

TC74HC4040P 12-STAGE BINARY COUNTER

GENERAL DESCRIPTION

The TC74HC4040 is a high speed CMOS 14-STAGE BINARY COUNTER/DIVIDER fabricated with silicon gate C²MOS technology.

It operates approximately ten times as fast as that of metal-gate CMOS IC (4040B) with the same power dissipation.

A clear input is used to reset the counter to all low level state. A high level at CLEAR accomplishes the reset function. A negative transition on the CLOCK input brings one increment to the counter. All divided output stages are provided, and 1/4096 divided frequency will be obtained at the last stage.

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

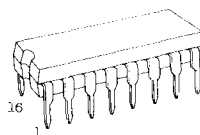
FEATURES

- High Speed $f_{max}=65\text{MHz(Typ.)}$ 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 10LSTTL Loads
- Symmetrical Output Impedance ... $|I_{OH}|=I_{OL}=4\text{mA (Min.)}$
- Balanced Propagation Delays $t_{PLH}=t_{PHL}$
- Wide Operating Voltage Range $V_{CC(opr)}=2\text{V} \sim 6\text{V}$
- Pin and Functional Compatible with 4040B.

ABSOLUTE MAXIMUM RATINGS

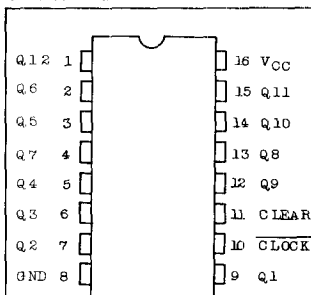
PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7$	V
DC Input Voltage	V_{IN}	$-0.5 \sim V_{CC}+0.5$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim V_{CC}+0.5$	V
Input Diode Current	I_{IK}	± 20	mA
Output Diode Current	I_{OK}	± 20	mA
DC Output Current	I_{OUT}	± 25	mA
DC V_{CC} /Ground Current	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 $T_a=-40^\circ\text{C} \sim 65^\circ\text{C}$ 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



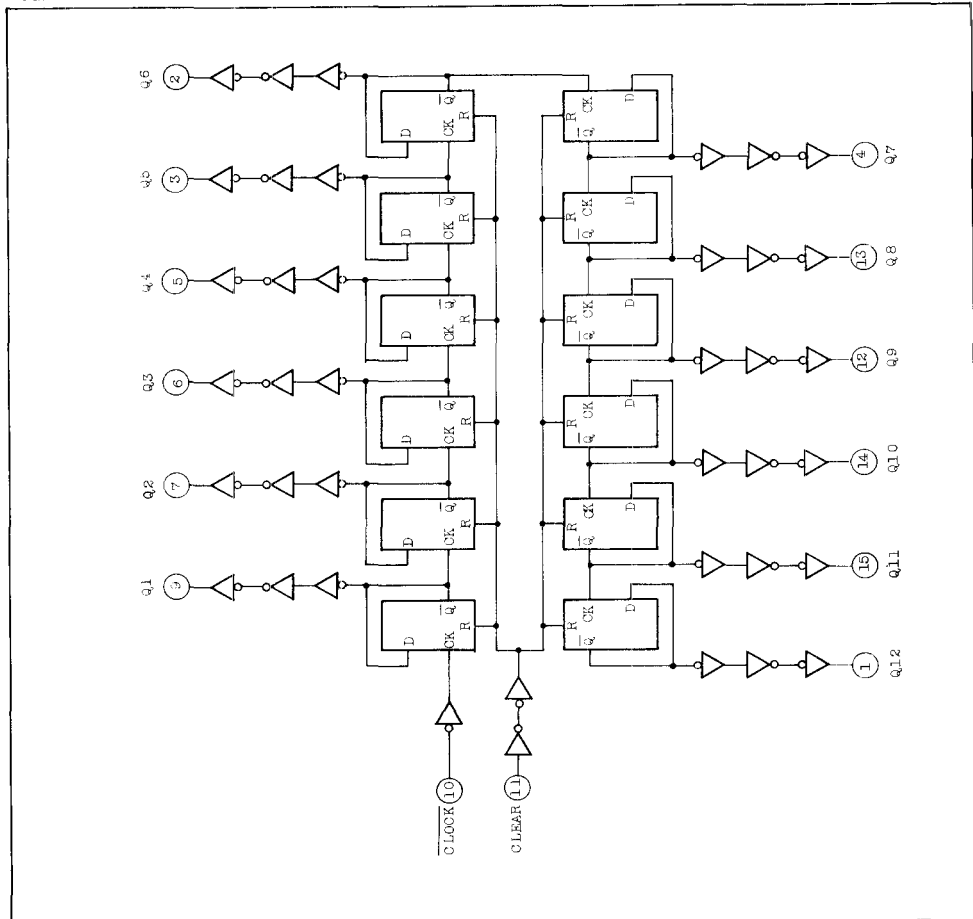
(TOP VIEW)

TRUTH TABLE

CLOCK	CLEAR	OUTPUT STATE
X	H	ALL OUTPUTS = "L"
L	L	NO CHANGE
L	L	ADVANCE TO NEXT STATE

X : DON'T CARE

LOGIC DIAGRAM

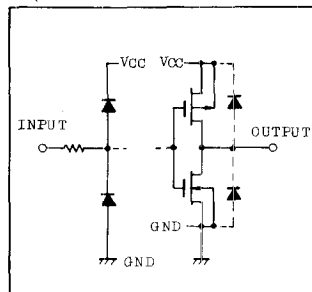


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RECOMMENDED OPERATING CONDITIONS

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	$T_a=25^{\circ}C$				$T_a=-40\sim85^{\circ}C$		UNIT
			V_{CC}	MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Input Voltage	V_{IH}		2.0	1.5	-	-	1.5	-	V
			4.5	3.15	-	-	3.15	-	
			6.0	4.2	-	-	4.2	-	
Low-Level Input Voltage	V_{IL}		2.0	-	-	0.5	-	0.5	V
			4.5	-	-	1.35	-	1.35	
			6.0	-	-	1.8	-	1.8	
High-Level Output Voltage	V_{OH}	$V_{IN}=V_{IH}$ or V_{IL}	$I_{OH}=-20\mu A$	2.0	1.9	2.0	-	1.9	V
				4.5	4.4	4.5	-	4.4	
				6.0	5.9	6.0	-	5.9	
			$I_{OH}=-4mA$ $I_{OH}=-5.2mA$	4.5	4.18	4.31	-	4.13	
Low-Level Output Voltage	V_{OL}	$V_{IN}=V_{IH}$ or V_{IL}	$I_{OL}=20\mu A$	2.0	-	0.0	0.1	-	V
				4.5	-	0.0	0.1	-	
				6.0	-	0.0	0.1	-	
			$I_{OL}=4mA$ $I_{OL}=5.2mA$	4.5	-	0.17	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	-	-	0.4	-	40.0	μA

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

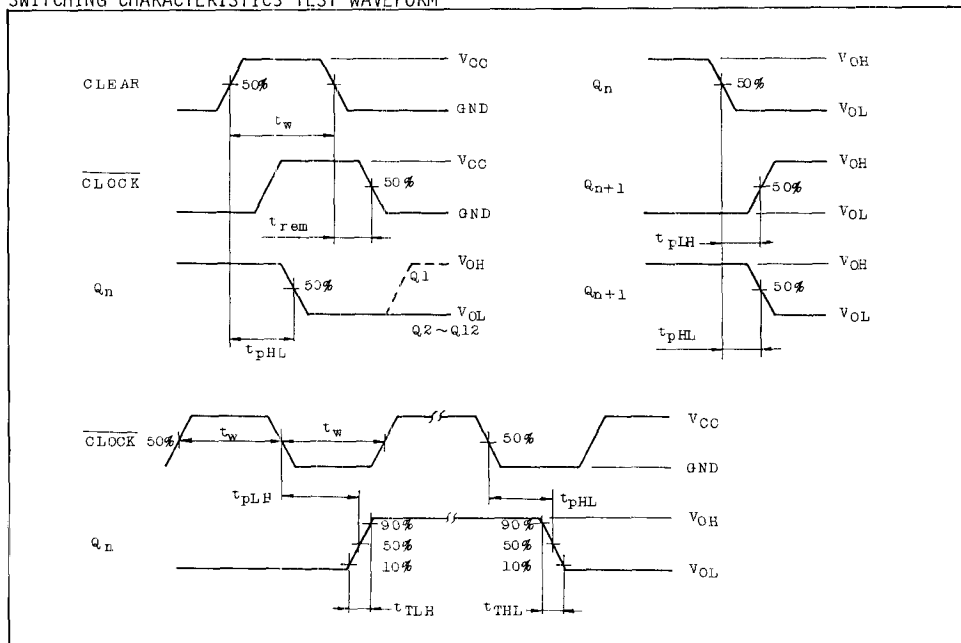
PARAMETER	SYMBOL	TEST CONDITION	$T_a=25^\circ\text{C}$				$T_a=-40\sim85^\circ\text{C}$		UNIT
			V_{CC}	MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time	t_{TLH} t_{THL}		2.0	-	30	75	-	90	ns
			4.5	-	9	15	-	18	
			6.0	-	8	13	-	16	
Propagation Delay Time (CLOCK - Q_1)	t_{pLH} t_{pHL}		2.0	-	88	175	-	210	
			4.5	-	22	35	-	42	
			6.0	-	19	30	-	36	
Propagation Delay Time ($Q_n - Q_{n+1}$)	t_{pLH} t_{pHL}		2.0	-	40	90	-	110	
			4.5	-	11	18	-	22	
			6.0	-	10	16	-	19	
Propagation Delay Time (CLEAR)	t_{pHL}		2.0	-	120	235	-	285	
			4.5	-	30	47	-	57	
			6.0	-	26	40	-	49	
Maximum Clock Frequency	f_{MAX}		2.0	5	12	-	4	-	MHz
			4.5	30	60	-	25	-	
			6.0	35	70	-	29	-	
Minimum Pulse Width (CLOCK)	$t_w(L)$ $t_w(H)$		2.0	-	32	75	-	90	ns
			4.5	-	8	15	-	18	
			6.0	-	7	13	-	16	
Minimum Pulse Width (CLEAR)	$t_w(H)$		2.0	-	60	125	-	150	
			4.5	-	15	25	-	30	
			6.0	-	13	22	-	26	
Minimum Removal Time	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	$C_{PD(1)}$			-	32	-	-	-	

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.

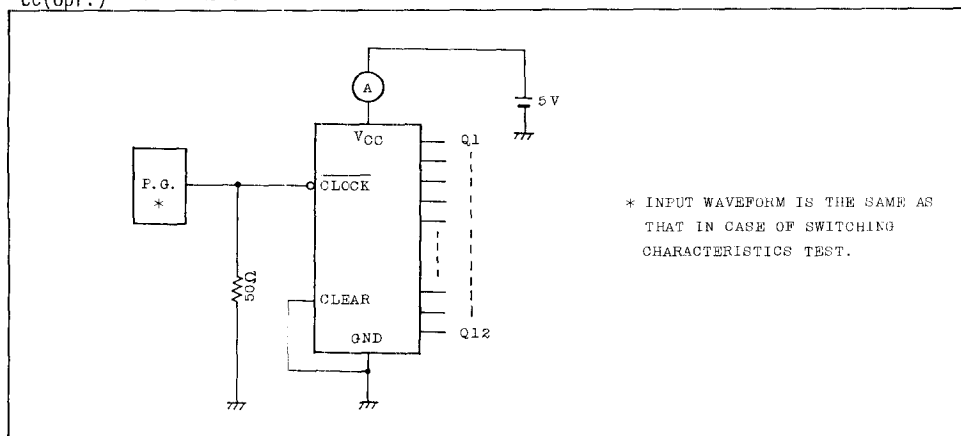
$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

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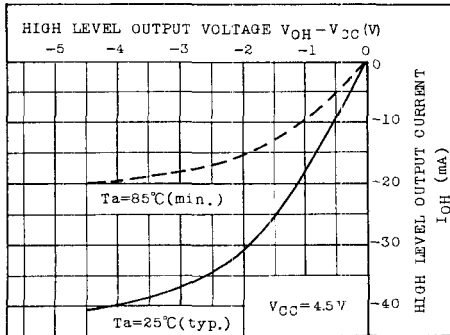
SWITCHING CHARACTERISTICS TEST WAVEFORM



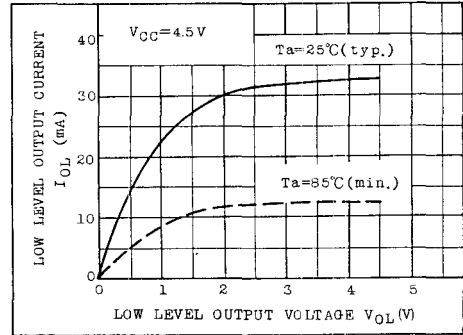
$I_{CC(opr.)}$ TEST CIRCUIT



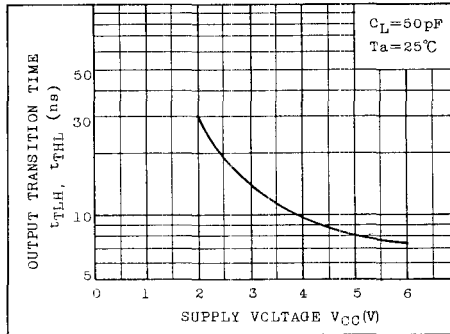
I_{OH} CHARACTERISTICS



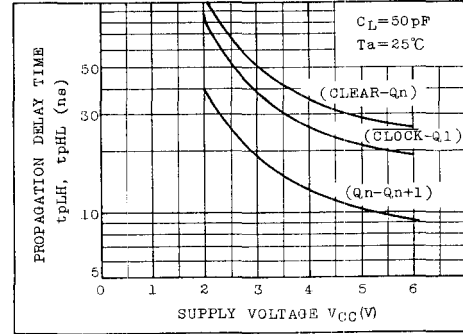
I_{OL} CHARACTERISTICS



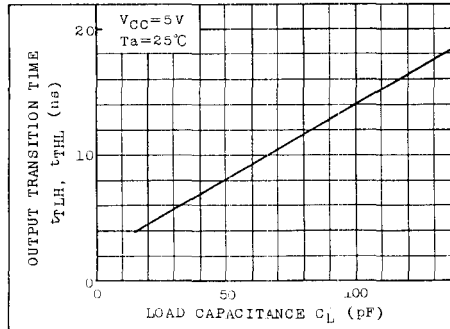
t_{TLH} , $t_{THL} - V_{CC}$ CHARACTERISTICS (TYP.)



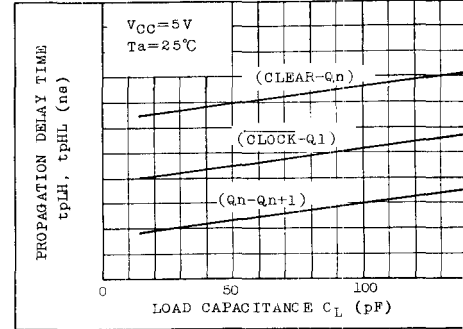
t_{pLH} , $t_{pHL} - V_{CC}$ CHARACTERISTICS (TYP.)



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

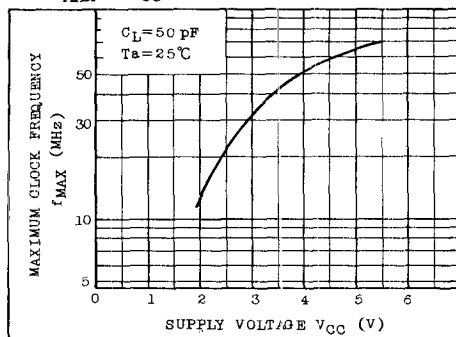


t_{pLH} , $t_{pHL} - C_L$ CHARACTERISTICS (TYP.)



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



$t_w(\text{CLEAR}, \overline{\text{CLOCK}}) - V_{CC}$ CHARACTERISTICS (TYP.)

