National Semiconductor

PRELIMINARY
April 1987

DM54ALS390/DM74ALS390 Dual 4-Bit Decade Counters

General Description

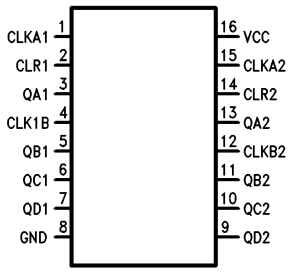
Each of these monolithic counters contains eight master-slave flip-flops and additional gating to implement two independent four bit counters in a single package.

To use their maximum count length, the B input is connected to the QA output. The input count pulses are applied to input A and the outputs are as described in the appropriate truth table. A symmetrical divide-by-ten count can be obtained by connecting the QD output to the A input and applying the input count to the B input.

Features

- Switching specifications at 50 pF
- Switching specifications guaranteed over full temperature and V_{CC} range
- Advanced oxide-isolated, ion-implanted Schottky TTL process
- Individual clocks for A and B flip-flops provide dual divide-by-2 and divide-by-5 counters
- Direct clear for each 4-bit counter

Connection Diagram



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Order Number DM54ALS390J, DM74ALS390M or DM74ALS390N
See NS Package Number J16A, M16A or N16A

Function Tables

BCD Count Sequence
(See Note 2)

Count	Output			
	QD	QC	QB	QA
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

Bi-Quinary (5-2)
(See Note 3)

Count	Output			
	QA	QD	QC	QB
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	H	L	L	L
6	H	L	L	H
7	H	L	H	L
8	H	L	H	H
9	H	H	L	L

Note 2: Output QA is connected to input B for BCD count

Note 3: Output QD is connected to input A for bi-quinary count

H = High Logic Level, L = Low Logic Level

This document contains information on a product under development. NSC reserves the right to change or discontinue this product without notice.

RRD-B30M105/Printed in U. S. A.

Absolute Maximum Rating

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

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	
DM54ALS	−55°C to +125°C
DM74ALS	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		DM54ALS390			DM74ALS390			Units
			Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply Voltage		4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High Level Input Voltage		2			2			V
V_{IL}	Low Level Input Voltage				0.7			0.8	V
I_{OH}	High Level Output Current				−0.4			−0.4	mA
I_{OL}	Low Level Output Current				4			8	mA
f_{COUNT}	Count Frequency	A Input	0			0			MHz
		B Input	0			0			
t_W	Pulse Width	A Input High							ns
		A Input Low							
		B Input High							
		Clear High							
t_{SU}	Clear Inactive-State Setup Time								ns
T_A	Free Air Operating Temperature		−55		125	0		70	°C

Electrical Characteristics over recommended free air temperature range

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
V_{IC}	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA				−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = 4.5V to 5.5V, I_{OH} = −0.4 mA		V_{CC} − 2			V
V_{OL}	Low Level Output Voltage	V_{CC} = Min	54/74ALS I_{OL} = 4 mA		0.25	0.4	V
			74ALS I_{OL} = 8 mA		0.35	0.5	
I_I	Input Current at Max, V_I = 7V Input Voltage	V_{CC} = Max, V_I = 7V	Clear			100	µA
			Input A			200	
			Input B			300	
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V	Clear			20	µA
			Input A			40	
			Input B			60	
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V	Clear			−100	µA
			Input A			−200	
			Input B			−300	
I_O	Output Drive Current (B Bus Ports Only)	V_{CC} = Max, V_O = 2.25V		−30		−112	mA
I_{CC}	Supply Current	V_{CC} = Max (Note 1)					mA

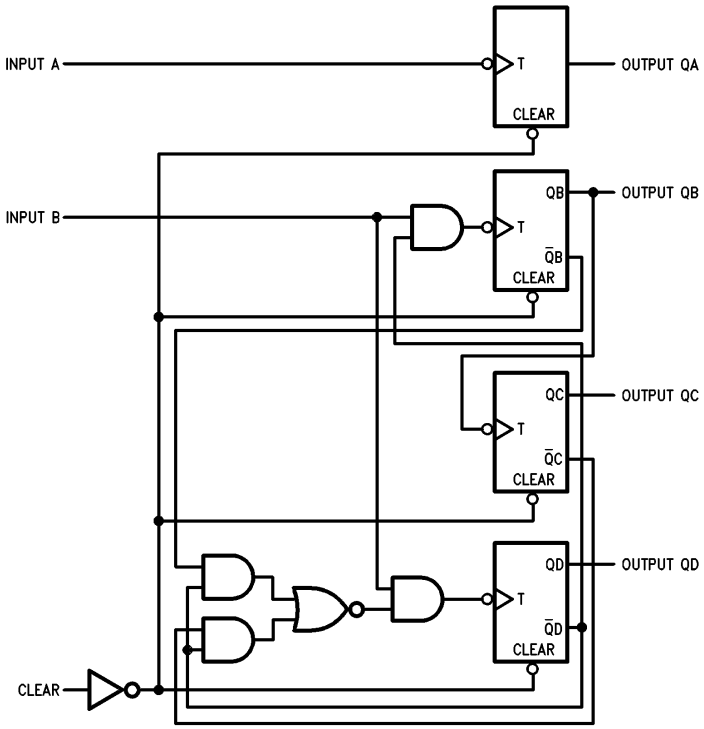
Switching Characteristics over recommended operating free air temperature range

Symbol	Parameter	Conditions	From (Input) To (Output)	DM54ALS390		DM74ALS390		Units
				Min	Max	Min	Max	
f_{max}	Maximum Clock Frequency	V_{CC} = 4.5 to 5.5V, R_L = 500,Ω C_L = 50 pF T_A = Min to Max (Note 2)	A to QA					MHz
			B to QB					
t_{PLH}	Propagation Delay Time Low to High Level Output		A to QA					ns
t_{PHL}	Propagation Delay Time High to Low Level Output		A to QA					ns
t_{PLH}	Propagation Delay Time Low to High Level Output		A to QC					ns
t_{PHL}	Propagation Delay Time High to Low Level Output		A to QC					ns
t_{PLH}	Propagation Delay Time Low to High Level Output		B to QB					ns
t_{PHL}	Propagation Delay Time High to Low Level Output		B to QB					ns
t_{PLH}	Propagation Delay Time Low to High Level Output		B to QC					ns
t_{PHL}	Propagation Delay Time High to Low Level Output		B to QC					ns
t_{PLH}	Propagation Delay Time Low to High Level Output		B to QD					ns
t_{PHL}	Propagation Delay Time High to Low Level Output		B to QD					ns
t_{PHL}	Propagation Delay Time High to Low Level Output		Clear to Any Q					ns

Note 1: I_{CC} is measured with all outputs open, both clear inputs grounded following momentary connection to 4.5V and all other inputs grounded.

Note 2: See Section 5 for test waveforms and output load.

Logic Diagram



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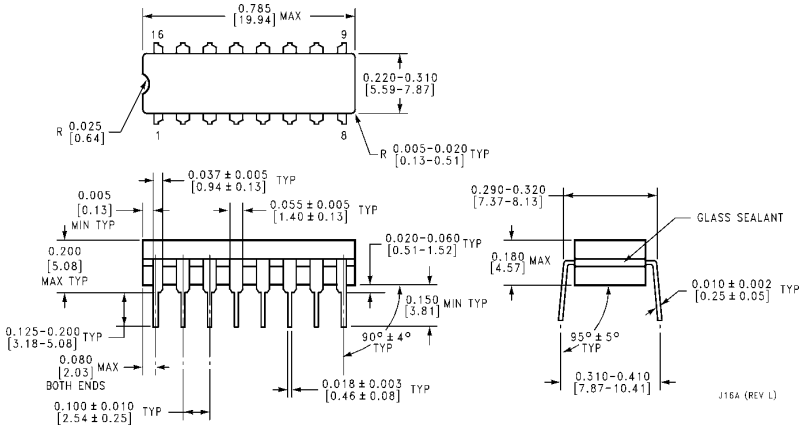
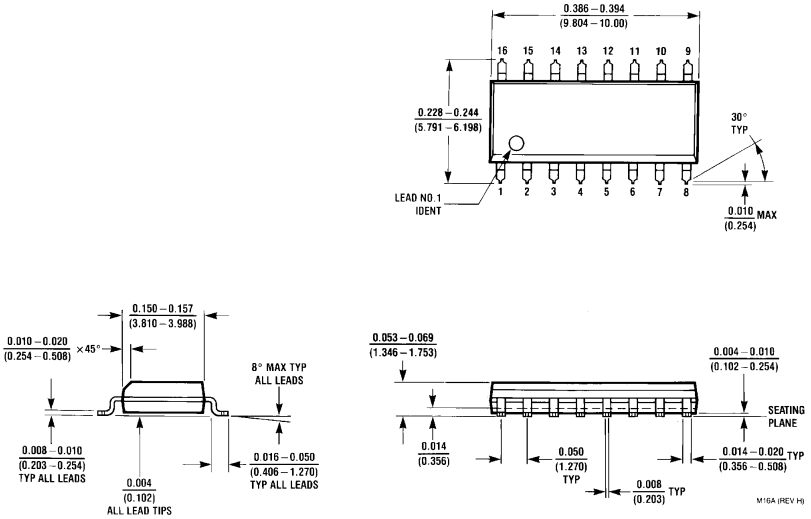
Physical Dimensions inches (millimeters)

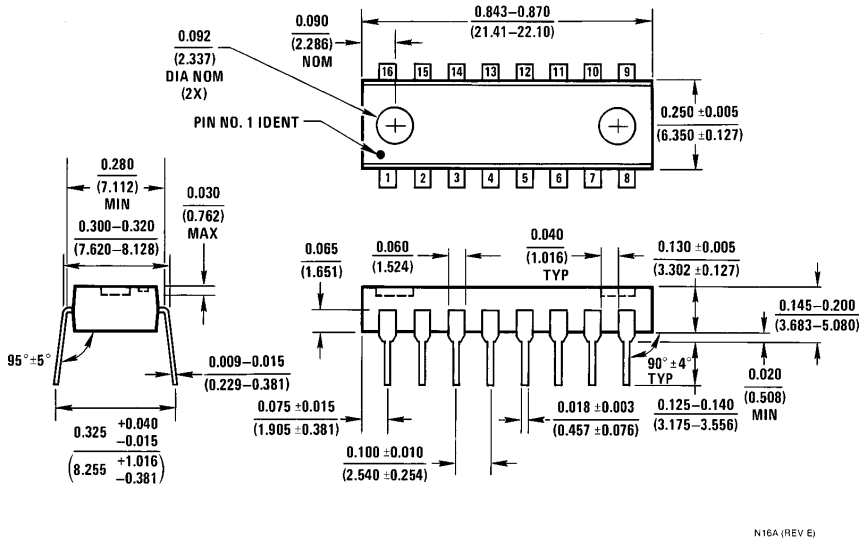


Ceramic Dual-In-Line Package (J)
Order Number DM54ALS390J
NS Package Number J16A



S.O. Package (M)
Order Number DM74ALS390M
NS Package Number M16A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number DM74ALS390N
NS Package Number N16A

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