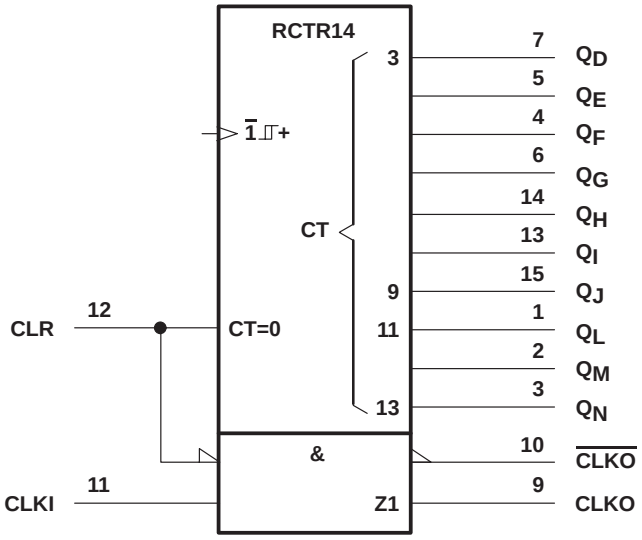
- **Allow Design of Either RC or Crystal Oscillator Circuits**
- **Package Options Include Plastic Small-Outline (D) and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs**

description

The ’HC4060 consist of an oscillator section and 14 ripple-carry binary counter stages. The oscillator configuration allows design of either RC or crystal-oscillator circuits. A high-to-low transition on the clock (CLKI) input increments the counter. A high level at the clear (CLR) input disables the oscillator ($\overline{\text{CLKO}}$ goes high and CLKO goes low) and resets the counter to zero (all Q outputs low).

The SN54HC4060 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74HC4060 is characterized for operation from –40°C to 85°C.

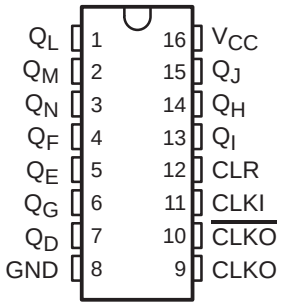
logic symbol†



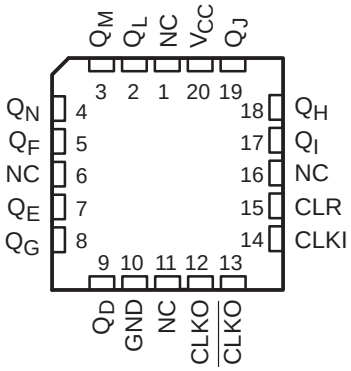
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown are for the D, J, N, and W packages.

SN54HC4060 . . . J OR W PACKAGE
SN74HC4060 . . . D OR N PACKAGE
(TOP VIEW)

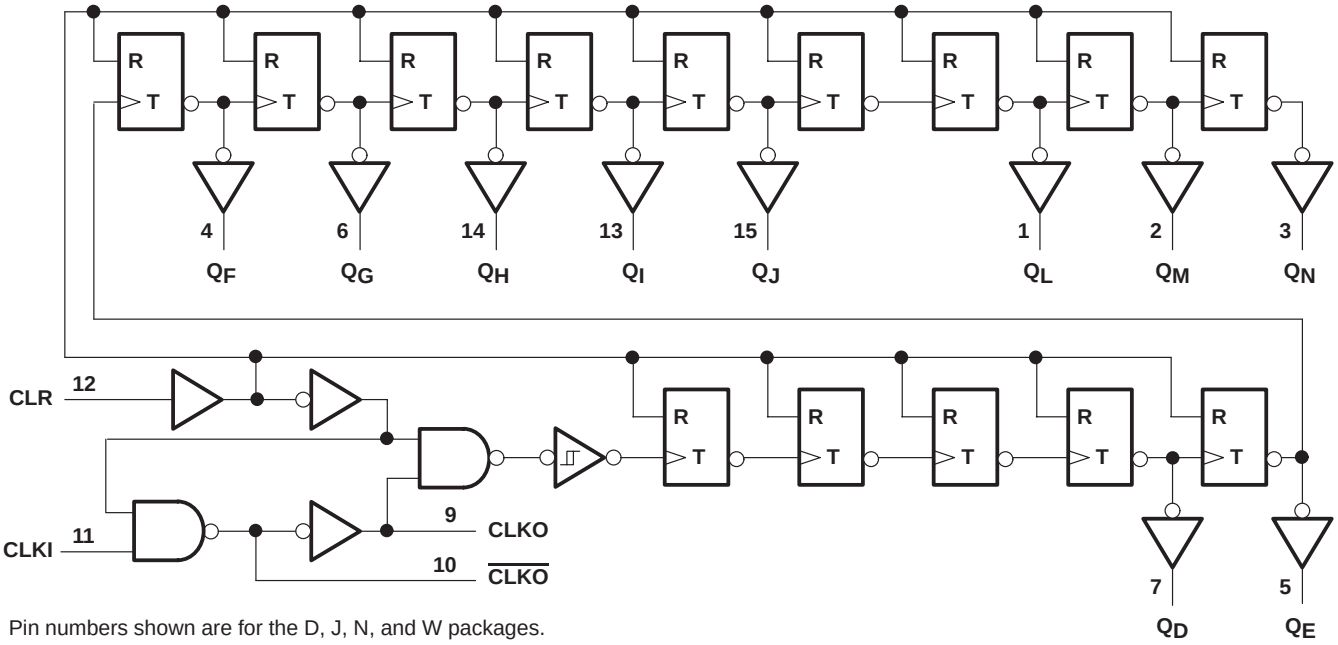


SN54HC4060 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

logic diagram (positive logic)



Pin numbers shown are for the D, J, N, and W packages.

absolute maximum ratings over operating free-air temperature range†

Supply voltage range, V_{CC}	–0.5 V to 7 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) (see Note 1)	±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1)	±20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	±25 mA
Continuous current through V_{CC} or GND	±50 mA
Package thermal impedance, θ_{JA} (see Note 2): D package	113°C/W
N package	78°C/W
Storage temperature range, T_{stg}	–65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

recommended operating conditions

			SN54HC4060			SN74HC4060			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage		2	5	6	2	5	6	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5			1.5			V
		V_{CC} = 4.5 V	3.15			3.15			
		V_{CC} = 6 V	4.2			4.2			
V_{IL}	Low-level input voltage	V_{CC} = 2 V	0		0.5	0		0.5	V
		V_{CC} = 4.5 V	0		1.35	0		1.35	
		V_{CC} = 6 V	0		1.8	0		1.8	
V_I	Input voltage		0		V_{CC}	0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	0		V_{CC}	V
t_t	Input transition (rise and fall) time	V_{CC} = 2 V	0		1000	0		1000	ns
		V_{CC} = 4.5 V	0		500	0		500	
		V_{CC} = 6 V	0		400	0		400	
T_A	Operating free-air temperature		–55		125	–40		85	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		V_{CC}	T_A = 25°C			SN54HC4060		SN74HC4060		UNIT
					MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	All outputs	V_I = V_{IH} or V_{IL}	I_{OH} = –20 μA	2 V	1.9	1.998		1.9		1.9		V
				4.5 V	4.4	4.499		4.4		4.4		
				6 V	5.9	5.999		5.9		5.9		
	Q outputs	V_I = V_{IH} or V_{IL}	I_{OH} = –4 mA	4.5 V	3.98	4.3		3.7		3.84		
			I_{OH} = –5.2 mA	6 V	5.48	5.8		5.2		5.34		
V_{OL}	All outputs	V_I = V_{IH} or V_{IL}	I_{OL} = 20 μA	2 V		0.002	0.1		0.1		0.1	V
				4.5 V		0.001	0.1		0.1		0.1	
				6 V		0.001	0.1		0.1		0.1	
	Q outputs	V_I = V_{IH} or V_{IL}	I_{OL} = 4 mA	4.5 V		0.17	0.26		0.4		0.33	
			I_{OL} = 5.2 mA	6 V		0.15	0.26		0.4		0.33	
I_I		V_I = V_{CC} or 0		6 V		±0.1	±100		±1000		±1000	nA
I_{CC}		V_I = V_{CC} or 0,	I_O = 0	6 V			8		160		80	μA
C_i				2 V to 6 V		3	10		10		10	pF

timing requirements over recommended operating free-air temperature range (unless otherwise noted)

			V_{CC}	T_A = 25°C		SN54HC4060		SN74HC4060		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		2 V	0	5.5	0	3.7	0	4.3	MHz
			4.5 V	0	28	0	19	0	22	
			6 V	0	33	0	22	0	25	
t_w	Pulse duration	CLKI high or low	2 V	90		135		115		ns
			4.5 V	18		27		23		
			6 V	15		23		20		
		CLR high	2 V	90		135		115		
			4.5 V	18		27		23		
			6 V	15		23		20		
t_{su}	Setup time, CLR inactive before CLKI↓		2 V	160		240		200		ns
			4.5 V	32		48		40		
			6 V	27		41		34		

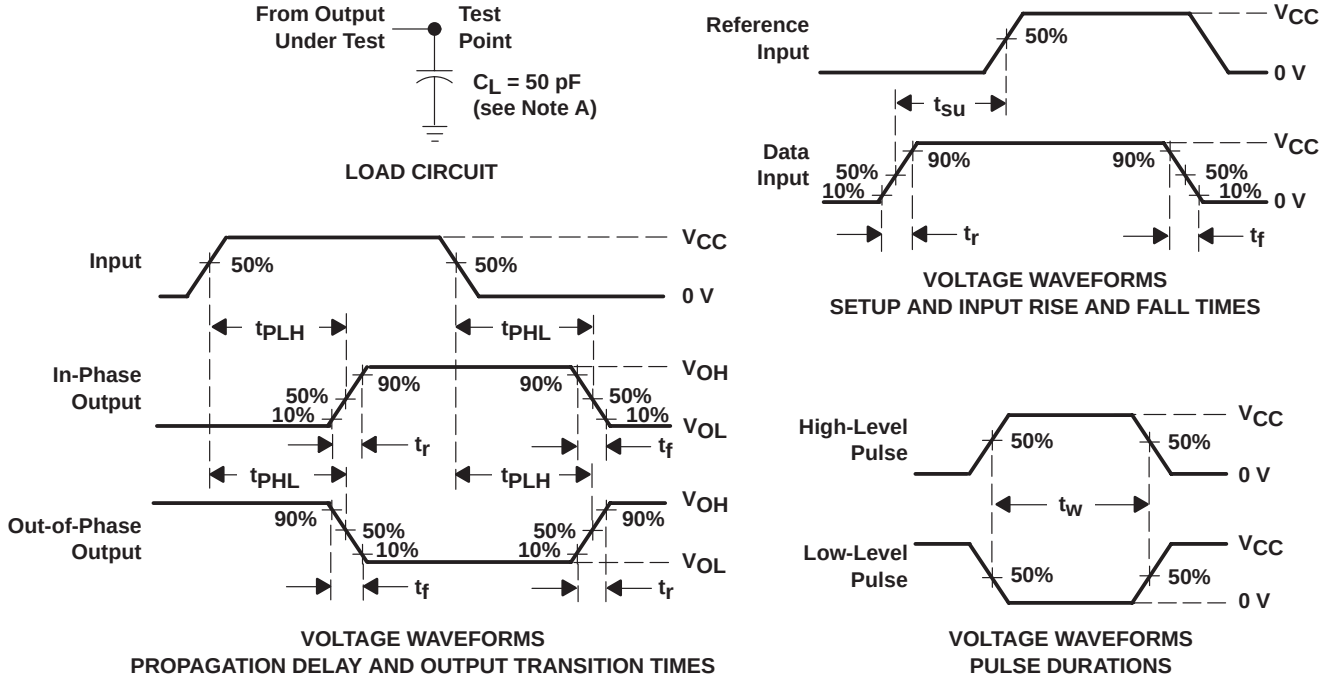
switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	T_A = 25°C			SN54HC4060		SN74HC4060		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			2 V	5.5	10		3.7		4.3		MHz
			4.5 V	28	45		19		22		
			6 V	33	53		22		25		
t_{pd}	CLKI	Q_D	2 V		240	490		735		615	ns
			4.5 V		58	98		147		123	
			6 V		42	83		125		105	
t_{PHL}	CLR	Any Q	2 V		66	140		210		175	ns
			4.5 V		18	28		42		35	
			6 V		14	24		36		30	
t_t		Any	2 V		28	75		110		95	ns
			4.5 V		8	15		22		19	
			6 V		6	30		19		16	

operating characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance	No load	88	pF

PARAMETER MEASUREMENT INFORMATION



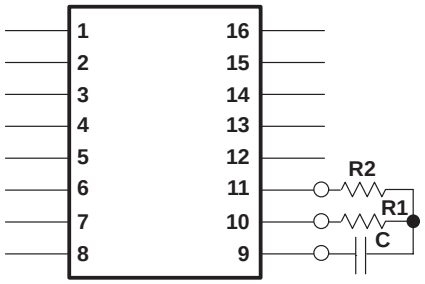
NOTES: A. C_L includes probe and test-fixture capacitance.
B. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r = 6 ns, t_f = 6 ns.
C. For clock inputs, f_{max} is measured when the input duty cycle is 50%.
D. The outputs are measured one at a time with one input transition per measurement.
E. t_{PLH} and t_{PHL} are the same as t_{pd}.

Figure 1. Load Circuit and Voltage Waveforms

CONNECTING AN RC OSCILLATOR CIRCUIT TO THE ’HC4060

The ’HC4060 consist of an oscillator section and 14 ripple-carry binary counter stages. The oscillator configuration allows design of either RC or crystal-oscillator circuits.

When an RC oscillator circuit is implemented, two resistors and a capacitor are required. The components are attached to the terminals as shown below:



To determine the values of capacitance and resistance necessary to obtain a specific oscillator frequency (f), use this formula:

$$f = \frac{1}{2(R1)(C)\left(\frac{0.405\ R2}{R1 + R2} + 0.693\right)}$$

If R2 > > R1 (i.e., R2 = 10R1), the above formula simplifies to:

$$f = \frac{0.455}{RC}$$

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