

July 1989

DM54LS491/74LS491 10-Bit Counter

General Description

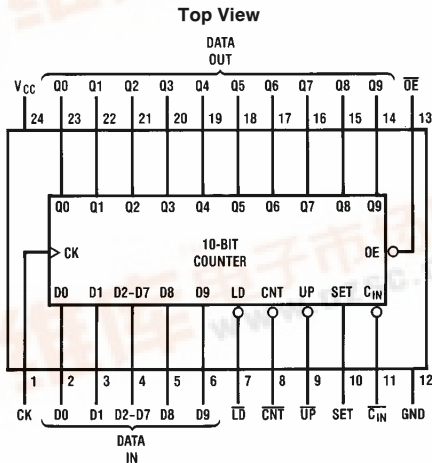
The ten-bit counter can count up, count down, set, and load 2 LSB's, 2 MSB's and 6 middle bits high or low as a group. All operations are synchronous with the clock. SET overrides LOAD, COUNT and HOLD. LOAD overrides COUNT. COUNT is conditional on C_{IN} , otherwise it holds.

All outputs are enabled when \overline{OE} is low, otherwise HIGH-Z. The 24 mA I_{OL} outputs are suitable for driving RAM/PROM address lines in video graphics systems.

Features/Benefits

- CRT vertical and horizontal timing generation
- Bus-structured pinout
- 24-pin SKINNYDIP saves space
- TRI-STATE® outputs drive bus lines
- Low current PNP inputs reduce loading

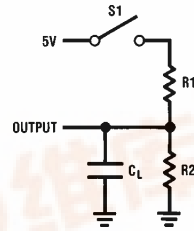
Connection Diagram



TL/L/8332-1

Order Number DM54LS491J,
DM74LS491J or DM74LS491N
See NS Package Number J24F or N24C

Standard Test Load



TL/L/8332-2

Function Table

| OE | CK | SET | LD | CNT | C _{IN} | UP | D9-D0 | Q9-Q0 | Operation |
|----|----|-----|----|-----|-----------------|----|-------|-----------|--------------|
| H | X | X | X | X | X | X | X | Z | Hi-Z |
| L | ↑ | H | X | X | X | X | X | H | Set all HIGH |
| L | ↑ | L | L | X | X | X | D | D | LOAD D |
| L | ↑ | L | H | H | X | X | X | Q | HOLD |
| L | ↑ | L | H | L | H | X | X | Q | HOLD |
| L | ↑ | L | H | L | L | L | X | Q plus 1 | Count UP |
| L | ↑ | L | H | L | L | H | X | Q minus 1 | Count DN |

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Absolute Maximum Ratings

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

Supply Voltage V_{CC} 7V
Input Voltage 5.5V

Off-State Output Voltage 5.5V
Storage Temperature -65° to $+150^{\circ}$ C

Operating Conditions

| Symbol | Parameter | Military | | | Commercial | | | Units |
|----------|--------------------------------|----------|-----|------|------------|-----|------|--------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| V_{CC} | Supply Voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| T_A | Operating Free-Air Temperature | -55 | | 125* | 0 | | 75 | $^{\circ}$ C |
| t_w | Width of Clock | High | 40 | | 40 | | | ns |
| | | Low | 35 | | 35 | | | |
| t_{SU} | Set-Up Time | 60 | | | 50 | | | ns |
| t_h | Hold Time | 0 | -15 | | 0 | -15 | | |

* Case temperature

Electrical Characteristics Over Operating Conditions

| Symbol | Parameter | Test Conditions | Min | Typ† | Max | Units | |
|-----------|-------------------------------|---|-----------------------|---------------------------|-------|---------|----|
| V_{IL} | Low-Level Input Voltage | | | | 0.8 | V | |
| V_{IH} | High-Level Input Voltage | | 2 | | | V | |
| V_{IC} | Input Clamp Voltage | $V_{CC} = \text{MIN}$ $I_I = -18 \text{ mA}$ | | | -1.5 | V | |
| I_{IL} | Low-Level Input Current | $V_{CC} = \text{MAX}$ $V_I = 0.4 \text{ V}$ | | | -0.25 | mA | |
| I_{IH} | High-Level Input Current | $V_{CC} = \text{MAX}$ $V_I = 2.4 \text{ V}$ | | | 25 | μ A | |
| I_I | Maximum Input Current | $V_{CC} = \text{MAX}$ $V_I = 5.5 \text{ V}$ | | | 1 | mA | |
| V_{OL} | Low-Level Output Voltage | $V_{CC} = \text{MIN}$ $V_{IL} = 0.8 \text{ V}$ $V_{IH} = 2 \text{ V}$ | MIL | $I_{OL} = 12 \text{ mA}$ | | 0.5 | V |
| | | | COM | $I_{OL} = 24 \text{ mA}$ | | | |
| V_{OH} | High-Level Output Voltage | $V_{CC} = \text{MIN}$ $V_{IL} = 0.8 \text{ V}$ $V_{IH} = 2 \text{ V}$ | MIL | $I_{OH} = -2 \text{ mA}$ | | 2.4 | V |
| | | | COM | $I_{OH} = 3.2 \text{ mA}$ | | | |
| I_{OZL} | Off-State Output Current | $V_{CC} = \text{MAX}$ $V_{IL} = 0.8 \text{ V}$ $V_{IH} = 2 \text{ V}$ | $V_O = 0.4 \text{ V}$ | | -100 | μ A | |
| I_{OZH} | | | $V_O = 2.4 \text{ V}$ | | 100 | μ A | |
| I_{OS} | Output Short-Circuit Current* | $V_{CC} = 5.0 \text{ V}$ | $V_O = 0 \text{ V}$ | | -30 | -130 | mA |
| I_{CC} | Supply Current | $V_{CC} = \text{MAX}$ | | 120 | 180 | mA | |

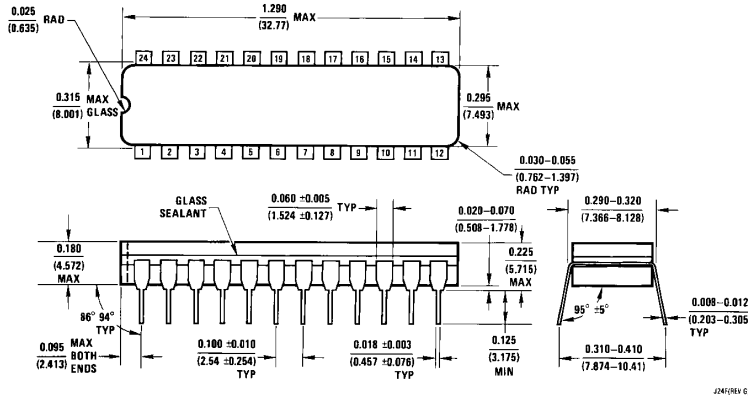
* No more than one output should be shorted at a time and duration of the short-circuit should not exceed one second.

† All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^{\circ}\text{C}$

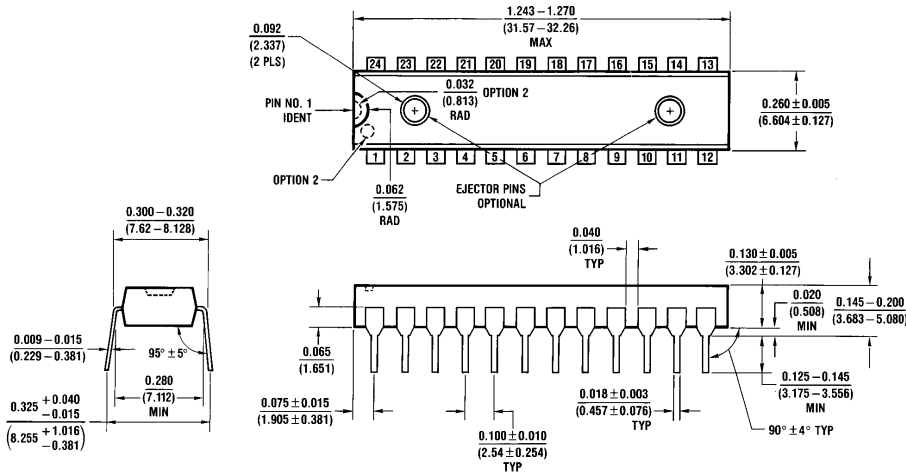
Switching Characteristics Over Operating Conditions

| Symbol | Parameter | Test Conditions (See Test Load) | Military | | | Commercial | | | Units |
|-----------|-------------------------|---|----------|-----|-----|------------|-----|-----|-------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| f_{MAX} | Maximum Clock Frequency | $C_L = 50 \text{ pF}$ $R_1 = 200 \Omega$ $R_2 = 390 \Omega$ | 10.5 | | | 12.5 | | | MHz |
| t_{PD} | Clock to Q | | | 20 | 35 | | 20 | 30 | ns |
| t_{PZX} | Output Enable Delay | | | 35 | 55 | | 35 | 45 | ns |
| t_{PXZ} | Output Disable Delay | | | 35 | 55 | | 35 | 45 | ns |

Physical Dimensions inches (millimeters)



24-Pin Narrow Ceramic Dual-In-Line Package (J)
Order Number DM54LS491J or DM74LS491J
NS Package Number J24F



24-Pin Narrow Plastic Dual-In-Line Package (N)
Order Number DM74LS491N
NS Package Number N24C

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