

**FAIRCHILD**  
SEMICONDUCTOR™

August 1986  
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## 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 DM74LS393 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 DM74LS393 has parallel outputs from each counter stage so that any submultiple of the input count frequency is available for system-timing signals.

### Features

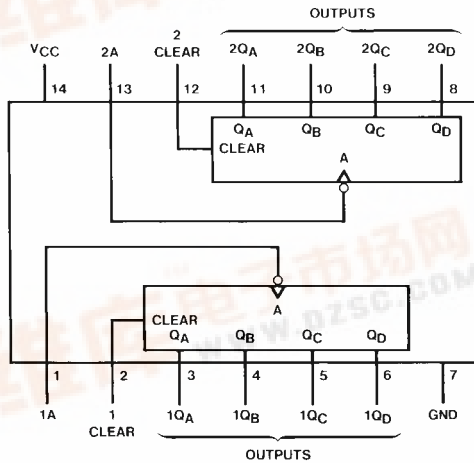
- Dual version of the popular DM74LS93
- DM74LS393 dual 4-bit binary counter with individual clocks
- Direct clear for each 4-bit counter
- Dual 4-bit versions can significantly improve system densities by reducing counter package count by 50%
- Typical maximum count frequency 35 MHz
- Buffered outputs reduce possibility of collector commutation

### Ordering Code:

Order Number	Package Number	Package Description
DM74LS393M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow
DM74LS373N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Connection Diagram



### Function Table

Counter Sequence (Each Counter)

Count	Outputs			
	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

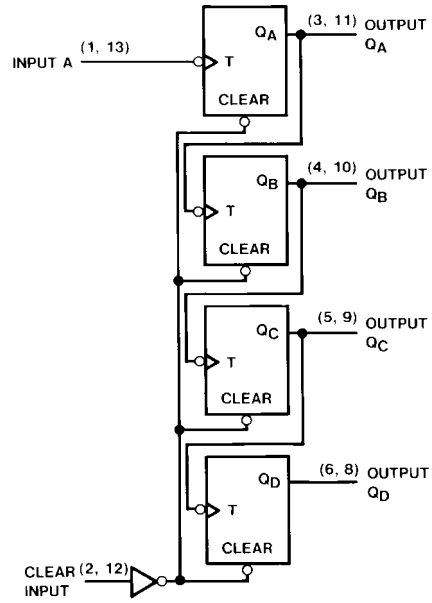
H = HIGH Logic Level  
L = LOW Logic Level

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DM74LS393

### Logic Diagram

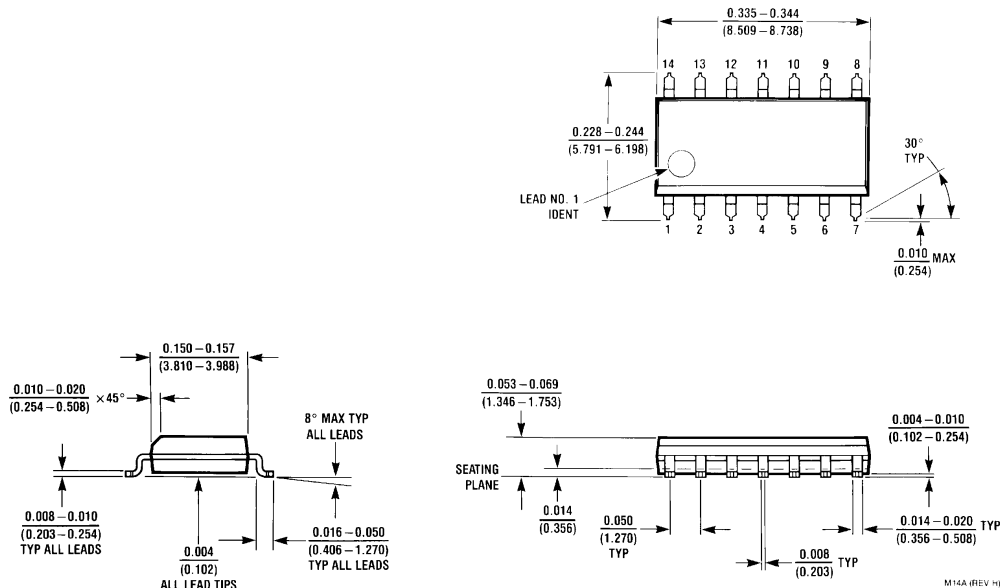


Absolute Maximum Ratings (Note 1)						
Supply Voltage		7V				
Input Voltage						
Clear		7V				
A		5.5V				
Operating Free Air Temperature Range		0°C to +70°C				
Storage Temperature Range		-65°C to +150°C				
<p><b>Note 1:</b> The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.</p>						
Recommended Operating Conditions						
Symbol	Parameter	Min	Nom	Max	Units	
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 2)	0		25	MHz	
f <sub>CLK</sub>	Clock Frequency (Note 3)	0		20	MHz	
t <sub>w</sub>	Pulse Width (Note 5)	A	20		ns	
		Clear HIGH	20			
t <sub>REL</sub>	Clear Release Time (Note 4)(Note 5)	25↓			ns	
T <sub>A</sub>	Free Air Operating Temperature	0		70	°C	
<p><b>Note 2:</b> C<sub>L</sub> = 15 pF, R<sub>L</sub> = 2 kΩ, T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5V.  <b>Note 3:</b> C<sub>L</sub> = 50 pF, R<sub>L</sub> = 2 kΩ, T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5V.  <b>Note 4:</b> The symbol (↓) indicates that the falling edge of the clear pulse is used for reference.  <b>Note 5:</b> T<sub>A</sub> = 25°C, and V<sub>CC</sub> = 5V.</p>						
Electrical Characteristics						
over recommended operating free air temperature range (unless otherwise noted)						
Symbol	Parameter	Conditions	Min	Typ (Note 6)	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			0.1	mA
		V <sub>CC</sub> = Max, V <sub>I</sub> = 5.5V	Clear		0.2	
I <sub>IH</sub>	HIGH Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V			20	μA
			Clear		40	
I <sub>IL</sub>	LOW Level Input Current	V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V			-0.4	mA
			Clear		-1.6	
I <sub>OS</sub>	Short Circuit Output Current	V <sub>CC</sub> = Max (Note 7)	-20		-100	mA
I <sub>CC</sub>	Supply Current	V <sub>CC</sub> = Max (Note 8)		15	26	mA
<p><b>Note 6:</b> All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.  <b>Note 7:</b> Not more than one output should be shorted at a time, and the duration should not exceed one second.  <b>Note 8:</b> 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.</p>						

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Switching Characteristics							
at $V_{CC} = 5V$ and $T_A = 25^\circ C$							
Symbol	Parameter	From (Input) To (Output)	$R_L = 2\ k\Omega$				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

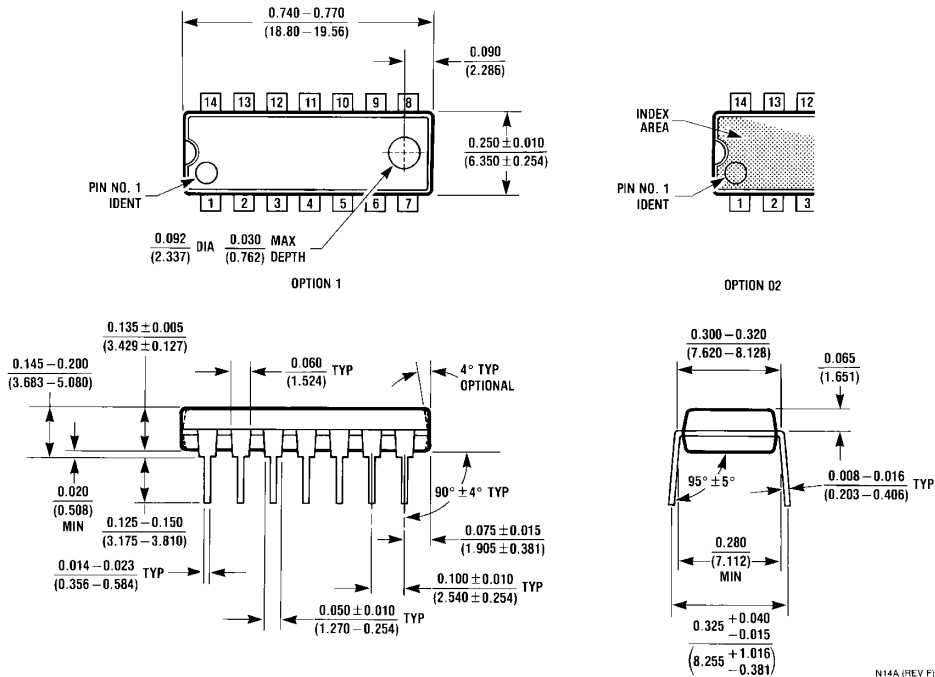
**Physical Dimensions** inches (millimeters) unless otherwise noted



**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150 Narrow  
Package Number M14A**

DM74LS393 Dual 4-Bit Binary Counter

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



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