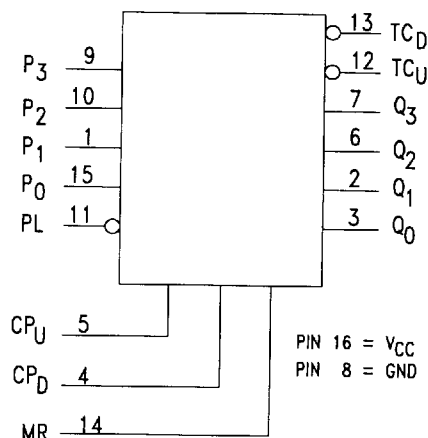


Synchronous Up/Down Decade and Binary Counters with CLEAR

The 74LS/ALS192 is an UP/DOWN BCD Decade (8421) Counter and the 74LS/ALS193 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.

- AVG's LS operates over extended V_{CC} from 4.5 to 5.5 V
- AVG's LS and ALS both have guaranteed DC and AC specification over full temperature and V_{CC} range
- Switching specifications for ALS at 50 pF
- AVG's ALS has the lowest speed power product (4pJ per gate typical) of all logic series



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

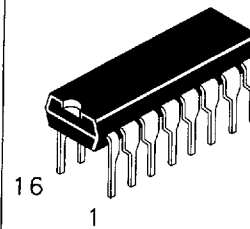
H=High Logic Level

L=Low Logic Level

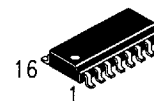
X=Don't Care

↑=Low to High Transition

DV74LS192
DV74ALS192
DV74LS193
DV74ALS193

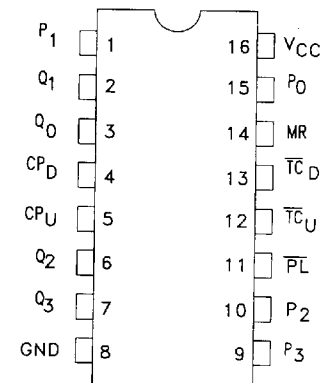


Plastic DIP
AVG-003 Case



Plastic SOP
AVG-004 Case

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.

LOGIC EQUATIONS FOR TERMINAL COUNT

LS192

$$\overline{TCU} = Q_0 \cdot Q_3 \cdot CPU$$

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

LS193

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

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

192, 193

ABSOLUTE MAXIMUM RATINGS

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

Symbol	Parameter	LS192, 193	ALS192, 193	Unit
V _{CC}	Supply Voltage	7.0	7.0	V
V _{IN}	Input Voltage	7.0	7.0	V
T _{STG}	Storage Temperature Range	−65 to +150	−65 to + 150	°C

GUARANTEED OPERATING CONDITIONS

Symbol	Parameter	LS192, 193		ALS192, 193		Unit
		Min	Max	Min	Max	
V _{CC}	Supply Voltage	4.5	5.5	4.5	5.5	V
V _{IH}	High Level Input Voltage	2.0		2.0		V
V _{IL}	Low Level Input Voltage		0.8		0.8	V
I _{OH}	High Level Output Current		−0.4		−0.4	mA
I _{OL}	Low Level Output Current		8.0		8.0	mA
T _A	Ambient Temperature Range	−10 to +70		−10 to +70		°C

DC ELECTRICAL CHARACTERISTICS over full operating conditions

Symbol	Parameter	Conditions		LS192, 193			ALS192, 193			Unit
				Min	Typ	Max	Min	Typ	Max	
V _{IK}	Input Clamp Voltage	V _{CC} = min, I _{IN} = −18 mA				−1.5			−1.5	V
V _{OH}	High Level Output Voltage	V _{CC} =min, I _{OH} =max		V _{CC} −2	3.5		V _{CC} −2			V
V _{OL}	Low Level Output Voltage	V _{CC} =min; I _{OL} =4 mA			0.25	0.4		0.25	0.4	V
		V _{CC} =min; I _{OL} =8 mA			0.35	0.5		0.35	0.5	
I _{IH}	High Level Input Current	V _{CC} =max, V _{IN} = 2.7V V _{CC} =max, V _{IN} = 7V				20			20	μA
						0.1			0.1	mA
						0.1			0.1	mA
I _{IL}	Low Level Input Current	V _{CC} =max, V _{IN} =0.4V	Up, Down Others			−0.4 −0.4			−0.2 −0.1	mA
I _O	Output Short Circuit Current	V _{CC} =max, V _O = 2.25V		−20		−110	−30		−112	mA
I _{CC}	Supply Current	V _{CC} =Max				34		12	22	mA

SWITCHING CHARACTERISTICS over full operating conditions

Symbol	Parameter		LS192, 193 C _L =15pF		ALS192, 193 C _L = 50 pF R _L = 500Ω		Unit
			Min	Max	Min	Max	
f _{MAX}	Maximum Clock Frequency	192 193	25 25		25 30		MHz
t _{PLH}	Propagation Delay, Clock Up Input to TCU Output			26	4	16	ns
t _{PHL}				24	5	18	
t _{PLH}	Propagation Delay, Clock Down Input to TCD Output			24	4	16	ns
t _{PHL}				24	5	18	
t _{PLH}	Propagation Delay, Clock to Q			38	4	19	ns
t _{PHL}				47	4	17	

Symbol	Parameter	LS192, 193 $C_L=15\text{pF}$		ALS192, 193 $C_L=50\text{pF}$ $R_L=500\Omega$		Unit
		Min	Max	Min	Max	
t_{PLH}	Propagation Delay, Parallel Load Output Q		40	8	30	ns
t_{PHL}			40	8	28	
t_{PHL}	Reset		35	5	17	ns

AC SETUP REQUIREMENTS

Symbol	Parameter		LS192, 193			ALS192, 193			Unit
			Min	Typ	Max	Min	Typ	Max	
t_w	Pulse Width, UP or DOWN	192 193	20 20			20 16.5			ns
t_w	Pulse Width, Parallel Load		20			20			ns
t_w	Pulse Width, Reset		20			10			ns
t_s	Data Setup Time		20			20			ns
t_h	Hold Time	Data	5.0			5.0			ns
t_{rec}	Recovery Time		40			20			ns

SWITCHING WAVEFORMS

