

TC74HC4017P DECADE COUNTER/DIVIDER

GENERAL DESCRIPTION

The TC74HC 4017 is a high speed CMOS DECADE JOHNSON COUNTER fabricated with silicon C²MOS 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 - Q10) and carry-out bit. This counter is advanced on the positive edge of clock signal when $\overline{CE}$ input is held low, or it is advanced on the negative edge of the clock enable signal ($\overline{CE}$) when CLOCK input is held high, and selected one of ten outputs goes high. Holding high the CLEAR 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.

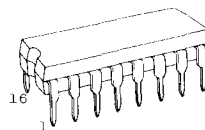
FEATURES:

- High Speed $f_{MAX}=36\text{MHz(Typ.)}$ 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 $V_{NIH}=V_{NIL}=28\% V_{CC}(\text{Min.})$
- Output Drive Capability 10 LSTTL Loads
- Symmetrical Output Impedance $|I_{OH}|=I_{OL}=4\text{mA}(\text{Min.})$
- Balanced Propagation Delays $t_{pLH}=t_{pHL}$
- Wide Operating Voltage Range $V_{CC}(\text{opr.})=2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 4017B

ABSOLUTE MAXIMUM RATINGS

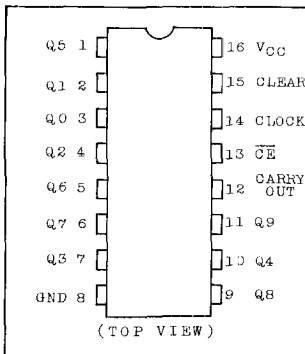
PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7$	V
DC Input Voltage	V_{IN}	$-0.5 \sim V_{CC}+0.5$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim V_{CC}+0.5$	V
Input Diode Current	I_{IK}	± 20	mA
Output Diode Current	I_{OK}	± 20	mA
DC Output Current	I_{OUT}	± 25	mA
DC V_{CC} /Ground Current	I_{CC}	± 50	mA
Power Dissipation	P_D	500*	mW
Storage Temperature	T_{stg}	$-65 \sim 150$	$^\circ\text{C}$
Lead Temperature 10sec	T_L	300	$^\circ\text{C}$

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



DIP(5-22E)

PIN ASSIGNMENT

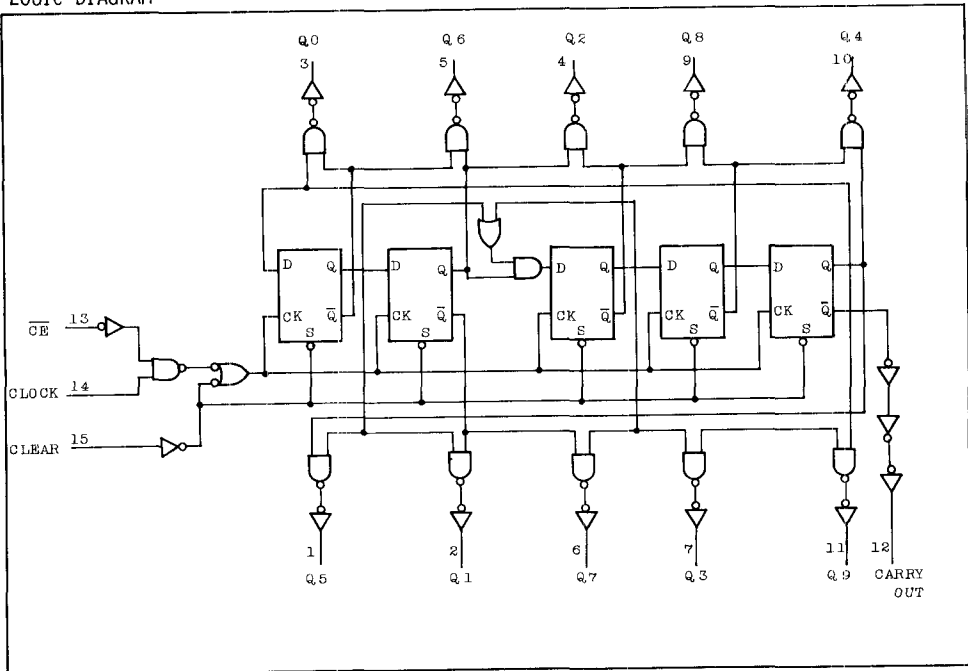


TRUTH TABLE

CLOCK	$\overline{CE}$	CLEAR	DECODE OUTPUT (H)
X	X	H	Q_0
L	X	L	Q_n
X	H	L	Q_n
	L	L	Q_{n+1}
	L	L	Q_n
H		L	Q_n
H		L	Q_{n+1}

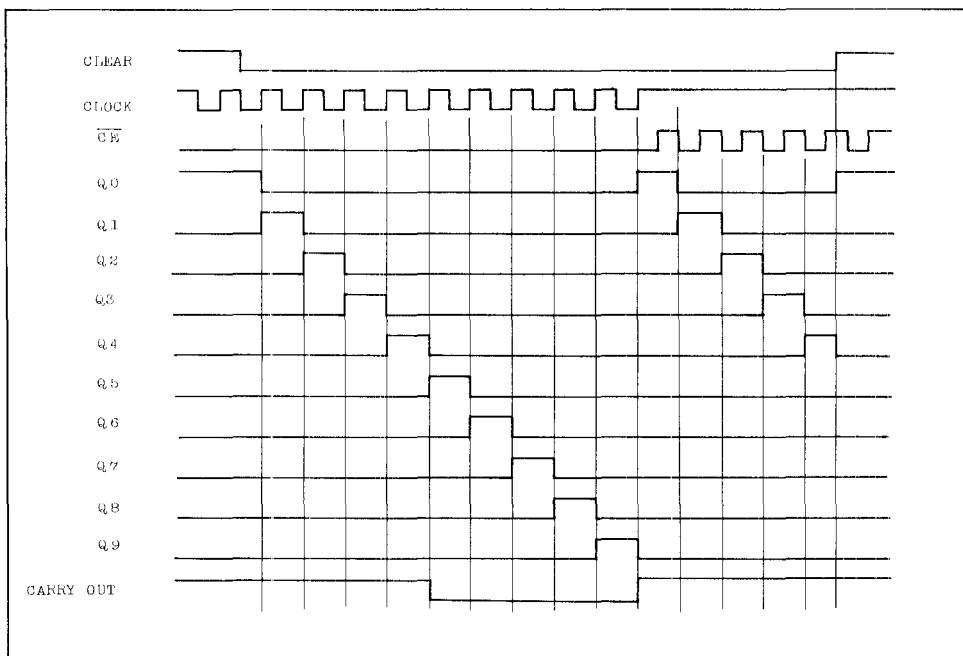
X: DON'T CARE
 Q_n : NO CHANGE

LOGIC DIAGRAM



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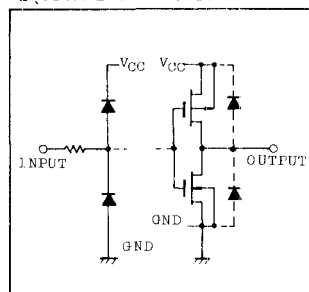
TIMING DIAGRAM



RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	LIMIT	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 ($V_{CC}=2.0V$) 0 ~ 500 ($V_{CC}=4.5V$) 0 ~ 400 ($V_{CC}=6.0V$)	ns

INPUT and OUTPUT
EQUIVALENT CIRCUIT



DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	V _{CC}	Ta=25°C			Ta=-40~85°C		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Input Voltage	V _{IH}		2.0 4.5 6.0	1.5 3.15 4.2	- - -	- - -	1.5 3.15 4.2	- - -	V
Low-Level Input Voltage	V _{IL}		2.0 4.5 6.0	- - -	- - -	0.5 1.35 1.8	- - -	0.5 1.35 1.8	V
High-Level Output Voltage	V _{OH}	V _{IN} =V _{IH} or V _{IL}	I _{OH} =-20μA I _{OH} =-4mA I _{OH} =-5.2mA	2.0 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	- - -	1.9 4.4 5.9	V
				4.5 6.0	4.18 5.68	4.31 5.80	- -	4.13 5.63	
				6.0	5.68	5.80	-	5.63	
Low-Level Output Voltage	V _{OL}	V _{IN} =V _{IH} or V _{IL}	I _{OL} =20μA I _{OL} =4mA I _{OL} =5.2mA	2.0 4.5 6.0	- - -	0.0 0.0 0.0	0.1 0.1 0.1	- - -	V
				4.5 6.0	- -	0.17 0.18	0.32 0.32	- -	
				6.0	-	0.18	0.32	-	
Input Leakage Current	I _{IN}	V _{IN} =V _{CC} or GND	6.0	-	-	0.1	-	1.0	μA
Quiescent Supply Current	I _{CC}	V _{IN} =V _{CC} or GND	6.0	-	-	4.0	-	40.0	

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

PARAMETER	SYMBOL	TEST CONDITION	V _{CC}	Ta=25°C			Ta=-40~85°C		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time	t _{TLH} t _{THL}		2.0 4.5 6.0	- - -	30 8 7	75 15 13	- - -	90 18 16	ns
			6.0	-	7	13	-	16	
			6.0	-	7	13	-	16	
Propagation Delay Time (CLOCK - Q, CARRY)	t _{pLH} t _{pHL}		2.0 4.5 6.0	- - -	110 30 26	205 41 35	- - -	250 50 42	
			6.0	-	26	35	-	42	
			6.0	-	26	35	-	42	
Propagation Delay Time (CLEAR - Q, CARRY)	t _{pLH} t _{pHL}		2.0 4.5 6.0	- - -	110 29 25	225 45 39	- - -	270 54 46	
			6.0	-	25	39	-	46	
			6.0	-	25	39	-	46	

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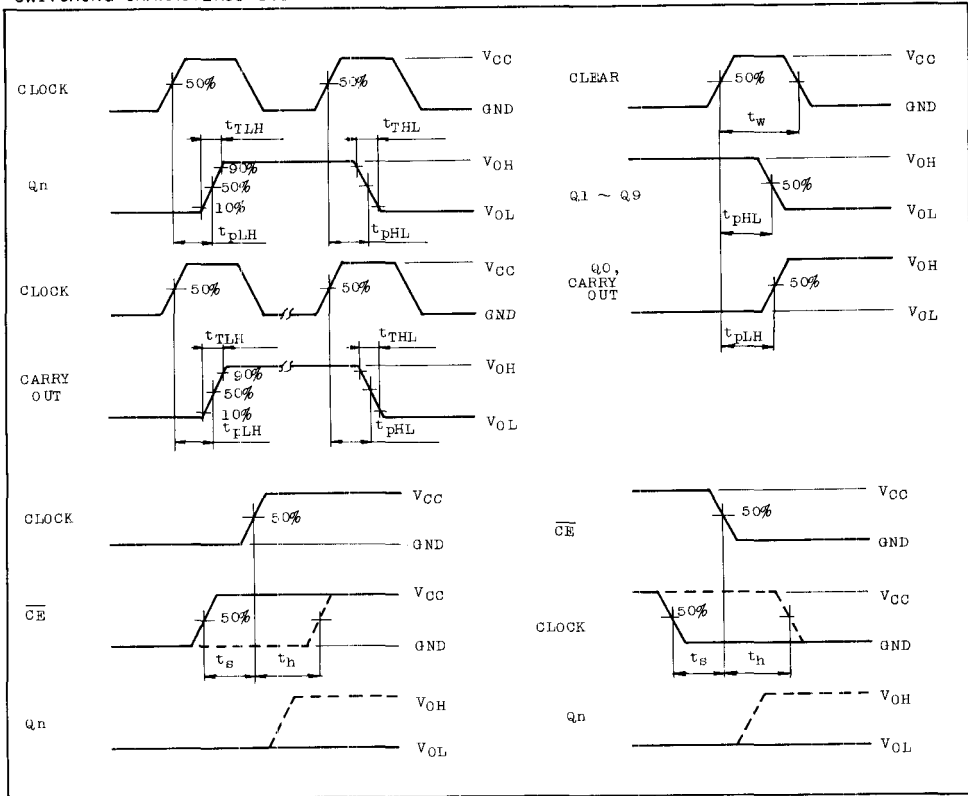
AC ELECTRICAL CHARACTERISTICS (Continued)

PARAMETER	SYMBOL	TEST CONDITION	Ta=25°C				Ta=-40~85°C		UNIT
			VCC	MIN.	TYP.	MAX.	MIN.	MAX.	
Maximum Clock Frequency	f _{MAX}		2.0	4	8	-	3	-	MHz
			4.5	20	33	-	16	-	
			6.0	23	38	-	17	-	
Minimum Pulse Width (CLOCK)	t _{w(L)} t _{w(H)}		2.0	-	30	75	-	90	ns
			4.5	-	8	15	-	18	
			6.0	-	7	13	-	16	
Minimum Pulse Width (CLEAR)	t _{w(H)}		2.0	-	30	75	-	90	
			4.5	-	8	15	-	18	
			6.0	-	7	13	-	16	
Minimum Set-up Time	t _s		2.0	-	-	0	-	0	
			4.5	-	-	0	-	0	
			6.0	-	-	0	-	0	
Minimum Hold Time	t _h		2.0	-	30	75	-	90	
			4.5	-	8	15	-	18	
			6.0	-	7	13	-	16	
Minimum Removal Time (CLEAR)	t _{rem}		2.0	-	30	75	-	90	
			4.5	-	8	15	-	18	
			6.0	-	7	13	-	16	
Input Capacitance	C _{IN}			-	5	10	-	10	pF
Power Dissipation Capacitance	C _{PD(1)}			-	74	-	-	-	

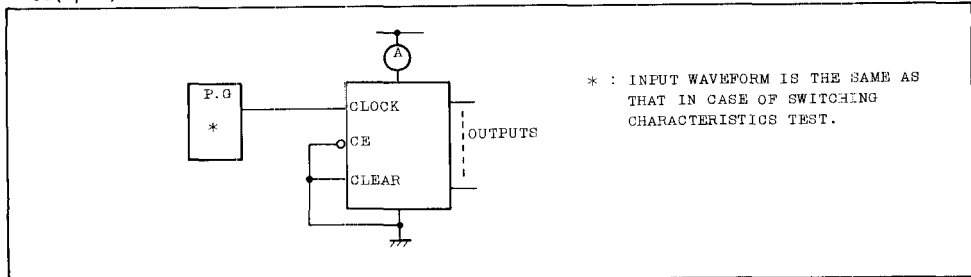
Note (1) C_{PD} is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit). Average operating current can be obtained by the equation hereunder.

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

SWITCHING CHARACTERISTICS TEST WAVEFORM

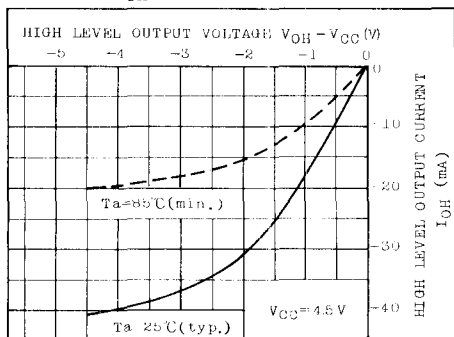


$I_{CC(opr.)}$ TEST CIRCUIT

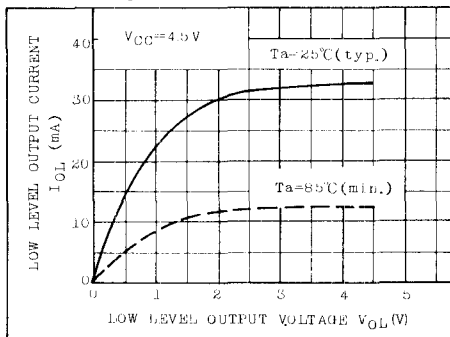


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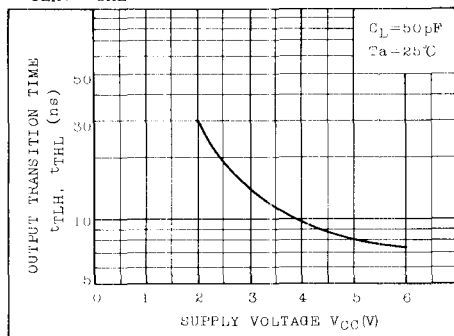
I_{OH} CHARACTERISTICS



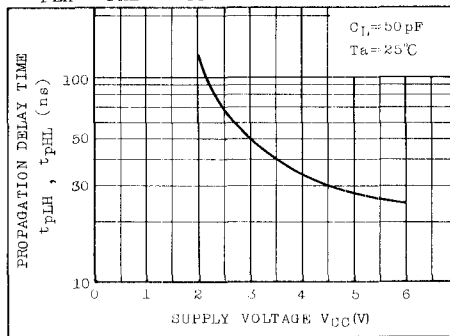
I_{OL} CHARACTERISTICS



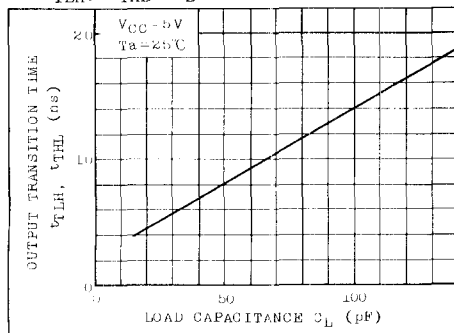
t_{TLH} , t_{THL} - V_{CC} CHARACTERISTICS (TYP.)



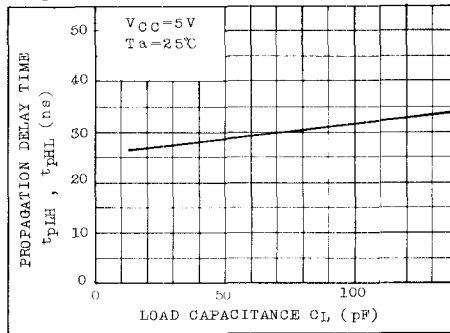
t_{PLH} , t_{PHL} - V_{CC} CHARACTERISTICS (TYP.)



t_{TLH} , t_{THL} - C_L CHARACTERISTICS (TYP.)



t_{PLH} , t_{PHL} - C_L CHARACTERISTICS (TYP.)



$f_{MAX} - V_{CC}$ CHARACTERISTICS (TYP.)

