

## DM54LS299/DM74LS299 8-Input Universal Shift/Storage Register with Common Parallel I/O Pins

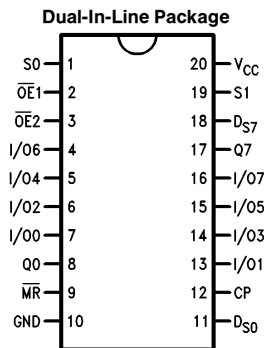
### General Description

The 'LS299 is an 8-bit universal shift/storage register with TRI-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
- TRI-STATE outputs for bus oriented applications

### Connection Diagram



TL/F/9827-1

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

Pin Names	Description
CP	Clock Pulse Input (Active Rising Edge)
DS0	Serial Data Input for Right Shift
DS7	Serial Data Input for Left Shift
S0, S1	Mode Select Inputs
MR	Asynchronous Master Reset Input (Active LOW)
OE1, OE2	TRI-STATE Output Enable Inputs (Active LOW)
I/O0-I/O7	Parallel Data Inputs or TRI-STATE Parallel Outputs
Q0-Q7	Serial Outputs

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## 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	
DM54	−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	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> , DS0, DS7 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> , DS0, DS7 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 MR to CP	10			10			ns

## Electrical Characteristics

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

Symbol	Parameter	Conditions	Min	Typ (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	DM54	2.5		V	
		V <sub>IL</sub> = Max	Q0, Q7	DM74	2.7		3.4
			I/O0–I/O7	DM74	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
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)	Sn		0.2	mA	

## Electrical Characteristics (Continued)

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

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
$I_{IH}$	High Level Input Current	$V_{CC} = \text{Max}, V_I = 2.7V$	Sn		40	$\mu A$
			Inputs		20	$\mu A$
$I_{IL}$	Low Level Input Current	$V_{CC} = \text{Max}, V_I = 0.4V$	Sn		-0.8	mA
			Inputs		-0.4	mA
$I_{OS}$	Short Circuit Output Current	$V_{CC} = \text{Max}$ (Note 2)	Q <sub>0</sub> , Q <sub>7</sub>	-20	-100	mA
			I/O <sub>0</sub> -I/O <sub>7</sub>	-30	-130	mA
$I_{CC}$	Supply Current	$V_{CC} = \text{Max}, \overline{OE} = 4.5V$			60	mA
$I_{OZH}$	TRI-STATE Output Off Current High	$V_{CC} = \text{Max}$ $V_O = 2.7V$			40	$\mu A$
$I_{OZL}$	TRI-STATE Output Off Current Low	$V_{CC} = \text{Max}$ $V_O = 0.4V$			-400	$\mu A$

**Note 1:** All typicals are at  $V_{CC} = 5V, T_A = 25^\circ C$ .

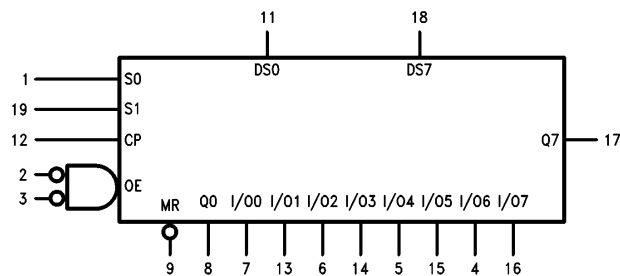
**Note 2:** Not more than one output should be shorted at a time, and the duration should not exceed one second.

## Switching Characteristics

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

Symbol	Parameter	$R_L = 2\text{ k}\Omega$ $C_L = 15\text{ pF}$		Units
		Min	Max	
$f_{max}$	Maximum Input Frequency	35		MHz
$t_{PLH}$ $t_{PHL}$	Propagation Delay CP to Q <sub>0</sub> or Q <sub>7</sub>		26 28	ns
$t_{PLH}$ $t_{PHL}$	Propagation Delay CP to I/O <sub>n</sub>		25 35	ns
$t_{PHL}$	Propagation Delay MR to Q <sub>0</sub> or Q <sub>7</sub>		28	ns
$t_{PHL}$	Propagation Delay MR to I/O <sub>n</sub>		35	ns
$t_{PZH}$ $t_{PZL}$	Output Enable Time		18 25	ns
$t_{PHZ}$ $t_{PLZ}$	Output Disable Time		15 20	ns

## Logic Symbol



TL/F/9827-2

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




## 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 TRI-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.

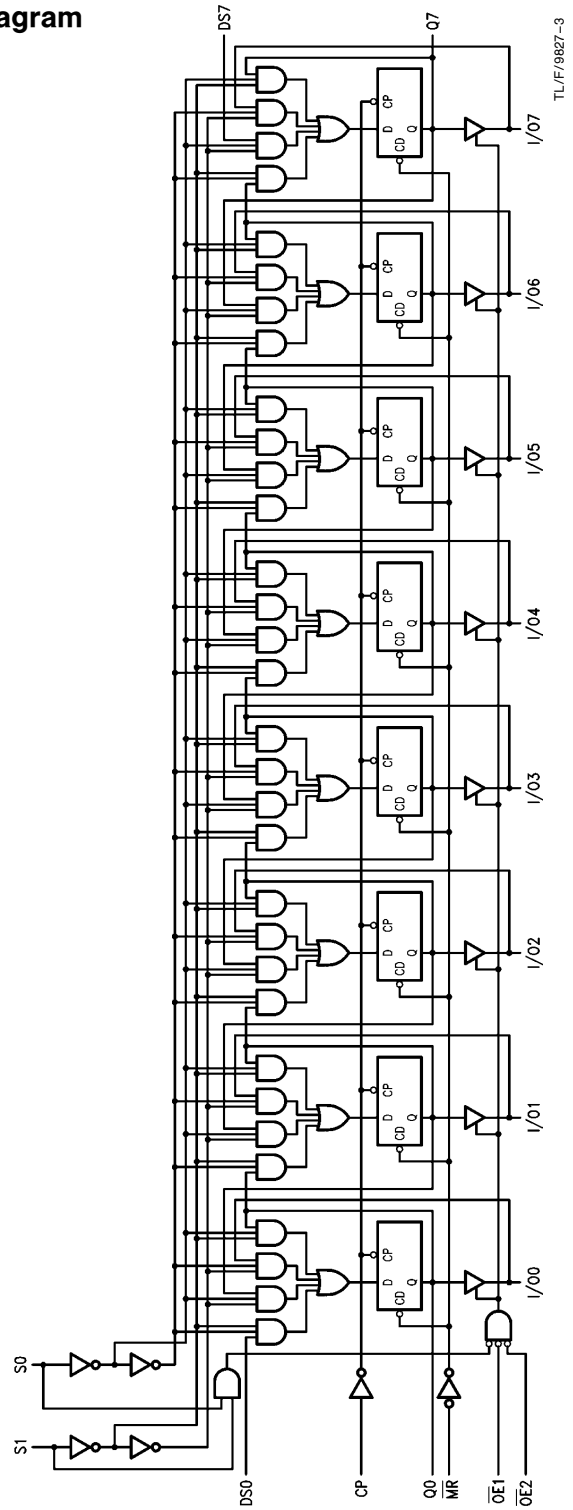
A HIGH signal on either  $\overline{OE1}$  or  $\overline{OE2}$  disables the TRI-STATE buffers and puts the I/O pins in the high impedance state. In this condition the shift, hold, load and reset operations can still occur. The TRI-STATE buffers are also disabled by HIGH signals on both S0 and S1 in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

Mode Select Table

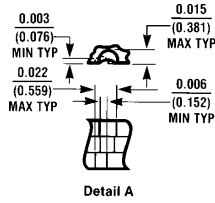
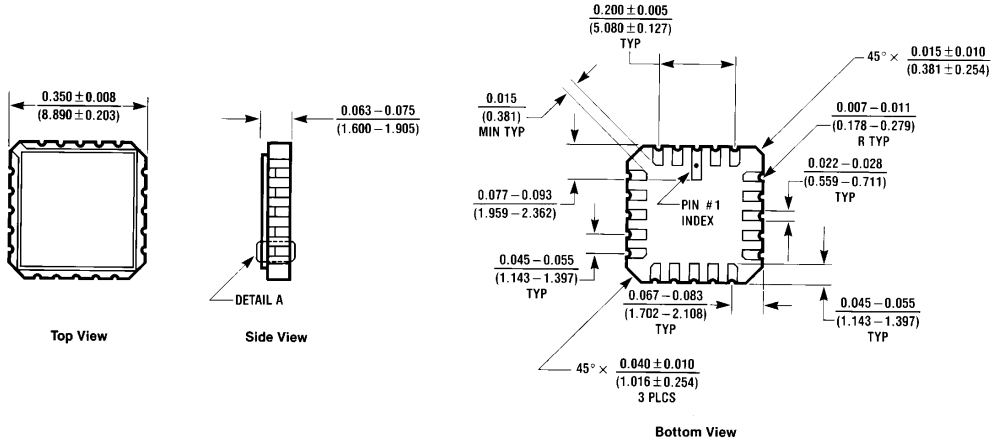
Inputs				Response
$\overline{MR}$	S1	S0	CP	
L	X	X	X	Asynchronous Reset; Q0–Q7 = LOW
H	H	H		Parallel Load; I/O <sub>n</sub> → Q <sub>n</sub>
H	L	H		Shift Right; D <sub>S0</sub> → Q0, Q0 → Q1, etc.
H	H	L		Shift Left; D <sub>S7</sub> → Q7, Q7 → Q6, etc.
H	L	L	X	Hold

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial

# Logic Diagram

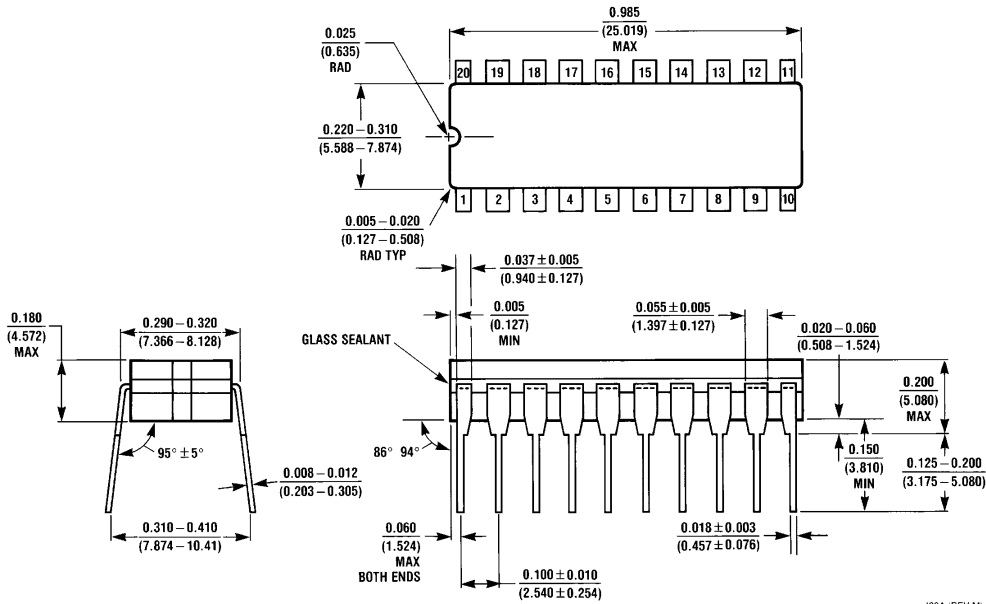


**Physical Dimensions** inches (millimeters)



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

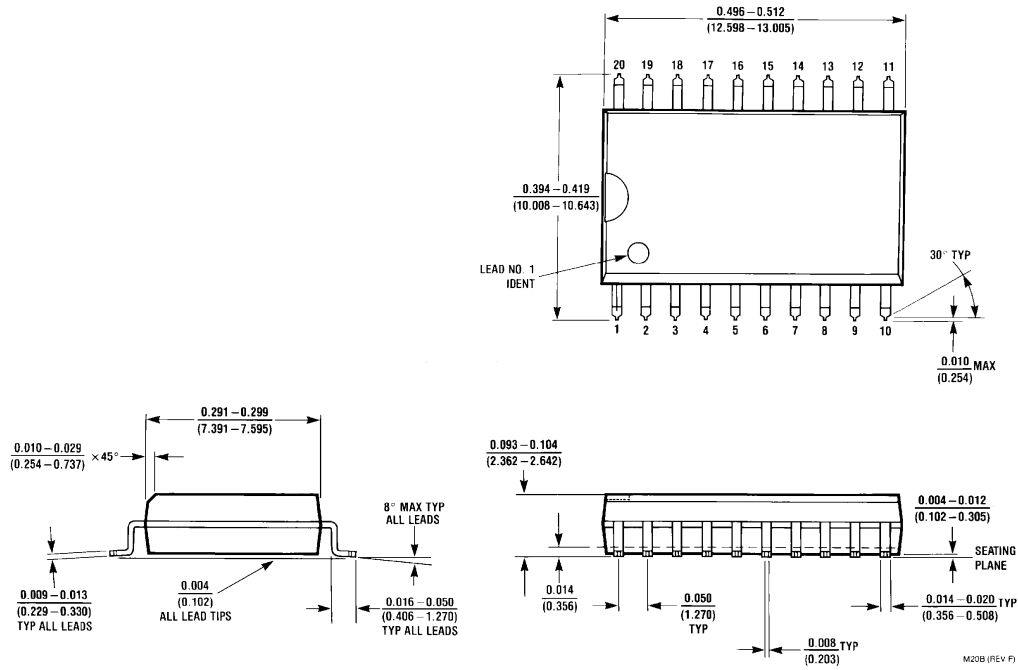
E20A (REV D)



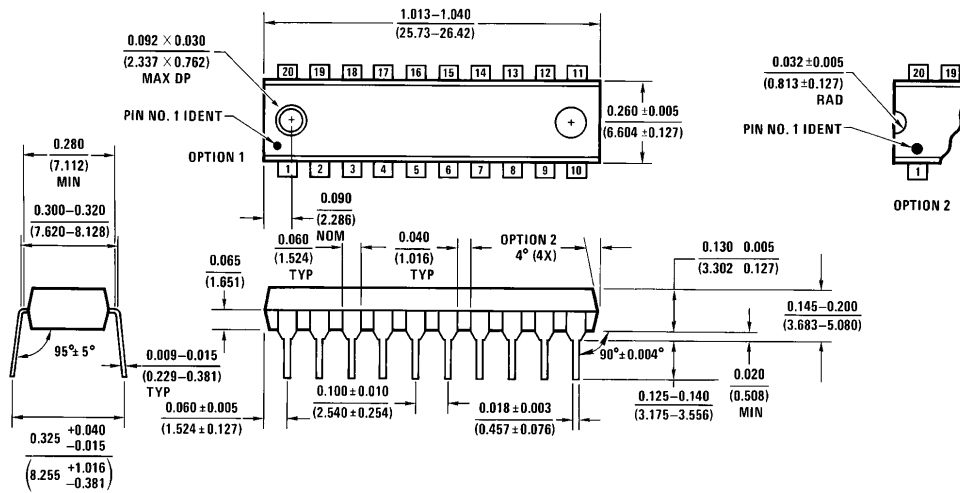
**20-Lead Ceramic Dual-In-Line Package (J)**  
 Order Number DM54LS299J  
 NS Package Number J20A

J20A (REV M)

**Physical Dimensions** inches (millimeters) (Continued)



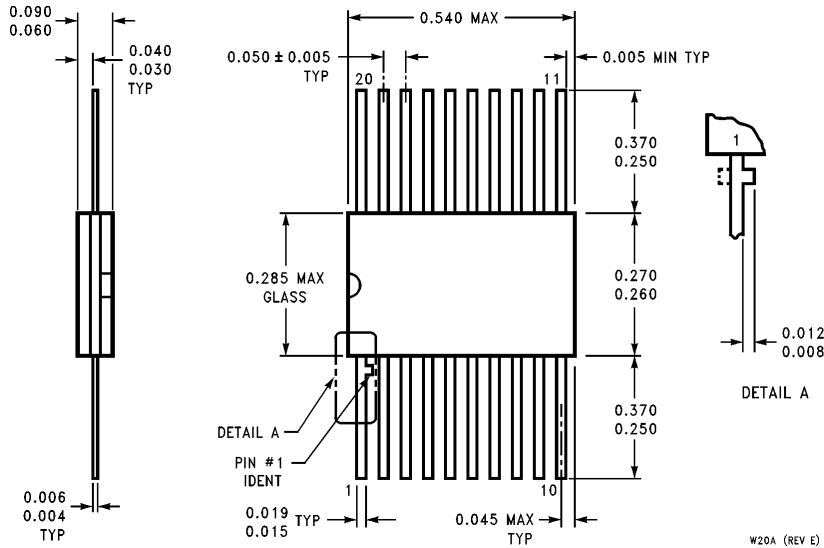
**20-Lead Wide Small Outline Molded Package (M)**  
**Order Number DM74LS299WM**  
**NS Package Number M20B**



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

**DM54LS299/DM74LS299 8-Input Universal Shift/Storage Register  
with Common Parallel I/O Pins**

**Physical Dimensions** inches (millimeters) (Continued)



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

W20A (REV E)

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