

14 STAGE BINARY COUNTER/OSCILLATOR

IN74HC4060A

The IN74HC4060A is an high speed CMOS 14-STAGE BINARY COUNTER/OSCILLATOR fabricated with silicon gate C²MOS technology. The oscillator configuration allows design of either RC or crystal oscillator circuits. A high level on the CLEAR accomplishes the reset function, i.e. all counter outputs are made low and the oscillator is disabled.

A negative transition on the clock input increments the counter. Ten kinds of divided output are provided; 4 to 10 and 12 to 14 stage inclusive. The maximum division available at Q12 is 1/16384 f oscillator.

The Clock Input ($\overline{\text{OI}}$) and the CLEAR input are equipped with protection circuits against static discharge and transient excess voltage.

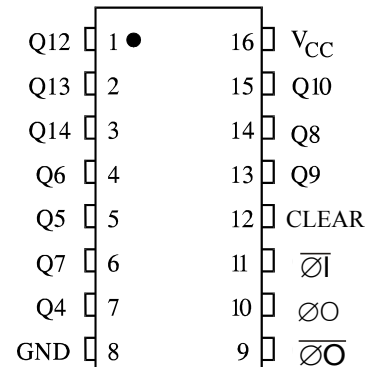
- LOW POWER DISSIPATION:
 $I_{CC} = 4 \mu\text{A}(\text{MAX.})$ at $T_A = 25^\circ\text{C}$
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 4 \text{ mA} (\text{MIN})$
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:
 $V_{CC} (\text{OPR}) = 2 \text{ V to } 6 \text{ V}$

ORDERING INFORMATION
 IN74HC4060AN Plastic
 IN74HC4060ADW SOIC
 $T_A = -55^\circ \text{ to } 125^\circ \text{ C}$ for all packages

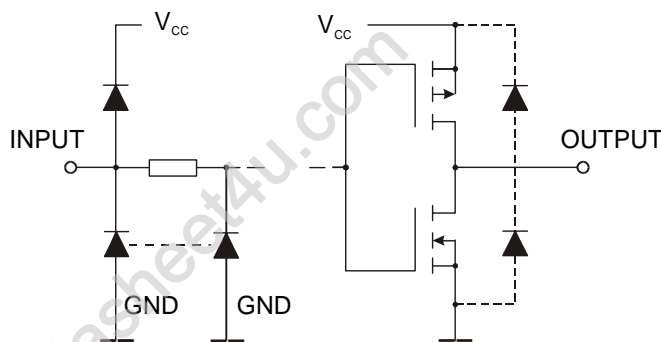
PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
01, 02, 03	Q12 to Q14	Counter Outputs
07, 05, 04, 06, 14, 13, 15	Q4 to Q10	Counter Outputs
09	$\overline{\text{CO}}$	External Capacitor Connection
10	CO	External Resistor Connection
11	$\overline{\text{OI}}$	Clock Input / Oscillator
12	CLEAR	Master Reset
08	GND	Ground (0V)
16	V _{CC}	Positive Supply Voltage



PIN ASSIGNMENT



INPUT AND OUTPUT EQUIVALENT CIRCUIT

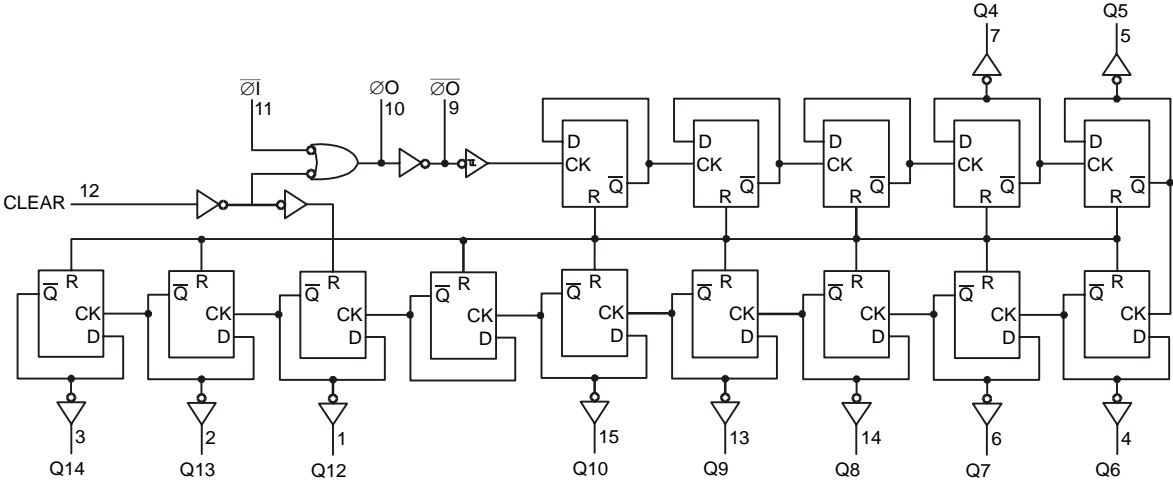


TRUTH TABLE

$\overline{\text{CI}}$	CLEAR	FUNCTION
X	H	COUNTER IS RESET TO ZERO STATE $\overline{\text{CO}}$ OUTPUT GOES TO HIGH LEVEL $\overline{\text{QO}}$ OUTPUT GOES TO LOW LEVEL
	L	COUNT UP ONE STEP
	L	NO CHANGE

X : Don't Care

LOGIC DIAGRAM



This logic diagram has not be used to estimate propagation delays

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage	-0.5 to +7	V
V _I	DC Input Voltage	-0.5 to V _{CC} + 0.5	V
V _O	DC Output Voltage	-0.5 to V _{CC} + 0.5	V
I _{IK}	DC Input Diode Current	± 20	mA
I _{OK}	DC Output Diode Current	± 20	mA
I _O	DC Output Current	± 25	mA
I _{CC} or I _{GND}	DC V _{CC} or Ground Current	± 50	mA
T _{stg}	Storage Temperature	-65 to +150	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit	
V _{CC}	Supply Voltage	2 to 6	V	
V _I	Input Voltage	0 to V _{CC}	V	
V _O	Output Voltage	0 to V _{CC}	V	
T _{OP}	Operating Temperature	-55 to +125	°C	
t _r , t _f	Input Rise and Fall Time	V _{CC} = 2.0 V	0 to 1000	ns
		V _{CC} = 4.5 V	0 to 500	ns
		V _{CC} = 6.0 V	0 to 400	ns

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Condition		Value				Unit
		V _{CC} (V)		T _A = 25°C		-55°C to 125°C		
				Min	Max	Min	Max	
V _{IH}	High Level Input Voltage	2.0		1.5		1.5		V
		4.5		3.15		3.15		
		6.0		4.2		4.2		
V _{IL}	Low Level Input Voltage	2.0			0.5		0.5	V
		4.5			1.35		1.35	
		6.0			1.8		1.8	
V _{OH}	High Level Output Voltage (Q Output)	2.0	I _O = -20 μA	1.9		1.9		V
		4.5	I _O = -20 μA	4.4		4.4		
		6.0	I _O = -20 μA	5.9		5.9		
		4.5	I _O = -4.0 μA	4.18		4.10		
		6.0	I _O = -5.2 μA	5.68		5.60		
V _{OL}	Low Level Output Voltage (Q Output)	2.0	I _O = 20 μA		0.1		0.1	V
		4.5	I _O = 20 μA		0.1		0.1	
		6.0	I _O = 20 μA		0.1		0.1	
		4.5	I _O = 4.0 μA		0.26		0.40	
		6.0	I _O = 5.2 μA		0.26		0.40	
V _{OH}	High Level Output Voltage ($\overline{\text{Q}}$, $\overline{\overline{\text{Q}}}$ Output)	2.0	I _O = -20 μA	1.8		1.8		V
		4.5	I _O = -20 μA	4.4		4.0		
		6.0	I _O = -20 μA	5.5		5.5		
V _{OL}	Low Level Output Voltage ($\overline{\text{Q}}$, $\overline{\overline{\text{Q}}}$ Output)	2.0	I _O = 20 μA		0.2		0.2	V
		4.5	I _O = 20 μA		0.5		0.5	
		6.0	I _O = 20 μA		0.5		0.5	
I _I	Input Leakage Current	6.0	V _I = V _{CC} or GND		±0.1		±1	μA
I _{CC}	Quiescent Supply Current	6.0	V _I = V _{CC} or GND		4		80	μA

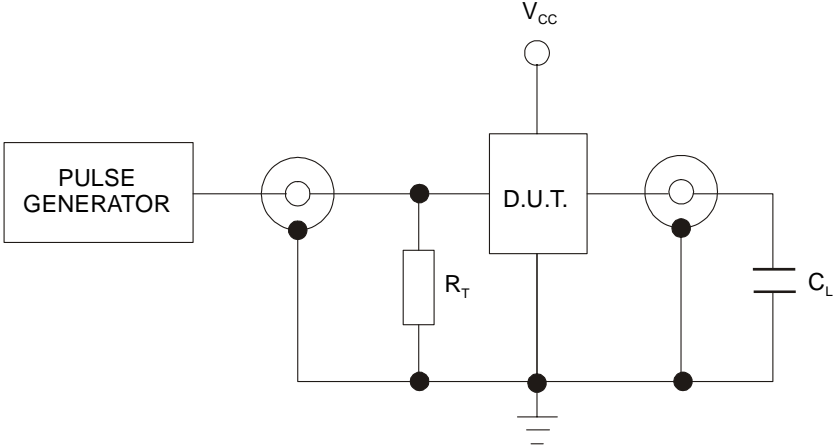
AC ELECTRICAL CHARACTERISTICS ($C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

Symbol	Parameter	Test Condition		Value				Unit
		V _{CC} (V)		T _A = 25°C		-55°C to 125°C		
				Min	Max	Min	Max	
t _{TLH} , t _{THL}	Output Transition Time	2.0			75		110	ns
		4.5			15		22	
		6.0			13		19	
t _{PLH} , t _{PHL}	Propagation Delay Time ($\overline{Q1-Q4}$)	2.0			300		450	ns
		4.5			60		90	
		6.0			51		76	
t _{PD}	Propagation Delay Time Difference (Q _n – Q _{n+1})	2.0			75		110	ns
		4.5			15		22	
		6.0			13		19	
t _{PHL}	Propagation Delay Time (CLEAR – Q _n)	2.0			195		295	ns
		4.5			39		59	
		6.0			33		50	
f _{MAX}	Maximum Clock Frequency	2.0		6		4		MHz
		4.5		30		20		
		6.0		35		24		
t _{W(H)} , t _{W(L)}	Minimum Pulse Width ($\overline{Q1}$)	2.0			75		110	ns
		4.5			15		22	
		6.0			13		19	
t _{W(H)}	Minimum Pulse Width (CLEAR)	2.0			75		110	ns
		4.5			15		22	
		6.0			13		19	
t _{REM}	Minimum Removal Time	2.0			100		150	ns
		4.5			20		30	
		6.0			17		26	

CAPACITIVE CHARACTERISTICS

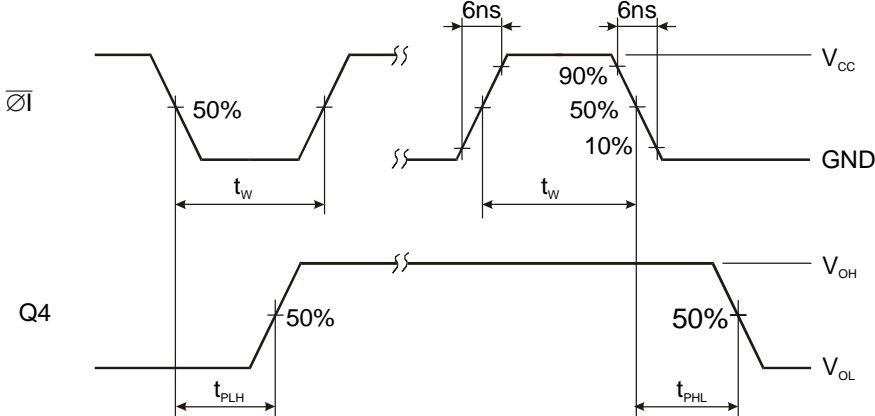
Symbol	Parameter	Test Condition		Value				Unit
		V _{CC} (V)		T _A = 25°C		-55°C to 125°C		
				Min	Max	Min	Max	
C _{IN}	Input Capacitance	5.0			10		10	pF

TEST CIRCUIT

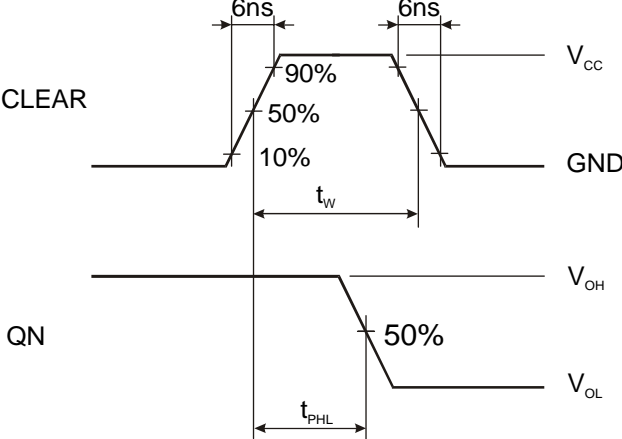


$C_L = 50 \text{ pF}$ or equivalent (includes jig and probe capacitance)
 $R_L = Z_{OUT}$ of pulse generator (typically 50Ω)

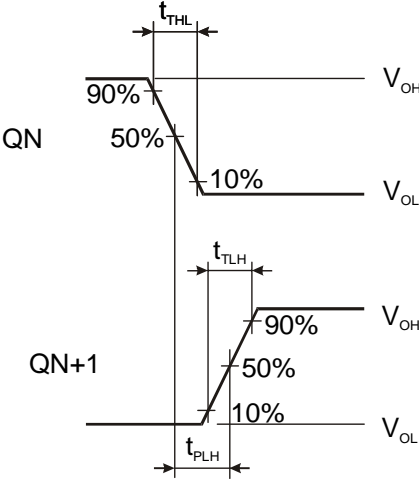
WAVEFORM 1: PROPAGATION DELAY TIMES, MINIMUM PULSE WIDTH ($\overline{Q1}$) ($f=1\text{MHz}$; 50% duty cycle)



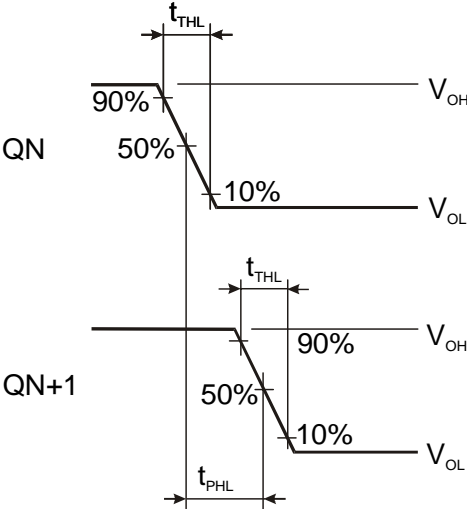
WAVEFORM 2 : PROPAGATION DELAY TIMES, MINIMUM PULSE WIDTH (CLEAR) ($f=1\text{MHz}$; 50% duty cycle)



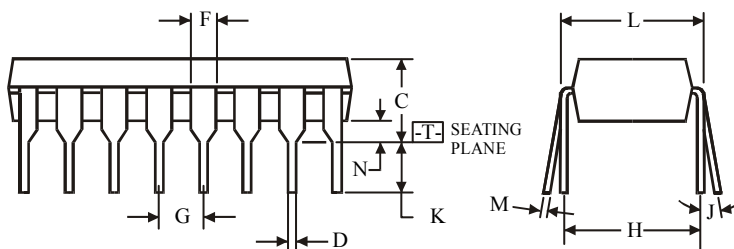
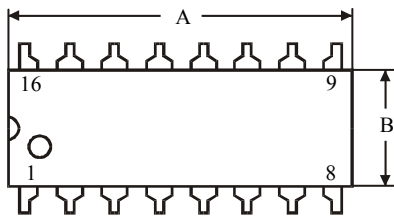
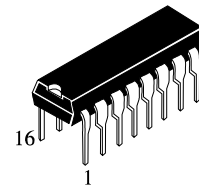
WAVEFORM 3 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



WAVEFORM 4 : PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



**N SUFFIX PLASTIC DIP
(MS - 001BB)**



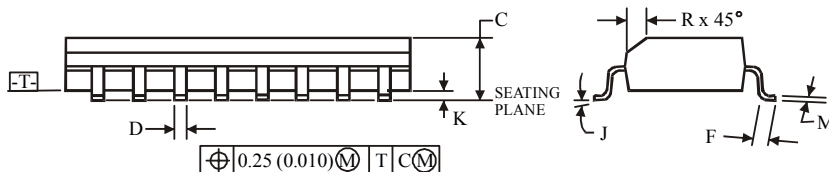
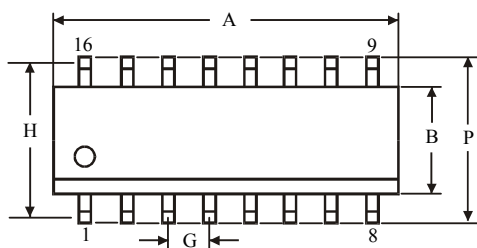
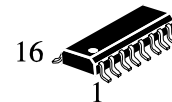
$$\oplus 0.25 (0.010) \text{ (M) } T$$

NOTES:

- Dimensions "A", "B" do not include mold flash or protrusions.
Maximum mold flash or protrusions 0.25 mm (0.010) per side.

Symbol	Dimension, mm	
	MIN	MAX
A	18.67	19.69
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

**D SUFFIX SOIC
(MS - 012AC)**



$$\oplus 0.25 (0.010) \text{ (M) } T \text{ C (M)}$$

NOTES:

- Dimensions A and B do not include mold flash or protrusion.
- Maximum mold flash or protrusion 0.15 mm (0.006) per side
for A; for B - 0.25 mm (0.010) per side.

Symbol	Dimension, mm	
	MIN	MAX
A	9.8	10
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5