

DM74LS293 4-Bit Binary Counter

General Description

The 'LS293 counter is electrically and functionally identical to the 'LS93. Only the arrangement of the terminals has been changed for the 'LS293.

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

All of these counters have a gated zero reset.

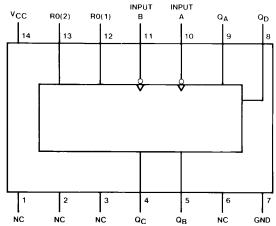
To use the maximum count length (four-bit binary) of these counters, the B input is connected to the Q_A output. The input count pulses are applied to input A and the outputs are as described in the appropriate function table.

Features

- GND and V_{CC} on Corner Pins (Pins 7 and 14 respectively)
- Typical power dissipation 45 mW
- Count frequency 42 MHz

Connection Diagram

Dual-In-Line Package



TL/F/6423-1

Order Number DM74LS293M or DM74LS293N See NS Package Number M14A or N14A

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 Input Voltage 7V Operating Free Air Temperature Range DM74LS 0°C to $\,+\,70^{\circ}\text{C}$

Storage Temperature Range $-65^{\circ}\text{C to} + 150^{\circ}\text{C}$

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 Supply Voltage | | | DM74LS293 | | | |
|------------------|--------------------------------|---------------------|------|-----------|------|-------|--|
| Symbol | | | Min | Nom | Max | Units | |
| V _{CC} | | | 4.75 | 5 | 5.25 | V | |
| V _{IH} | High Level Input Voltage | е | 2 | | | V | |
| V _{IL} | Low Level Input Voltage | | | | 0.8 | V | |
| Гон | High Level Output Current | | | | -0.4 | mA | |
| loL | Low Level Output Current | | | | 8 | mA | |
| f _{CLK} | Clock Frequency (Note 1) | A to Q _A | 0 | | 32 | MHz | |
| | | B to Q _B | 0 | | 16 | | |
| fCLK | Clock Frequency | A to Q _A | 0 | | 20 | MHz | |
| | (Note 2) | B to Q _B | 0 | | 10 | | |
| t _W | Pulse Width | Α | 15 | | | | |
| | (Note 6) | В | 30 | | | ns | |
| | | Reset | 15 | | | | |
| t _{REL} | Reset Release Time (Note 6) | | 25 | | | ns | |
| TA | 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 3) | Max | Units |
|-----------------|---------------------------------|--|-------|-----|-----------------|------|-------|
| VI | Input Clamp Voltage | $V_{CC} = Min, I_{I} = -18 \text{ mA}$ | | | | -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 |
| | | $I_{OL} = 4 \text{ mA}, V_{CC} = Min$ | | | 0.25 | 0.4 | |
| lı | Input Current @ Max | $V_{CC} = Max$ $V_{I} = 7V$ | Reset | | | 0.1 | |
| | Input Voltage | | Α | | | 0.2 | mA |
| | | | В | | | 0.2 | |
| I _{IH} | High Level Input | $V_{CC} = Max$ $V_{I} = 2.7V$ | Reset | | | 20 | |
| | Current | | Α | | | 40 | μΑ |
| | | | В | | | 40 | |
| IIL | Low Level Input | $V_{CC} = Max$ $V_{I} = 0.4V$ | Reset | | | -0.4 | |
| Current | Current | | Α | | | -2.4 | mA |
| | | | В | | | -1.6 | |
| los | Short Circuit Output Current | V _{CC} = Max (Note 4) | | -20 | | -100 | mA |
| Icc | Supply Current | V _{CC} = Max (Note 5) | | | 9 | 15 | mA |

$\textbf{Switching Characteristics} \text{ at V}_{CC} = 5 \text{V and T}_{A} = 25^{\circ}\text{C (See Section 1 for Test Waveforms and Output Load)}$

| Symbol | Parameter | From (Input) | | | | | |
|------------------|--|---------------------|------------------------|-----|------------------------|-----|---------|
| | | | C _L = 15 pF | | C _L = 50 pF | | Units |
| | | | Min | Max | Min | Max | |
| t _{MAX} | Maximum Clock | A to Q _A | 32 | | 20 | | MHz |
| | Frequency | B to Q _B | 16 | | 10 | | 1711 12 |
| t _{PLH} | Propagation Delay Time Low to High Level Output | A to Q _A | | 16 | | 23 | ns |
| t _{PHL} | Propagation Delay Time High to Low Level Output | A to Q _A | | 18 | | 30 | ns |
| t _{PLH} | Propagation Delay Time Low to High Level Output | A to Q _D | | 70 | | 87 | ns |
| t _{PHL} | Propagation Delay Time High to Low Level Output | A to Q _D | | 70 | | 93 | ns |
| t _{PLH} | Propagation Delay Time Low to High Level Output | B to Q _B | | 16 | | 23 | ns |
| t _{PHL} | Propagation Delay Time High to Low Level Output | B to Q _B | | 21 | | 35 | ns |
| t _{PLH} | Propagation Delay Time Low to High Level Output | B to Q _C | | 32 | | 48 | ns |
| t _{PHL} | Propagation Delay Time High to Low Level Output | B to Q _C | | 35 | | 53 | ns |
| t _{PLH} | Propagation Delay Time Low to High Level Output | B to Q _D | | 51 | | 71 | ns |
| t _{PHL} | Propagation Delay Time High to Low Level Output | B to Q _D | | 51 | | 71 | ns |
| t _{PHL} | Propagation Delay Time High to Low Level Output | SET-0 to Any Q | | 40 | | 53 | ns |

Note 1: $C_L=$ 15 pF, $R_L=$ 2 $k\Omega$, $T_A=$ 25°C and $V_{CC}=$ 5V.

Note 2: $C_L = 50 \text{ pF}$, $R_L = 2 \text{ k}\Omega$, $T_A = 25^{\circ}\text{C}$ and $V_{CC} = 5\text{V}$.

Note 3: All typicals are at $V_{CC}=5V$, $T_A=25^{\circ}C$.

Note 4: Not more than one output should be shorted at a time, and the duration should not exceed one second.

Note 5: I_{CC} is measured with all outputs open, both RO inputs grounded following momentary connection to 4.5V and all other inputs grounded.

Note 6: $T_A = 25^{\circ}C$ and $V_{CC} = 5V$.

Function Tables

Count Sequence (See Note C)

| Count | Outputs | | | | | | |
|-------|----------------|---------|---------|---------|--|--|--|
| Count | Q _D | Q_{C} | Q_{B} | Q_{A} | | | |
| 0 | L | L | L | L | | | |
| 1 | L | L | L | Н | | | |
| 2 | L | L | Н | L | | | |
| 3 | L | L | Н | Н | | | |
| 4 | L | Н | L | L | | | |
| 5 | L | Н | L | Н | | | |
| 6 | L | Н | Н | L | | | |
| 7 | L | Н | Н | Н | | | |
| 8 | Н | L | L | L | | | |
| 9 | Н | L | L | Н | | | |
| 10 | Н | L | Н | L | | | |
| 11 | Н | L | Н | Н | | | |
| 12 | Н | Н | L | L | | | |
| 13 | Н | Н | L | Н | | | |
| 14 | Н | Н | Н | L | | | |
| 15 | Н | Н | Н | Н | | | |

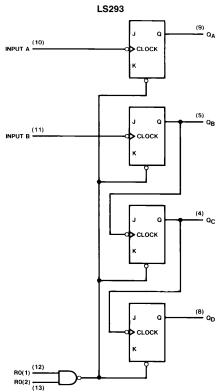
Reset/Count Truth Table

| Reset Inputs | | Outputs | | | | |
|--------------|-------|---------|---------|---------|---------|--|
| R0(1) | R0(2) | Q_D | Q_{C} | Q_{B} | Q_{A} | |
| Н | Н | L | L | L | L | |
| L | Χ | COUNT | | | | |
| Х | L | COUNT | | | | |

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

Note C: Output $Q_{\mbox{\scriptsize A}}$ is connected to input B.

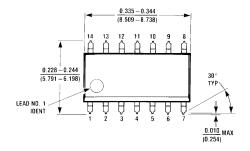
Logic Diagram

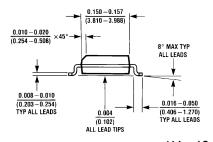


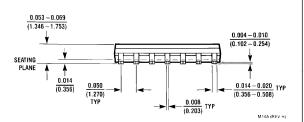
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Note: The J and K inputs shown without connection are for reference only and are functionally at a high level.



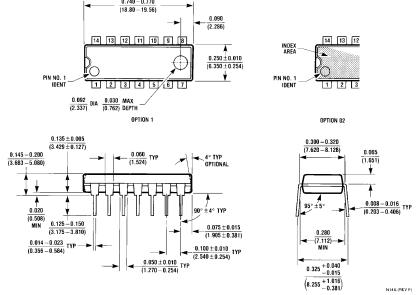






14-Lead Small Outline Molded Package (M) Order Number DM74LS293M NS Package Number M14A

Physical Dimensions inches (millimeters) (Continued)



14-Lead Molded Dual-In-Line Package (N) Order Number DM74LS293N NS Package Number N14A

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