

## MM74HC4060

### 14 Stage Binary Counter

#### General Description

The MM74HC4060 is a high speed binary ripple carry counter. These counters are implemented utilizing advanced silicon-gate CMOS technology to achieve speed performance similar to LS-TTL logic while retaining the low power and high noise immunity of CMOS.

The MM74HC4060 is a 14-stage counter, which device increments on the falling edge (negative transition) of the input clock, and all their outputs are reset to a low level by applying a logical high on their reset input. The MM74HC4060 also has two additional inputs to enable easy connection of either an RC or crystal oscillator.

This device is pin equivalent to the CD4060. All inputs are protected from damage due to static discharge by protection diodes to  $V_{CC}$  and ground.

#### Features

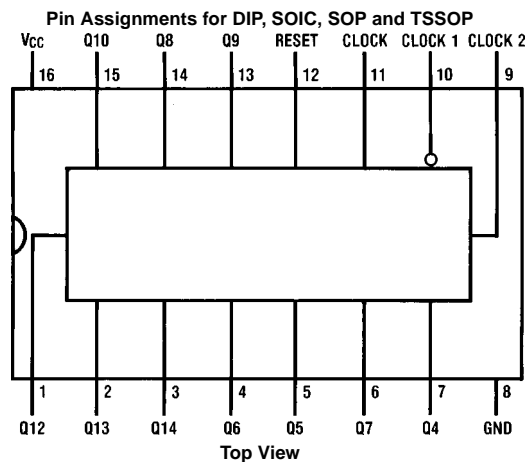
- Typical propagation delay: 16 ns
- Wide operating voltage range: 2–6V
- Low input current: 1  $\mu$ A maximum
- Low quiescent current: 80  $\mu$ A maximum (74 Series)
- Output drive capability: 10 LS-TTL loads

#### Ordering Code:

Order Number	Package Number	Package Description
MM74HC4060M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74HC4060SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HC4060MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HC4060N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

#### Connection Diagram





**Absolute Maximum Ratings** (Note 1)

(Note 2)

Supply Voltage ( $V_{CC}$ )	−0.5 to +7.0V
DC Input Voltage ( $V_{IN}$ )	−1.5 to $V_{CC} + 1.5V$
DC Output Voltage ( $V_{OUT}$ )	−0.5 to $V_{CC} + 0.5V$
Clamp Diode Current ( $I_{CD}$ )	±20 mA
DC Output Current, per pin ( $I_{OUT}$ )	±25 mA
DC $V_{CC}$ or GND Current, per pin ( $I_{CC}$ )	±50 mA
Storage Temperature Range ( $T_{STG}$ )	−65°C to +150°C
Power Dissipation ( $P_D$ )	
(Note 3)	600 mW
S.O. Package only	500 mW
Lead Temperature ( $T_L$ )	
(Soldering 10 seconds)	260°C

**Recommended Operating Conditions**

	Min	Max	Units
Supply Voltage ( $V_{CC}$ )	2	6	V
DC Input or Output Voltage ( $V_{IN}$ , $V_{OUT}$ )	0	$V_{CC}$	V
Operating Temperature Range ( $T_A$ )	−40	+85	°C
Input Rise or Fall Times ( $t_r$ , $t_f$ ) $V_{CC} = 2.0V$		1000	ns
$V_{CC} = 4.5V$		500	ns
$V_{CC} = 6.0V$		400	ns

**Note 1:** Maximum Ratings are those values beyond which damage to the device may occur.**Note 2:** Unless otherwise specified all voltages are referenced to ground.**Note 3:** Power Dissipation temperature derating: plastic "N" package:  
−12 mW/°C from 65°C to 85°C.**DC Electrical Characteristics** (Note 4)

Symbol	Parameter	Conditions	V <sub>CC</sub>	T <sub>A</sub> = 25°C		T <sub>A</sub> = −40 to 85°C	T <sub>A</sub> = −55 to 125°C	Units
				Typ	Guaranteed Limits			
V <sub>IH</sub>	Minimum HIGH Level Voltage (Not Applicable to Pins 9 & 10)		2.0V		1.5	1.5	1.5	V
			4.5V		3.15	3.15	3.15	V
			6.0V		4.2	4.2	4.2	V
V <sub>IL</sub>	Maximum LOW Level Input Voltage (Not Applicable to Pins 9 & 10)		2.0V		0.5	0.5	0.5	V
			4.5V		1.35	1.35	1.35	V
			6.0V		1.8	1.8	1.8	V
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 20 μA	2.0V	2.0	1.9	1.9	1.9	V
			4.5V	4.5	4.4	4.4	4.4	V
			6.0V	6.0	5.9	5.9	5.9	V
	Except Pins 9 & 10	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 4.0 mA  I <sub>OUT</sub>   ≤ 5.2 mA	4.5V	4.2	3.98	3.84	3.7	V
			6.0V	5.7	5.48	5.34	5.2	V
	Pins 9 & 10	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   = 0.4 mA  I <sub>OUT</sub>   = 0.52 mA			3.98	3.84	3.7	V
					5.48	5.34	5.2	V
V <sub>OL</sub>	Maximum LOW Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 20 μA	2.0V	0	0.1	0.1	0.1	V
			4.5V	0	0.1	0.1	0.1	V
			6.0V	0	0.1	0.1	0.1	V
	Except Pins 9 & 10	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   ≤ 4.0 mA  I <sub>OUT</sub>   ≤ 5.2 mA	4.5V	0.2	0.26	0.33	0.4	V
			6.0V	0.2	0.26	0.33	0.4	V
	Pins 9 & 10	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   = 0.4 mA  I <sub>OUT</sub>   = 0.52 mA			0.26	0.33	0.4	V
					0.26	0.33	0.4	V
I <sub>IN</sub>	Maximum Input Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	6.0V		±0.1	±1.0	±1.0	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND I <sub>OUT</sub> = 0 μA	6.0V		8.0	80	160	μA

**Note 4:** For a power supply of 5V ±10% the worst case output voltages ( $V_{OH}$ , and  $V_{OL}$ ) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case  $V_{IH}$  and  $V_{IL}$  occur at  $V_{CC} = 5.5V$  and 4.5V respectively. (The  $V_{IH}$  value at 5.5V is 3.85V.) The worst case leakage current ( $I_{IN}$ ,  $I_{CC}$ , and  $I_{OZ}$ ) occur for CMOS at the higher voltage and so the 6.0V values should be used.

## AC Electrical Characteristics

$V_{CC} = 5V$ ,  $T_A = 25^\circ C$ ,  $C_L = 15\text{ pF}$ ,  $t_r = t_f = 6\text{ ns}$

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
$f_{MAX}$	Maximum Clock Frequency			30	MHz
$t_{PHL}$ , $t_{PLH}$	Maximum Propagation Delay to $Q_4$	(Note 5)	40	20	ns
$t_{PHL}$ , $t_{PLH}$	Maximum Propagation Delay to any Q		16	40	ns
$t_{REM}$	Minimum Reset Removal Time		10	20	ns
$t_W$	Minimum Pulse Width		10	16	ns

## AC Electrical Characteristics

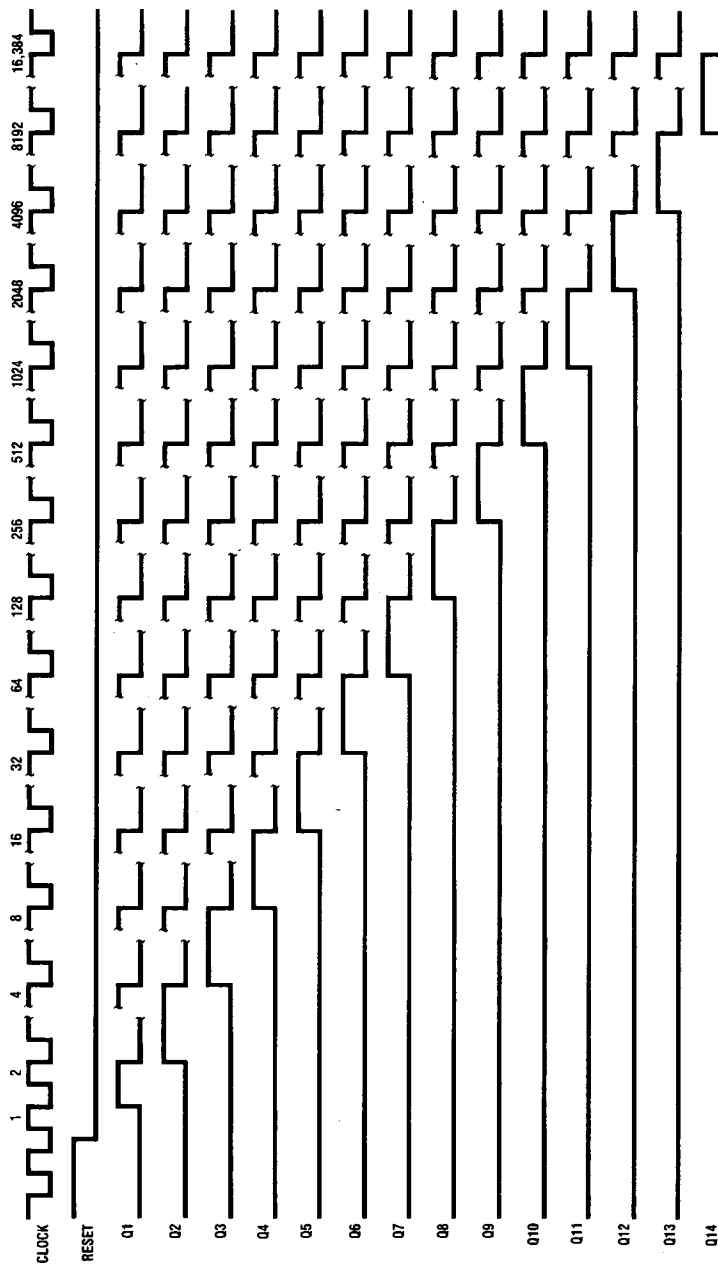
$V_{CC} = 2.0V$  to  $6.0V$ ,  $C_L = 50\text{ pF}$ ,  $t_r = t_f = 6\text{ ns}$  (unless otherwise specified)

Symbol	Parameter	Conditions	V <sub>CC</sub>	T <sub>A</sub> = 25°C		T <sub>A</sub> = −40 to 85°C	T <sub>A</sub> = −55 to 125°C	Units
				Typ	Guaranteed Limits			
f <sub>MAX</sub>	Maximum Operating Frequency		2.0V		6	5	4	MHz
			4.5V		30	24	20	MHz
			6.0V		35	28	24	MHz
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation Delay Clock to Q <sub>4</sub>		2.0V	120	380	475	171	ns
			4.5V	42	76	95	114	ns
			6.0V	35	65	81	97	ns
t <sub>PHL</sub>	Maximum Propagation Delay Reset to any Q		2.0V	72	240	302	358	ns
			4.5V	24	48	60	72	ns
			6.0V	20	41	51	61	ns
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation Delay Between Stages Q <sub>n</sub> to Q <sub>n+1</sub>		2.0V		125	156	188	ns
			4.5V		25	31	38	ns
			6.0V		21	26	31	ns
t <sub>REM</sub>	Minimum Reset Removal Time		2.0V		100	125	150	ns
			4.5V		20	25	30	ns
			6.0V		17	21	25	ns
t <sub>W</sub>	Minimum Pulse Width		2.0V		80	100	120	ns
			4.5V		16	20	24	ns
			6.0V		14	17	20	ns
t <sub>r</sub> , t <sub>f</sub>	Maximum Input Rise and Fall Time		2.0V		1000	1000	1000	ns
			4.5V		500	500	500	ns
			6.0V		400	400	400	ns
t <sub>THL</sub> , t <sub>TLH</sub>	Maximum Output Rise and Fall Time		2.0V	30	75	95	110	ns
			4.5V	10	15	19	22	ns
			6.0V	9	13	16	19	ns
C <sub>PD</sub>	Power Dissipation Capacitance (Note 6)	(per package)		55				pF
C <sub>IN</sub>	Maximum Input Capacitance			5	10	10	10	pF

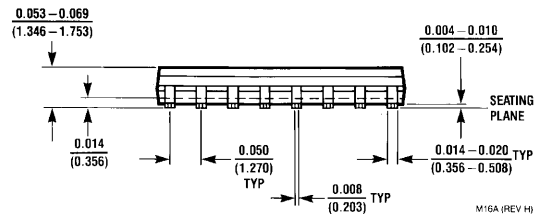
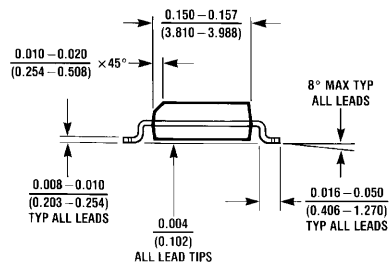
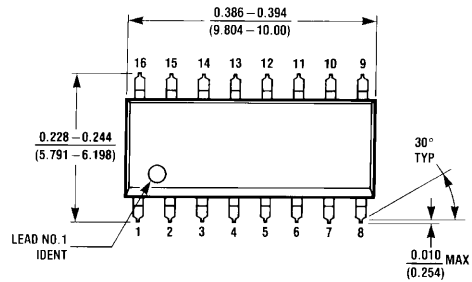
**Note 5:** Typical Propagation delay time to any output can be calculated using:  $t_p = 17 + 12(N-1)$  ns; where N is the number of the output,  $Q_W$ , at  $V_{CC} = 5V$ .

**Note 6:**  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

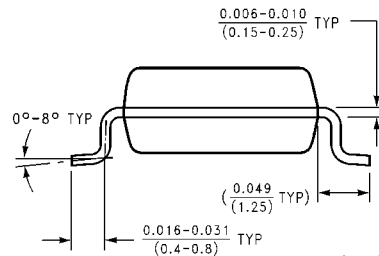
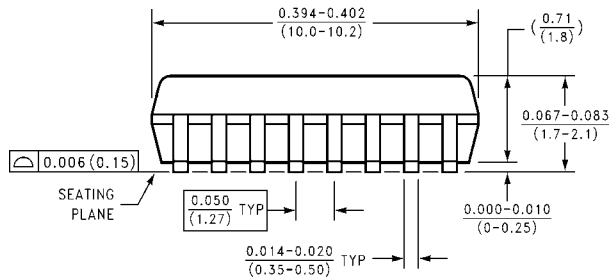
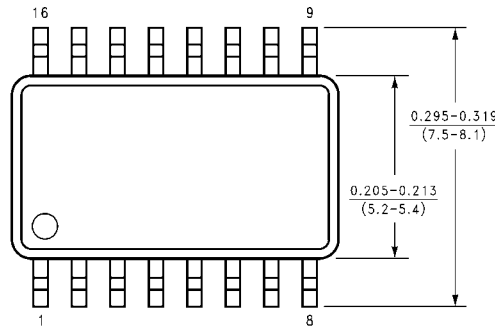
# Timing Diagram



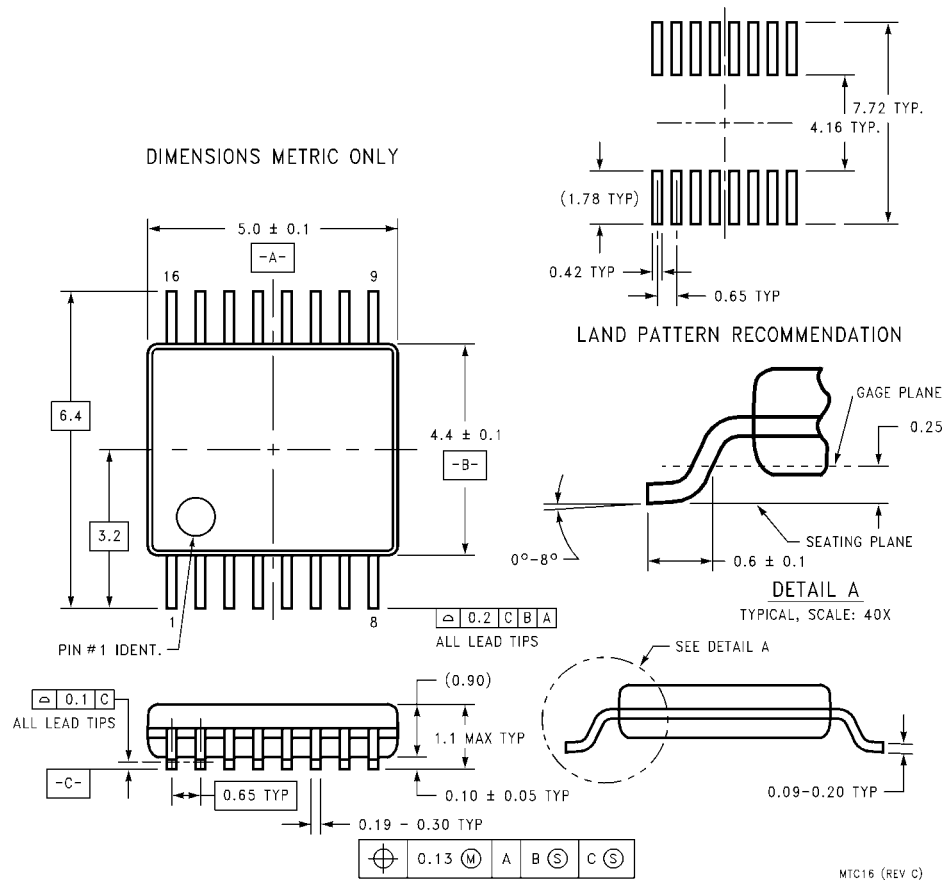
# Physical Dimensions inches (millimeters) unless otherwise noted



**16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow  
Package Number M16A**

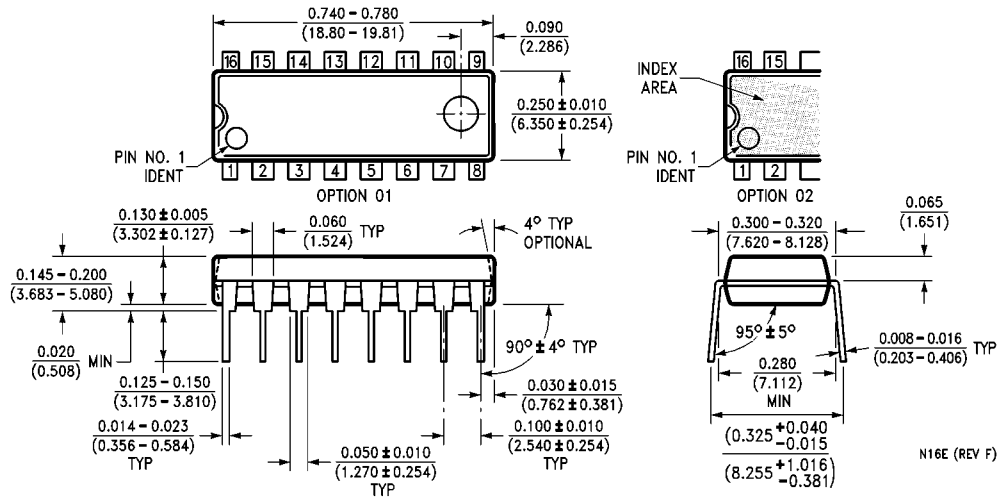


**16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide  
Package Number M16D**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)


**16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC16**

## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide  
Package Number N16E

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