

## DM74LS393 Dual 4-Bit Binary Counter

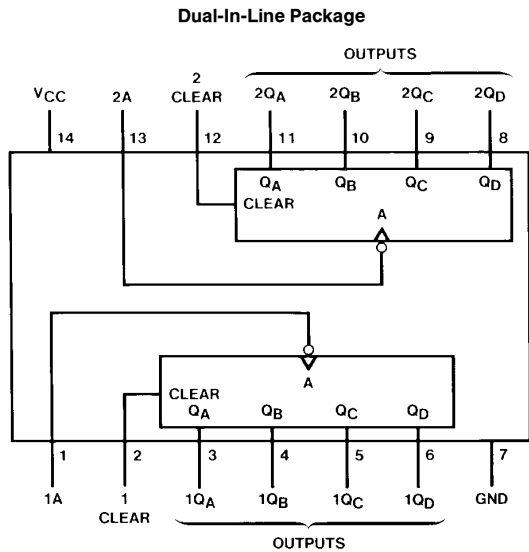
### General Description

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



TL/F/6434-1

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

### Function Table

Count	Count Sequence (Each Counter)			
	Q <sub>D</sub>	Q <sub>C</sub>	Q <sub>B</sub>	Q <sub>A</sub>
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 <sub>CC</sub>	Supply Voltage	4.75	5	5.25	V
V <sub>IH</sub>	High Level Input Voltage	2			V
V <sub>IL</sub>	Low Level Input Voltage			0.8	V
I <sub>OH</sub>	High Level Output Current			-0.4	mA
I <sub>OL</sub>	Low Level Output Current			8	mA
f <sub>CLK</sub>	Clock Frequency (Note 1)	0		25	MHz
f <sub>CLK</sub>	Clock Frequency (Note 2)	0		20	MHz
t <sub>w</sub>	Pulse Width (Note 7)	A	20		ns
		Clear High	20		
t <sub>REL</sub>	Clear Release Time (Notes 3 & 7)	25 ↓			ns
T <sub>A</sub>	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 <sub>I</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min, I <sub>I</sub> = -18 mA			-1.5	V
V <sub>OH</sub>	High Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OH</sub> = Max V <sub>IL</sub> = Max, V <sub>IH</sub> = Min	2.7	3.4		V
V <sub>OL</sub>	Low Level Output Voltage	V <sub>CC</sub> = Min, I <sub>OL</sub> = Max V <sub>IL</sub> = Max, V <sub>IH</sub> = Min		0.35	0.5	V
		I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = Min		0.25	0.4	
I <sub>I</sub>	Input Current @ Max Input Voltage	V <sub>CC</sub> = Max, V <sub>I</sub> = 7V	Clear		0.1	mA
		V <sub>CC</sub> = Max, V <sub>I</sub> = 5.5V	A		0.2	
I <sub>IH</sub>	High Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V	Clear		20	μA
			A		40	
I <sub>IL</sub>	Low Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V	Clear		-0.4	mA
			A		-1.6	
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max (Note 5)	-20		-100	mA
I <sub>CC</sub>	Supply Current	V <sub>CC</sub> = Max (Note 6)		15	26	mA

Note 1: C<sub>L</sub> = 15 pF, R<sub>L</sub> = 2 kΩ, T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5V.

Note 2: C<sub>L</sub> = 50 pF, R<sub>L</sub> = 2 kΩ, T<sub>A</sub> = 25°C and V<sub>CC</sub> = 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<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

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

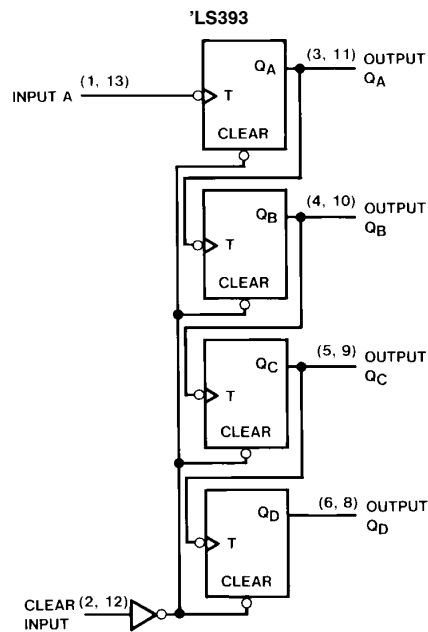
Note 6: I<sub>CC</sub> is measured with all outputs open, both CLEAR inputs grounded following momentary connection to 4.5V, and all other inputs grounded.

Note 7: T<sub>A</sub> = 25°C, and V<sub>CC</sub> = 5V.

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

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

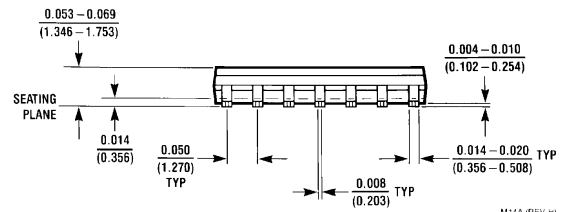
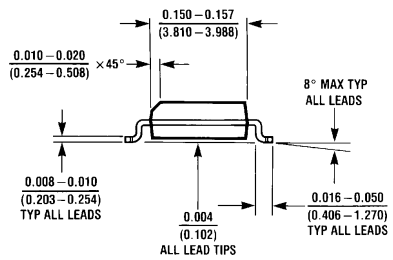
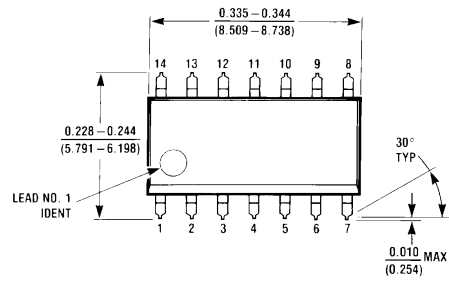
**Logic Diagram**



TL/F/6434-2



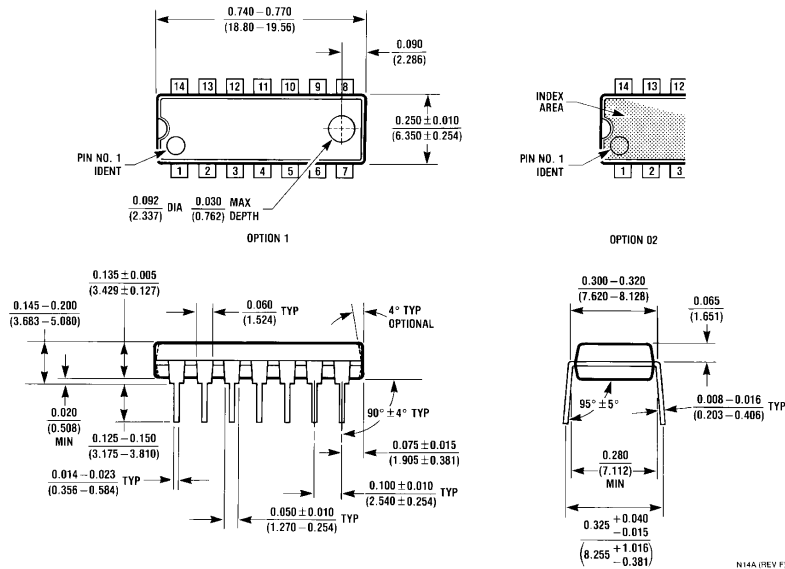
**Physical Dimensions** inches (millimeters)



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

M14A (REV HI)

**Physical Dimensions** inches (millimeters) (Continued)



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

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