

DM54LS295A/DM74LS295A 4-Bit Shift Register with TRI-STATE® Outputs

General Description

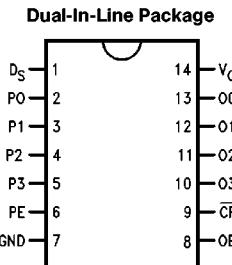
The 'LS295A is a 4-bit shift register with serial and parallel synchronous operating modes, and independent TRI-STATE output buffers. The Parallel Enable input (PE) controls the shift-right or parallel load operation. All data transfers and shifting occur synchronous with the HIGH-to-LOW clock transition.

The TRI-STATE output buffers are controlled by an active HIGH Output Enable input (OE). Disabling the output buffers does not affect the shifting or loading of input data, but it does inhibit serial expansion. The device is fabricated with the Schottky barrier diode process for high speed.

Features

- Fully synchronous serial or parallel data transfers
- Negative edge-triggered clock input
- Parallel enable mode control input
- TRI-STATE bussable output buffers

Connection Diagram

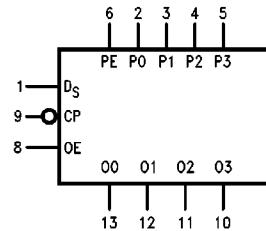


TL/F/10183-1

**Order Number DM54LS295AJ, DM54LS295AW,
DM74LS295AM or DM74LS295AN**

See NS Package Number J14A, M14A, N14A or W14B

Logic Symbol



TL/F/10183-2

V_{CC} = Pin 14
GND = Pin 7

Pin Names	Description
PE	Parallel Enable Input (Active HIGH)
D _S	Serial Data Input
P0-P3	Parallel Data Inputs
OE	TRI-STATE Output Enable Input (Active HIGH)
CP	Clock Pulse Input (Active Falling Edge)
O0-O3	TRI-STATE Outputs

TRI-STATE® is a registered trademark of National Semiconductor Corporation.

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	
DM54LS	-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	DM54LS295A			DM74LS295A			Units
		Min	Nom	Max	Min	Nom	Max	
V _{CC}	Supply Voltage	4.5	5	5.5	4.75	5	5.25	V
V _{IH}	High Level Input Voltage	2			2			V
V _{IL}	Low Level Input Voltage			0.7			0.8	V
I _{OH}	High Level Output Current			-1.0			-2.6	mA
I _{OL}	Low Level Output Current			4			8	mA
T _A	Free Air Operating Temperature	-55		125	0		70	°C
t _s (H) t _s (L)	Setup Time HIGH or LOW D _S , P _n to \overline{CP}	20 20			20 20			ns
t _h (H) t _h (L)	Hold Time HIGH or LOW D _S , P _n to \overline{CP}	10 10			10 10			ns
t _s (H) t _s (L)	Setup Time HIGH or LOW PE to \overline{CP}	20 20			20 20			ns
t _h (H) t _h (L)	Hold Time HIGH or LOW PE to \overline{CP}	0 0			0 0			ns
t _w (L)	\overline{CP} Pulse Width LOW	20			20			ns

Electrical Characteristics

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

Symbol	Parameter	Conditions		Min	Typ (Note 1)	Max	Units
V _I	Input Clamp Voltage	$V_{CC} = \text{Min}$, I _I = -18 mA				-1.5	V
V _{OH}	High Level Output Voltage	$V_{CC} = \text{Min}$, I _{OH} = Max, V _{IL} = Max	DM54	2.4			V
			DM74	2.4			
V _{OL}	Low Level Output Voltage	$V_{CC} = \text{Min}$, I _{OL} = Max, V _{IH} = Min	DM54		0.4		V
			DM74		0.5		
		I _{OL} = 4 mA, V _{CC} = Min	DM74		0.4		
I _I	Input Current @ Max Input Voltage	$V_{CC} = \text{Max}$, V _I = 7V V _I = 10V (DM54)				0.1	mA
I _{IH}	High Level Input Current	$V_{CC} = \text{Max}$, V _I = 2.7V				20	μ A
I _{IL}	Low Level Input Current	$V_{CC} = \text{Max}$, V _I = 0.4V				-0.4	mA
I _{os}	Short Circuit Output Current	$V_{CC} = \text{Max}$ (Note 2)	DM54	-20		-100	mA
			DM74	-20		-100	
I _{cc}	Supply Current Outputs ON	$V_{CC} = \text{Max}$, P _n = GND PE, DS, OE = 4.5V, \overline{CP} = $\overline{\text{--}}$				23	mA
	Outputs OFF	$V_{CC} = \text{Max}$, PE, DS = 4.5V P _n , OE, \overline{CP} = GND				25	mA

Electrical Characteristics (Continued)

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

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
I _{OZH}	Off-State Output Current with High Level Output Voltage Applied	V _{CC} = Max, V _O = 2.7V V _{IH} = Min, V _{IL} = Max			20	µA
I _{OZL}	Off-State Output Current with Low Level Output Voltage Applied	V _{CC} = Max, V _O = 0.4V V _{IH} = Min, V _{IL} = Max			-20	µA

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°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°C

Symbol	Parameter	R _L = 2 kΩ, C _L = 15 pF		Units
		Min	Max	
f _{max}	Maximum Shift Frequency	30		MHz
t _{PLH} t _{PHL}	Propagation Delay CP to Q _n		30 26	ns
t _{PZH} t _{PZL}	Output Enable Time		18 20	ns
t _{PHZ} t _{PLZ}	Output Disable Time		24 20	ns

Functional Description

This device is a 4-bit shift register with serial and parallel synchronous operating modes. It has a Serial Data (D_S) and four Parallel Data (P_0 - P_3) inputs and four parallel TRI-STATE output buffers (O_0 - O_3). When the Parallel Enable (PE) input is HIGH, data is transferred from the Parallel Data inputs (P_0 - P_3) into the register synchronous with the HIGH-to-LOW transition of the Clock (\bar{CP}). When the PE is LOW, a HIGH-to-LOW transition on the clock transfers the serial data on the D_S input to the register Q_0 , and shifts data from Q_0 to Q_1 , Q_1 to Q_2 and Q_2 to Q_3 . The input data and parallel enable are fully edge-triggered and must be stable only one setup time before the HIGH-to-LOW clock transition.

The TRI-STATE output buffers are controlled by an active HIGH Output Enable input (OE). When the OE is HIGH, the four register outputs appear at the O_0 - O_3 outputs. When OE is LOW, the outputs are forced to a high impedance OFF state. The TRI-STATE output buffers are completely independent of the register operation, i.e., the input transitions on the OE input do not affect the serial or parallel data transfers of the register. If the outputs are tied together, all but one device must be in the high impedance state to avoid high currents that would exceed the maximum ratings. Designers should ensure that Output Enable signals to TRI-STATE devices whose outputs are tied together are designed so there is no overlap.

Mode Select Table

Operating Mode	Inputs			Outputs				
	PE	\bar{CP}	D_S	P_n	Q_0	Q_1	Q_2	Q_3
Shift Right	I I	— —	I h	X X	L H	q_0 q_0	q_1 q_1	q_2 q_2
Parallel Load	h	— —	X	p_n	p_0	p_1	p_2	p_3

*The indicated data appears at the Q outputs when OE is HIGH. When OE is LOW, the indicated data is loaded into the register, but the outputs are all forced to the high impedance OFF state.

P_n (q_n) = Lower case letters indicate the state of the referenced input (or output) one set-up time prior to the HIGH-to-LOW clock transition.

I = LOW Voltage Level one set-up time prior to the HIGH-to-LOW clock transition.

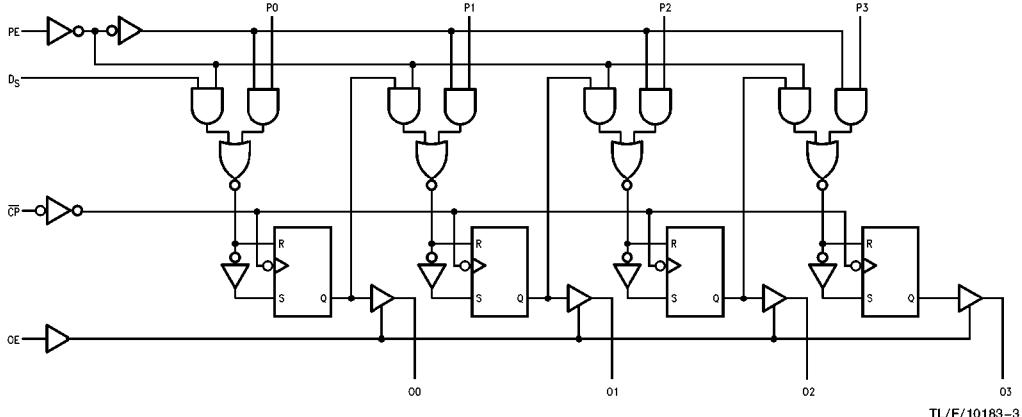
h = HIGH Voltage Level one set-up time prior to the HIGH-to-LOW clock transition.

H = HIGH Voltage Level

L = LOW Voltage Level

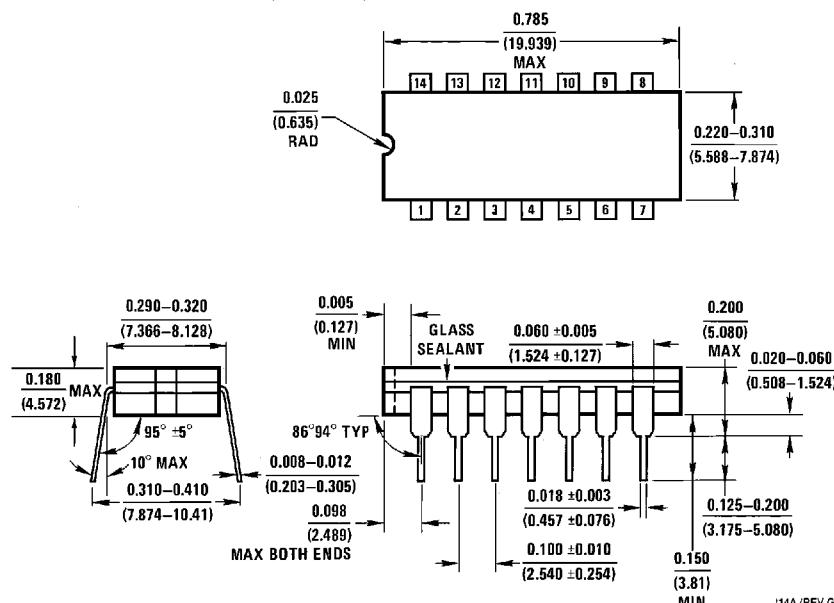
X = Immaterial

Logic Diagram



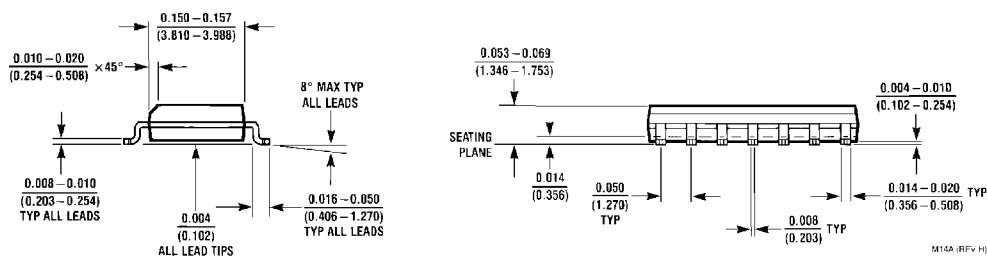
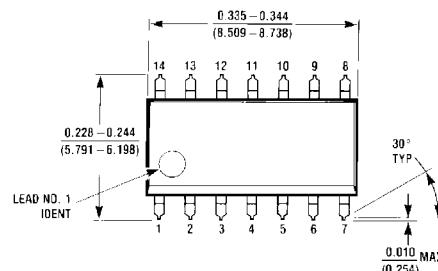
TL/F/10189-3

Physical Dimensions inches (millimeters)



14-Lead Ceramic Dual-In-Line Package (J)
Order Number DM54LS295AJ
NS Package Number J14A

J14A (REV G)

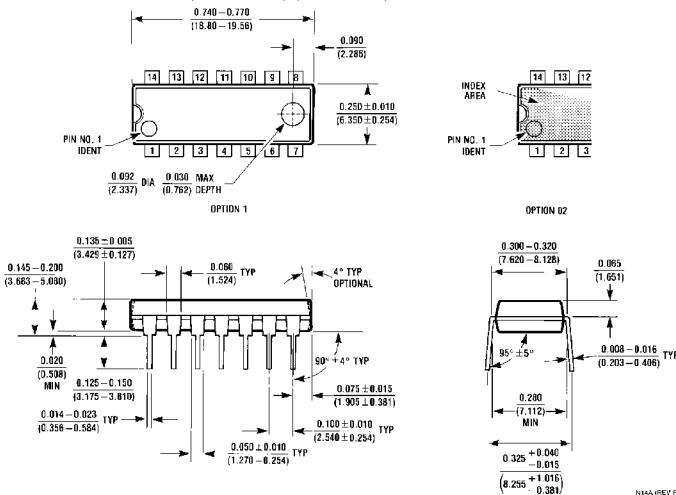


14-Lead Small Outline Molded Package (M)
Order Number DM74LS295AM
NS Package Number M14A

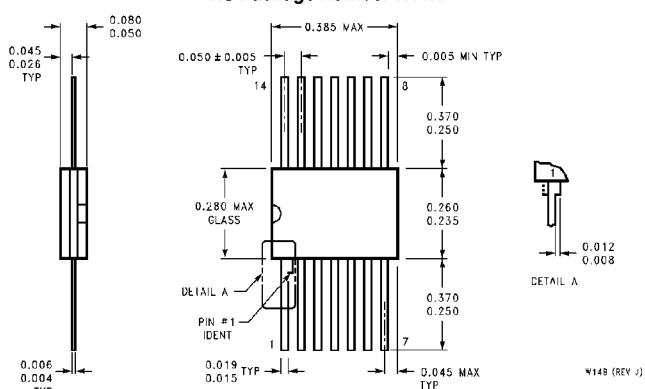
M14A (REV H)

DM54LS295A/DM74LS295A 4-Bit Shift Register with TRI-STATE Outputs

Physical Dimensions inches (millimeters) (Continued)



14-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS295AN
PCB Package Number N11A



**14-Lead Ceramic Flat Package (W)
Order Number DM54LS295AW
NS Package Number W14B**

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**National Semiconductor
Corporation**
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 767-7219

National Semiconductor
Europe

Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

**National Semiconductor
Hong Kong Ltd.**
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

**National Semiconductor
Japan Ltd.**
Tel: 81-043-299-2309
Fax: 81-043-299-2408