

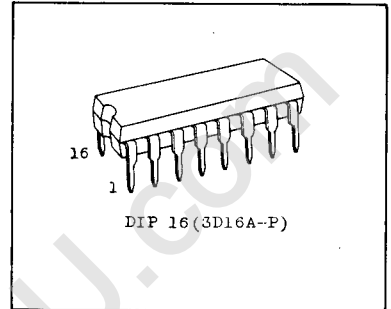
TC40192BP PRESETTABLE BCD UP/DOWN COUNTER (Dual Clock with Reset)

TC40193BP PRESETTABLE BINARY UP/DOWN COUNTER (Dual Clock with Reset)

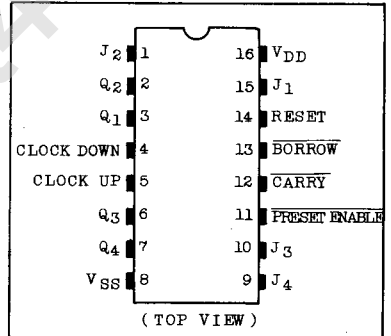
TC40192BP/TC40193BP is a synchronous 4-bit up/down counter.

The RESET input is active at "H" level, and the PRESET ENABLE input is active at "L" level; both of them perform asynchronous operation.

In the clock, the up-count input and the down-count input are independent each other, and each input performs count operation at the rising edge of the pulse. And the clock in the counter takes the logic sum of counting up and counting down; therefore, one clock input can be used as a clock inhibit input. The functions and pin assignment of TC40192BP and TC40193BP are compatible with those of 74192 and 74193 of TTL.



PIN ASSIGNMENT



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 Temperature Range	T _A	-40 ~ 85	°C
Storage Temperature Range	T _{stg}	-65 ~ 150	°C
Lead Temp./Time	T _{sol}	260°C · 10 sec	

TRUTH TABLE

(TC40192BP, TC40193BP)

CLOCK UP	CLOCK DOWN	PRESET ENABLE	RESET	ACTION
↓	H	H	L	COUNT UP
↑	H	H	L	NO COUNT
H	↓	H	L	COUNT DOWN
H	↑	H	L	NO COUNT
*	*	L	L	PRESET
*	*	*	H	RESET

* : Don't care

(TC40192BP)

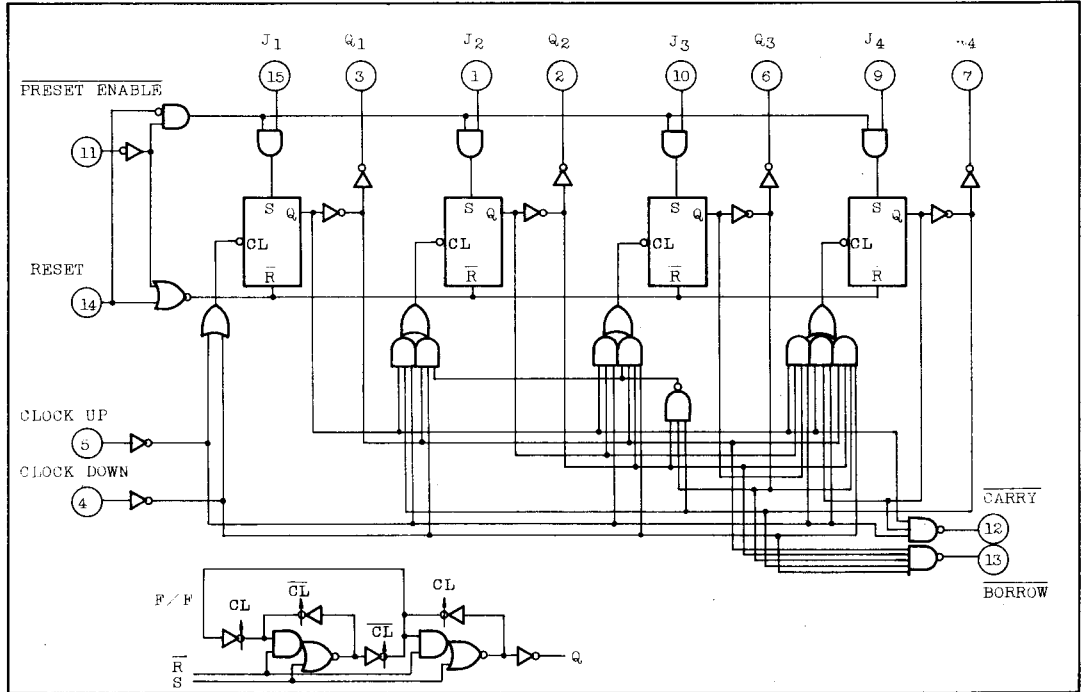
COUNT	Q ₁	Q ₂	Q ₃	Q ₄
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H

(TC40193BP)

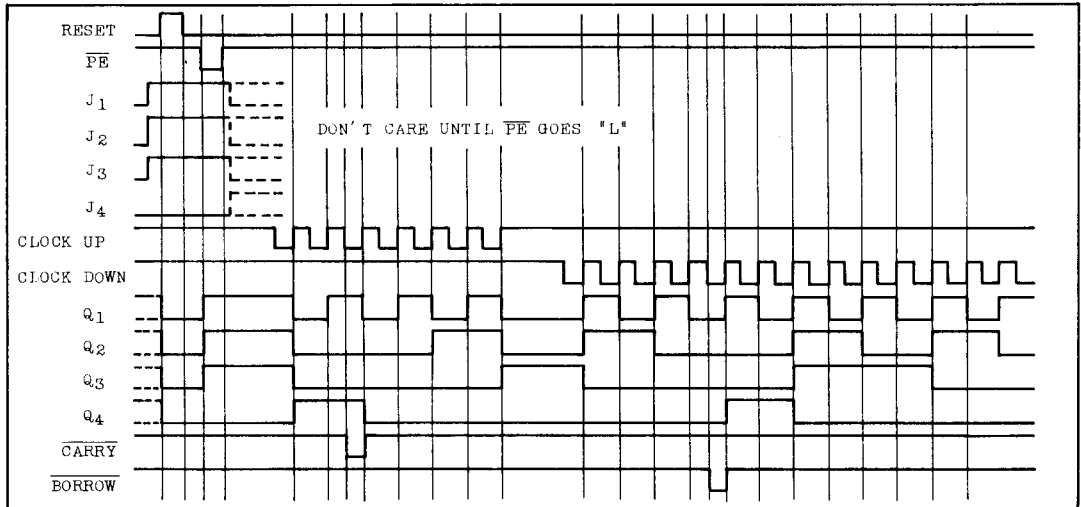
COUNT	Q ₁	Q ₂	Q ₃	Q ₄
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	A	L	H	L
A	L	H	L	H
B	H	H	L	H
C	L	L	H	H
D	H	L	H	H
E	L	H	H	H
F	H	H	H	H

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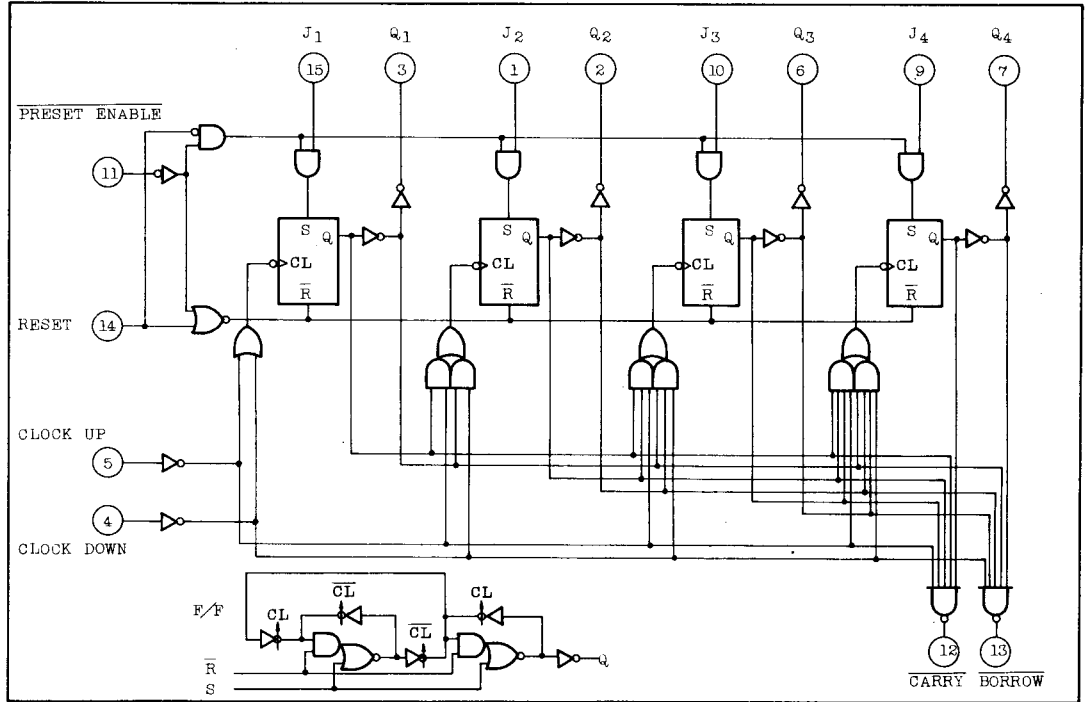
LOGIC DIAGRAM (TC40192BP)



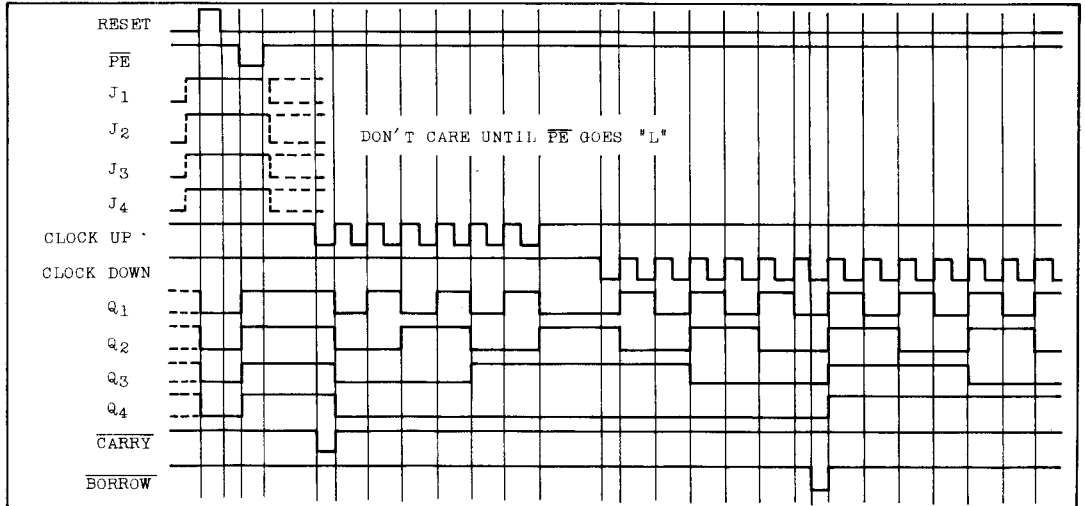
TIMING CHART (TC40192BP)



LOGIC DIAGRAM (TC40193BP)



TIMING CHART (TC40193BP)



TC40192BP, TC40193BP

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

CHARACTERISTIC	SYMBOL	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	
Output High Current	I _{OH}	V _{OH} =4.6V V _{OH} =2.5V V _{OH} =9.5V V _{OH} =13.5V V _{IN} =V _{SS} , V _{DD}	5	-0.61	-	-0.51	-1.0	-	-0.42	-	mA
			5	-2.5	-	-2.1	-4.0	-	-1.7	-	
			10	-1.5	-	-1.3	-2.2	-	-1.1	-	
			15	-4.0	-	-3.4	-9.0	-	-2.8	-	
Output Low Current	I _{OL}	V _{OL} =0.4V V _{OL} =0.5V V _{OL} =1.5V V _{IN} =V _{SS} , V _{DD}	5	0.61	-	0.51	1.5	-	0.42	-	mA
			10	1.5	-	1.3	3.8	-	1.1	-	
			15	4.0	-	3.4	15.0	-	2.8	-	
Input High Voltage	V _{IH}	V _{OUT} =0.5V, 4.5V V _{OUT} =1.0V, 9.0V V _{OUT} =1.5V, 13.5V I _{OUT} < 1μA	5	3.5	-	3.5	2.75	-	3.5	-	V
			10	7.0	-	7.0	5.5	-	7.0	-	
			15	11.0	-	11.0	8.25	-	11.0	-	
Input Low Voltage	V _{IL}	V _{OUT} =0.5V, 4.5V V _{OUT} =1.0V, 9.0V V _{OUT} =1.5V, 13.5V I _{OUT} < 1μA	5	-	1.5	-	2.25	1.5	-	1.5	V
			10	-	3.0	-	4.5	3.0	-	3.0	
			15	-	4.0	-	6.75	4.0	-	4.0	
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	

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.	
Quiescent Device Current	IDD	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)

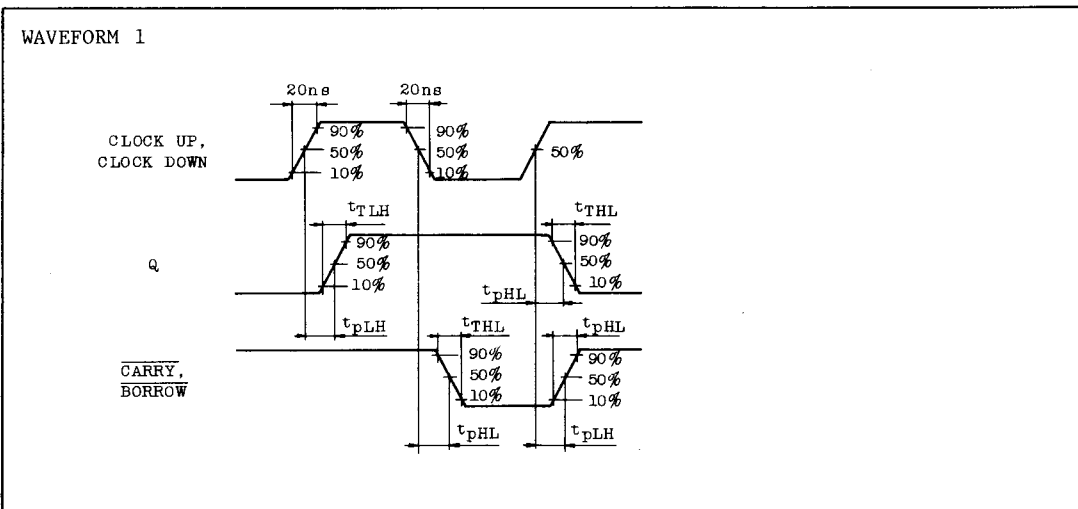
CHARACTERISTIC	SYMBOL	TEST CONDITION	V _{DD} (V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t _{TLH}		5	-	80	200	ns
			10	-	50	100	
			15	-	40	80	
Output Transition Time (High to Low)	t _{THL}		5	-	80	200	ns
			10	-	50	100	
			15	-	40	80	
Propagation Delay Time (CLOCK UP, CLOCK DOWN - Q)	t _{pLH} t _{pHL}		5	-	450	900	ns
			10	-	180	360	
			15	-	130	260	
Propagation Delay Time (RESET - Q)	t _{pHL}		5	-	400	800	ns
			10	-	160	320	
			15	-	120	240	
Propagation Delay Time (\overline{PE} - Q)	t _{pLH} t _{pHL}		5	-	420	840	ns
			10	-	170	340	
			15	-	120	240	
Propagation Delay Time (CLOCK UP - \overline{CARRY} , CLOCK DOWN - BORROW)	t _{pLH} t _{pHL}		5	-	220	440	ns
			10	-	95	190	
			15	-	70	140	
Propagation Delay Time (RESET, \overline{PE} - BORROW, CARRY)	t _{pLH} t _{pHL}		5	-	490	980	ns
			10	-	190	380	
			15	-	130	260	
Min. Clock Pulse Width	t _w		5	-	250	500	ns
			10	-	100	200	
			15	-	70	140	

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

CHARACTERISTIC	SYMBOL	TEST CONDITION	VDD(V)	MIN.	TYP.	MAX.	UNIT
Min. Pulse Width (RESET)	t _{WH}		5	-	100	480	ns
			10	-	40	300	
			15	-	35	260	
Min. Pulse Width ($\overline{\text{PE}}$)	t _{WL}		5	-	80	240	
			10	-	30	170	
			15	-	25	140	
Max. Clock Frequency	f _{CL}		5	1	2	-	MHz
			10	2.5	5	-	
			15	3.5	7	-	
Max. Clock Input Rise Time. Max. Clock Input Fall Time.	t _{rCL}		5	20	-	-	μs
			10	2.5	-	-	
	t _{fCL}		15	1	-	-	
Min. Removal Time (RESET, $\overline{\text{PE}}$ - CLOCK)	t _{rem}		5	-	-40	80	ns
			10	-	-16	40	
			15	-	-14	30	
Input Capacitance	C _{IN}			-	5	7.5	pF

WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS



WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

