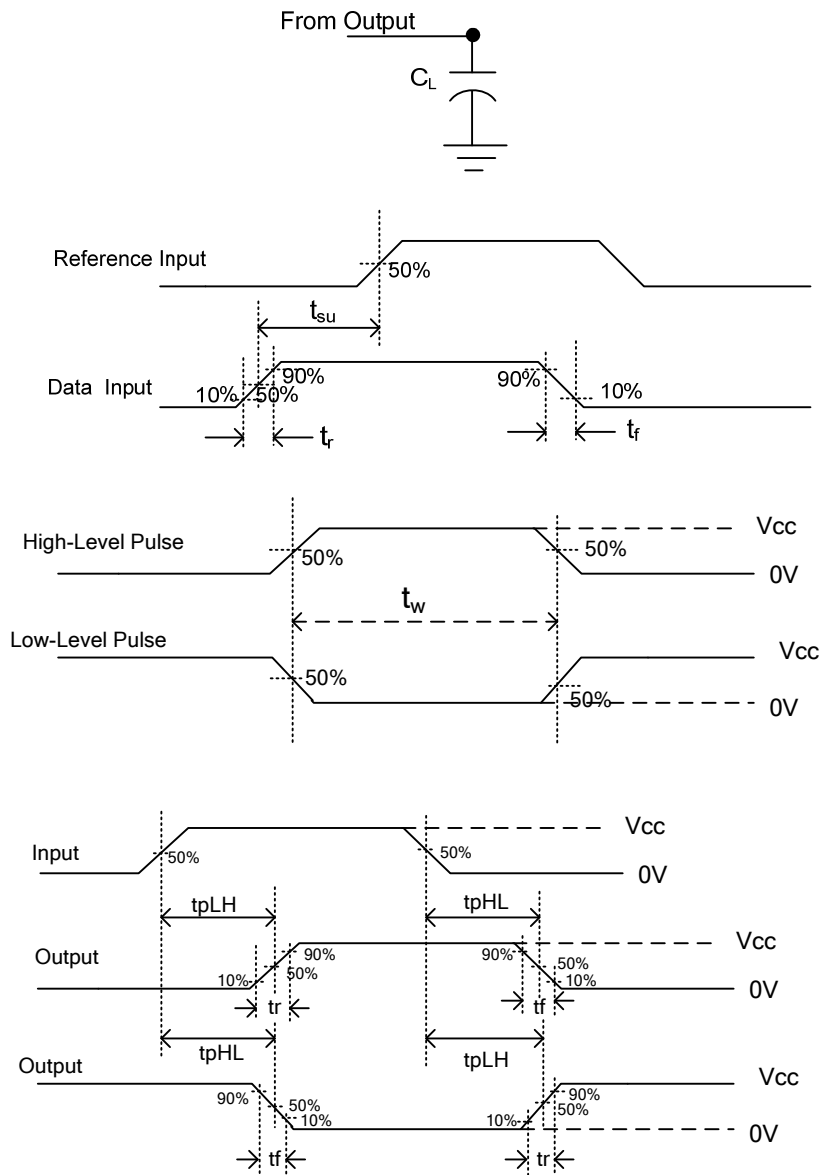
(over recommended operating free-air temperature range, C<sub>L</sub>=50pF, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Propagation delay from C <sub>LKI</sub> to Q <sub>D</sub>	t <sub>PD</sub>	V <sub>CC</sub> =2V		240	490	ns
		V <sub>CC</sub> =4.5V		58	98	
		V <sub>CC</sub> =6V		42	83	
Propagation delay from C <sub>LKI</sub> to Any Q	t <sub>PHL</sub>	V <sub>CC</sub> =2V		66	140	ns
		V <sub>CC</sub> =4.5V		18	28	
		V <sub>CC</sub> =6V		24	24	
Output rise or fall time	t <sub>t</sub>	V <sub>CC</sub> =2V		28	75	ns
		V <sub>CC</sub> =4.5V		8	15	
		V <sub>CC</sub> =6V		6	13	
Maximum Clock Pulse Frequency	f <sub>max</sub>	V <sub>CC</sub> =2V	5.5	10		MHz
		V <sub>CC</sub> =4.5V	28	45		
		V <sub>CC</sub> =6V	33	53		

### ■ OPERATING CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	C <sub>PD</sub>	No load		88		pF

## ■ TEST CIRCUIT AND WAVEFORMS



Note: A.  $C_L = 50\text{pF}$ ,  $C_L$  includes probe and jig capacitance.

B. All input pulses are supplied by generators having the following characteristics : PRR  $\leq 1\text{MHz}$ ,  $Z_o = 50\Omega$ ,  $t_r \leq 6\text{ns}$ ,  $t_f \leq 6\text{ns}$ .

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

D.  $t_{pLH}$  and  $t_{pHL}$  are the same as  $t_{pd}$ .

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