

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.

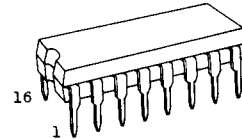
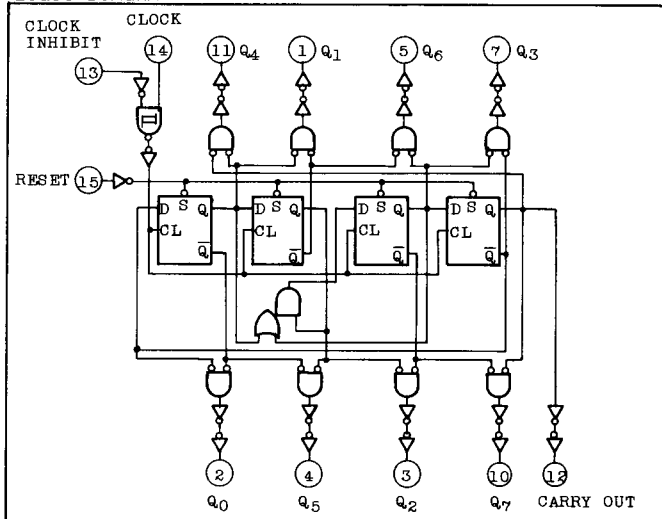
Depending on the number of count pulses applied to CLOCK or CLOCK INHIBIT input, one of eight outputs Q₀ through Q₇ becomes "H". The counter advances its counting state by rising edge of CLOCK when CLOCK INHIBIT="L" and by falling edge of CLOCK INHIBIT when CLOCK="H".

RESET input with "H" level resets the counter to Q₀="H" and Q₁~Q₇="L" regardless of CLOCK and CLOCK INHIBIT.

MAXIMUM RATINGS

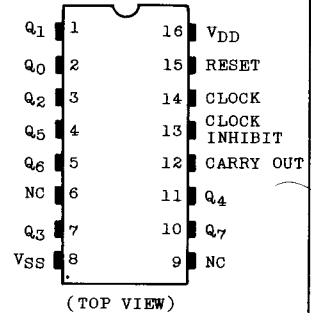
CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V _{DD}	V _{SS} -0.5 ~ V _{SS} +20	V
Input Voltage	V _{IN}	V _{SS} -0.5 ~ V _{DD} +0.5	V
Output Voltage	V _{OUT}	V _{SS} -0.5 ~ V _{DD} +0.5	V
DC Input Current	I _{IN}	±10	mA
Power Dissipation	P _D	300	mW
Operating Ambient Temperature Range	T _A	-40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

LOGIC DIAGRAM



DIP 16 (3D16A-P)

PIN ASSIGNMENT



(TOP VIEW)

TRUTH TABLE

CLOCK Δ	INPUTS		SELECTED OUTPUT
	CLOCK INHIBIT Δ	RESET	
*	*	H	Q ₀
*	H	L	Q _n (NC)
L	*	L	Q _n (NC)
\downarrow	L	L	Q _n + 1
\uparrow	L	L	Q _n (NC)
H	\downarrow	L	Q _n (NC)
H	\uparrow	L	Q _n + 1

Δ ; Level Change

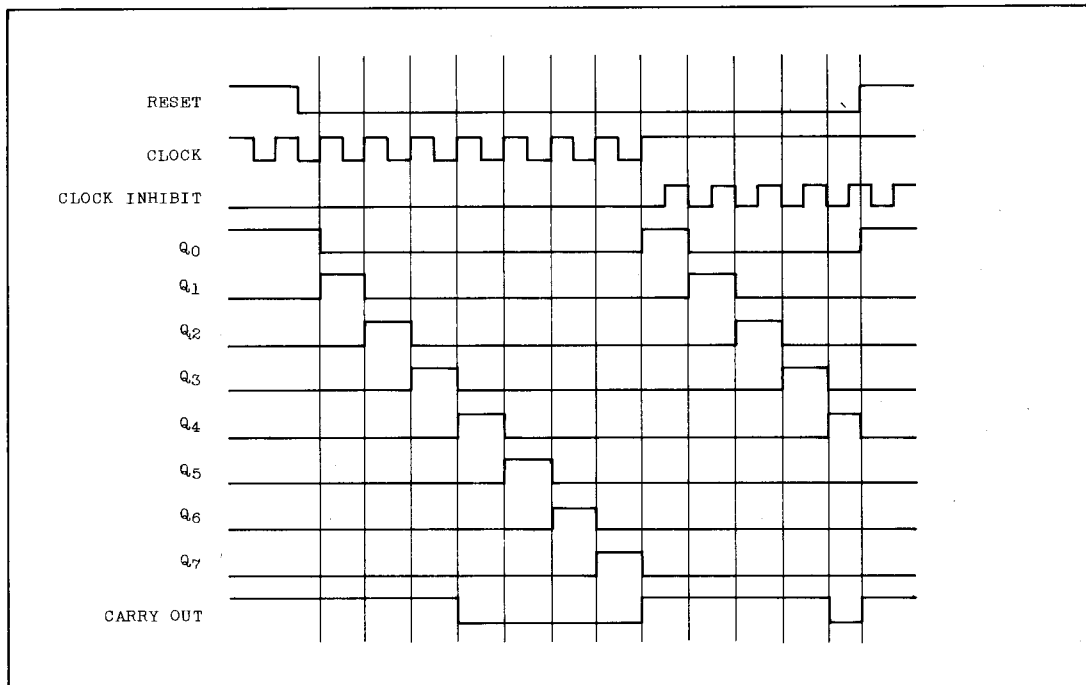
* ; Don't Care

NC ; No Change

CARRY OUT { "H" ... Q₀~Q₃ = "H"

"L" ... Q₄~Q₇ = "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	SYM-BOL	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} < 1μA 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} < 1μA V _{IN} =V _{SS} ,V _{DD}	5	-	0.05	-	0.00	0.05	-	0.05	V
			10	-	0.05	-	0.00	0.05	-	0.05	
			15	-	0.05	-	0.00	0.05	-	0.05	

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

CHARACTERISTIC	SYM-BOL	TEST CONDITION	V _{DD} (V)	-40°C		25°C			85°C		UNIT	
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.		
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	-	mA	
		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} < 1μA										
Input Low Voltage	V _{IL}	V _{OUT} =0.5V, 4.5V	5	-	1.5	-	2.25	1.5	-	1.5	V	
		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} < 1μA										
Input Current	"H" Level	I _{IH}	V _{IH} =18V	18	-	0.1	-	10 ⁻⁵	0.1	-	1.0	μA
	"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 (T_a=25°C, V_{SS}=0V, C_L=50pF)

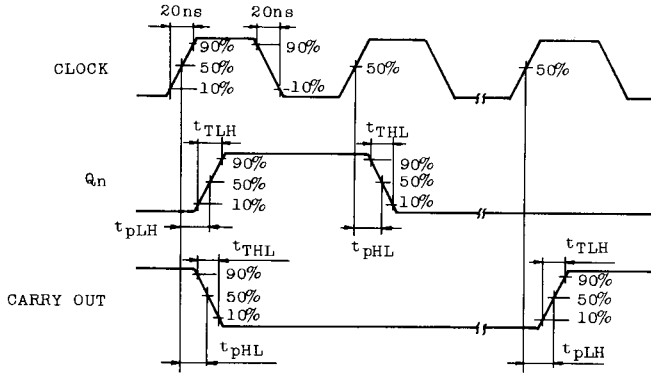
CHARACTERISTIC	SYMBOL	TEST CONDITION	V _{DD} (V)	MIN.	TYP.	MAX.	UNIT
			10	-	50	100	
			15	-	40	80	
Output Transition Time (High to Low)	t _{THL}		5	-	80	200	ns
			10	-	50	100	
			15	-	40	80	

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta=25°C, VSS=0V, CL=50pF)

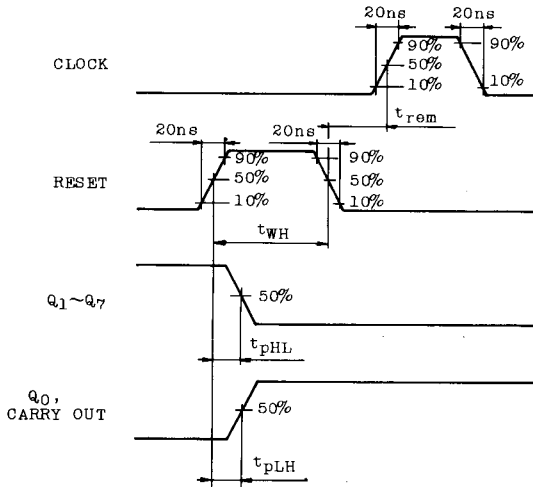
CHARACTERISTIC	SYMBOL	TEST CONDITION	V _{DD} (V)	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time (CLOCK - Qn)	t _{pLH} t _{pHL}		5	-	325	650	ns
			10	-	135	270	
			15	-	85	170	
Propagation Delay Time (CLOCK - CARRY OUT)	t _{pLH} t _{pHL}		5	-	280	600	
			10	-	110	250	
			15	-	75	160	
Propagation Delay Time (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.

