

## DM74LS299

### 8-Input Universal Shift/Storage Register with Common Parallel I/O Pins

#### General Description

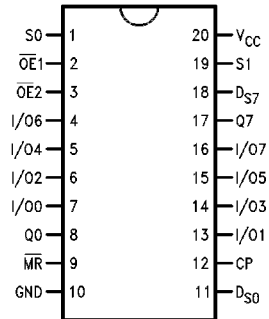
The <sup>LS</sup>299 is an 8-bit universal shift/storage register with 3-STATE outputs. Four modes of operation are possible: hold (store), shift left, shift right and load data. The parallel load inputs and flip-flop outputs are multiplexed to reduce the total number of package pins. Separate outputs are provided for flip-flops Q0 and Q7 to allow easy cascading. A separate active LOW Master Reset is used to reset the register.

#### Features

- Common I/O for reduced pin count
- Four operation modes: shift left, shift right, load and store
- Separate shift right serial input and shift left serial input for easy cascading
- 3-STATE outputs for bus oriented applications

#### Connection Diagram

Dual-In-Line Package



DS009827-1

Order Number DM54LS299E, DM54LS299J, DM54LS299W,  
DM74LS299WM or DM74LS299N  
See Package Number E20A, J20A, M20B, N20A or W20A

| Pin Names       | Description                                      |
|-----------------|--------------------------------------------------|
| CP              | Clock Pulse Input (Active Rising Edge)           |
| D <sub>S0</sub> | Serial Data Input for Right Shift                |
| D <sub>S7</sub> | Serial Data Input for Left Shift                 |
| S0, S1          | Mode Select Inputs                               |
| MR              | Asynchronous Master Reset Input (Active LOW)     |
| OE1, OE2        | 3-STATE Output Enable Inputs (Active LOW)        |
| I/O0–I/O7       | Parallel Data Inputs or 3-STATE Parallel Outputs |
| Q0–Q7           | Serial Outputs                                   |

DM74LS299 8-Input Universal Shift/Storage Register with Common Parallel I/O Pins

## Absolute Maximum Ratings (Note 1)

|                                      |    |                           |                 |
|--------------------------------------|----|---------------------------|-----------------|
| Supply Voltage                       | 7V | DM54                      | -55°C to +125°C |
| Input Voltage                        | 7V | DM74LS                    | 0°C to +70°C    |
| Operating Free Air Temperature Range |    | Storage Temperature Range | -65°C to +150°C |

## Recommended Operating Conditions

| Symbol             | Parameter                                                  | DM54LS299 |     |      | DM74LS299 |     |      | 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                                  | Q0, Q7    |     | -0.4 |           |     | -0.4 | mA    |
|                    |                                                            | I/O0-I/O7 |     | -2.6 |           |     | -2.6 | mA    |
| I <sub>OL</sub>    | Low Level Output Current                                   | Q0, Q7    |     | 4    |           |     | 8    | mA    |
|                    |                                                            | I/O0-I/O7 |     | 12   |           |     | 24   | mA    |
| T <sub>A</sub>     | Free Air Operating Temperature                             | -55       |     | 125  | 0         |     | 70   | °C    |
| t <sub>s</sub> (H) | Setup Time HIGH or LOW                                     | 24        |     |      | 24        |     |      | ns    |
| t <sub>s</sub> (L) | S0 or S1 to CP                                             | 24        |     |      | 24        |     |      | ns    |
| t <sub>h</sub> (H) | Hold Time HIGH or LOW                                      | 5         |     |      | 0         |     |      | ns    |
| t <sub>h</sub> (L) | S0 or S1 to CP                                             | 5         |     |      | 0         |     |      | ns    |
| t <sub>s</sub> (H) | Setup Time HIGH or LOW                                     | 15        |     |      | 10        |     |      | ns    |
| t <sub>s</sub> (L) | I/O <sub>n</sub> , D <sub>S0</sub> , D <sub>S7</sub> to CP | 15        |     |      | 10        |     |      | ns    |
| t <sub>h</sub> (H) | Hold Time HIGH or LOW                                      | 5         |     |      | 0         |     |      | ns    |
| t <sub>h</sub> (L) | I/O <sub>n</sub> , D <sub>S0</sub> , D <sub>S7</sub> to CP | 5         |     |      | 0         |     |      | ns    |
| t <sub>w</sub> (H) | CP Pulse Width HIGH or LOW                                 | 15        |     |      | 15        |     |      | ns    |
| t <sub>w</sub> (L) |                                                            | 15        |     |      | 15        |     |      | ns    |
| t <sub>w</sub> (L) | $\overline{MR}$ Pulse Width LOW                            | 15        |     |      | 15        |     |      | ns    |
| t <sub>rec</sub>   | Recovery Time                                              | 10        |     |      | 10        |     |      | ns    |
|                    | $\overline{MR}$ to CP                                      |           |     |      |           |     |      |       |

**Note 1:** 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.

## Electrical Characteristics

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

| Symbol          | Parameter                         | Conditions                                         | Min            | Typ<br>(Note 2) | 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       | DM54           | 2.5             |      | V     |     |
|                 |                                   | V <sub>IL</sub> = Max                              | Q0, Q7         | DM74            | 2.7  |       | 3.4 |
|                 |                                   |                                                    | I/O0-I/O7      |                 | 2.4  |       |     |
| V <sub>OL</sub> | Low Level Output Voltage          | V <sub>CC</sub> = Min, I <sub>OL</sub> = Max       | DM54           |                 | 0.4  | V     |     |
|                 |                                   | V <sub>IH</sub> = Min                              | DM74           |                 | 0.35 |       | 0.5 |
|                 |                                   | I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = Min      | DM74           |                 | 0.25 |       | 0.4 |
| I <sub>I</sub>  | Input Current @ Max Input Voltage | V <sub>CC</sub> = Max, V <sub>I</sub> = 10V (DM54) | Inputs         |                 | 0.1  | mA    |     |
|                 |                                   | V <sub>I</sub> = 7V (DM74)                         | S <sub>n</sub> |                 | 0.2  | mA    |     |
| I <sub>IH</sub> | High Level Input Current          | V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V       | S <sub>n</sub> |                 | 40   | μA    |     |
|                 |                                   |                                                    | Inputs         |                 | 20   | μA    |     |
| I <sub>IL</sub> | Low Level Input Current           | V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V       | S <sub>n</sub> |                 | -0.8 | mA    |     |
|                 |                                   |                                                    | Inputs         |                 | -0.4 | mA    |     |

## Electrical Characteristics (Continued)

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

| Symbol    | Parameter                          | Conditions                                  | Min           | Typ<br>(Note 2) | Max  | Units   |    |
|-----------|------------------------------------|---------------------------------------------|---------------|-----------------|------|---------|----|
| $I_{OS}$  | Short Circuit<br>Output Current    | $V_{CC} = \text{Max}$<br>(Note 3)           | $Q_0, Q_7$    | -20             |      | -100    | mA |
|           |                                    |                                             | $I/O_0-I/O_7$ | -30             |      | -130    |    |
| $I_{CC}$  | Supply Current                     | $V_{CC} = \text{Max}, \overline{OE} = 4.5V$ |               |                 | 60   | mA      |    |
| $I_{OZH}$ | 3-STATE Output Off<br>Current High | $V_{CC} = \text{Max}$<br>$V_O = 2.7V$       |               |                 | 40   | $\mu A$ |    |
| $I_{OZL}$ | 3-STATE Output Off<br>Current Low  | $V_{CC} = \text{Max}$<br>$V_O = 0.4V$       |               |                 | -400 | $\mu A$ |    |

**Note 2:** All typicals are at  $V_{CC} = 5V, T_A = 25^\circ C$ .

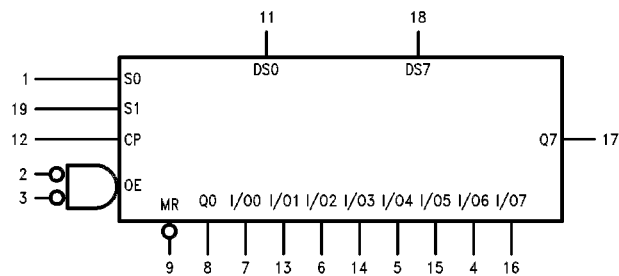
**Note 3:** Not more than one output should be shorted at a time, and the duration should not exceed one second.

## Switching Characteristics

$V_{CC} = +5.0V, T_A = +25^\circ C$  (See Section 1 for waveforms and load configurations)

| Symbol    | Parameter                                              | $R_L = 2\text{ k}\Omega$<br>$C_L = 15\text{ pF}$ |     | Units |
|-----------|--------------------------------------------------------|--------------------------------------------------|-----|-------|
|           |                                                        | Min                                              | Max |       |
| $f_{max}$ | Maximum Input Frequency                                | 35                                               |     | MHz   |
| $t_{PLH}$ | Propagation Delay                                      |                                                  | 26  | ns    |
| $t_{PHL}$ | CP to $Q_0$ or $Q_7$                                   |                                                  | 28  |       |
| $t_{PLH}$ | Propagation Delay                                      |                                                  | 25  | ns    |
| $t_{PHL}$ | CP to $I/O_n$                                          |                                                  | 35  |       |
| $t_{PHL}$ | Propagation Delay<br>$\overline{MR}$ to $Q_0$ or $Q_7$ |                                                  | 28  | ns    |
| $t_{PHL}$ | Propagation Delay<br>$\overline{MR}$ to $I/O_n$        |                                                  | 35  | ns    |
| $t_{PZH}$ | Output Enable Time                                     |                                                  | 18  | ns    |
| $t_{PZL}$ |                                                        |                                                  | 25  |       |
| $t_{PHZ}$ | Output Disable Time                                    |                                                  | 15  | ns    |
| $t_{PLZ}$ |                                                        |                                                  | 20  |       |

## Logic Symbol



$V_{CC} = \text{Pin } 20$   
 $GND = \text{Pin } 10$

## Functional Description

The 'LS299 contains eight edge-triggered D-type flip-flops and the interstage logic necessary to perform synchronous shift left, shift right, parallel load and hold operations. The type of operation is determined by the S0 and S1, as shown in the Mode Select Table. All flip-flop outputs are brought out through 3-STATE buffers to separate I/O pins that also serve as data inputs in the parallel load mode. Q0 and Q7 are also brought out on other pins for expansion in serial shifting of longer words.

A LOW signal on  $\overline{MR}$  overrides the Select and CP inputs and resets the flip-flops. All other state changes are initiated by the rising edge of the clock. Inputs can change when the clock is in either state provided only that the recommended setup and hold times, relative to the rising edge of CP, are observed.

A HIGH signal on either  $\overline{OE1}$  or  $\overline{OE2}$  disables the 3-STATE buffers and puts the I/O pins in the high impedance state. In this condition the shift, hold, load and reset operations can still occur. The 3-STATE buffers are also disabled by HIGH signals on both S0 and S1 in preparation for a parallel load operation.

## Mode Select Table

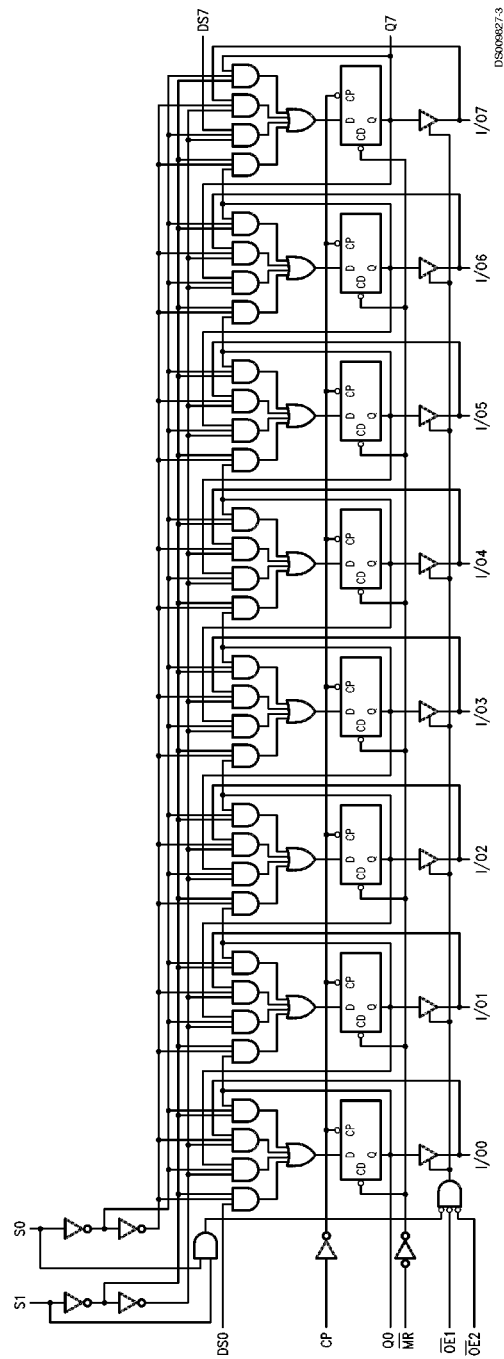
| Inputs          |    |    |    | Response                                                          |
|-----------------|----|----|----|-------------------------------------------------------------------|
| $\overline{MR}$ | S1 | S0 | CP |                                                                   |
| L               | X  | X  | X  | Asynchronous Reset; Q0–Q7 = LOW                                   |
| H               | H  | H  | ↘  | Parallel Load; $I/O_n \rightarrow Q_n$                            |
| H               | L  | H  | ↘  | Shift Right; $D_{S0} \rightarrow Q0$ , $Q0 \rightarrow Q1$ , etc. |
| H               | H  | L  | ↘  | Shift Left; $D_{S7} \rightarrow Q7$ , $Q7 \rightarrow Q6$ , etc.  |
| H               | L  | L  | X  | Hold                                                              |

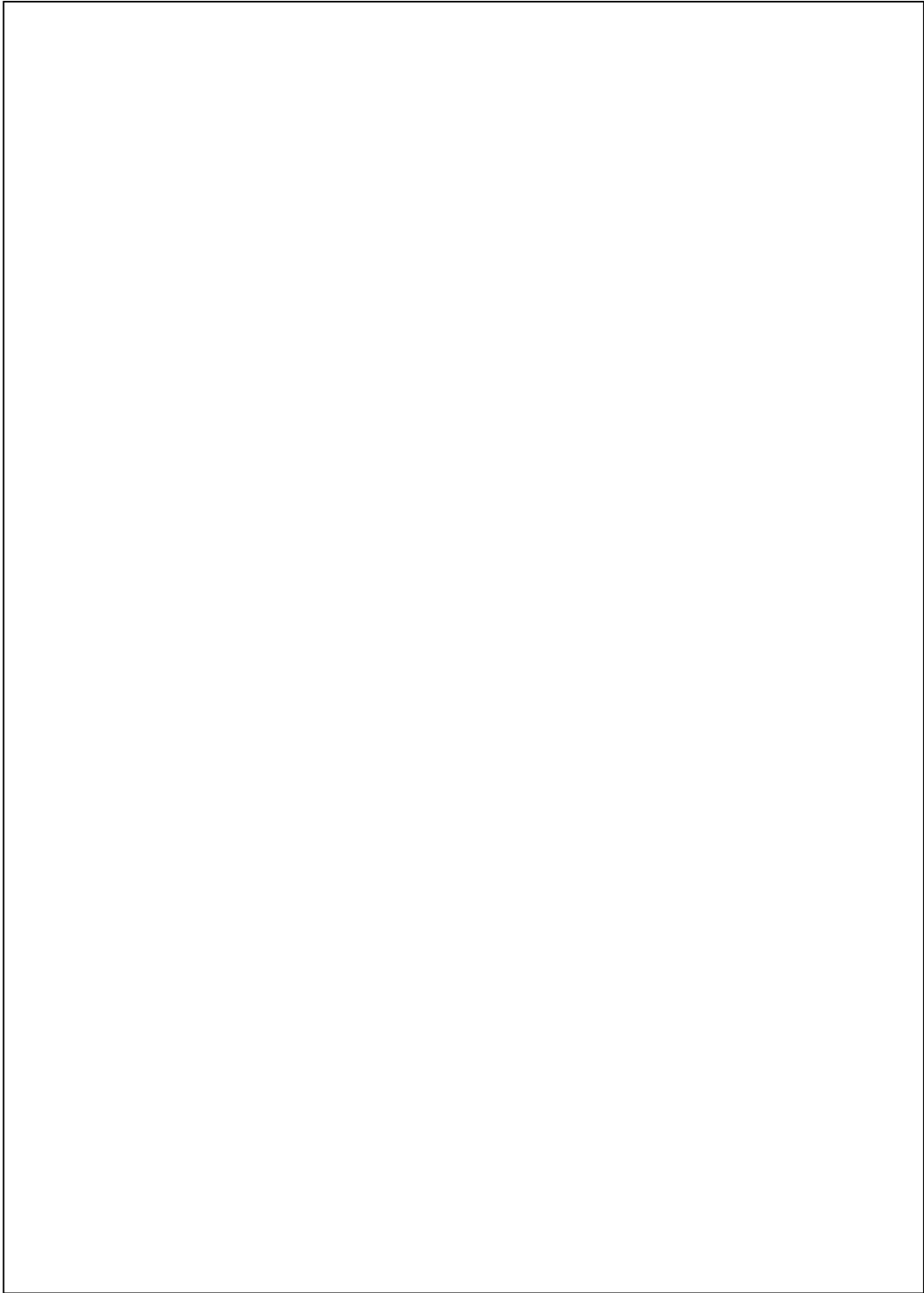
H = HIGH Voltage Level

L = LOW Voltage Level

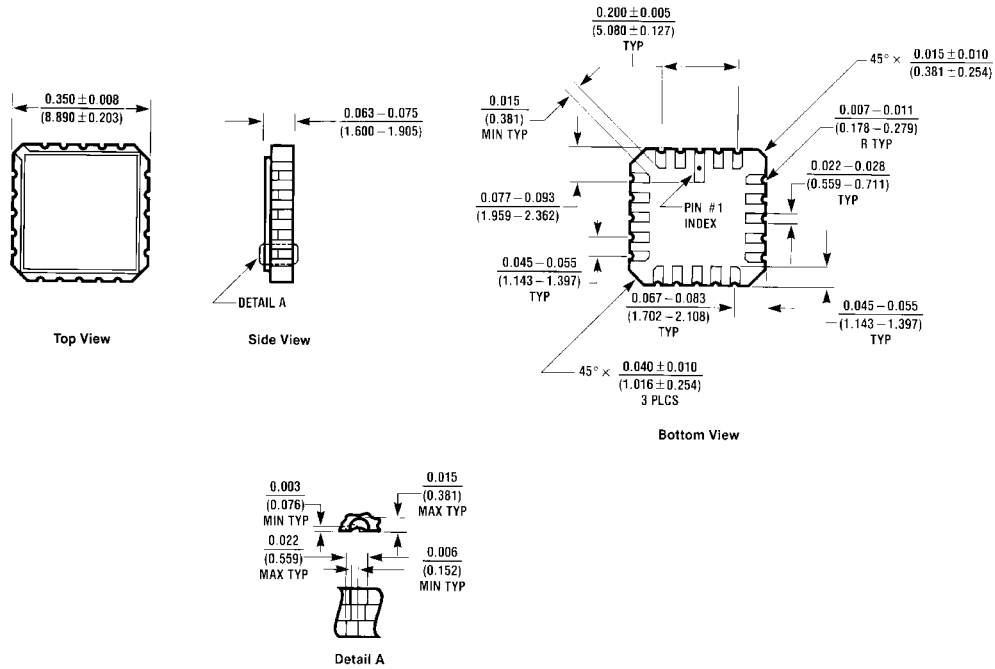
X = Immaterial

# Logic Diagram





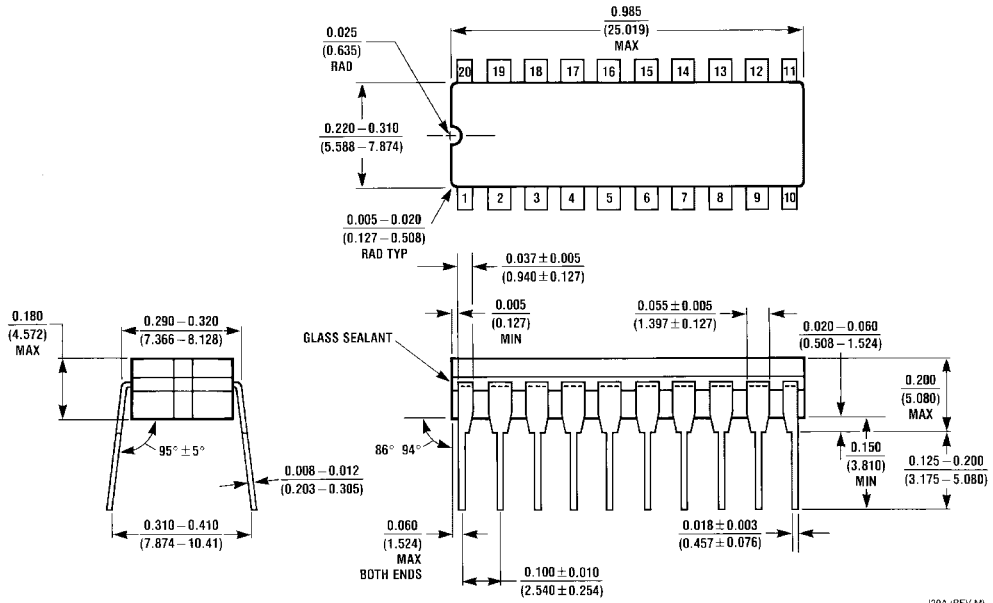
**Physical Dimensions** inches (millimeters) unless otherwise noted



L20A (REV D)

**Ceramic Leadless Chip Carrier Package (E)**  
**Order Number DM54LS299E**  
**Package Number E20A**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

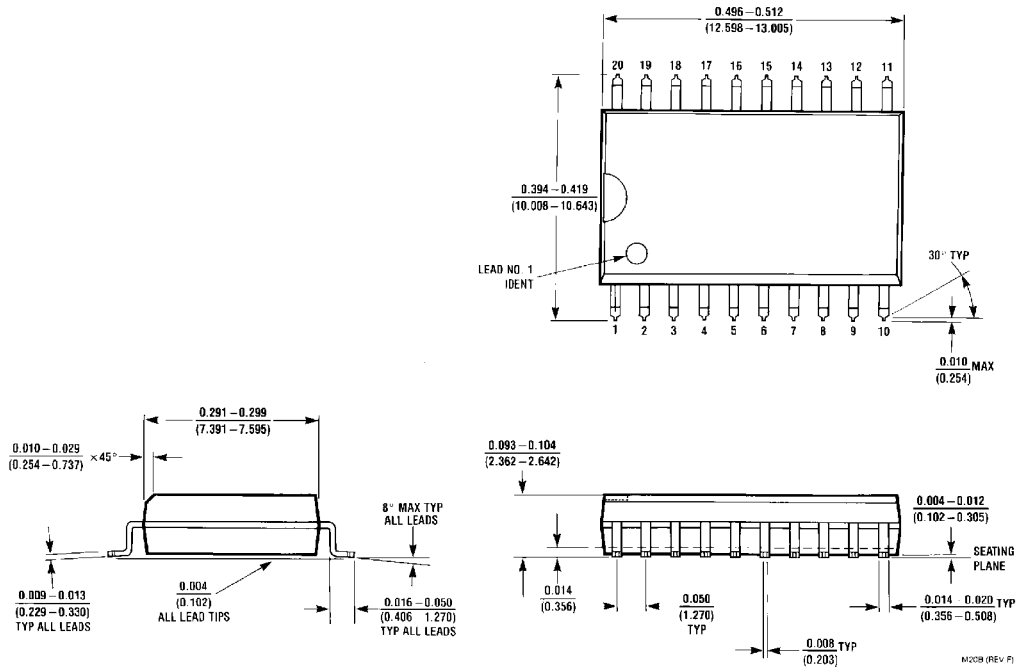


**20-Lead Ceramic Dual-In-Line Package (J)**  
**Order Number DM54LS299J**  
**Package Number J20A**

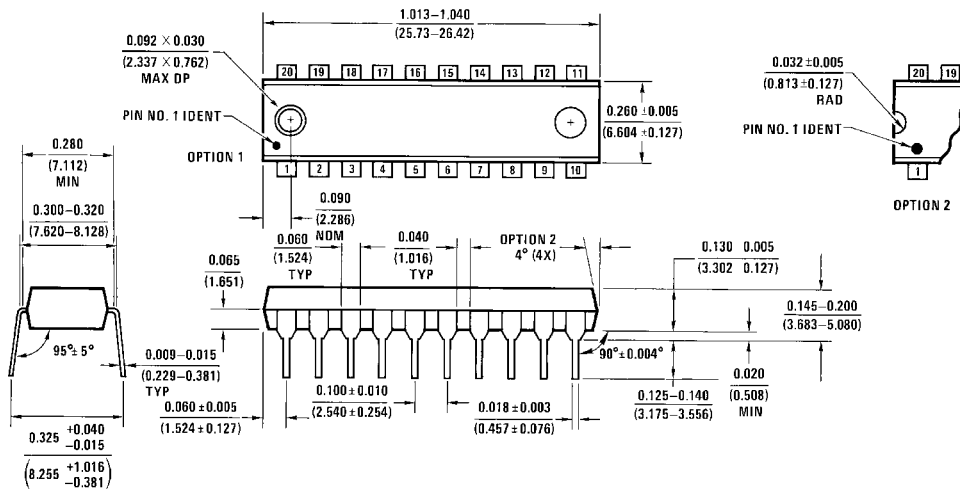
J20A (REV M)



**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

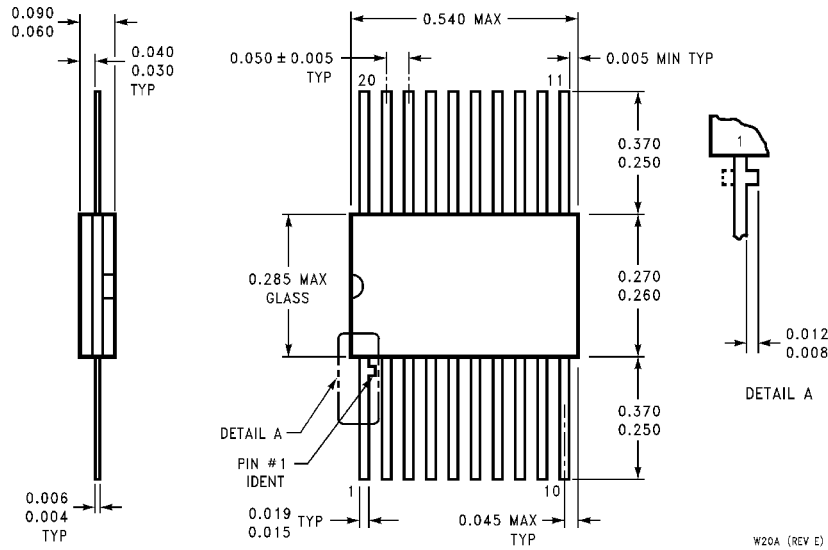


**20-Lead Wide Small Outline Molded Package (M)**  
**Order Number DM74LS299WM**  
**Package Number M20B**



**20-Lead Molded Dual-In-Line Package (N)**  
**Order Number DM74LS299N**  
**Package Number N20A**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**20-Lead Ceramic Flat Package (W)**  
**Order Number DM54LS299W**  
**Package Number W20A**

W20A (REV E)

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