TC74HC4022AP/AF

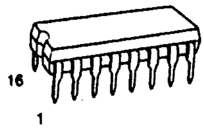
Octal Counter/Divider

The TC74HC4022A is a high speed CMOS OCTAL COUNTER DIVIDER fabricated with silicon gate C^2MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation. It contains 4-stage divided-by-8 Johnson counter with 8 decoded output (Q0 ~ Q7) and carry-out bit.

The counter is advanced on the positive edge of clock signal when clock enable signal $\overline{\text{CLOCK ENABLE}}$ input is held low, or it is advanced on the negative edge of the enable signal 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.



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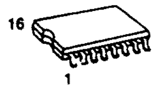
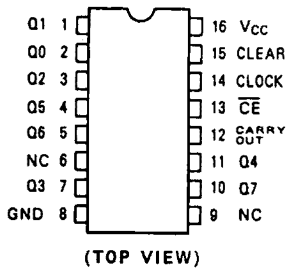


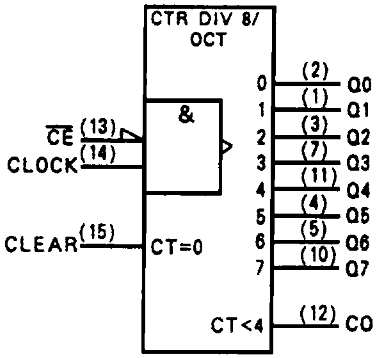
F

Features

- High Speed: f_{MAX} = 57MHz(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: $t_{pLH} = t_{pHL}$
- Wide Operating Voltage Range: V_{CC}(opr) = 2V ~ 6V
- Pin and Function Compatible with 4022B



Pin Assignment



IEC Logic Symbol

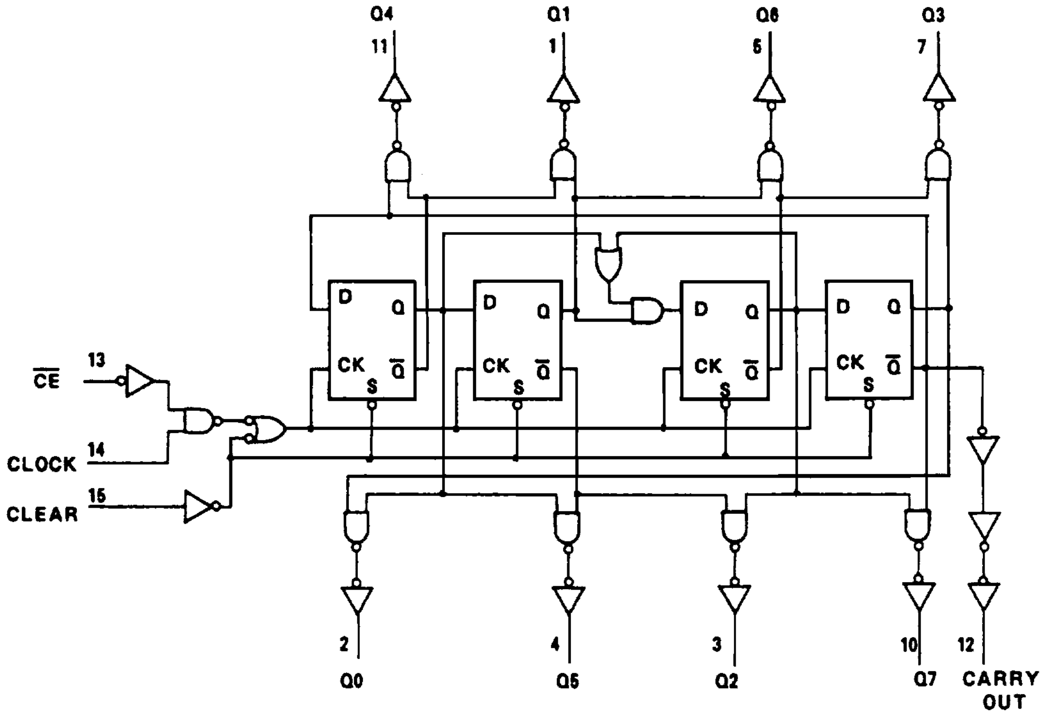
Truth Table

Inputs			Decode Output (H)
CLOCK	$\overline{CE}$	CLEAR	
X	X	H	Qo
L	X	L	Qn
X	H	L	Qn
↑	L	L	Qn + 1
↓	L	L	Qn
H	↑	L	Qn
H	↓	L	Qn + 1

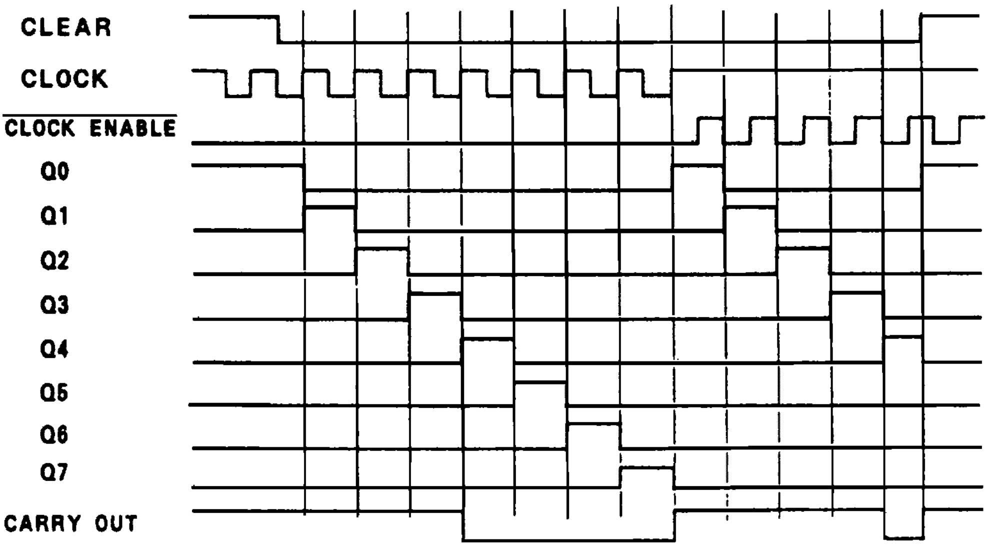
X: Don't Care

Carry Out "H"...Q_0~Q_4 = "H"

"L"...Q_5~Q_9 = "H"



Logic 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(SOIC)	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. From Ta = 65°C to 85°C a derating factor of -10mW/°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} = 2.0V) 0 ~ 500(V_{CC} = 4.5V) 0 ~ 400(V_{CC} = 6.0V)	ns

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 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	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
			I_{OH} = -4 mA I_{OH} = -5.2mA	4.5 6.0	4.18 5.68	4.31 5.80	– –	4.13 5.63	– –	
Low-Level Output Voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20μA	2.0 4.5 6.0	– – –	0.0 0.0 0.0	0.1 0.1 0.1	– – –	0.1 0.1 0.1	V
			I_{OL} = 4 mA I_{OL} = 5.2mA	4.5 6.0	– –	0.17 0.18	0.26 0.26	– –	0.33 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	

Timing Requirements (Input $t_r = t_f = 6ns$)

Parameter	Symbol	Test Condition		Ta = 25°C		Ta = -40 ~ 85°C	Unit
			V_{CC}	Typ.	Limit	Limit	
Minimum Pulse Width (CLOCK)	$t_{W(L)}$ $t_{W(H)}$	–	2.0 4.5 6.0	– – –	75 15 13	95 19 16	ns
Minimum Pulse Width (CLEAR)	$t_{W(H)}$	–	2.0 4.5 6.0	– – –	75 15 13	95 19 16	
Minimum Set-up Time	t_s	–	2.0 4.5 6.0	– – –	0 0 0	0 0 0	
Minimum Hold Time	t_h	–	2.0 4.5 6.0	– – –	75 15 13	95 19 16	
Minimum Removal Time (CLEAR)	t_{rem}	–	2.0 4.5 6.0	– – –	50 10 9	65 13 11	
Clock Frequency	f	–	2.0 4.5 6.0	– – –	6 31 36	5 25 29	MHz

AC Electrical Characteristics ($C_L = 15pF$, $V_{CC} = 5V$, Ta = 25°C)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Output Transition Time	t_{TLH} t_{THL}	–	–	4	8	ns
Propagation Delay Time (CLOCK, $\overline{CE}$-Q, CARRY)	t_{pLH} t_{pHL}	–	–	17	27	
Propagation Delay Time (CLEAR--Q, CARRY)	t_{pLH} t_{pHL}	–	–	15	25	
Maximum Clock Frequency	f_{MAX}	–	33	57	–	MHz

AC Electrical Characteristics ($C_L = 50pF$, Input $t_r = t_f = 6ns$)

Parameter	Symbol	Test Condition		Ta = 25°C			Ta = -40 ~ 85°C		Unit
			V_{CC}	Min	Typ.	Max.	Min.	Max.	
Output Transition Time	t_{TLH} t_{THL}	–	2.0 4.5 6.0	– – –	30 8 7	75 15 13	– – –	95 19 16	ns
Propagation Delay Time (CLOCK, $\overline{CE}$-Q, CARRY)	t_{pLH} t_{pHL}	–	2.0 4.5 6.0	– – –	71 21 16	160 32 27	– – –	200 40 34	
Propagation Delay Time (CLEAR--Q, CARRY)	t_{pLH} t_{pHL}	–	2.0 4.5 6.0	– – –	69 19 15	145 29 25	– – –	180 36 31	
Maximum Clock Frequency	f_{MAX}	–	2.0 4.5 6.0	6 31 36	11 51 63	– – –	5 25 29	– – –	MHz
Input Capacitance	C_{IN}	–		–	5	10	–	10	pF
Power Dissipation Capacitance	C_{PD}(1)	–		–	53	–	–	–	

Note (1) C_{PD} 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:
$I_{CC(opr)} = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}$