

## DM74S299 3-STATE 8-Bit Universal Shift/Storage Register

### General Description

This Schottky TTL eight-bit universal register features multiplexed inputs/outputs to achieve full eight bit data handling in a single 20-pin package. Two function-select inputs and two output-control inputs can be used to choose the modes of operation listed in the function table.

Synchronous parallel loading is accomplished by taking both function-select lines, S0 and S1, HIGH. This places the 3-STATE outputs in a high-impedance state, which permits data that is applied on the input/output lines to be clocked into the register. Reading out of the register can be accomplished while the outputs are enabled in any mode. A direct overriding input is provided to clear the register whether the outputs are ENABLED or OFF.

### Features

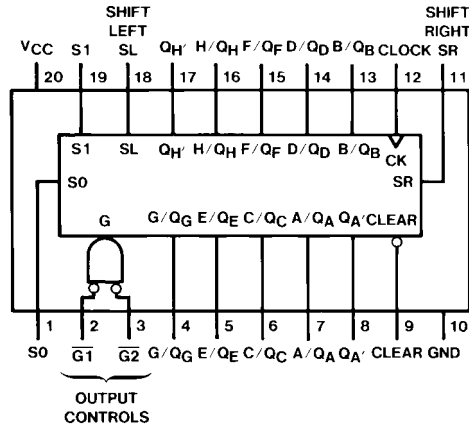
- Multiplexed inputs/outputs provide improved bit density
- Four modes of operation:
 

Hold (Store)	Shift Left
Shift Right	Load Data
- 3-STATE outputs drive bus lines directly
- Can be cascaded for N-bit word lengths
- Operates with outputs enabled or at high Z
- Guaranteed shift (clock) frequency 50 MHz
- Typical power dissipation 700 mW

### Ordering Code:

Order Number	Package Number	Package Description
DM74S299N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

### Connection Diagram



### Function Table

Mode	Inputs						Inputs/Outputs								Outputs			
	Clear	Function Select		Output Control		Clock	Serial		A/Q <sub>A</sub>	B/Q <sub>B</sub>	C/Q <sub>C</sub>	D/Q <sub>D</sub>	E/Q <sub>E</sub>	F/Q <sub>F</sub>	G/Q <sub>G</sub>	H/Q <sub>H</sub>	Q <sub>A'</sub>	Q <sub>H'</sub>
		S1	S0	G1 (Note 1)	G2 (Note 1)		SL	SR										
Clear	L	X	L	L	L	X	X	X	L	L	L	L	L	L	L	L	L	L
	L	L	X	L	L	X	X	X	L	L	L	L	L	L	L	L	L	L
Hold	H	L	L	L	L	X	X	X	Q <sub>A0</sub>	Q <sub>B0</sub>	Q <sub>C0</sub>	Q <sub>D0</sub>	Q <sub>E0</sub>	Q <sub>F0</sub>	Q <sub>G0</sub>	Q <sub>H0</sub>	Q <sub>A0</sub>	Q <sub>H0</sub>
	H	X	X	L	L	L	X	X	Q <sub>A0</sub>	Q <sub>B0</sub>	Q <sub>C0</sub>	Q <sub>D0</sub>	Q <sub>E0</sub>	Q <sub>F0</sub>	Q <sub>G0</sub>	Q <sub>H0</sub>	Q <sub>A0</sub>	Q <sub>H0</sub>
Shift Right	H	L	H	L	L	↑	X	H	H	Q <sub>An</sub>	Q <sub>Bn</sub>	Q <sub>Cn</sub>	Q <sub>Dn</sub>	Q <sub>En</sub>	Q <sub>Fn</sub>	Q <sub>Gn</sub>	H	Q <sub>Gn</sub>
	H	L	H	L	L	↑	X	L	L	Q <sub>An</sub>	Q <sub>Bn</sub>	Q <sub>Cn</sub>	Q <sub>Dn</sub>	Q <sub>En</sub>	Q <sub>Fn</sub>	Q <sub>Gn</sub>	L	Q <sub>Gn</sub>
Shift Left	H	H	L	L	L	↑	H	X	Q <sub>Bn</sub>	Q <sub>Cn</sub>	Q <sub>Dn</sub>	Q <sub>En</sub>	Q <sub>Fn</sub>	Q <sub>Gn</sub>	Q <sub>Hn</sub>	H	Q <sub>Bn</sub>	H
	H	H	L	L	L	↑	L	X	Q <sub>Bn</sub>	Q <sub>Cn</sub>	Q <sub>Dn</sub>	Q <sub>En</sub>	Q <sub>Fn</sub>	Q <sub>Gn</sub>	Q <sub>Hn</sub>	L	Q <sub>Bn</sub>	L
Load	H	H	H	X	X	↑	X	X	a	b	c	d	e	f	g	h	a	h

a...h = The level of the steady-state input at inputs A through H, respectively. These data are loaded into the flip-flops while the flip-flop outputs are isolated from the input/output terminals.

H = HIGH Level

L = LOW Logic Level

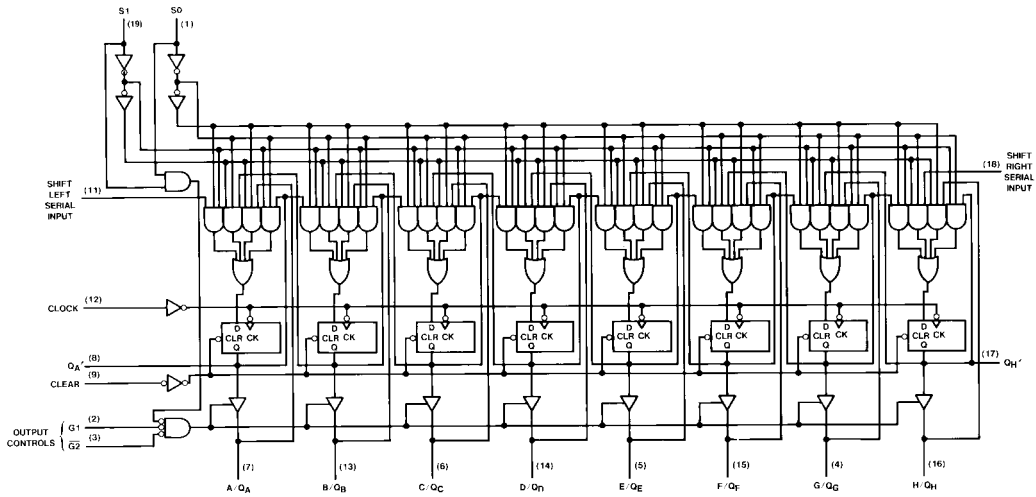
X = Either LOW or HIGH Logic Level

Q<sub>A0</sub>...Q<sub>H0</sub> = The output logic level of Q<sub>x</sub> before the indicated input conditions were established.

Q<sub>An</sub>...Q<sub>Hn</sub> = The output logic level before the active transition (↑) of the clock input.

**Note 1:** When one or both output controls are HIGH the eight input/output terminals are disabled to the high-impedance state; however, sequential operation or clearing of the register is not affected

### Logic Diagram



**Absolute Maximum Ratings**(Note 2)

Supply Voltage	7V
Input Voltage	5.5V
Operating Free Air Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C to +150°C

**Note 2:** 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 tables 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	Min	Nom	Max	Units
V <sub>CC</sub>	Supply Voltage	4.75	5	5.25	V
V <sub>IH</sub>	HIGH Level Input Voltage	2			V
V <sub>IL</sub>	LOW Level Input Voltage			0.8	V
I <sub>OH</sub>	HIGH Level Output Current (Q <sub>A</sub> thru Q <sub>H</sub> )			-6.5	mA
	HIGH Level Output Current (Q <sub>A'</sub> , Q <sub>H'</sub> )			-0.5	
I <sub>OL</sub>	LOW Level Output Current (Q <sub>A</sub> thru Q <sub>H</sub> )			20	mA
	HIGH Level Output Current (Q <sub>A'</sub> , Q <sub>H'</sub> )			6	
f <sub>CLK</sub>	Clock Frequency (Note 3)	0	70	50	MHz
f <sub>CLK</sub>	Clock Frequency (Note 4)	0	60	40	MHz
t <sub>W</sub>	Pulse Width (Note 5)	Clock HIGH	10		ns
		Clock LOW	10		
		Clear LOW	10		
t <sub>SU</sub>	Setup Time (Note 6)(Note 5)(Note 7)	Select	15 <sup>↑</sup>		ns
		Data HIGH	7 <sup>↑</sup>		
		Data LOW	5 <sup>↑</sup>		
t <sub>H</sub>	Hold Time (Note 5)(Note 7)	5 <sup>↑</sup>			ns
t <sub>REL</sub>	Clear Release Time (Note 5)	10 <sup>↑</sup>			ns
T <sub>A</sub>	Free Air Operating Temperature	0		70	°C

**Note 3:** C<sub>L</sub> = 15 pF, R<sub>L</sub> = 280Ω, T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5V.

**Note 4:** C<sub>L</sub> = 50 pF, R<sub>L</sub> = 280Ω, T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5V.

**Note 5:** T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5V.

**Note 6:** The symbol (↑) indicates the rising edge of the clock pulse is used for reference.

**Note 7:** Data includes the two serial inputs and the eight input/output data lines.

## Electrical Characteristics

over recommended operating free air temperature (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 8)	Max	Units
$V_I$	Input Clamp Voltage	$V_{CC} = \text{Min}$ , $I_I = -18 \text{ mA}$			-1.2	V
$V_{OH}$	HIGH Level Output Voltage	$V_{CC} = \text{Min}$ , $I_{OH} = \text{Max}$	$Q_A$ thru $Q_H$	2.4	3.2	V
	Output Voltage	$V_{IL} = \text{Max}$ , $V_{IH} = \text{Min}$	$Q_A'$ , $Q_H'$	2.7	3.4	
$V_{OL}$	LOW Level Output Voltage	$V_{CC} = \text{Min}$ , $I_{OL} = \text{Max}$ $V_{IH} = \text{Min}$ , $V_{IL} = \text{Max}$			0.5	V
$I_I$	Input Current @ Max Input Voltage	$V_{CC} = \text{Max}$ , $V_I = 5.5 \text{ V}$			1	mA
$I_{IH}$	HIGH Level Input Current	$V_{CC} = \text{Max}$ $V_I = 2.7 \text{ V}$	A thru H, S0, S1		100	$\mu\text{A}$
			Any Other		50	
$I_{IL}$	LOW Level Input Current	$V_{CC} = \text{Max}$ $V_I = 0.5 \text{ V}$	Clock, Clear		-2	mA
			S0, S1		-0.5	
			Other		-0.25	
$I_{OZH}$	Off-State Output Current with HIGH Level Output Voltage Applied ( $Q_A$ thru $Q_H$ )	$V_{CC} = \text{Max}$ , $V_O = 2.4 \text{ V}$ $V_{IH} = \text{Min}$ , $V_{IL} = \text{Max}$			100	$\mu\text{A}$
$I_{OZL}$	Off-State Output Current with LOW Level Output Voltage Applied ( $Q_A$ thru $Q_H$ )	$V_{CC} = \text{Max}$ , $V_O = 0.5 \text{ V}$ $V_{IH} = \text{Min}$ , $V_{IL} = \text{Max}$			-250	$\mu\text{A}$
$I_{OS}$	Short Circuit Output Current ( $Q_A$ thru $Q_H$ )	$V_{CC} = \text{Max}$ (Note 10)	-40		-100	mA
	Short Circuit Output Current ( $Q_A'$ , $Q_H'$ )	$V_{CC} = \text{Max}$ (Note 10)	-20		-100	
$I_{CC}$	Supply Current	$V_{CC} = \text{Max}$		140	225	mA

**Note 8:**  $T_A = 25^\circ\text{C}$  and  $V_{CC} = 5 \text{ V}$ .

**Note 9:** All typicals are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

**Note 10:** Not more than one output should be shorted at a time, and the duration should not exceed one second.

## Switching Characteristics

at  $V_{CC} = 5 \text{ V}$  and  $T_A = 25^\circ\text{C}$  (See Section 1 for Test Waveforms and Output Load)

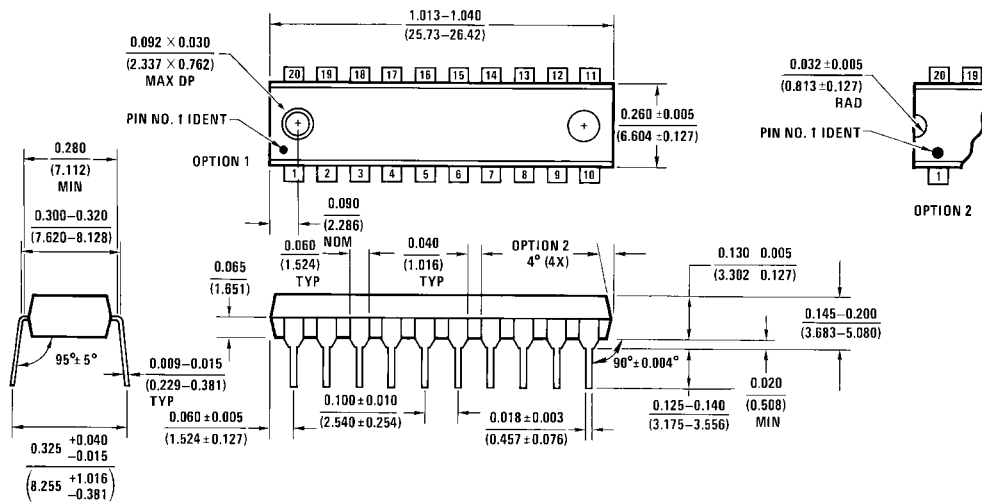
Symbol	Parameter	From (Input) To (Output)	$R_L = 280\Omega$ (Note 12)				Units
			$C_L = 15 \text{ pF}$		$C_L = 50 \text{ pF}$		
			Min	Max	Min	Max	
$f_{MAX}$	Maximum Clock Frequency	(Note 13)	50		40		MHz
$t_{PLH}$	Propagation Delay Time LOW-to-HIGH Level Output (Note 12)	Clock to $Q_A'$ or $Q_H'$		20		22	ns
$t_{PHL}$	Propagation Delay Time HIGH-to-LOW Level Output (Note 12)	Clock to $Q_A'$ or $Q_H'$		20		23	ns
$t_{PLH}$	Propagation Delay Time LOW-to-HIGH Level Output	Clock to $Q_A$ thru $Q_H$				21	ns
$t_{PHL}$	Propagation Delay Time HIGH-to-LOW Level Output	Clock to $Q_A$ thru $Q_H$				21	ns
$t_{PHL}$	Propagation Delay Time HIGH-to-LOW Level Output (Note 12)	Clear to $Q_A'$ or $Q_H'$		21		24	ns
$t_{PHL}$	Propagation Delay Time HIGH-to-LOW Level Output	Clear to $Q_A$ thru $Q_H$				24	ns
$t_{PZH}$	Output Enable Time to HIGH Level Output	$\overline{G}1, \overline{G}2$ to $Q_A$ thru $Q_H$				18	ns
$t_{PZL}$	Output Enable Time to LOW Level Output	$\overline{G}1, \overline{G}2$ to $Q_A$ thru $Q_H$				18	ns
$t_{PHZ}$	Output Disable Time to HIGH Level Output (Note 11)	$\overline{G}1, \overline{G}2$ to $Q_A$ thru $Q_H$		12			ns
$t_{PLZ}$	Output Disable Time to LOW Level Output (Note 11)	$\overline{G}1, \overline{G}2$ to $Q_A$ thru $Q_H$		12			ns

**Note 11:**  $C_L = 5 \text{ pF}$ .

**Note 12:**  $R_L = 1 \text{ K}\Omega$  for delays measured to  $Q_A'$  and  $Q_H'$ .

**Note 13:** For testing  $f_{MAX}$  all outputs are loaded simultaneously.

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



**20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide  
Package Number N20A**

N20A (REV G)

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