

DM54L93 Decade, Divide-by-12, and Binary Counters

General Description

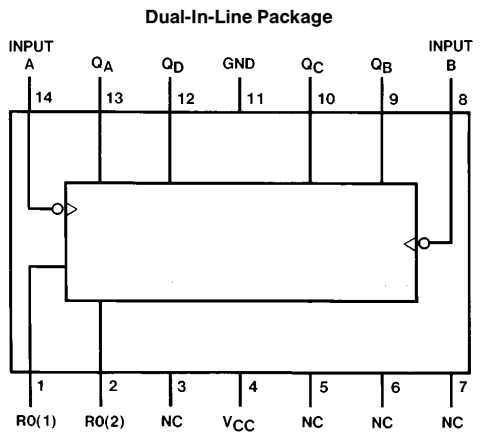
Each of these monolithic counters contains four master-slave flip-flops and additional gating to provide a divide-by-two counter and a three-stage binary counter for which the count cycle length is divide-by-eight.

To use their maximum count length (decade, divide-by-twelve, or four-bit binary), the B input is connected to the Q_A output. The input count pulses are applied to input A and the outputs are as described in the appropriate truth table.

Features

- Typical power dissipation 16 mW
- Count frequency 15 MHz

Connection Diagram



Order Number DM54L93J or DM54L93W
See NS Package Number J14A or W14B

Function Tables

COUNT SEQUENCE
(See Note A)

Count	Output			
	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

RESET/COUNT TRUTH TABLE (Note B)

Reset Inputs		Output			
R0(1)	R0(2)	Q _D	Q _C	Q _B	Q _A
H	H	L	L	L	L
L	X	COUNT			
X	L	COUNT			

Note A: Output Q_A is connected to input B

Note B: H = High Level, L = Low Level, X = Don't Care.

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	8V
Input Voltage	5.5V
Operating Free Air Temperature Range	
DM54L	–55°C to +125°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	DM54L93			Units
		Min	Nom	Max	
V _{CC}	Supply Voltage	4.5	5	5.5	V
V _{IH}	High Level Input Voltage	2			V
V _{IL}	Low Level Input Voltage			0.7	V
I _{OH}	High Level Output Current			–0.2	mA
I _{OL}	Low Level Output Current			2	mA
f _{CLK}	Clock Frequency (Note 5)	0		6	MHz
t _w	Pulse Width (Note 5)	A	90		ns
		B	90		
		Reset	200		
t _{REL}	Reset Release time (Note 5)	200			ns
T _A	Free Air Operating Temperature	–55		125	°C

Electrical Characteristics over recommended operating free air temperature (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V _{OH}	High Level Output Voltage	V _{CC} = Min, I _{OH} = Max V _{IL} = Max, V _{IH} = Min	2.4	3.4		V
V _{OL}	Low Level Output Voltage	V _{CC} = Min, I _{OL} = Max V _{IL} = Max, V _{IH} = Min (Note 4)		0.15	0.3	V
I _I	Input Current @ Max Input Voltage	V _{CC} = Max V _I = 5.5V	Reset		0.1	mA
			A		0.2	
			B		0.2	
I _{IH}	High Level Input Current	V _{CC} = Max V _I = 2.4V	Reset		10	μA
			A		20	
			B		20	
I _{IL}	Low Level Input Current	V _{CC} = Max V _I = 0.3V	Reset		–0.18	mA
			A		–0.36	
			B		–0.36	
I _{OS}	Short Circuit Output Current	V _{CC} = Max (Note 2)	–3		–15	mA
I _{CC}	Supply Current	V _{CC} = Max (Note 3)			5.5	mA

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 2: Not more than one output should be shorted at a time.

Note 3: I_{CC} is measured with all outputs open, R0 inputs grounded following momentary connection to 4.5V and all other inputs grounded.

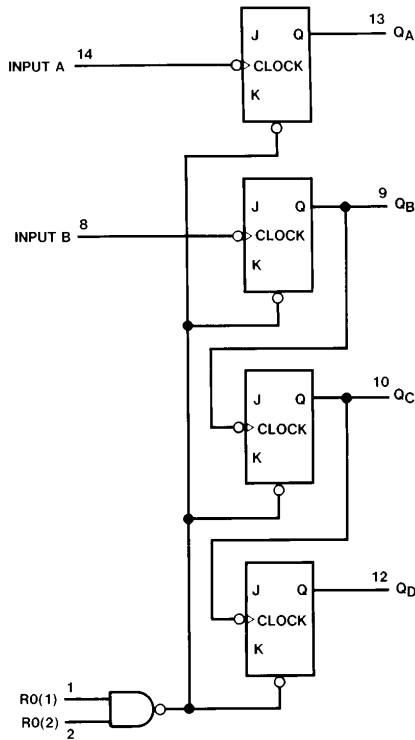
Note 4: Q_A outputs are tested at I_{OL} = max plus the limit value of I_{IL} for the B input. This permits driving the B input while maintaining full fan-out capability.

Note 5: T_A = 25°C and V_{CC} = 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)	$R_L = 4\text{ k}\Omega, C_L = 50\text{ pF}$		Units
			Min	Max	
f_{MAX}	Maximum Clock Frequency	A to Q_A	6		MHz
t_{PLH}	Propagation Delay Time Low to High Level Output	A to Q_D		400	ns
t_{PHL}	Propagation Delay Time High to Low Level Output	A to Q_D		400	ns

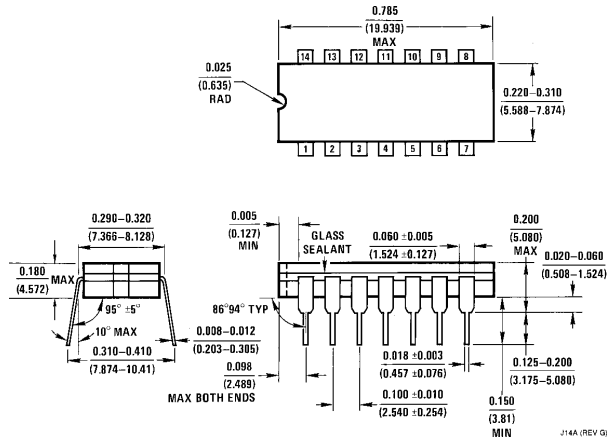
Logic Diagram



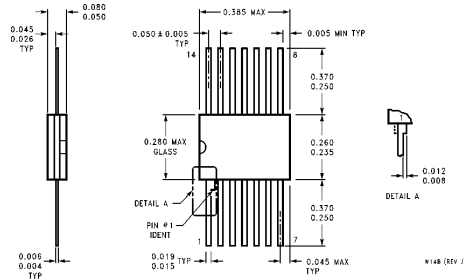
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The J and K inputs shown without connection are for reference only and are functionally at a high level.

Physical Dimensions inches (millimeters)



14-Lead Ceramic Dual-In-Line Package (J)
Order Number DM54L93J
NS Package Number J14A



14-Lead Ceramic Flat Package (W)
Order Number DM54L93W
NS Package Number W14B

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