

# TC74HC4017AP, TC74HC4017AF

## DECADE COUNTER / DIVIDER

The TC74HC4017A is a high speed CMOS DECADE JOHNSON COUNTER fabricated with silicon gate C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

It contains 5-stage divided-by-10 Johnson counter with 10 decoded output (Q0 - Q9) and carry-out bit.

This counter is advanced on the positive edge of clock signal when clock enable signal ( $\overline{CE}$ ) input is held low, or it is advanced on the negative edge of the  $\overline{CE}$  when CK input is held high, and selected one of ten outputs goes high. Holding high the CLR input, this counter is cleared to its zero state without regard to the other input conditions.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### FEATURES:

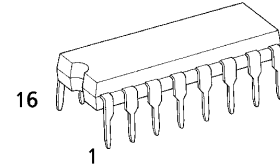
- High Speed..... $f_{MAX} = 87\text{MHz}$  (typ.)  
at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}$ (Max.) at  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min.)
- Output drive Capability..... 10 LSTTL Loads
- Symmetrical Output Impedance...  $|I_{OH}| = I_{OL} = 4\text{mA}$  (Min.)
- Balanced Propagation Delays.....  $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range...  $V_{CC}$  (opr.) = 2V ~ 6V
- Pin and Function Compatible with 4017B

### IEC LOGIC SYMBOL

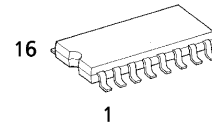
INPUTS			DECODE OUTPUT (H)
CK	$\overline{CE}$	CLR	
X	X	H	Q0
L	X	L	Qn
X	H	L	Qn
$\uparrow$	L	L	Qn + 1
$\downarrow$	L	L	Qn
H	$\uparrow$	L	Qn
H	$\downarrow$	L	Qn + 1

X : Don't Care

CARRY OUT  $\begin{cases} \text{"H"} & \dots Q0 \sim Q4 = \text{"H"} \\ \text{"L"} & \dots Q5 \sim Q9 = \text{"H"} \end{cases}$

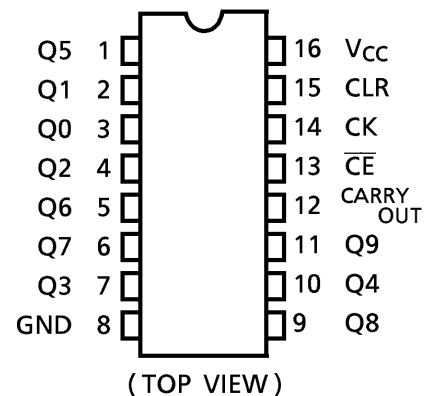


P (DIP16-P-300-2.54A)  
Weight : 1.00g (Typ.)

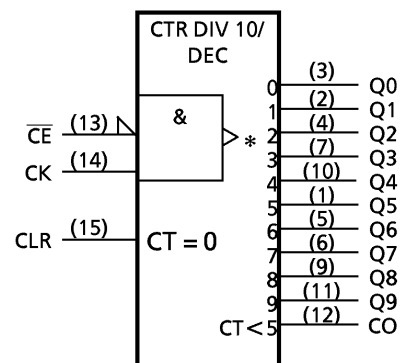


F (SOP16-P-300-1.27)  
Weight : 0.18g (Typ.)

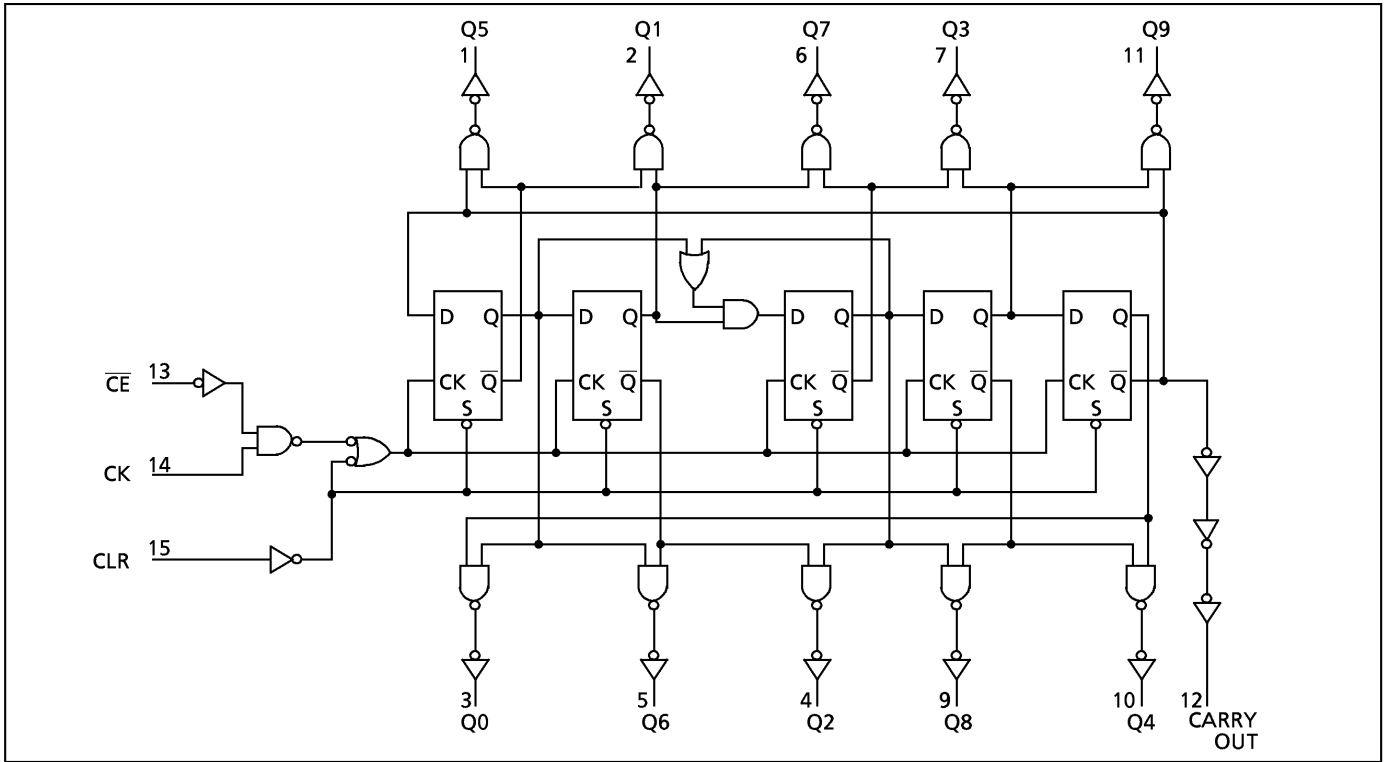
### PIN ASSIGNMENT



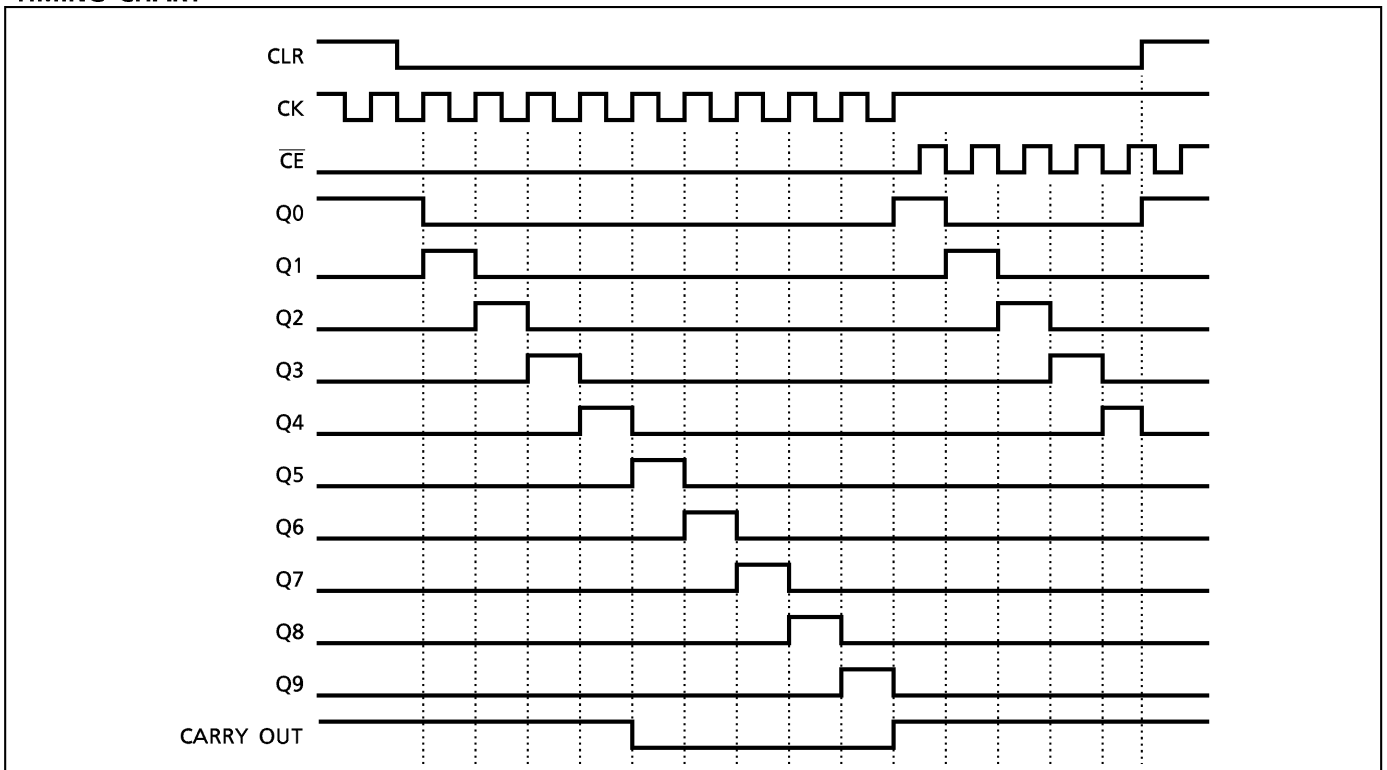
### ICE LOGIC SYMBOL



SYSTEM DIAGRAM



TIMING CHART



## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	$V_{CC}$	-0.5~7	V
DC Input Voltage	$V_{IN}$	-0.5~ $V_{CC}+0.5$	V
DC Output Voltage	$V_{OUT}$	-0.5~ $V_{CC}+0.5$	V
Input Diode Current	$I_{IK}$	±20	mA
Output Diode Current	$I_{OK}$	±20	mA
DC Output Current	$I_{OUT}$	±25	mA
DC $V_{CC}$ /Ground Current	$I_{CC}$	±50	mA
Power Dissipation	$P_D$	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	$T_{stg}$	-65~150	°C

\*500mW in the range of  $T_a = -40^{\circ}\text{C} \sim 65^{\circ}\text{C}$ . From  $T_a = 65^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  a derating factor of  $-10\text{mW}/^{\circ}\text{C}$  shall be applied until 300mW.

## RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	$V_{CC}$	2~6	V
Input Voltage	$V_{IN}$	0~ $V_{CC}$	V
Output Voltage	$V_{OUT}$	0~ $V_{CC}$	V
Operating Temperature	$T_{opr}$	-40~85	°C
Input Rise and Fall Time	$t_r, t_f$	0~1000 ( $V_{CC} = 2.0\text{V}$ ) 0~500 ( $V_{CC} = 4.5\text{V}$ ) 0~400 ( $V_{CC} = 6.0\text{V}$ )	ns

## DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}$ (V)	$T_a = 25^{\circ}\text{C}$			$T_a = -40 \sim 85^{\circ}\text{C}$		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.		
High - Level Input Voltage	$V_{IH}$		2.0	1.50	—	—	1.50	—	V	
			4.5	3.15	—	—	3.15	—		
			6.0	4.20	—	—	4.20	—		
Low - Level Input Voltage	$V_{IL}$		2.0	—	—	0.50	—	0.50	V	
			4.5	—	—	1.35	—	1.35		
			6.0	—	—	1.80	—	1.80		
High - Level Output Voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -20\mu\text{A}$	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
			$I_{OH} = -4\text{ mA}$ $I_{OH} = -5.2\text{ mA}$	4.5	4.18	4.31	—	4.13	—	
				6.0	5.68	5.80	—	5.63	—	
Low - Level Output Voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 20\mu\text{A}$	2.0	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
			$I_{OL} = 4\text{ mA}$ $I_{OL} = 5.2\text{ mA}$	4.5	—	0.17	0.26	—	0.33	
				6.0	—	0.18	0.26	—	0.33	
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	±0.1	—	±1.0	$\mu\text{A}$	
Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	4.0	—	40.0		

**TIMING REQUIREMENTS ( Input  $t_r = t_f = 6ns$  )**

PARAMETER	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	Ta = 25°C		Ta = -40~85°C	UNIT
				TYP.	LIMIT	LIMIT	
Minimum Pulse Width (CK)	t <sub>W(L)</sub> t <sub>W(H)</sub>		2.0	—	75	95	ns
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Pulse Width (CLR)	t <sub>W(H)</sub>		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Set-up Time	t <sub>s</sub>		2.0	—	50	60	
			4.5	—	10	12	
			6.0	—	9	11	
Minimum Hold Time	t <sub>h</sub>		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Removal Time (CLR)	t <sub>rem</sub>		2.0	—	50	60	
			4.5	—	10	12	
			6.0	—	9	11	
Clock Frequency	f		2.0	—	5	4	MHz
			4.5	—	25	20	
			6.0	—	29	25	

**AC ELECTRICAL CHARACTERISTICS ( C<sub>L</sub> = 15pF, V<sub>CC</sub> = 5V, Ta = 25°C, Input  $t_r = t_f = 6ns$  )**

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	t <sub>TLH</sub> t <sub>THL</sub>		—	6	12	ns
	Propagation Delay Time (CK, $\overline{CE}$ -Q, CARRY)	t <sub>pLH</sub> t <sub>pHL</sub>	—	21	34	
Propagation Delay Time (CLR-Q, CARRY)		t <sub>pLH</sub> t <sub>pHL</sub>	—	19	30	
Maximum Clock Frequency	f <sub>MAX</sub>		29	87	—	MHz

**AC ELECTRICAL CHARACTERISTICS ( C<sub>L</sub> = 50pF, Input  $t_r = t_f = 6ns$  )**

PARAMETER	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time	t <sub>TLH</sub> t <sub>THL</sub>		2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation Delay Time (CK, $\overline{CE}$ -Q, CARRY)	t <sub>pLH</sub> t <sub>pHL</sub>		2.0	—	85	195	—	440	
			4.5	—	25	39	—	88	
			6.0	—	20	33	—	75	
Propagation Delay Time (CLR-Q, CARRY)	t <sub>pLH</sub> t <sub>pHL</sub>		2.0	—	75	175	—	375	
			4.5	—	22	35	—	75	
			6.0	—	18	30	—	64	
Maximum Clock Frequency	f <sub>MAX</sub>		2.0	5	18	—	4	—	MHz
			4.5	25	68	—	20	—	
			6.0	29	90	—	24	—	
Input Capacitance	C <sub>IN</sub>			—	5	10	—	10	pF
Power Dissipation Capacitance	C <sub>PD</sub> (1)			—	38	—	—	—	

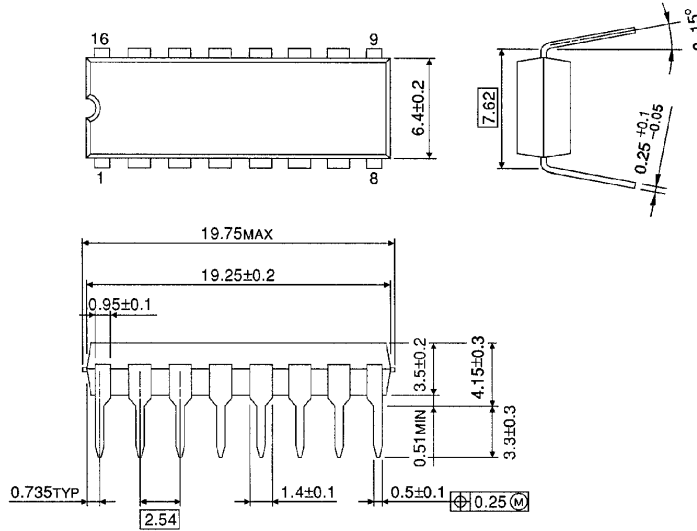
Note (1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

**DIP 16PIN PACKAGE DIMENSIONS (DIP16-P-300-2.54A)**

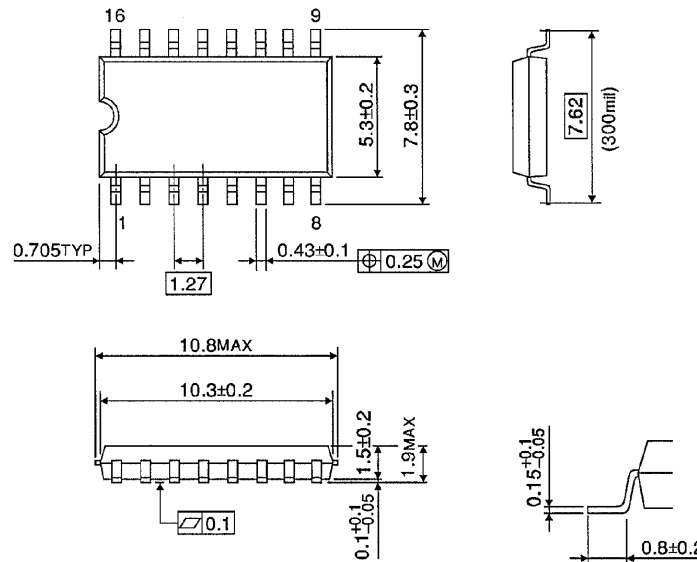
Unit in mm



Weight : 1.00g (Typ.)

**SOP 16PIN (200mil BODY) PACKAGE DIMENSIONS (SOP16-P-300-1.27)**

Unit in mm



Weight : 0.18g (Typ.)

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000707EBA

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