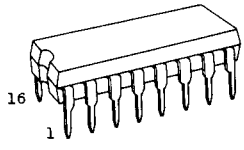
TC4022BP

C²MOS DIGITAL INTEGRATED CIRCUIT
SILICON MONOLITHIC

TC4022BP OCTAL COUNTER/DIVIDER

TC4022BP is octal Johnson counter consisting of 4 stage D-type flip-flops and equipped with decoder which convert the output to octal.
Depending on the number of count pulses applied to CLOCK or CLOCK INHIBIT input, one of eight outputs Q_0 through Q_7 becomes "H". The counter advances its counting state by rising edge of CLOCK when CLOCK INHIBIT="L" and by falling edge of CLOCK INHIBIT when CLOCK="H".
RESET input with "H" level resets the counter to Q_0="H" and $Q_1 \sim Q_7$="L" regardless of CLOCK and CLOCK INHIBIT.

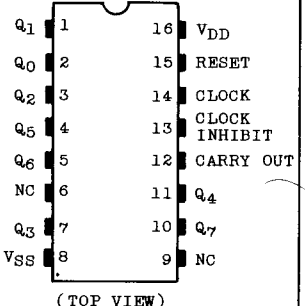


DIP 16(3D16A-P)

MAXIMUM RATINGS

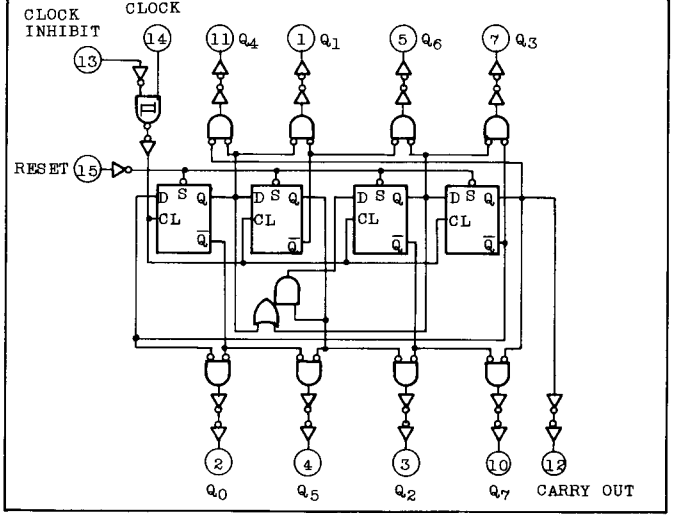
CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V_{DD}	V_{SS}-0.5 ~ V_{SS}+20	V
Input Voltage	V_{IN}	V_{SS}-0.5 ~ V_{DD}+0.5	V
Output Voltage	V_{OUT}	V_{SS}-0.5 ~ V_{DD}+0.5	V
DC Input Current	I_{IN}	±10	mA
Power Dissipation	P_D	300	mW
Operating Ambient Temperature Range	T_A	-40 ~ 85	°C
Storage Temperature Range	T_{stg}	-65 ~ 150	°C
Lead Temp./Time	T_{sol}	260°C ·10sec	

PIN ASSIGNMENT



(TOP VIEW)

LOGIC DIAGRAM

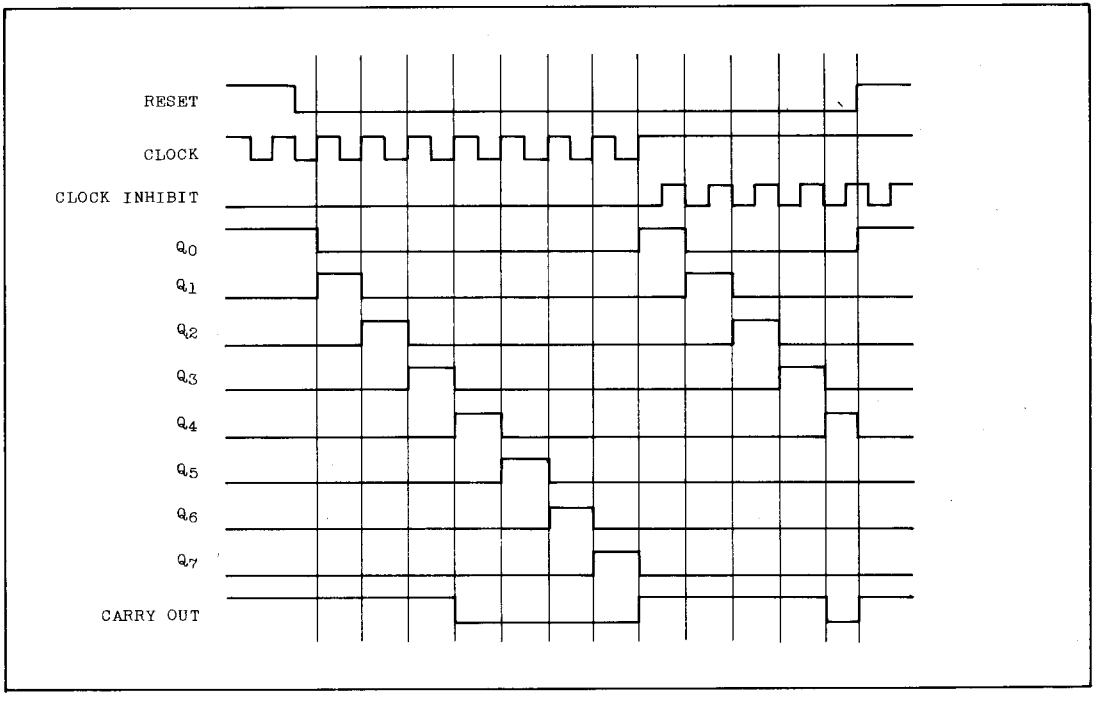


TRUTH TABLE

INPUTS			SELECTED OUTPUT
CLOCK △	CLOCK INHIBIT△	RESET	
*	*	H	Q_0
*	H	L	Q_n(NC)
L	*	L	Q_n(NC)
↑	L	L	Q_n + 1
↓	L	L	Q_n(NC)
H	↑	L	Q_n(NC)
H	↓	L	Q_n + 1

△ ; Level Change
* ; Don't Care
NC ; No Change
CARRY OUT {"H" ··· $Q_0 \sim Q_3$="H" / "L" ··· $Q_4 \sim Q_7$="H"}

TIMING CHART



RECOMMENDED OPERATING CONDITIONS (V_{SS}=0V)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
DC Supply Voltage	V_{DD}		3	-	18	V
Input Voltage	V_{IN}		0	-	V_{DD}	V

STATIC ELECTRICAL CHARACTERISTICS (V_{SS}=0V)

CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{DD} (V)	-40°C		25°C			85°C		UNIT
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Output Voltage	V_{OH}	$\|I_{OUT}\| < 1\mu A$ $V_{IN}=V_{SS},V_{DD}$	5	4.95	-	4.95	5.00	-	4.95	-	V
			10	9.95	-	9.95	10.00	-	9.95	-	
			15	14.95	-	14.95	15.00	-	14.95	-	
Low-Level Output Voltage	V_{OL}	$\|I_{OUT}\| < 1\mu A$ $V_{IN}=V_{SS},V_{DD}$	5	-	0.05	-	0.00	0.05	-	0.05	
			10	-	0.05	-	0.00	0.05	-	0.05	
			15	-	0.05	-	0.00	0.05	-	0.05	

STATIC ELECTRICAL CHARACTERISTICS (V_{SS}=0V)

CHARACTERISTIC	SYM-BOL	TEST CONDITION	V_{DD} (V)	-40°C MIN.	-40°C MAX.	25°C MIN.	25°C TYP.	25°C MAX.	85°C MIN.	85°C MAX.	UNIT
Output High Current	I_{OH}	V_{OH}=4.6V	5	-0.61	-	-0.51	-1.0	-	-0.42	-	mA
		V_{OH}=2.5V	5	-2.5	-	-2.1	-4.0	-	-1.7	-	
		V_{OH}=9.5V	10	-1.5	-	-1.3	-2.2	-	-1.1	-	
		V_{OH}=13.5V	15	-4.0	-	-3.4	-9.0	-	-2.8	-	
		V_{IN}=V_{SS},V_{DD}									
Output Low Current	I_{OL}	V_{OL}=0.4V	5	0.61	-	0.51	1.5	-	0.42	-	
		V_{OL}=0.5V	10	1.5	-	1.3	3.8	-	1.1	-	
		V_{OL}=1.5V	15	4.0	-	3.4	15.0	-	2.8	-	
		V_{IN}=V_{SS},V_{DD}									
Input High Voltage	V_{IH}	V_{OUT}=0.5V,4.5V	5	3.5	-	3.5	2.75	-	3.5	-	V
		V_{OUT}=1.0V,9.0V	10	7.0	-	7.0	5.5	-	7.0	-	
		V_{OUT}=1.5V,13.5V	15	11.0	-	11.0	8.25	-	11.0	-	
		$\|I_{OUT}\| < 1\mu A$									
Input Low Voltage	V_{IL}	V_{OUT}=0.5V,4.5V	5	-	1.5	-	2.25	1.5	-	1.5	
		V_{OUT}=1.0V,9.0V	10	-	3.0	-	4.5	3.0	-	3.0	
		V_{OUT}=1.5V,13.5V	15	-	4.0	-	6.75	4.0	-	4.0	
		$\|I_{OUT}\| < 1\mu A$									
Input Current "H" Level	I_{IH}	V_{IH}=18V	18	-	0.1	-	10^{-5}	0.1	-	1.0	μA
Input Current "L" Level	I_{IL}	V_{IL}=0V	18	-	-0.1	-	-10^{-5}	-0.1	-	-1.0	
Quiescent Device Current	I_{DD}	V_{IN}=V_{SS},V_{DD} *	5	-	5	-	0.005	5	-	150	μA
			10	-	10	-	0.010	10	-	300	
			15	-	20	-	0.015	20	-	600	

* All valid input combinations.

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta=25°C, V_{SS}=0V, C_L=50pF)

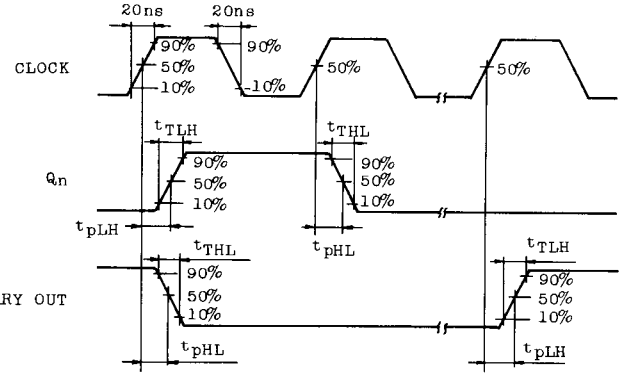
CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{DD} (V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t_{TLH}		5	-	80	200	ns
			10	-	50	100	
			15	-	40	80	
Output Transition Time (High to Low)	t_{THL}		5	-	80	200	
			10	-	50	100	
			15	-	40	80	

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta=25°C, V_{SS}=0V, C_L=50pF)

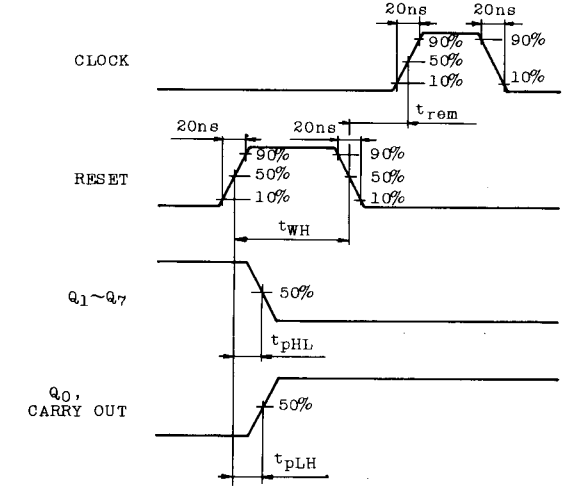
CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{DD} (V)	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time (CLOCK - Q_n)	t_{pLH} t_{pHL}		5	-	325	650	ns
			10	-	135	270	
			15	-	85	170	
Propagation Delay Time (CLOCK - CARRY OUT)	t_{pLH} t_{pHL}		5	-	280	600	
			10	-	110	250	
			15	-	75	160	
Propagation Delay Time (RESET - Q, RESET - CARRY OUT)	t_{pLH} t_{pHL}		5	-	265	530	
			10	-	115	230	
			15	-	85	170	
Max. Clock Frquency	f_{CL}		5	2.5	6	-	MHz
			10	5	12	-	
			15	6.7	13.5	-	
Min. Clock Pulse Width	t_w		5	-	85	200	ns
			10	-	40	90	
			15	-	35	60	
Min. Pulse Width (RESET)	t_{WH}		5	-	50	200	
			10	-	20	110	
			15	-	15	60	
Max. Clock Rise Time Max. Clock Fall Time	t_{rCL} t_{fCL}		5	No Limit			μs
			10				
			15				
Min. Set-up Time (CLOCK INHIBIT - CLOCK)	t_{SU}		5	-	30	230	ns
			10	-	15	100	
			15	-	10	70	
Min. Removal Time (RESET - CLOCK)	t_{rem}		5	-	-55	400	ns
			10	-	-20	275	
			15	-	-15	150	
Input Capacitance	C_{IN}			-	5	7.5	pF

WAVEFORMS FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

WAVEFORM 1.



WAVEFORM 2.



WAVEFORM 3.