FAIRCHILD SEMICONDUCTOR™

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DM74LS390
Dual 4-Bit Decade Counter

General Description

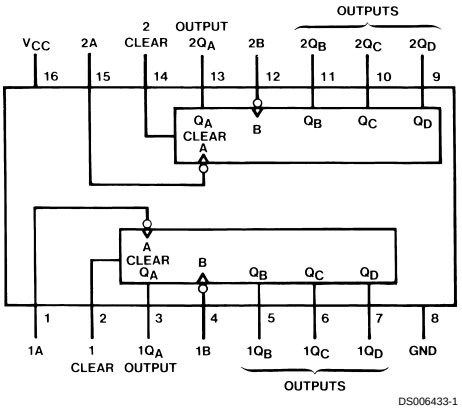
Each of these monolithic circuits contains eight master-slave flip-flops and additional gating to implement two individual four-bit counters in a single package. The 'LS390 incorporates dual divide-by-two and divide-by-five counters, which can be used to implement cycle lengths equal to any whole and/or cumulative multiples of 2 and/or 5 up to divide-by-100. When connected as a bi-quinary counter, the separate divide-by-two circuit can be used to provide symmetry (a square wave) at the final output stage. The 'LS390 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 'LS90
- 'LS390 . . . individual clocks for A and B flip-flops provide dual ÷ 2 and ÷ 5 counters
- Direct clear for each 4-bit counter
- Dual 4-bit version 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



DS006433-1

Order Number DM74LS390M or DM74LS390N
See Package Number M16A or N16E

Function Tables

BCD Count Sequence

(Each Counter) (Note 1)

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

Bi-Quinary (5-2)

(Each Counter) (Note 2)

Count	Outputs			
	Q_A	Q_D	Q_C	Q_B
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 1: Output Q_A is connected to input B for BCD count.

Note 2: Output Q_D is connected to input A for Bi-quinary count.

Note 3: H = High Level, L = Low Level.

Absolute Maximum Ratings (Note 4)

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

Recommended Operating Conditions

Symbol	Parameter		DM74LS390			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 5)	A to Q_A	0		25	MHz
		B to Q_B	0		20	
f_{CLK}	Clock Frequency (Note 6)	A to Q_A	0		20	MHz
		B to Q_B	0		15	
t_W	Pulse Width (Note 5)	A	20			ns
		B	25			
		Clear High	20			
t_{REL}	Clear Release Time (Notes 7, 8)		25↓			ns
T_A	Free Air Operating Temperature		0		70	˚C

Note 4: *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.*

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

Note 6: C_L = 50 pF, R_L = 2 kΩ, T_A = 25˚C and V_{CC} = 5V.

Note 7: The symbol (↓) indicates the falling edge of the clear pulse is used for reference.

Note 8: T_A = 25˚C and V_{CC} = 5V.

Electrical Characteristics

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

Symbol	Parameter	Conditions		Min	Typ (Note 9)	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	
			B			0.4	
I_{IH}	High Level Input Current	V_{CC} = Max V_I = 2.7V	Clear			20	µA
			A			40	
			B			80	
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V	Clear			−0.4	mA
			A			−1.6	
			B			−2.4	
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 10)	DM74	−20		−100	mA

Electrical Characteristics (Continued)

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

Symbol	Parameter	Conditions	Min	Typ (Note 9)	Max	Units
I_{CC}	Supply Current	V_{CC} = Max (Note 11)		15	26	mA

Note 9: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 10: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 11: I_{CC} is measured with all outputs open, both CLEAR inputs grounded following momentary connection to 4.5 and all other inputs grounded.

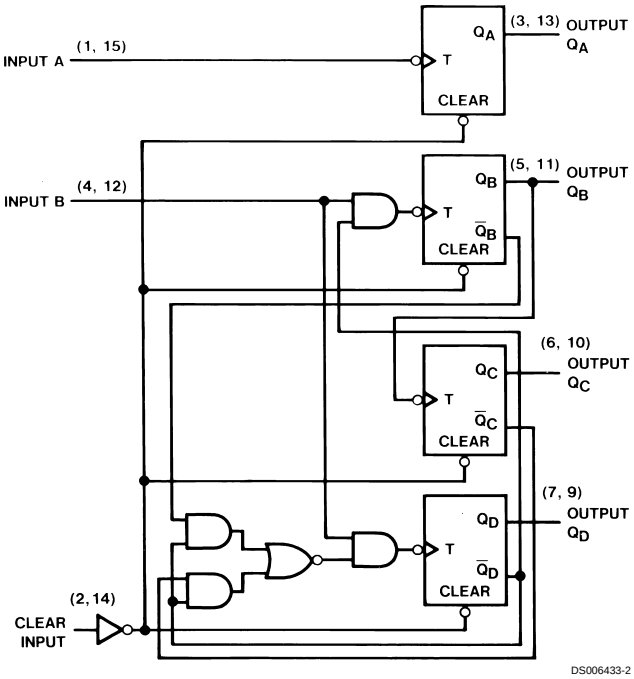
Switching Characteristics

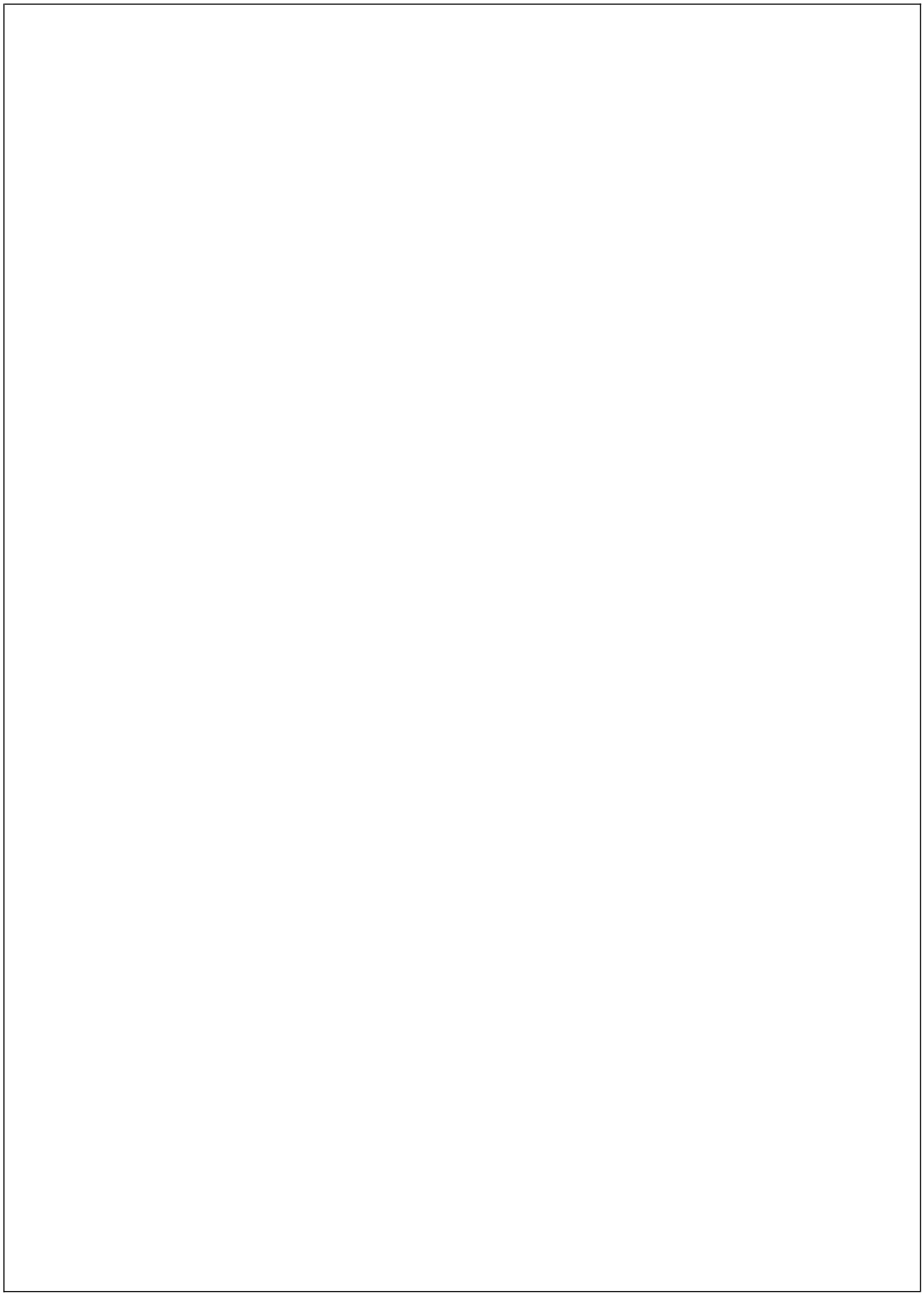
at V_{CC} = 5V and T_A = 25°C

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
		B to Q_B	20		15		
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_C		60		81	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	A to Q_C		60		81	ns
t_{PLH}	Propagation Delay Time Low to High Level Output	B to Q_B		21		27	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	B to Q_B		21		33	ns
t_{PLH}	Propagation Delay Time Low to High Level Output	B to Q_C		39		51	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	B to Q_C		39		54	ns
t_{PLH}	Propagation Delay Time Low to High Level Output	B to Q_D		21		27	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	B to Q_D		21		33	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	Clear to Any Q		39		45	ns

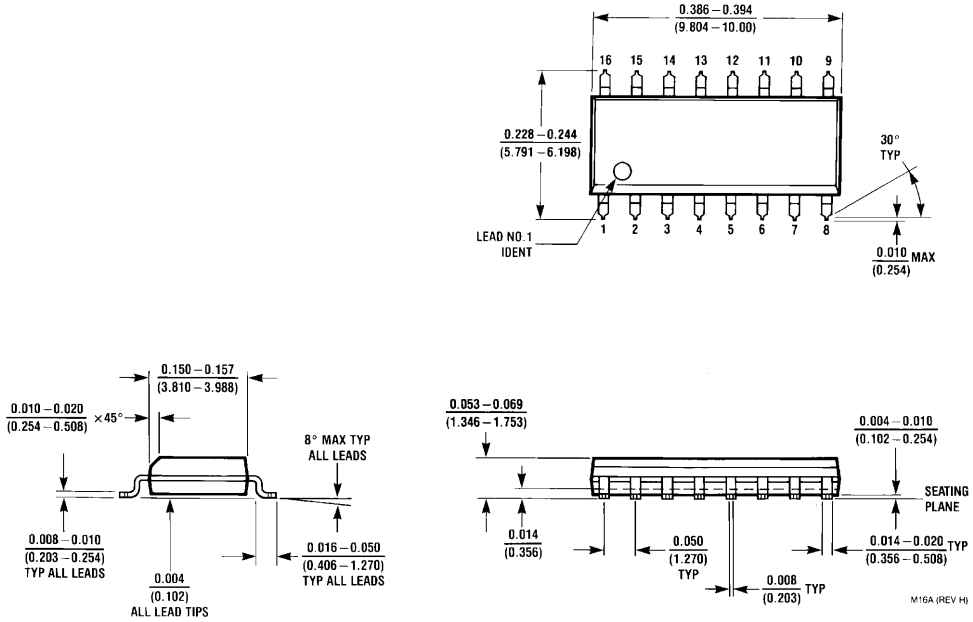
Logic Diagram

'LS390

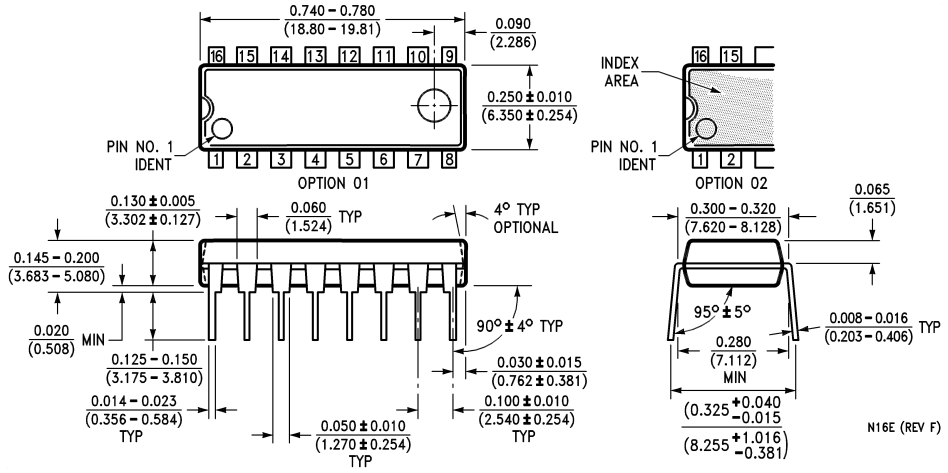




Physical Dimensions inches (millimeters) unless otherwise noted



16-Lead Small Outline Molded Package (M)
Order Number DM74LS390M
Package Number M16A



16-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS390N
Package Number N16E

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