



T-45-23-13

LS490

## 54LS490/DM74LS490 Dual Decade Counter

### General Description

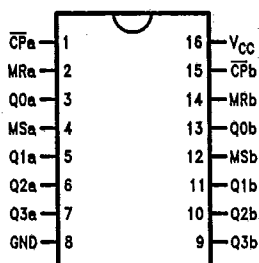
The 'LS490 contains a pair of high speed 4-stage ripple counters. Each half of the 'LS490 has individual Clock, Master Reset and Master Set (Preset 9) Inputs. Each section counts in the 8421 BCD code.

### Features

- Dual version of 54LS/74LS90
- Individual asynchronous clear and preset to 9 for each counter
- Count frequency—typically 65 MHz
- Input clamp diodes limit high speed termination effects
- TTL and CMOS compatible

### Connection Diagram

Dual-In-Line Package



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Order Number 54LS490DMQB, 54LS490FMB, DM54LS490M or DM54LS490N  
See NS Package Number J16A, M16A, N16E or W16A

| Pin Names | Description                               |
|-----------|-------------------------------------------|
| MS        | Master Set (Set to 9) Input (Active HIGH) |
| MR        | Master Reset Input (Active HIGH)          |
| CP        | Clock Pulse Input (Active Falling Edge)   |
| Q0-Q3     | Counter Outputs                           |

**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                       | 7V              |
| Input Voltage                        | 7V              |
| Operating Free Air Temperature Range |                 |
| 54LS                                 | -55°C to +125°C |
| DM74LS                               | 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                      | 54LS490 |     |      | DM74LS490 |     |      | Units |
|--------------------|--------------------------------|---------|-----|------|-----------|-----|------|-------|
|                    |                                | Min     | Nom | Max  | Min       | Nom | Max  |       |
| V <sub>CC</sub>    | Supply Voltage                 | 4.5     | 5   | 5.5  | 4.75      | 5   | 5.25 | V     |
| V <sub>IH</sub>    | High Level Input Voltage       | 2       |     |      | 2         |     |      | V     |
| V <sub>IL</sub>    | Low Level Input Voltage        |         |     | 0.7  |           |     | 0.8  | V     |
| I <sub>OH</sub>    | High Level Output Current      |         |     | -0.4 |           |     | -0.4 | mA    |
| I <sub>OL</sub>    | Low Level Output Current       |         |     | 4    |           |     | 8    | mA    |
| T <sub>A</sub>     | Free Air Operating Temperature | -55     |     | 125  | 0         |     | 70   | °C    |
| t <sub>w</sub> (L) | CP Pulse Width LOW             | 12.5    |     |      | 12.5      |     |      | ns    |
| t <sub>w</sub> (H) | MR, MS Pulse Width HIGH        | 20      |     |      | 20        |     |      | ns    |
| t <sub>rec</sub>   | Recovery Time, MR or MS to CP  | 15      |     |      | 15        |     |      | ns    |

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

| Symbol          | Parameter                         | Conditions                                                             | Min         | Typ<br>(Note 1) | 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,<br>V <sub>IL</sub> = Max | 54LS<br>2.5 |                 |      | V     |
|                 |                                   |                                                                        | DM74<br>2.7 |                 |      |       |
| V <sub>OL</sub> | Low Level Output Voltage          | V <sub>CC</sub> = Min, I <sub>OL</sub> = Max,<br>V <sub>IH</sub> = Min | 54LS        |                 | 0.4  | V     |
|                 |                                   |                                                                        | DM74        |                 | 0.5  |       |
|                 |                                   | I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = Min                          | DM74        |                 | 0.4  |       |
| I <sub>I</sub>  | Input Current @ Max Input Voltage | V <sub>CC</sub> = Max, V <sub>I</sub> = 10V                            | Inputs      |                 | 100  | μA    |
|                 |                                   |                                                                        | CP          |                 | 200  |       |
| I <sub>IH</sub> | High Level Input Current          | V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V                           | Inputs      |                 | 20   | μA    |
|                 |                                   |                                                                        | CP          |                 | 40   |       |
| I <sub>IL</sub> | Low Level Input Current           | V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V                           | Inputs      | -0.03           | -0.4 | mA    |
|                 |                                   |                                                                        | CP          | -0.18           | -2.4 |       |
| I <sub>OS</sub> | Short Circuit Output Current      | V <sub>CC</sub> = Max<br>(Note 2)                                      | 54LS        | -20             | -100 | mA    |
|                 |                                   |                                                                        | DM74        | -20             | -100 |       |
| I <sub>CC</sub> | Supply Current                    | V <sub>CC</sub> = Max                                                  |             |                 | 26   | mA    |

Note 1: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 25°C.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

LS490

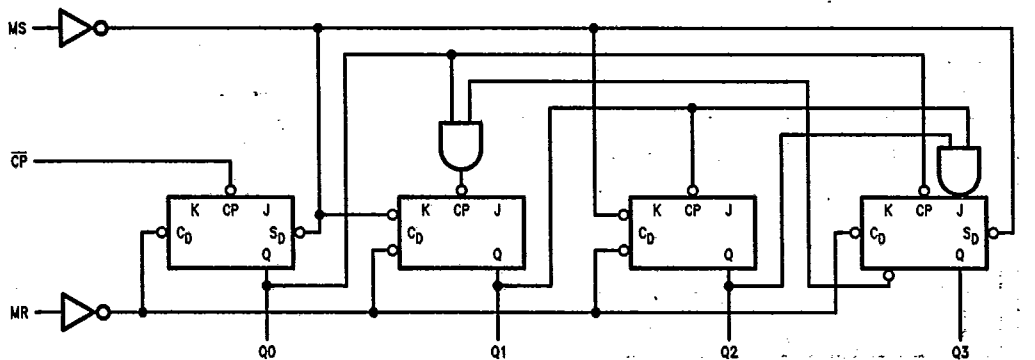
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# Switching Characteristics

V<sub>CC</sub> = +5.0V, T<sub>A</sub> = +25°C (See Section 4 for test waveforms and output load)

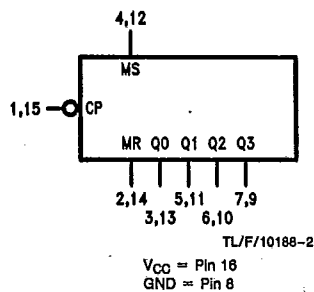
| Symbol                               | Parameter                           | R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 15 pF |          | Units |
|--------------------------------------|-------------------------------------|-----------------------------------------------|----------|-------|
|                                      |                                     | Min                                           | Max      |       |
| f <sub>max</sub>                     | Maximum Clock Frequency             | 40                                            |          | MHz   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>CP to Q0       |                                               | 15<br>15 | ns    |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>CP to Q1 or Q3 |                                               | 30<br>30 | ns    |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>CP to Q2       |                                               | 45<br>45 | ns    |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>MS to Qn       |                                               | 35<br>35 | ns    |
| t <sub>PHL</sub>                     | Propagation Delay<br>MR to Qn       |                                               | 39       | ns    |

## Logic Diagram (one-half shown)

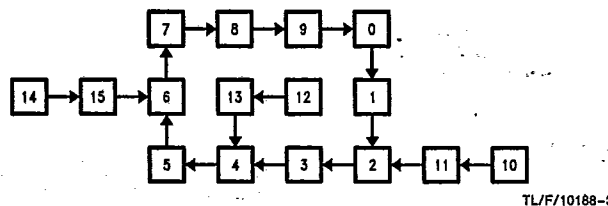


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## Logic Symbol



## State Diagram



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