

SN54298, SN54LS298, SN74298, SN74LS298 QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE

SDLS098 MARCH 1974 - REVISED MARCH 1988

- Selects One of Two 4-Bit Data Sources and Stores Data Synchronously with System Clock

- Applications:
Dual Source for Operands and Constants in Arithmetic Processor; Can Release Processor Register Files for Acquiring New Data

Implement Separate Registers Capable of Parallel Exchange of Contents Yet Retain External Load Capability

Universal Type Register for Implementing Various Shift Patterns; Even Has Compound Left-Right Capabilities

description

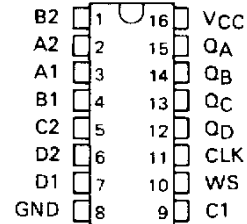
These monolithic quadruple two-input multiplexers with storage provide essentially the equivalent functional capabilities of two separate MSI functions (SN54157/SN74157 or SN54LS157/SN74LS157 and SN54175/SN74175 or SN54LS175/SN74LS175) in a single 16-pin package.

When the word-select input is low, word 1 (A1, B1, C1, D1) is applied to the flip-flops. A high input to word select will cause the selection of word 2 (A2, B2, C2, D2). The selected word is clocked to the output terminals on the negative-going edge of the clock pulse.

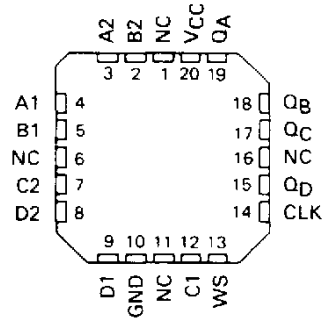
Typical power dissipation is 195 milliwatts for the '298 and 65 milliwatts for the 'LS298. SN54298 and SN54LS298 are characterized for operation over the full military temperature range of -55°C to 125°C ; SN74298 and SN74LS298 are characterized for operation from 0°C to 70°C .

SN54298, SN54LS298 . . . J OR W PACKAGE
SN74298 . . . N PACKAGE
SN74LS298 . . . D OR N PACKAGE

(TOP VIEW)



SN54LS298 . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

FUNCTION TABLE

INPUTS		OUTPUTS			
WORD SELECT	CLOCK	Q _A	Q _B	Q _C	Q _D
L	↓	a1	b1	c1	d1
H	↓	a2	b2	c2	d2
X	H	Q _{A0}	Q _{B0}	Q _{C0}	Q _{D0}

H = high level (steady state)
L = low level (steady state)
X = irrelevant (any input, including transitions)
↓ = transition from high to low level
a1, a2, etc. = the level of steady state input at A1, A2, etc.
Q_{A0}, Q_{B0}, etc. = the level of Q_A, Q_B, etc. entered on the most recent ↓ transition of the clock input.

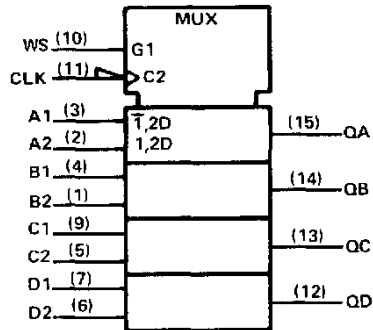
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TEXAS
INSTRUMENTS

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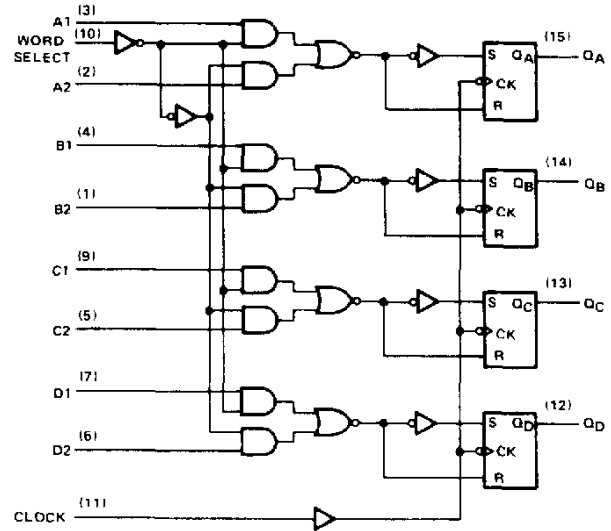
SN54298, SN54LS298, SN74298, SN74LS298 QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE

logic symbol†

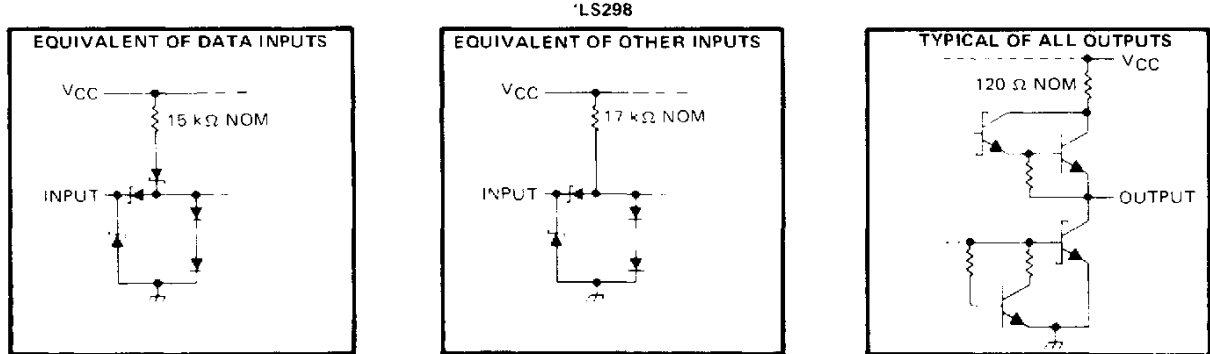
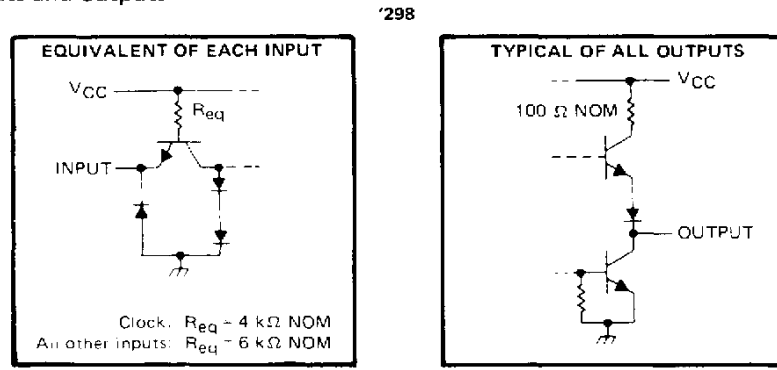


†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.
Pin numbers shown are for D, J, N, and W packages.

logic diagram (positive logic)



schematics of inputs and outputs



SN54298, SN74298 QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Operating free-air temperature range: SN54298	-55°C to 125°C
SN74298	0°C to 70°C
Storage temperature	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54298			SN74298			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			-800			-800	μ A
Low-level output current, I_{OL}			16			16	mA
Width of clock pulse, high or low level, t_W		20			20		ns
Setup time, t_{SU}	Data	15		15			ns
	Word select	25		25			
Hold time, t_H	Data	5		5			ns
	Word select	0		0			
Operating free-air temperature, T_A		-55	125		0	70	°C

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

PARAMETER	TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
V_{IH} High-level input voltage		2			V
V_{IL} Low-level input voltage				0.8	V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}$, $I_I = -12 \text{ mA}$			-1.5	V
V_{OH} High-level output voltage	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OH} = -800 \mu\text{A}$	2.4	3.2		V
V_{OL} Low-level output voltage	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.8 \text{ V}$, $I_{OL} = 16 \text{ mA}$			0.4	V
I_I Input current at maximum input voltage	$V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$			1	mA
I_{IH} High-level input current	$V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$			40	μ A
I_{IL} Low-level input current	$V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$			-1.6	mA
I_{OS} Short-circuit output current§	$V_{CC} = \text{MAX}$	SN54298	-20	-57	mA
		SN74298	-18	-57	
I_{CC} Supply current	$V_{CC} = \text{MAX}$, See Note 2		39	65	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

§ Not more than one output should be shorted at a time.

NOTE 2: With all outputs open and all inputs except clock low, I_{CC} is measured after applying a momentary 4.5 V, followed by ground, to the clock input.

switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH} Propagation delay time, low-to-high-level output	$C_L = 15 \text{ pF}$, $R_L = 400 \Omega$,		18	27	ns
t_{PHL} Propagation delay time, high-to-low-level output	See Note 3		21	32	

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

SN54LS298, SN74LS298 QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	7 V
Operating free-air temperature range: SN54LS298	-55°C to 125°C
SN74LS298	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54LS298			SN74LS298			UNIT	
	MIN	NOM	MAX	MIN	NOM	MAX		
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V	
High-level output current, I_{OH}			-400			-400	μ A	
Low-level output current, I_{OL}			4			8	mA	
Width of clock pulse, high or low level, t_w	20			20			ns	
Setup time, t_{SU}	Data	15		15			ns	
	Word select	25		25				
Hold time, t_H	Data	5		5			ns	
	Word select	0		0				
Operating free-air temperature, T_A			-55	125		0	70	°C

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

PARAMETER	TEST CONDITIONS [†]	SN54LS298			SN74LS298			UNIT
		MIN	TYP [‡]	MAX	MIN	TYP [‡]	MAX	
V_{IH} High-level input voltage		2			2			V
V_{IL} Low-level input voltage				0.7			0.8	V
V_{IK} Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$			-1.5			-1.5	V
V_{OH} High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = -400 \mu\text{A}$	2.5	3.4		2.7	3.4		V
V_{OL} Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OL} = 4 \text{ mA}$ $I_{OL} = 8 \text{ mA}$		0.25	0.4		0.25	0.4	V
I_I Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$			0.1			0.1	mA
I_{IH} High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$			20			20	μ A
I_{IL} Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-0.4			-0.4	mA
I_{OS} Short-circuit output current [§]	$V_{CC} = \text{MAX}$	-20		-100	-20		-100	mA
I_{CC} Supply current	$V_{CC} = \text{MAX},$ See Note 2		13	21		13	21	mA

[†]For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

[§]Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

NOTE 2: With all outputs open and all inputs except clock low, I_{CC} is measured after applying a momentary 4.5 V, followed by ground, to the clock input.

switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ \text{C}$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH} Propagation delay time, low-to-high-level output	$C_L = 15 \text{ pF}, R_L = 2 \text{ k}\Omega,$		18	27	ns
t_{PHL} Propagation delay time, high-to-low-level output	See Note 3		21	32	

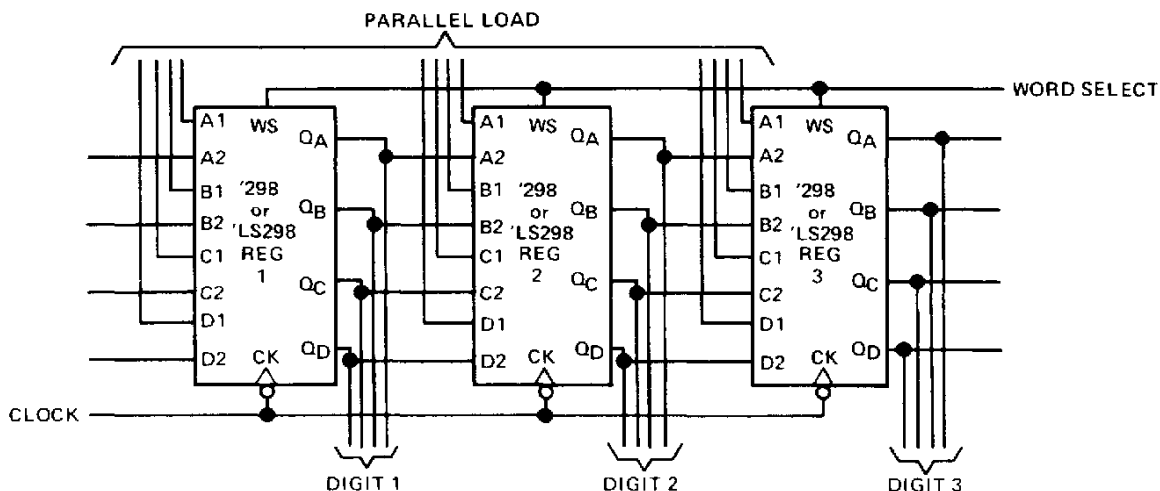
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SN54298, SN54LS298, SN74298, SN74LS298 QUADRUPLE 2-INPUT MULTIPLEXERS WITH STORAGE

TYPICAL APPLICATION DATA

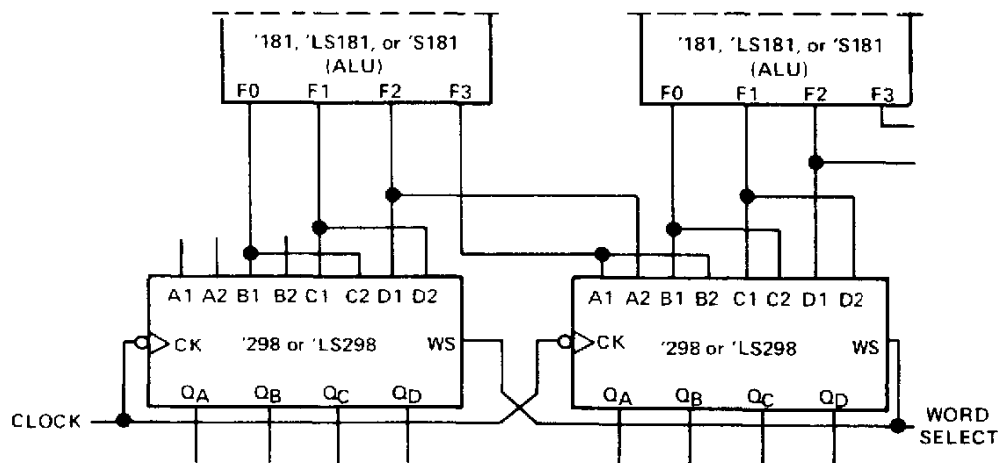
This versatile multiplexer/register can be connected to operate as a shift register that can shift N-places in a single clock pulse.

The following figure illustrates a BCD shift register that will shift an entire 4-bit BCD digit in one clock pulse.



When the word-select input is high and the registers are clocked, the contents of register 1 is transferred (shifted) to register 2 and etc. In effect, the BCD digits are shifted one position. In addition, this application retains a parallel-load capability which means that new BCD data can be entered in the entire register with one clock pulse. This arrangement can be modified to perform the shifting of binary data for any number of bit locations.

Another function that can be implemented with the '298 or 'LS298 is a register that can be designed specifically for supporting multiplier or division operations. The example below is a one place/two-place shift register.



When word select is low and the register is clocked, the outputs of the arithmetic/logic units (ALU's) are shifted one place. When word select is high and the registers are clocked, the data is shifted two places.

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SN54LS298, Quadruple 2-Input Multiplexers With Storage
 DEVICE STATUS: **ACTIVE**

PARAMETER NAME	SN54LS298	SN74LS298
Voltage Nodes (V)	5	5
Vcc range (V)	4.5 to 5.5	4.75 to 5.25
Input Level	TTL	TTL
Output Level	TTL	TTL
Output Drive (mA)		-0.4/8
Output	2S	2S
From	2	2
To	1	1

FEATURES

[▲Back to Top](#)

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- Applications:
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 - Universal Type Register for Implementing Various Shift Patterns; Even Has Compound Left-Right Capabilities

DESCRIPTION

[▲Back to Top](#)

These monolithic quadruple two-input multiplexers with storage provide essentially the equivalent functional capabilities of two separate MSI functions (SN54157/SN74157 or SN54LS157/SN74LS157 and SN54175/SN74175 or SN54LS175/SN74LS175) in a single 16-pin package.

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Typical power dissipation is 195 milliwatts for the '298 and 65 milliwatts for the 'LS298. SN54298 and SN54LS298 are characterized for operation over the full military temperature range of -55°C to 125°C; SN74298 and SN74LS298 are characterized for operation from 0°C to 70°C.

TECHNICAL DOCUMENTS

[▲Back to Top](#)

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DATASHEET

[▲Back to Top](#)

Full datasheet in Acrobat PDF: [sn54ls298.pdf](#) (144 KB) (Updated: 03/01/1988)

APPLICATION NOTES

[▲Back to Top](#)

View Application Notes for [Digital Logic](#)

- [Designing With Logic \(Rev. C\)](#) (SDYA009C - Updated: 06/01/1997)
- [Designing with the SN54/74LS123 \(Rev. A\)](#) (SDLA006A - Updated: 03/01/1997)
- [Evaluation of Nickel/Palladium/Gold-Finished Surface-Mount Integrated Circuits](#) (SZZA026 - Updated: 06/20/2001)
- [Input and Output Characteristics of Digital Integrated Circuits](#) (SDYA010 - Updated: 10/01/1996)
- [Live Insertion](#) (SDYA012 - Updated: 10/01/1996)
- [TI IBIS File Creation, Validation, and Distribution Processes](#) (SZZA034 - Updated: 08/29/2002)
- [Understanding and Interpreting Texas Instruments Standard-Logic Products Data Sh \(Rev. A\)](#) (SZZA036A - Updated: 02/27/2003)

MORE LITERATURE

[▲Back to Top](#)

- [Enhanced Plastic Portfolio Brochure](#) (SGZB004, 387 KB - Updated: 08/19/2002)
- [Logic Reference Guide](#) (SCYB004, 1032 KB - Updated: 10/23/2001)
- [MicroStar Junior BGA Design Summary](#) (SCET004, 167 KB - Updated: 07/28/2000)
- [Military Brief](#) (SGYN138, 803 KB - Updated: 10/10/2000)
- [Overview of IEEE Std 91-1984, Explanation of Logic Symbols Training Booklet \(Rev. A\)](#) (SDYZ001A, 138 KB - Updated: 07/01/1996)
- [Palladium Lead Finish User's Manual](#) (SDYV001, 2041 KB - Updated: 11/01/1996)
- [QML Class V Space Products Military Brief \(Rev. A\)](#) (SGZN001A, 257 KB - Updated: 10/07/2002)

USER GUIDES

[▲Back to Top](#)

- [LOGIC Pocket Data Book](#) (SCYD013, 4837 KB - Updated: 12/05/2002)

PRICING/AVAILABILITY/PKG

[▲Back to Top](#)

DEVICE INFORMATION Updated Daily								TI INVENTORY STATUS As Of 09:00 AM GMT, 17 Apr 2003			REPORTED DISTRIBUTOR INVENTORY As Of 09:00 AM GMT, 17 Apr 2003		
ORDERABLE DEVICE	STATUS	PACKAGE TYPE PINS	TEMP (°C)	DSCC NUMBER	PRODUCT CONTENT	BUDGETARY PRICING QTY SUS	STD PACK QTY	IN STOCK	IN PROGRESS QTY DATE	LEAD TIME	DISTRIBUTOR COMPANY REGION	IN STOCK	PURCHASE
7601901EA	ACTIVE	CDIP (J) 16	-55 TO 125		View Contents	1KU 2.00	1	<u>110</u> *	> 10k 20 May	6 WKS	Avnet Americas	116	BUY NOW
7601901FA	ACTIVE	CFP (W) 16	-55 TO 125		View Contents	1KU 6.86	1	<u>0</u> *	> 10k 20 May	6 WKS	None Reported View Distributors		
SN54LS298J	ACTIVE	CDIP (J) 16	-55 TO 125		View Contents	1KU 1.70	1	<u>177</u> *	279 05 May	6 WKS	Avnet Americas	557	BUY NOW
									> 10k 20 May		EBV Electronik Europe	75	BUY NOW
SNJ54LS298FK	ACTIVE	LCCC (FK) 20	-55 TO 125		View Contents	1KU 7.32	1	<u>0</u> *	3536 20 May	6 WKS	None Reported View Distributors		
									> 10k 27 May				
SNJ54LS298J	ACTIVE	CDIP (J) 16	-55 TO 125	7601901EA	View Contents	1KU 2.00	1	<u>0</u> *	> 10k 20 May	6 WKS	None Reported View Distributors		
SNJ54LS298W	ACTIVE	CFP (W) 16	-55 TO 125	7601901FA	View Contents	1KU 6.86	1	<u>15</u> *	> 10k 20 May	6 WKS	None Reported View Distributors		

Table Data Updated on: 4/17/2003

