National Semiconductor

DM74LS393 Dual 4-Bit Binary Counter

General Description

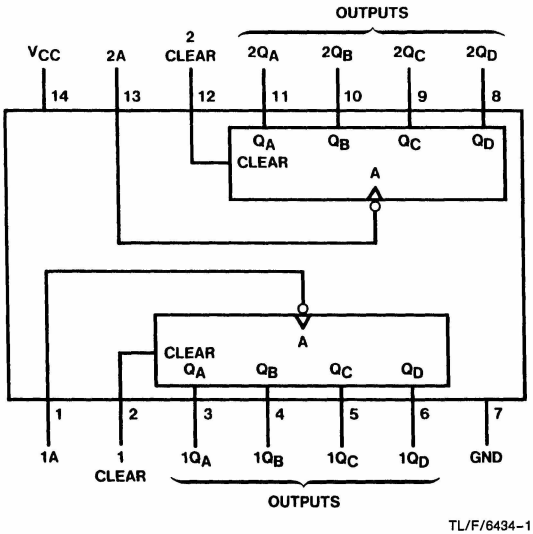
Each of these monolithic circuits contains eight master-slave flip-flops and additional gating to implement two individual four-bit counters in a single package. The 'LS393 comprises two independent four-bit binary counters each having a clear and a clock input. N-bit binary counters can be implemented with each package providing the capability of divide-by-256. The LS393 has parallel outputs from each counter stage so that any submultiple of the input count freqency is available for system-timing signals.

Features

- Dual version of the popular 'LS93
- 'LS393 dual 4-bit binary counter with individual clocks
- Direct clear for each 4-bit counter
- Dual 4-bit versions can significantly improve system densities by reducing counter package count by 50%
- Typical maximum count frequency 35 MHz
- Buffered outputs reduce possibility of collector commutation

Connection Diagram

Dual-In-Line Package



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Order Number DM74LS393M or DM74LS393N
See NS Package Number M14A or N14A

Function Table

Count Sequence (Each Counter)

Count	Outputs			
	Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

H = High Logic Level
L = Low Logic Level

Absolute Maximum Ratings (Note)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	7V
Input Voltage	
Clear	7V
A	5.5V
Operating Free Air Temperature Range	
DM74LS	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note: *The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.*

Recommended Operating Conditions

Symbol	Parameter		DM74LS393			Units
			Min	Nom	Max	
V_{CC}	Supply Voltage		4.75	5	5.25	V
V_{IH}	High Level Input Voltage		2			V
V_{IL}	Low Level Input Voltage				0.8	V
I_{OH}	High Level Output Current				−0.4	mA
I_{OL}	Low Level Output Current				8	mA
f_{CLK}	Clock Frequency (Note 1)		0		25	MHz
f_{CLK}	Clock Frequency (Note 2)		0		20	MHz
t_W	Pulse Width (Note 7)	A	20			ns
		Clear High	20			
t_{REL}	Clear Release Time (Notes 3 & 7)		25 ↓			ns
T_A	Free Air Operating Temperature		0		70	°C

Electrical Characteristics over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ (Note 4)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA				−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = Min, I_{OH} = Max, V_{IL} = Max, V_{IH} = Min		2.7	3.4		V
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max, V_{IL} = Max, V_{IH} = Min			0.35	0.5	V
		I_{OL} = 4 mA, V_{CC} = Min			0.25	0.4	
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 7V	Clear			0.1	mA
		V_{CC} = Max, V_I = 5.5V	A			0.2	
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V	Clear			20	μA
			A			40	
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V	Clear			−0.4	mA
			A			−1.6	
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 5)		−20		−100	mA
I_{CC}	Supply Current	V_{CC} = Max (Note 6)			15	26	mA

Note 1: C_L = 15 pF, R_L = 2 kΩ, T_A = 25°C and V_{CC} = 5V.

Note 2: C_L = 50 pF, R_L = 2 kΩ, T_A = 25°C and V_{CC} = 5V.

Note 3: The symbol (↓) indicates that the falling edge of the clear pulse is used for reference.

Note 4: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 5: Not more than one output should be shorted at a time, and the duration should not exceed one second.

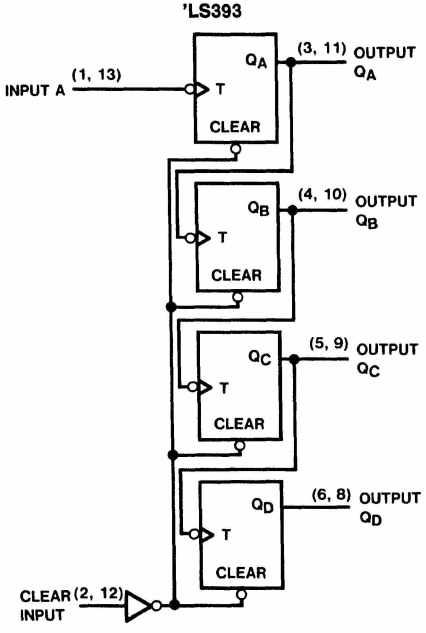
Note 6: I_{CC} is measured with all outputs open, both CLEAR inputs grounded following momentary connection to 4.5V, and all other inputs grounded.

Note 7: T_A = 25°C, and V_{CC} = 5V.

Switching Characteristics at V_{CC} = 5V and T_A = 25°C (See Section 1 for Test Waveforms and Output Load)

Symbol	Parameter	From (Input) To (Output)	R_L = 2 kΩ				Units
			C_L = 15 pF		C_L = 50 pF		
			Min	Max	Min	Max	
f_{MAX}	Maximum Clock Frequency	A to Q_A	25		20		MHz
t_{PLH}	Propagation Delay Time Low to High Level Output	A to Q_A		20		24	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	A to Q_A		20		30	ns
t_{PLH}	Propagation Delay Time Low to High Level Output	A to Q_D		60		87	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	A to Q_D		60		87	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	Clear to Any Q		39		45	ns

Logic Diagram



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