TC74HC4024P/F

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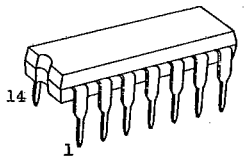
TC74HC4024P/F 7-STAGE BINARY COUNTER

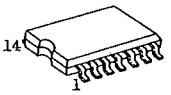
The TC74HC4024 is a high speed CMOS 7-STAGE BINARY COUNTER/DIVIDER fabricated with silicon gate C^2MOS technology.
It operates approximately ten times as fast as that of metal-gate CMOS IC (4024B) with the same power dissipation.
A clear input is used to reset the counter to the all low level state. A high level at CLEAR accomplishes the reset function. A negative transition on the $\overline{CLOCK}$ input brings one increment to the counter. Seven kinds of divided output are provided; 1'st and 4 stage thru 7 stage. And at the last stage, 1/128 divided frequency will be obtained.
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES:

- High Speed ..... f_{max}=60MHz(Typ.) at V_{CC}=5V
- Low Power Dissipation ..... I_{CC}=4μA (Max.) at Ta=25°C
- High Noise Immunity ..... $V_{NIH}=V_{NIL}$=28% V_{CC}(Min.)
- Output Drive Capability ..... 10 LSTTL Loads
- Symmetrical Output Impedance .... $|I_{OH}|=I_{OL}$=4mA(Min.)
- Balanced Propagation Delays ..... $t_{pLH} \fallingdotseq t_{pHL}$
- Wide Operating Voltage Range ..... V_{CC}(Opr.)=2V ∿ 6V
- Pin and Function Compatible with 4024B.



DIP14(3D14A-P)



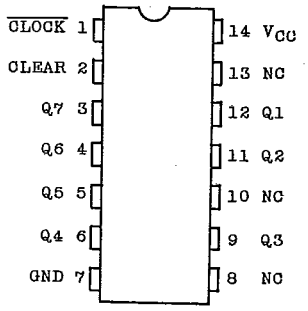
MFP14(F14GB-P)

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(MFP)	mW
Storage Temperature	T_{stg}	-65 ∿ 150	°C
Lead Temperature 10sec	T_L	300	°C

* 500mW in the range of Ta=-40°C ∿ 65°C and from Ta=65°C up to 85°C derating factor of -10mW/°C shall be applied until 300mW.

PIN ASSIGNMENT



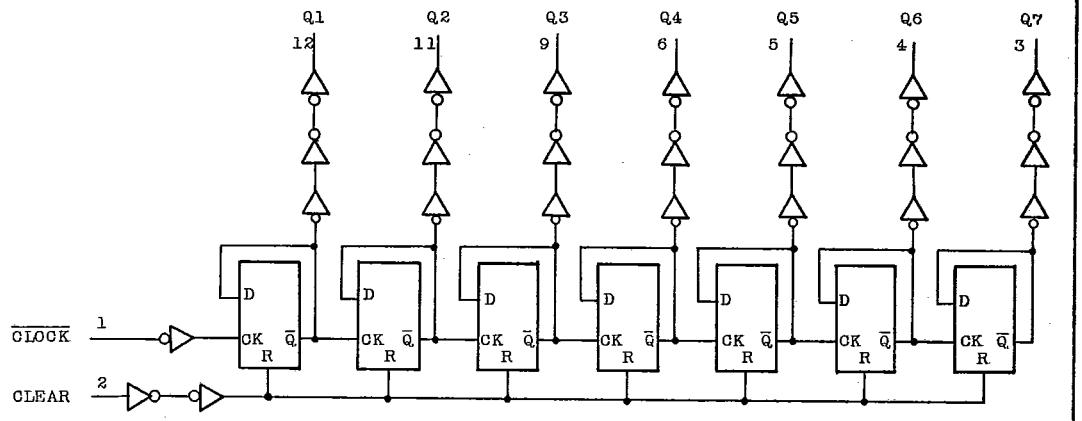
(TOP VIEW)

TRUTH TABLE

$\overline{CLOCK}$	CLEAR	OUTPUT STATE
X	H	ALL OUTPUTS = "L"
↓	L	NO CHANGE
↑	L	ADVANCE TO NEXT STATE

X : DON'T CARE

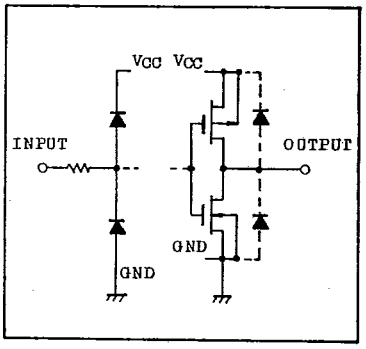
LOGIC DIAGRAM



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 MIN.	Ta=25°C TYP.	Ta=25°C MAX.	Ta=-40~85°C MIN.	Ta=-40~85°C MAX.	UNIT
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	
				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}=-20μA	2.0	1.9	2.0	-	1.9	-	
				4.5	4.4	4.5	-	4.4	-	
				6.0	5.9	6.0	-	5.9	-	
			I_{OH}=-4mA	4.5	4.18	4.31	-	4.13	-	
			I_{OH}=-5.2mA	6.0	5.68	5.80	-	5.63	-	
Low-Level Output Voltage	V_{OL}	$V_{IN}=V_{IH}$ or V_{IL}	I_{OL}=20μA	2.0	-	0.0	0.1	-	0.1	
				4.5	-	0.0	0.1	-	0.1	
				6.0	-	0.0	0.1	-	0.1	
			I_{OL}=4mA	4.5	-	0.17	0.26	-	0.33	
			I_{OL}=5.2mA	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	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 MIN.	Ta=25°C TYP.	Ta=25°C MAX.	Ta=-40~85°C MIN.	Ta=-40~85°C MAX.	UNIT
Output Transition Time	t_{TLH} t_{THL}		2.0	-	30	75	-	95	ns
			4.5	-	8	15	-	19	
			6.0	-	7	13	-	16	
Propagation Delay Time ($\overline{CLOCK}$ - Q1)	t_{pLH} t_{pHL}		2.0	-	72	145	-	180	
			4.5	-	18	29	-	36	
			6.0	-	15	25	-	31	
Propagation Delay Time Difference (Qn - Qn+1)	Δtpd		2.0	-	28	60	-	75	
			4.5	-	7	12	-	15	
			6.0	-	6	10	-	13	
Propagation Delay Time (CLEAR - Qn)	t_{pHL}		2.0	-	96	185	-	230	
			4.5	-	24	37	-	46	
			6.0	-	20	31	-	39	
Maximum Clock Frequency	f_{MAX}		2.0	6	14	-	5	-	MHz
			4.5	30	55	-	24	-	
			6.0	35	65	-	28	-	
Minimum Pulse Width ($\overline{CLOCK}$)	$t_{w(L)}$ $t_{w(H)}$		2.0	-	30	75	-	95	ns
			4.5	-	8	15	-	19	
			6.0	-	7	13	-	16	

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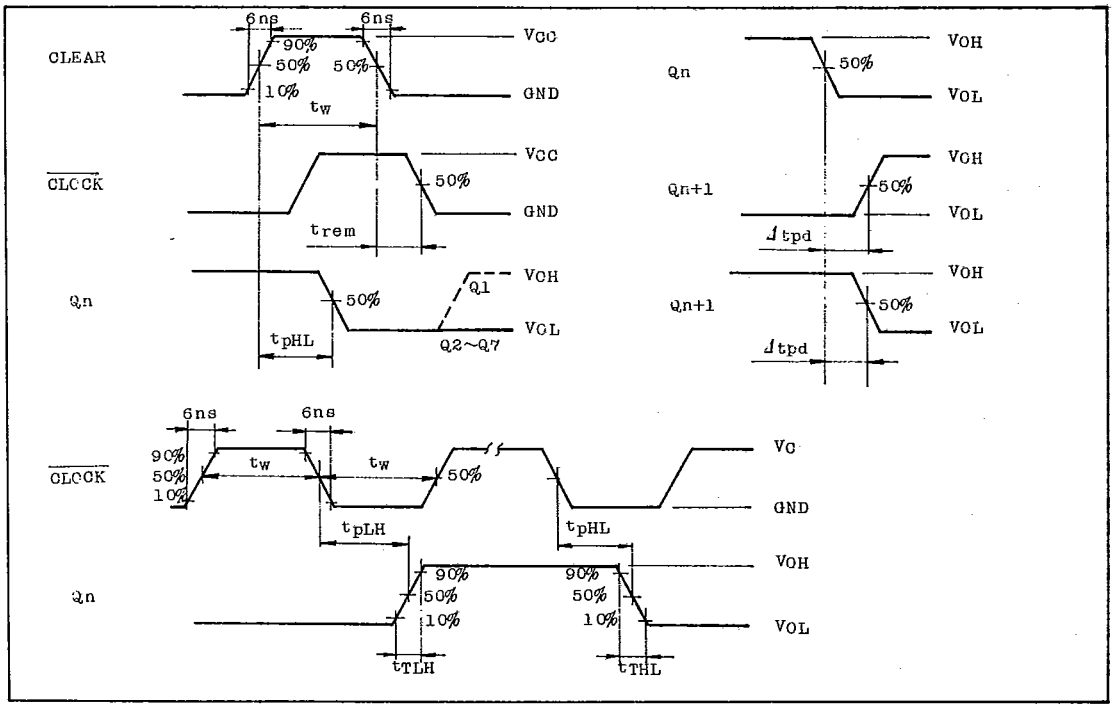
AC ELECTRICAL CHARACTERISTICS (Continued)

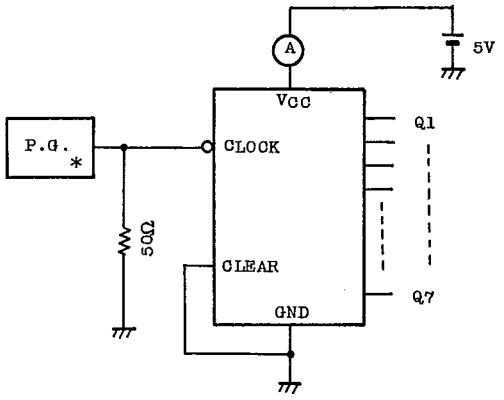
PARAMETER	SYMBOL	TEST CONDITION	V_{CC}	Ta=25°C			Ta=-40~85°C		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	
Minimum Pulse Width (CLEAR)	$t_{W(H)}$		2.0	-	30	75	-	95	ns
			4.5	-	8	15	-	19	
			6.0	-	7	13	-	16	
Minimum Removal Time	t_{rem}		2.0	-	15	50	-	65	
			4.5	-	3	10	-	13	
			6.0	-	3	9	-	11	
Input Capacitance	C_{IN}			-	5	10	-	10	pF
Power Dissipation Capacitance	$C_{PD(1)}$			-	42	-	-	-	

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



* : INPUT WAVEFORM IS THE SAME AS THAT IN CASE OF SWITCHING CHARACTERISTICS TEST.