

DM74LS393 Dual 4-Bit Binary Counter

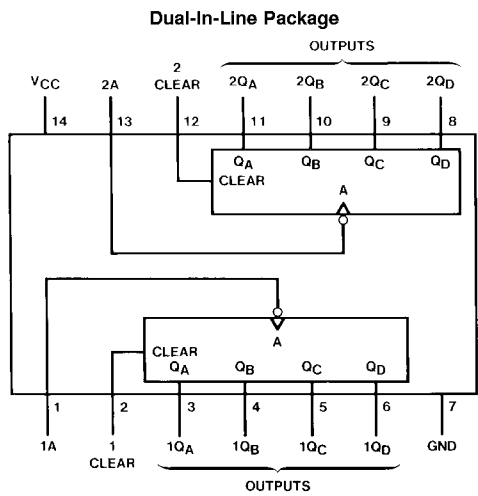
General Description

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 frequency 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



Order Number DM74LS393M or DM74LS393N
See 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 1)

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

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 2)	0		25	MHz
f _{CLK}	Clock Frequency (Note 3)	0		20	MHz
t _W	Pulse Width (Note 8)	A	20		ns
		Clear High	20		
t _{REL}	Clear Release Time (Notes 4, 8)	25↓			ns
T _A	Free Air Operating Temperature	0		70	°C

Note 1: 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.

Electrical Characteristics

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

Symbol	Parameter	Conditions	Min	Typ (Note 5)	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 6)	-20		-100	mA
I _{CC}	Supply Current	V _{CC} = Max (Note 7)		15	26	mA

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

Note 3: C_L = 50 pF, R_L = 2 kΩ, T_A = 25°C and V_{CC} = 5V.

Note 4: The symbol (↓) indicates that the falling edge of the clear pulse is used for reference.

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

Note 6: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 7: I_{CC} is measured with all outputs open, both CLEAR inputs grounded following momentary connection to 4.5V, and all other inputs grounded.

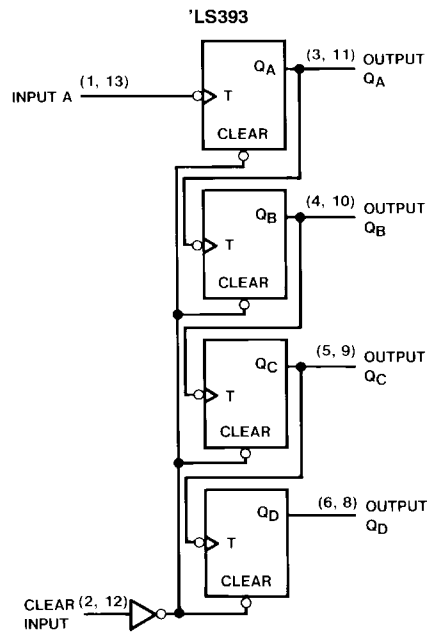
Note 8: T_A = 25°C, and V_{CC} = 5V.

Switching Characteristics

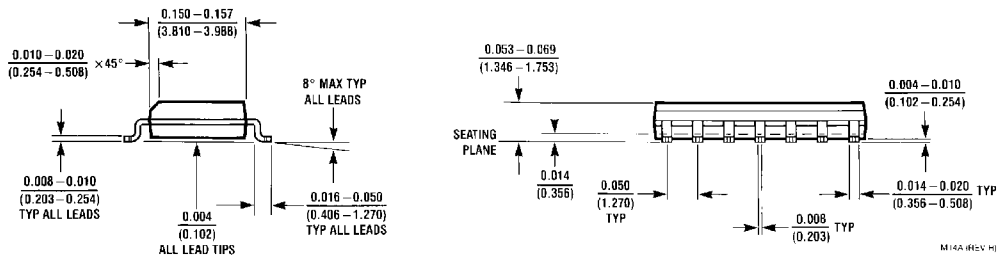
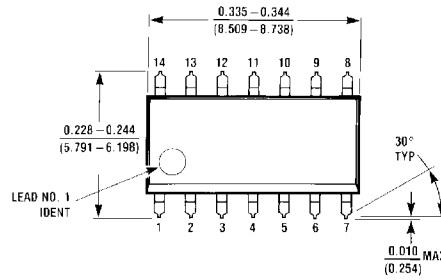
at $V_{CC} = 5V$ and $T_A = 25^\circ C$

Symbol	Parameter	From (Input) To (Output)	$R_L = 2\text{ k}\Omega$				Units
			$C_L = 15\text{ pF}$		$C_L = 50\text{ pF}$		
			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

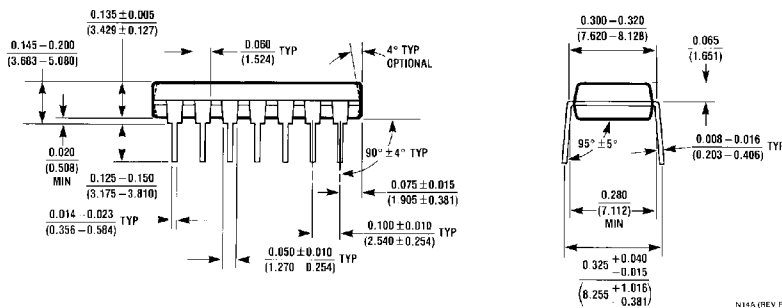
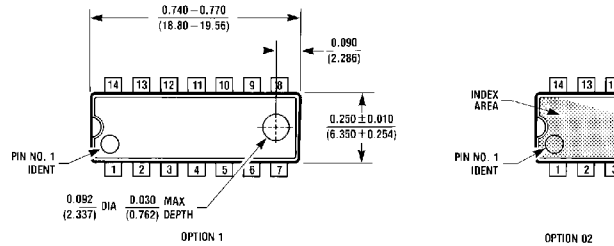
Logic Diagram



Physical Dimensions inches (millimeters) unless otherwise noted



14-Lead Small Outline Molded Package (M)
Order Number DM74LS393M
Package Number M14A



14-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS393N
Package Number N14A