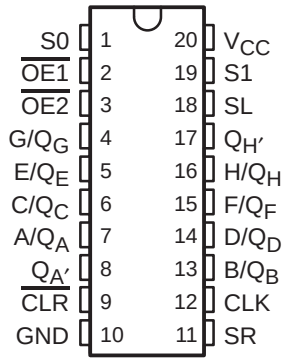
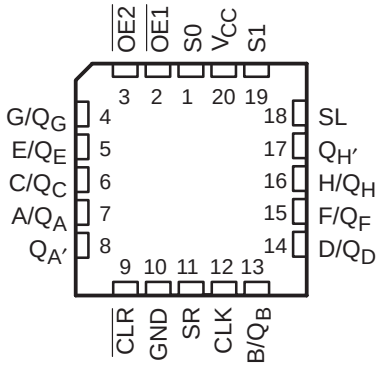
- **Multiplexed I/O Ports Provide Improved Bit Density**
- **Four Modes of Operation:**
  - **Hold (Store)**
  - **Shift Right**
  - **Shift Left**
  - **Load Data**
- **Operate With Outputs Enabled or at High Impedance**
- **3-State Outputs Drive Bus Lines Directly**
- **Can Be Cascaded for n-Bit Word Lengths**
- **Synchronous Clear**
- **Applications:**
  - **Stacked or Push-Down Registers**
  - **Buffer Storage**
  - **Accumulator Registers**
- **Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs**

SN54ALS323 . . . J PACKAGE
SN74ALS323 . . . DW OR N PACKAGE
(TOP VIEW)



SN54ALS323 . . . FK PACKAGE
(TOP VIEW)



description

These 8-bit universal shift/storage registers feature multiplexed input/output (I/O) ports to achieve full 8-bit data handling in a 20-pin package. Two function-select (S0, S1) inputs and two output-enable ($\overline{OE1}$, $\overline{OE2}$) inputs can be used to choose the modes of operation listed in the function table.

Synchronous parallel loading is accomplished by taking both S0 and S1 high. This places the 3-state outputs in the high-impedance state and permits data applied on the I/O ports to be clocked into the register. Reading out of the register can be accomplished while the outputs are enabled in any mode. Clearing occurs synchronously when the clear ($\overline{CLR}$) input is low. Taking either $\overline{OE1}$ or $\overline{OE2}$ high disables the outputs but has no effect on clearing, shifting, or storing data.

The SN54ALS323 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74ALS323 is characterized for operation from 0°C to 70°C.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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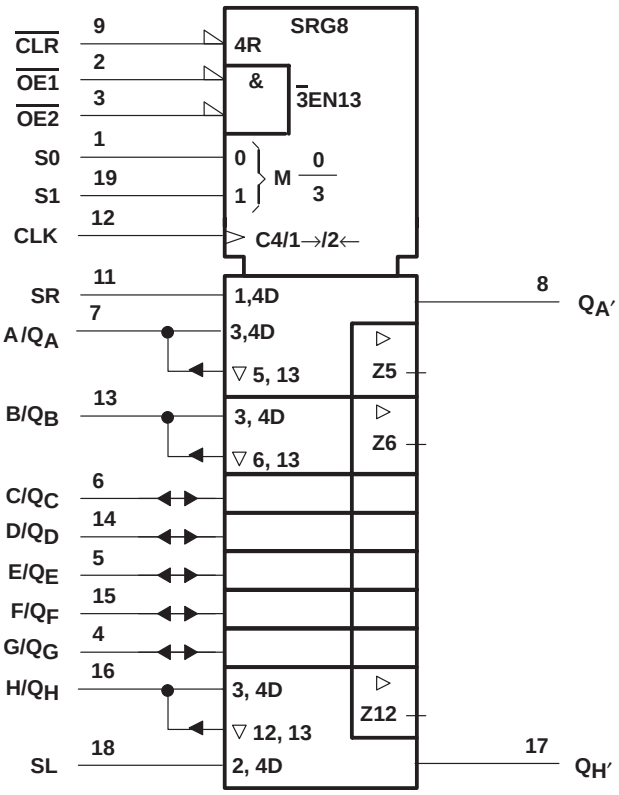
FUNCTION TABLE

MODE	INPUTS								I/O PORTS								OUTPUTS	
	$\overline{CLR}$	S1	S0	$\overline{OE1}$†	$\overline{OE2}$†	CLK	SL	SR	A/Q_A	B/Q_B	C/Q_C	D/Q_D	E/Q_E	F/Q_F	G/Q_G	H/Q_H	$Q_{A'}$	$Q_{H'}$
Clear	L	X	L	L	L	↑	X	X	L	L	L	L	L	L	L	L	L	L
	L	L	X	L	L	↑	X	X	L	L	L	L	L	L	L	L	L	L
	L	H	H	X	X	↑	X	X	X	X	X	X	X	X	X	X	L	L
Hold	H	L	L	L	L	X	X	X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}	Q_{E0}	Q_{F0}	Q_{G0}	Q_{H0}	Q_{A0}	Q_{H0}
	H	X	X	L	L	L	X	X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}	Q_{E0}	Q_{F0}	Q_{G0}	Q_{H0}	Q_{A0}	Q_{H0}
Shift	H	L	H	L	L	↑	X	H	H	Q_{An}	Q_{Bn}	Q_{Cn}	Q_{Dn}	Q_{En}	Q_{Fn}	Q_{Gn}	H	Q_{Gn}
Right	H	L	H	L	L	↑	X	L	L	Q_{An}	Q_{Bn}	Q_{Cn}	Q_{Dn}	Q_{En}	Q_{Fn}	Q_{Gn}	L	Q_{Gn}
Shift	H	H	L	L	L	↑	H	X	Q_{Bn}	Q_{Cn}	Q_{Dn}	Q_{En}	Q_{Fn}	Q_{Gn}	Q_{Hn}	H	Q_{Bn}	H
Left	H	H	L	L	L	↑	L	X	Q_{Bn}	Q_{Cn}	Q_{Dn}	Q_{En}	Q_{Fn}	Q_{Gn}	Q_{Hn}	L	Q_{Bn}	L
Load	H	H	H	X	X	↑	X	X	a	b	c	d	e	f	g	h	a	h

NOTE: a . . . h = the level of the steady-state input at inputs A through H, respectively. This data is loaded into the flip-flops while the flip-flop outputs are isolated from the I/O terminals.

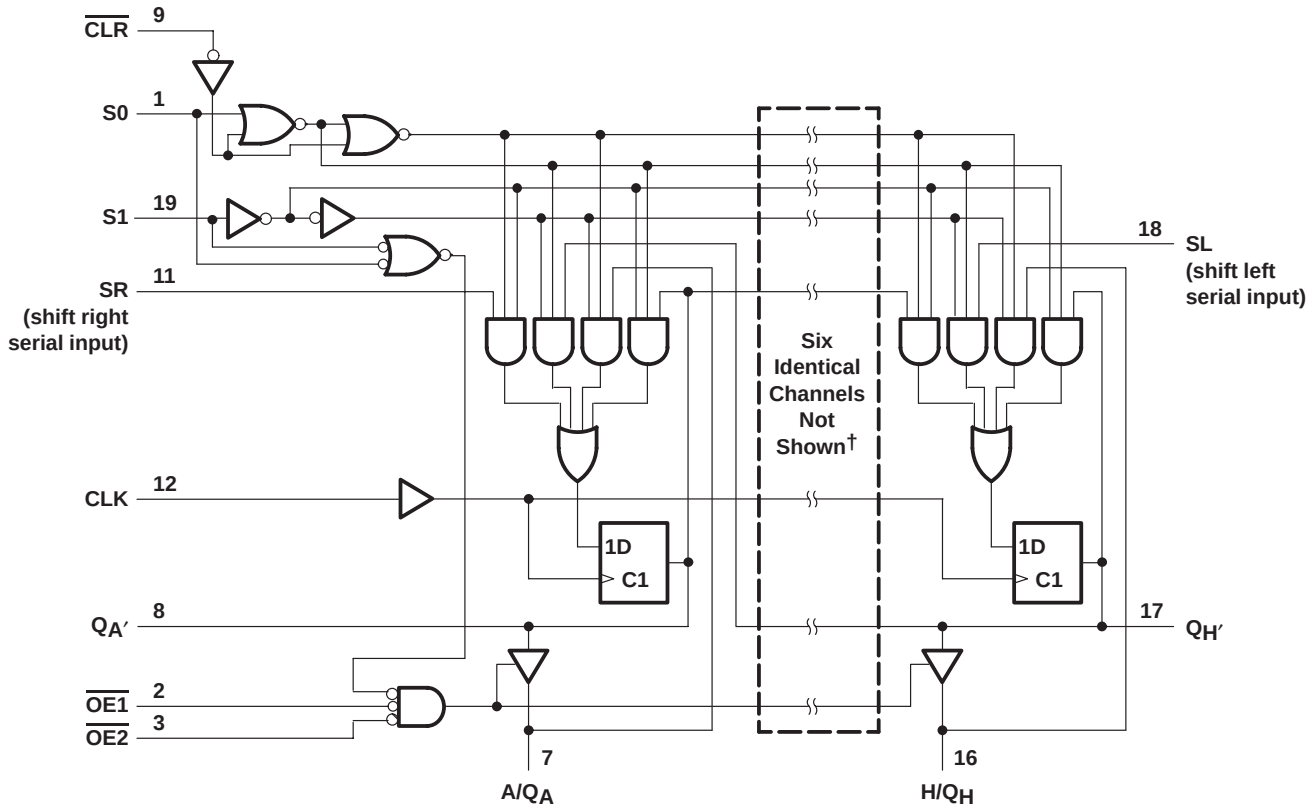
† When one or both output-enable inputs are high, the eight I/O terminals are disabled to the high-impedance state; however, sequential operation or clearing of the register is not affected.

logic symbol‡



‡ This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



† I/O ports not shown: B/Q_B (13), C/Q_C (6), D/Q_D (14), E/Q_E (5), F/Q_F (15), and G/Q_G (4).

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

Supply voltage, V_{CC} . . . . . 7 V
Input voltage, V_I: All inputs . . . . . 7 V
I/O ports . . . . . 5.5 V
Operating free-air temperature range, T_A: SN54ALS323 . . . . . −55°C to 125°C
SN74ALS323 . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

recommended operating conditions

			SN54ALS323			SN74ALS323			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage		4.5	5	5.5	4.5	5	5.5	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	$Q_{A'}$ or $Q_{H'}$			–0.4			–0.4	mA
		Q_A thru Q_H			–1			–2.6	
I_{OL}	Low-level output current	$Q_{A'}$ or $Q_{H'}$			4			8	mA
		Q_A thru Q_H			12			24	
T_A	Operating free-air temperature		–55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS		SN54ALS323			SN74ALS323			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}		V_{CC} = 4.5 V,	I_I = –18 mA			–1.5			–1.5	V
V_{OH}	Any output	V_{CC} = 4.5 V to 5.5 V,	I_{OH} = – 0.4 mA	V_{CC} –2			V_{CC} –2			V
	Q_A thru Q_H	V_{CC} = 4.5 V	I_{OH} = – 1 mA	2.4	3.3					
			I_{OH} = – 2.6 mA				2.4	3.2		
V_{OL}	$Q_{A'}$ or $Q_{H'}$	V_{CC} = 4.5 V	I_{OL} = 4 mA		0.25	0.4		0.25	0.4	V
			I_{OL} = 8 mA					0.35	0.5	
	Q_A thru Q_H	V_{CC} = 4.5 V	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	
			I_{OL} = 24 mA					0.35	0.5	
I_I	A thru H	V_{CC} = 5.5 V	V_I = 5.5 V			0.1			0.1	mA
	Any others		V_I = 7 V			0.1			0.1	
I_{IH}‡		V_{CC} = 5.5 V,	V_I = 2.7 V			20			20	µA
I_{IL}‡	S0, S1, SR, SL	V_{CC} = 5.5 V,	V_I = 0.4 V			–0.2			–0.2	mA
	Any others					–0.1			–0.1	
I_{OS}§	$Q_{A'}$ or $Q_{H'}$	V_{CC} = 5.5 V,	V_O = 2.25 V	–15		–70	–15		–70	mA
	Q_A thru Q_H			–20		–112	–30		–112	
I_{CC}		V_{CC} = 5.5 V	Outputs high		15	28		15	28	mA
			Outputs low		22	38		22	38	
			Outputs disabled		23	40		23	40	

† All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡ For I/O ports (Q_A thru Q_H), the parameters I_{IH} and I_{IL} include the off-state output current.
§ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I_{OS}.

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

				SN54ALS323		SN74ALS323		UNIT
				MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency (at 50% duty cycle)			0	17	0	17	MHz
t_w	Pulse duration	CLK high or low		22		16.5		ns
t_{su}	Setup time before CLK↑	S0 or S1		25		20		ns
		Serial or parallel data	High	18		16		
			Low	15		6		
		$\overline{CLR}$ active		25		20		
	Inactive-state setup time before CLK↑†	$\overline{CLR}$		18		16		
t_h	Hold time after CLK↑	S0 or S1		0		0		ns
		Serial or parallel data		0		0		

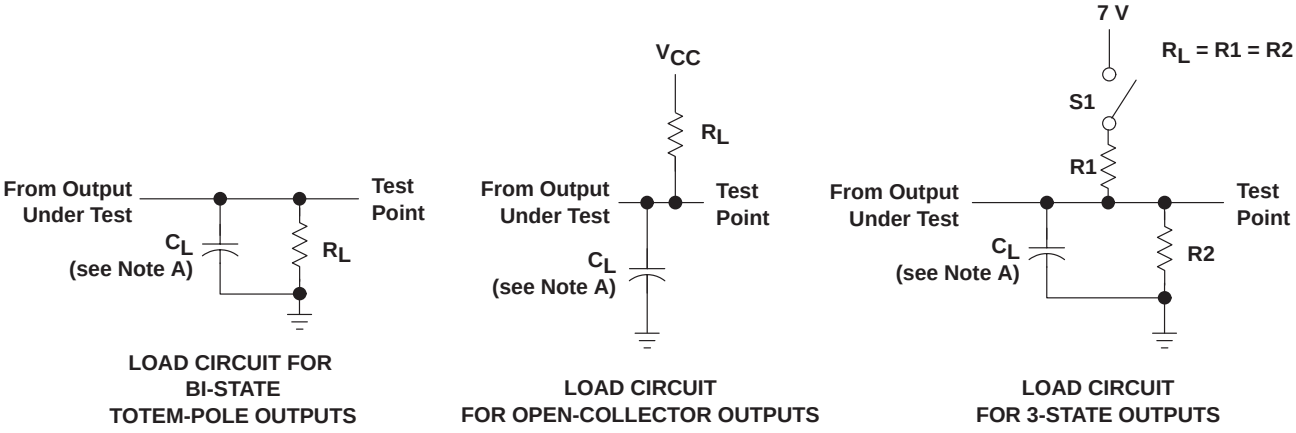
† Inactive-state setup time is also referred to as recovery time.

switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 4.5 V to 5.5 V, C_L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T_A = MIN to MAX‡				UNIT
			SN54ALS323		SN74ALS323		
			MIN	MAX	MIN	MAX	
f_{max}			17		17		MHz
t_{PLH}	CLK	Q_A thru Q_H	2	19	4	13	ns
t_{PHL}			4	25	7	19	
t_{PLH}	CLK	$Q_{A'}$ or $Q_{H'}$	2	21	5	15	ns
t_{PHL}			4	25	8	18	
t_{PZH}	$\overline{OE1}$, $\overline{OE2}$	Q_A thru Q_H	5	22	6	16	ns
t_{PZL}			6	27	8	22	
t_{PZH}	S0, S1	Q_A thru Q_H	5	27	7	17	ns
t_{PZL}			6	27	8	22	
t_{PHZ}	$\overline{OE1}$, $\overline{OE2}$	Q_A thru Q_H	1	15	1	8	ns
t_{PLZ}			4	38	5	15	
t_{PHZ}	S0, S1	Q_A thru Q_H	1	16	1	12	ns
t_{PLZ}			4	34	8	25	

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

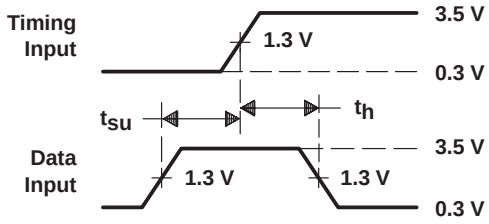
PARAMETER MEASUREMENT INFORMATION
SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



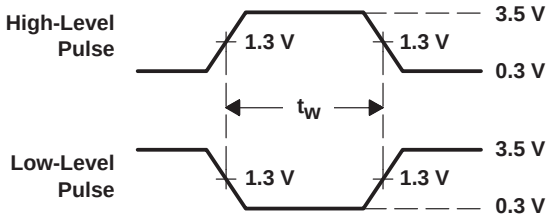
LOAD CIRCUIT FOR BI-STATE TOTEM-POLE OUTPUTS

LOAD CIRCUIT FOR OPEN-COLLECTOR OUTPUTS

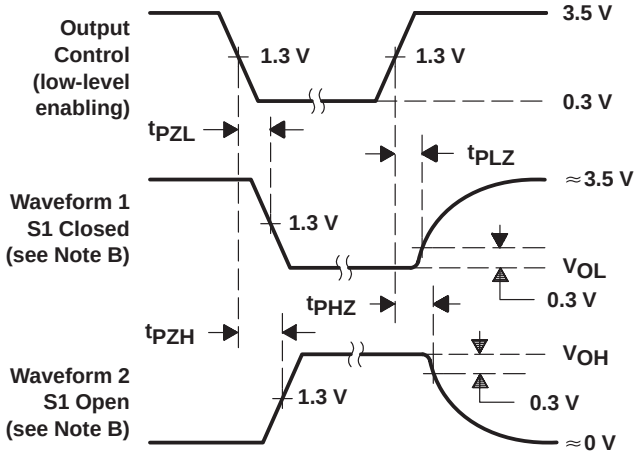
LOAD CIRCUIT FOR 3-STATE OUTPUTS



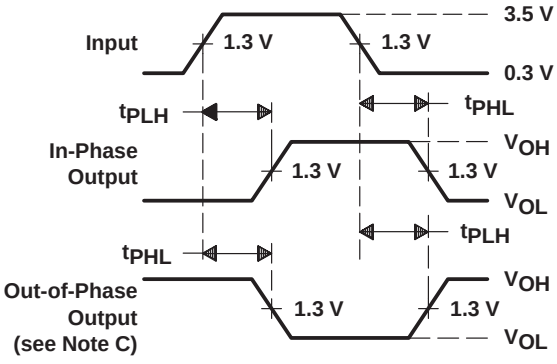
VOLTAGE WAVEFORMS SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PULSE DURATIONS



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES

NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. When measuring propagation delay items of 3-state outputs, switch S1 is open.
D. All input pulses have the following characteristics: PRR ≤ 1 MHz, $t_r = t_f = 2$ ns, duty cycle = 50%.
E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

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