

Technical Data

DV74HCT192 and DV74HCT193 Available Q2, 1995

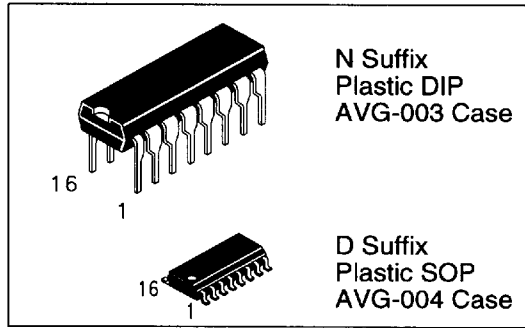
Synchronous Up/Down Decade and Binary Counters with CLEAR

The 74HC/HCT192 is an UP/DOWN BCD Decade (8421) Counter and the 74HC/HCT193 is an UP/DOWN MODULO-16 Binary Counter. Separate Count Up and Count Down Clocks are used and in either counting mode the circuits operate synchronously. The outputs change state synchronous with the LOW-to-HIGH transitions on the clock inputs.

Separate Terminal Count Up and Terminal Count Down outputs are provided which are used as the clocks for subsequent stage without extra logic. Individual preset inputs allow the circuits to be used as programmable counters. Both the Parallel Load (PL) and the Master Reset (MR) inputs asynchronously override the clocks.

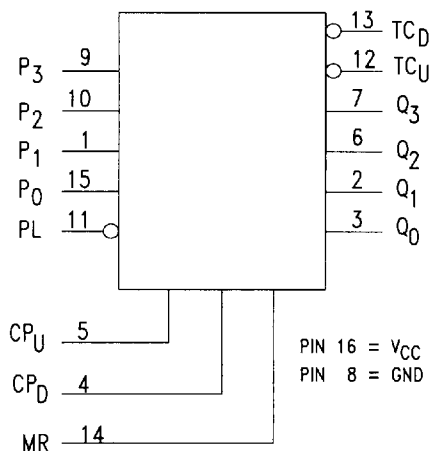
- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2 to 6 V for HC devices
- Low Input Current: 1 μ A
- DC, AC parameters guaranteed from -55°C to 125°C

DV74HC192
DV74HCT192
DV74HC193
DV74HCT193

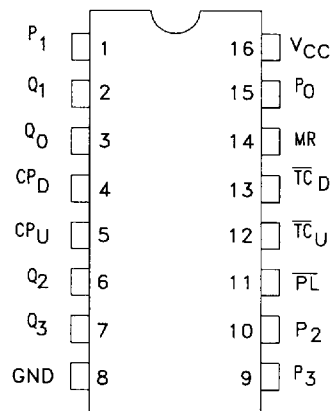


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LOGIC DIAGRAM



PIN ASSIGNMENT



NOTE:
 The LS/ALS 192 can be preset to any state, but will not count beyond 9. If preset to state 10, 11, 12, 13, 14 or 15, it will follow the sequence 10, 11, 6: 12, 13, 4: 14, 15, 2 if counting Up, and follow the sequence 15, 14, 13, 12, 11, 10, 9 if counting Down.

MODE SELECT TABLE

Inputs				Mode
Reset	Parallel Load	Clock Up	Clock Down	
H	X	X	X	RESET (Async)
L	L	X	X	PRESET (Async)
L	H	H	H	No Change
L	H	↑	H	Count Up
L	H	H	↑	Count Down

H=High Logic Level L=Low Logic Level
 X=Don't Care ↑=Low to High Transition

LOGIC EQUATIONS FOR TERMINAL COUNT

LS192
 $\overline{TCU} = Q_0 \cdot Q_3 \cdot CPU$
 $\overline{TCD} = Q_0 \cdot Q_1 \cdot Q_2 \cdot Q_3 \cdot CPD$

LS193
 $\overline{TCU} = Q_0 \cdot Q_1 \cdot Q_2 \cdot Q_3 \cdot CPU$
 $\overline{TCD} = Q_0 \cdot Q_1 \cdot Q_2 \cdot Q_3 \cdot CPD$

ABSOLUTE MAXIMUM RATINGS

Maximum ratings are those values beyond which damage to the device may occur.

Symbol	Parameter	Value	Unit
V _{CC}	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
V _{IN}	DC Input Voltage (Referenced to GND)	-1.5 to V _{CC} +1.5	V
V _{OUT}	DC Output Voltage (Referenced to GND)	-0.5 to V _{CC} +0.5	V
I _{IN}	DC Input Current, per Pin	± 20	mA
I _{OUT}	DC Output Current, per Pin	± 25	mA
I _{CC}	DC Supply Current, V _{CC} and GND Pins	± 50	mA
P _D	Power Dissipation in Still Air, Plastic DIP SOP Package	750 500	mW
T _{STG}	Storage Temperature Range	-65 to +150	°C
TL	Lead Temperature, 1mm from Case for 10 Seconds	260	°C

GUARANTEED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V _{CC}	DC Supply Voltage, HC (HCT), Referenced to GND	2.0 (4.5)	6.0 (5.5)	V
V _{IN} , V _{OUT}	DC Input Voltage, Output Voltage, Referenced to GND	0	V _{CC}	V
T _A	Ambient Temperature	-55	+125	°C
t _r , t _f	Input Rise and Fall Time: HC: V _{CC} =2.0V HCT: V _{CC} =5.5V / HC: V _{CC} =4.5V HC: V _{CC} =6.0V	0 0 0	1000 500 400	ns

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DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} V	Guaranteed Limits			Unit
				25°C to -55°C	≤85°C	≤125°C	
V _{IH}	Minimum High-Level Input Voltage	V _{OUT} =0.1 V, I _{OUT} ≤20μA or V _{OUT} = V _{CC} -0.1V	2.0	1.5	1.5	1.5	V
			4.5	3.15	3.15	3.15	
			6.0	4.2	4.2	4.2	
V _{IL}	Maximum Low- Level Input Voltage	V _{OUT} =0.1 V, I _{OUT} ≤20μA or V _{OUT} = V _{CC} -0.1V	2.0	0.3	0.3	0.3	V
			4.5	0.9	0.9	0.9	
			6.0	1.2	1.2	1.2	
V _{OH}	Minimum High-Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0	1.9	1.9	1.9	V
			4.5	4.4	4.4	4.4	
		V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0mA I _{OUT} ≤ 5.2 mA	4.5	3.98	3.84	3.7	
			6.0	5.48	5.34	5.2	
V _{OL}	Maximum Low Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0	0.1	0.1	0.1	V
			4.5	0.1	0.1	0.1	
		V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 6.0mA I _{OUT} ≤ 7.8 mA	4.5	0.26	0.33	0.40	V
			6.0	0.26	0.33	0.40	
I _{IN}	Maximum Input Leakage Current	V _{IN} = V _{CC} or GND	6.0	± 0.1	± 1.0	± 1.0	μA
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND, I _{OUT} = 0 μA (Per Package)	6.0	8.0	80	160	μA

AC ELECTRICAL CHARACTERISTICS over full operating conditions ($C_L=50pF$, Input $t_r=t_f=6ns$)

Symbol	Parameter	Vcc V	Guaranteed Limit			Unit
			25°C to -55°C	≤85°C	≤125°C	
f _{max}	Maximum Count Frequency	2.0	12	3.2	2.6	MHz
		4.5	36	16	13	
		6.0	43	19	15	
t _{PLH} , t _{PHL}	Maximum Propagation Delay Time, Clock to Output	2.0	215	270	325	ns
		4.5	43	54	65	
		6.0	37	46	55	
t _{PLH} , t _{PHL}	Maximum Propagation Delay Time, Clock to Terminal Count	2.0	125	155	190	ns
		4.5	25	31	38	
		6.0	21	26	32	
t _{PLH} , t _{PHL}	Maximum Propagation Delay Time, Load to Output	2.0	215	270	325	ns
		4.5	43	54	65	
		6.0	37	46	55	
t _{TLH} , t _{THL}	Maximum Output Transition Time	2.0	75	95	110	ns
		4.5	15	20	23	
		6.0	13	18	20	

AC OPERATING REQUIREMENTS

Symbol	Parameter	Vcc V	Guaranteed Limit			Unit
			25°C to -55°C	≤85°C	≤125°C	
t _s	Setup Time, P _m to Clock	2.0	100	125	150	ns
		4.5	20	25	30	
		6.0	18	22	26	
t _h	Hold Time, Clock to P _m	2.0	0	0	0	ns
		4.5	0	0	0	
		6.0	0	0	0	
t _w	Clock Pulse Width	2.0	150	190	225	ns
		4.5	30	38	45	
		6.0	26	33	38	
t _w	Load or Clear Pulse Width	2.0	100	125	150	ns
		4.5	20	25	30	
		6.0	17	26	26	

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DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	Vcc V	Guaranteed Limits						Unit
				25°C to -55°C		≤85°C		≤125°C		
				Min	Max	Min	Max	Min	Max	
V _{IH}	Minimum High-Level Input Voltage	V _{OUT} = 0.1 V or V _{CC} - 0.1 V I _{OUT} ≤ 20 μA	4.5	2.00		2.00		2.00		V
			5.5	2.00		2.00		2.00		
V _{IL}	Maximum Low- Level Input Voltage	V _{OUT} = 0.1 V or V _{CC} - 0.1 V I _{OUT} ≤ 20 μA	4.5		0.80		0.80		0.80	V
			5.5		0.80		0.80		0.80	
V _{OH}	Minimum High-Level Output Voltage	V _{IN} = V _{IH} or V _{IH}	4.5	4.40		4.40		4.40		V
		I _{OUT} ≤ 20 μA	5.5	5.40		5.40		5.40		
		V _{IN} = V _{IL} or V _{IH} I _{OUT} ≤ 4.0 mA	4.5	3.98		3.84		3.70		
V _{OL}	Maximum Low Level Output Voltage	V _{IN} = V _{IH} or V _{IL}	4.5		0.1		0.1		0.1	V
		I _{OUT} ≤ 20 μA	5.5		0.1		0.1		0.1	
		V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 4.0mA	4.5		0.26		0.33		0.40	
I _{IN}	Maximum Input Leakage Current	V _{IN} = V _{CC} or GND	5.5		± 0.1		± 1.0		± 1.0	μA

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Symbol	Parameter	Conditions	V _{CC} V	Guaranteed Limits						Unit
				25°C to -55°C		≤85°C		≤125°C		
				Min	Max	Min	Max	Min	Max	
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND I _{OUT} = 0 μA	5.5		8.0		80		160	μA
Δ I _{CC}	Additional Quiescent Supply Current	V _{IN} =2.4V, Any One Input V _{IN} =V _{CC} or GND, Other Inputs I _{OUT} =0 μA	5.5	≥ -55°C		25°C to 125°C				mA
				2.9		2.4				

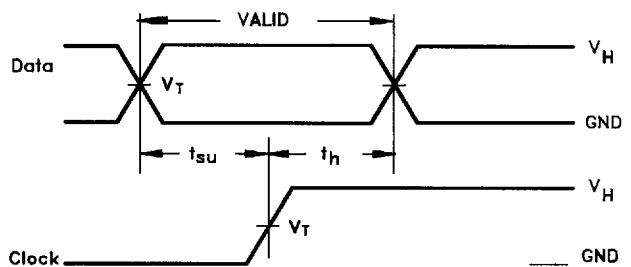
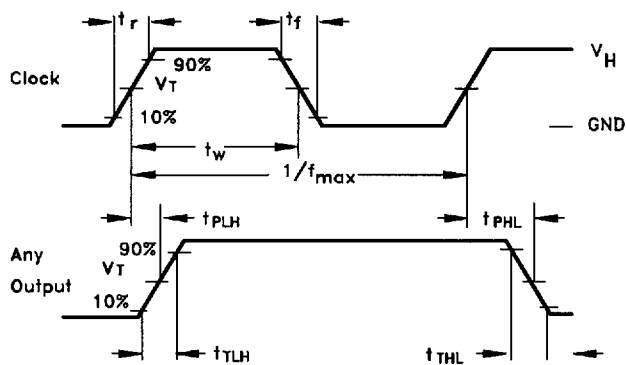
AC CHARACTERISTICS

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			25°C to -55°C	≤85°C	≤125°C	
f _{max}	Maximum Count Frequency	5.0 ±10%	29	13	11	MHz
t _{PLH}	Maximum Propagation Delay Time, Clock to Output		38	48	58	ns
t _{PLH}	Maximum Propagation Delay Time, Clock to Terminal Count		28	35	42	ns
t _{PLH} , t _{PHL}	Maximum Propagation Delay Time, Load to Output		50	65	75	ns
t _{TLH} , t _{THL}	Maximum Output Transition Time		15	20	23	ns

AC OPERATING REQUIREMENTS

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			25°C to -55°C	≤85°C	≤125°C	
t _s	Setup Time, P _m to Clock	5.0 ±10%	20	25	30	ns
t _h	Hold Time, Clock to P _m		0	0	0	ns
t _w	Clock Pulse Width		30	38	45	ns
t _w	Load or Clear Pulse Width		20	25	30	ns

SWITCHING WAVEFORMS



Input and Output Threshold Voltage: V_T = 50% V_{CC} for HC, 1.3V for HCT, V_H = V_{CC} for HC, 3V for HCT

