

# SN54ALS323, SN74ALS323 8-BIT UNIVERSAL SHIFT/STORAGE REGISTERS WITH SYNCHRONOUS CLEAR AND 3-STATE OUTPUTS

SDAS267A – DECEMBER 1982 – REVISED DECEMBER 1994

- **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**

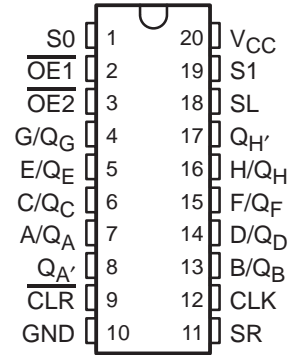
## description

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.

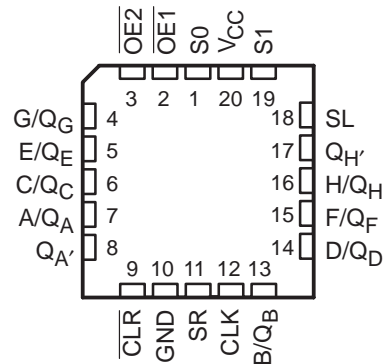
Synchronous parallel loading is accomplished by taking both S0 and S1 high. This places the 3-state outputs in the high-impedance state and permits data applied on the I/O ports to be clocked into the register. Reading out of the register can be accomplished while the outputs are enabled in any mode. 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  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS323 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

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



SN54ALS323 . . . FK PACKAGE  
(TOP VIEW)



# SN54ALS323, SN74ALS323

## 8-BIT UNIVERSAL SHIFT/STORAGE REGISTERS

### WITH SYNCHRONOUS CLEAR AND 3-STATE OUTPUTS

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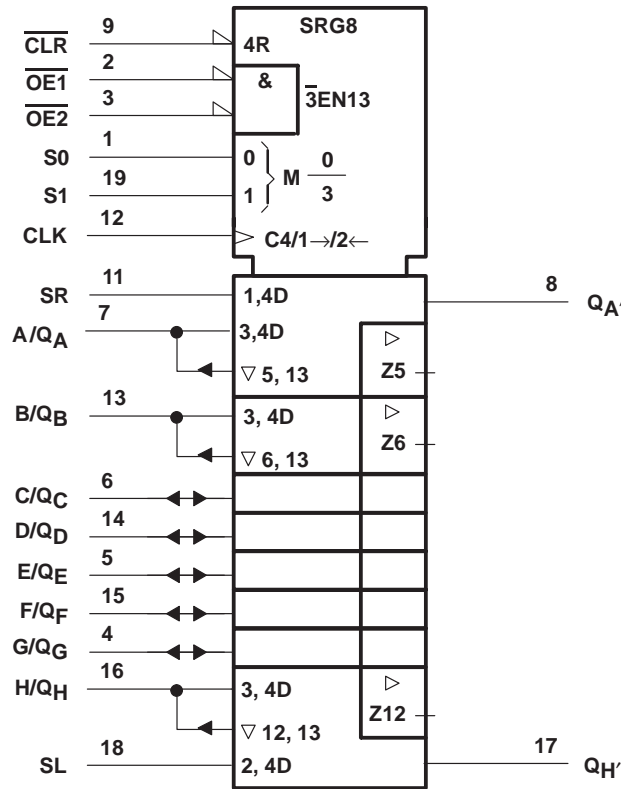
FUNCTION TABLE

MODE	INPUTS								I/O PORTS								OUTPUTS			
	CLR	S1	S0	OE1†	OE2†	CLK	SL	SR	A/QA	B/QB	C/QC	D/QD	E/QE	F/QF	G/QG	H/QH	QA'	QH'		
Clear	L	X	L	L	L	↑	X	X	L	L	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	L
	L	H	H	X	X	↑	X	X	X	X	X	X	X	X	X	X	X	X	L	L
Hold	H	L	L	L	L	X	X	X	QA0	QB0	QC0	QD0	QE0	QF0	QG0	QH0	QA0	QH0	QA0	QH0
	H	X	X	L	L	L	X	X	QA0	QB0	QC0	QD0	QE0	QF0	QG0	QH0	QA0	QH0	QA0	QH0
Shift Right	H	L	H	L	L	↑	X	H	H	QA <sub>n</sub>	QB <sub>n</sub>	QC <sub>n</sub>	QD <sub>n</sub>	QE <sub>n</sub>	QF <sub>n</sub>	QG <sub>n</sub>	H	QA <sub>n</sub>	H	QA <sub>n</sub>
	H	L	H	L	L	↑	X	L	L	QA <sub>n</sub>	QB <sub>n</sub>	QC <sub>n</sub>	QD <sub>n</sub>	QE <sub>n</sub>	QF <sub>n</sub>	QG <sub>n</sub>	L	QA <sub>n</sub>	L	QA <sub>n</sub>
Shift Left	H	H	L	L	L	↑	H	X	QB <sub>n</sub>	QC <sub>n</sub>	QD <sub>n</sub>	QE <sub>n</sub>	QF <sub>n</sub>	QG <sub>n</sub>	QH <sub>n</sub>	H	QB <sub>n</sub>	H	QB <sub>n</sub>	QB <sub>n</sub>
	H	H	L	L	L	↑	L	X	QB <sub>n</sub>	QC <sub>n</sub>	QD <sub>n</sub>	QE <sub>n</sub>	QF <sub>n</sub>	QG <sub>n</sub>	QH <sub>n</sub>	L	QB <sub>n</sub>	L	QB <sub>n</sub>	QB <sub>n</sub>
Load	H	H	H	X	X	↑	X	X	a	b	c	d	e	f	g	h	a	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‡

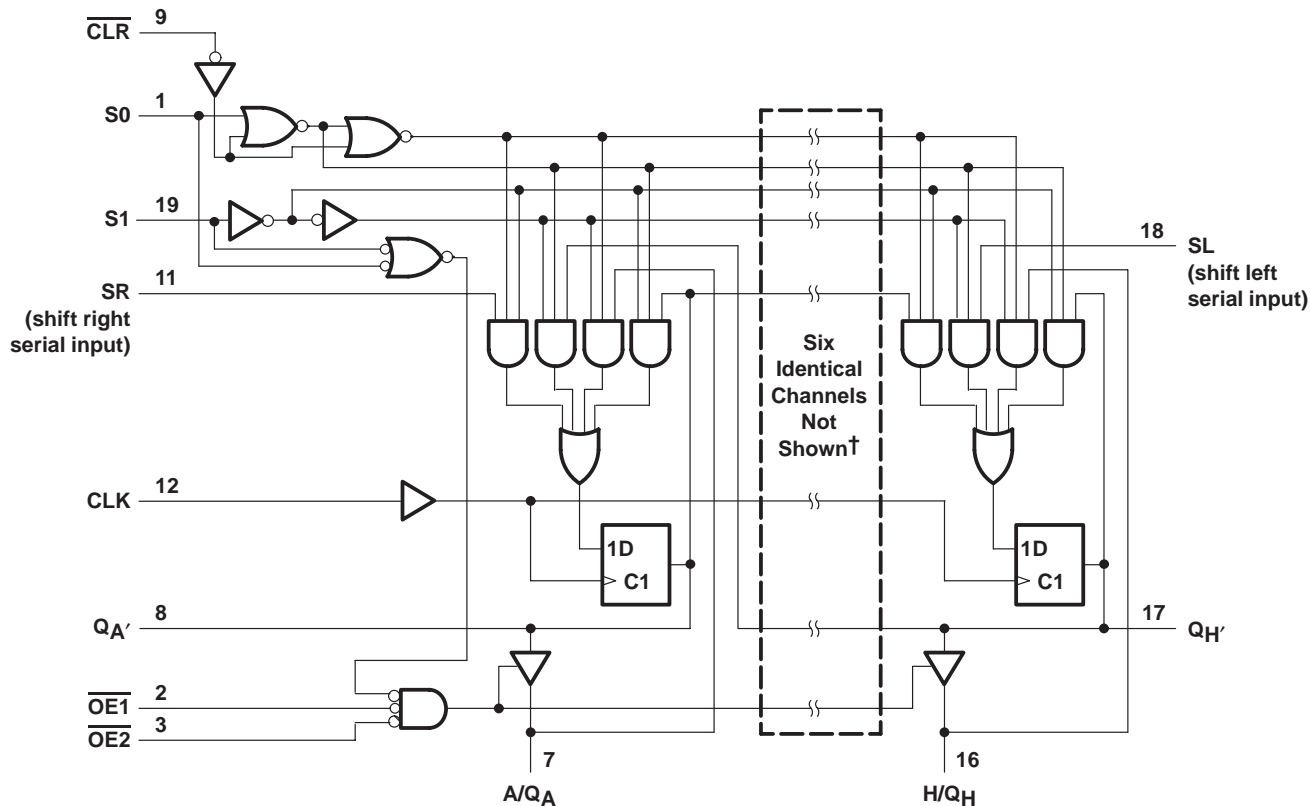


‡ This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

**SN54ALS323, SN74ALS323**  
**8-BIT UNIVERSAL SHIFT/STORAGE REGISTERS**  
**WITH SYNCHRONOUS CLEAR AND 3-STATE OUTPUTS**

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**logic diagram (positive logic)**



† I/O ports not shown: B/Q<sub>B</sub> (13), C/Q<sub>C</sub> (6), D/Q<sub>D</sub> (14), E/Q<sub>E</sub> (5), F/Q<sub>F</sub> (15), and G/Q<sub>G</sub> (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.

# SN54ALS323, SN74ALS323

## 8-BIT UNIVERSAL SHIFT/STORAGE REGISTERS

### WITH SYNCHRONOUS CLEAR AND 3-STATE OUTPUTS

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

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

‡ 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,  $I_{OS}$ .

# SN54ALS323, SN74ALS323 8-BIT UNIVERSAL SHIFT/STORAGE REGISTERS WITH SYNCHRONOUS CLEAR AND 3-STATE OUTPUTS

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

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

$\dagger$  Inactive-state setup time is also referred to as recovery time.

## switching characteristics (see Figure 1)

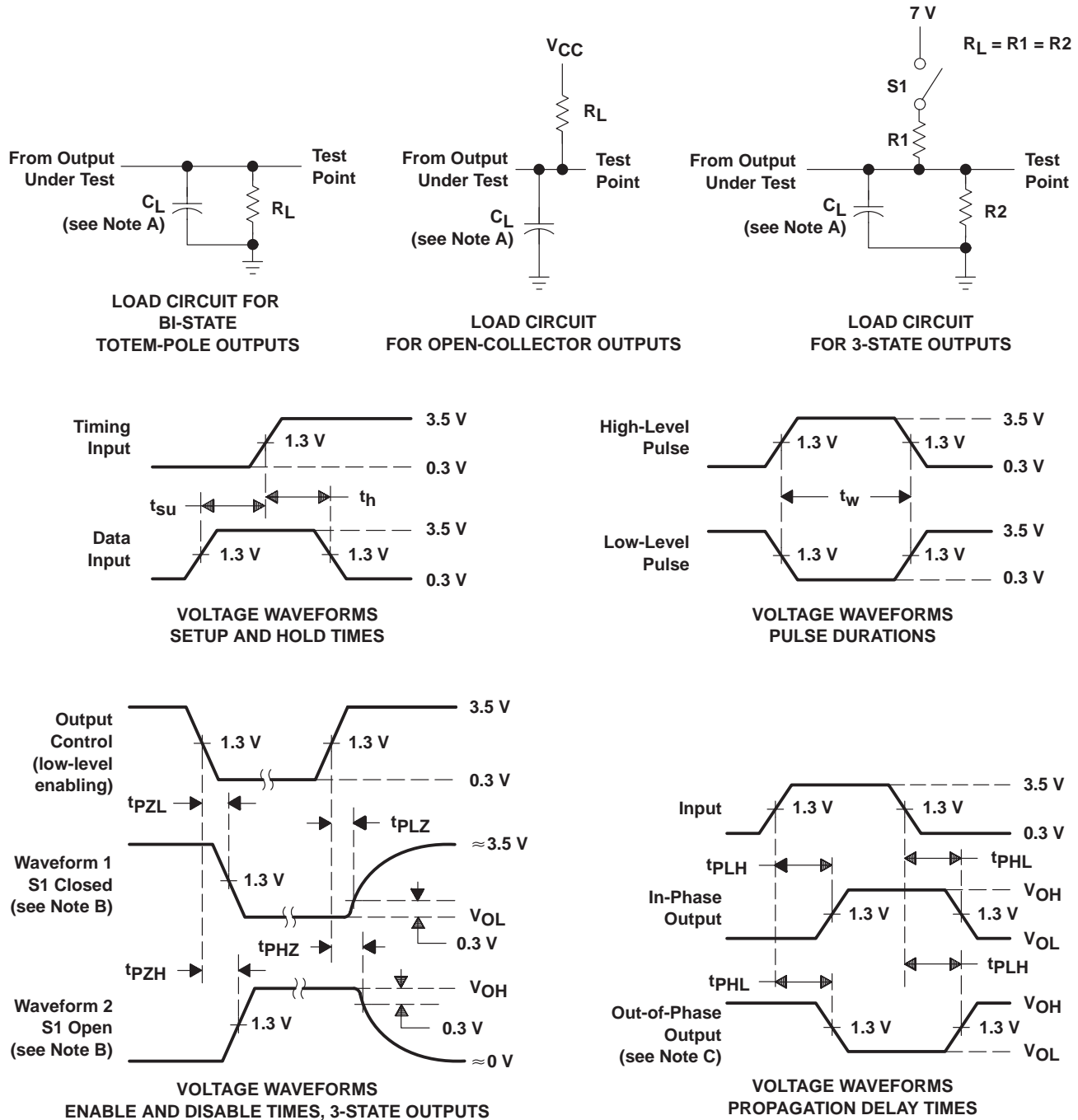
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>1</sub> = 500 $\Omega$ , R <sub>2</sub> = 500 $\Omega$ , T <sub>A</sub> = MIN to MAX $\ddagger$				UNIT
			SN54ALS323		SN74ALS323		
			MIN	MAX	MIN	MAX	
$f_{\text{max}}$			17		17	MHz	
$t_{\text{PLH}}$	CLK	Q <sub>A</sub> thru Q <sub>H</sub>	2	19	4	13	ns
$t_{\text{PHL}}$			4	25	7	19	
$t_{\text{PLH}}$	CLK	Q <sub>A'</sub> or Q <sub>H'</sub>	2	21	5	15	ns
$t_{\text{PHL}}$			4	25	8	18	
$t_{\text{PZH}}$	$\overline{\text{OE}}1, \overline{\text{OE}}2$	Q <sub>A</sub> thru Q <sub>H</sub>	5	22	6	16	ns
$t_{\text{PZL}}$			6	27	8	22	
$t_{\text{PZH}}$	S0, S1	Q <sub>A</sub> thru Q <sub>H</sub>	5	27	7	17	ns
$t_{\text{PZL}}$			6	27	8	22	
$t_{\text{PHZ}}$	$\overline{\text{OE}}1, \overline{\text{OE}}2$	Q <sub>A</sub> thru Q <sub>H</sub>	1	15	1	8	ns
$t_{\text{PLZ}}$			4	38	5	15	
$t_{\text{PHZ}}$	S0, S1	Q <sub>A</sub> thru Q <sub>H</sub>	1	16	1	12	ns
$t_{\text{PLZ}}$			4	34	8	25	

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

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**WITH SYNCHRONOUS CLEAR AND 3-STATE OUTPUTS**

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



- 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:  $PRR \leq 1$  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**

PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
83021022A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
8302102RA	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
8302102SA	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
SN54ALS323J	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SN74ALS323DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS323DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS323DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS323DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS323DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS323DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS323N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS323N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74ALS323NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS323NSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS323NSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS323NSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54ALS323FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54ALS323J	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ54ALS323W	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**TAPE AND REEL INFORMATION**



**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ALS323DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74ALS323NSR	SO	NS	20	2000	330.0	24.4	8.2	13.0	2.5	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALS323DWR	SOIC	DW	20	2000	346.0	346.0	41.0
SN74ALS323NSR	SO	NS	20	2000	346.0	346.0	41.0

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

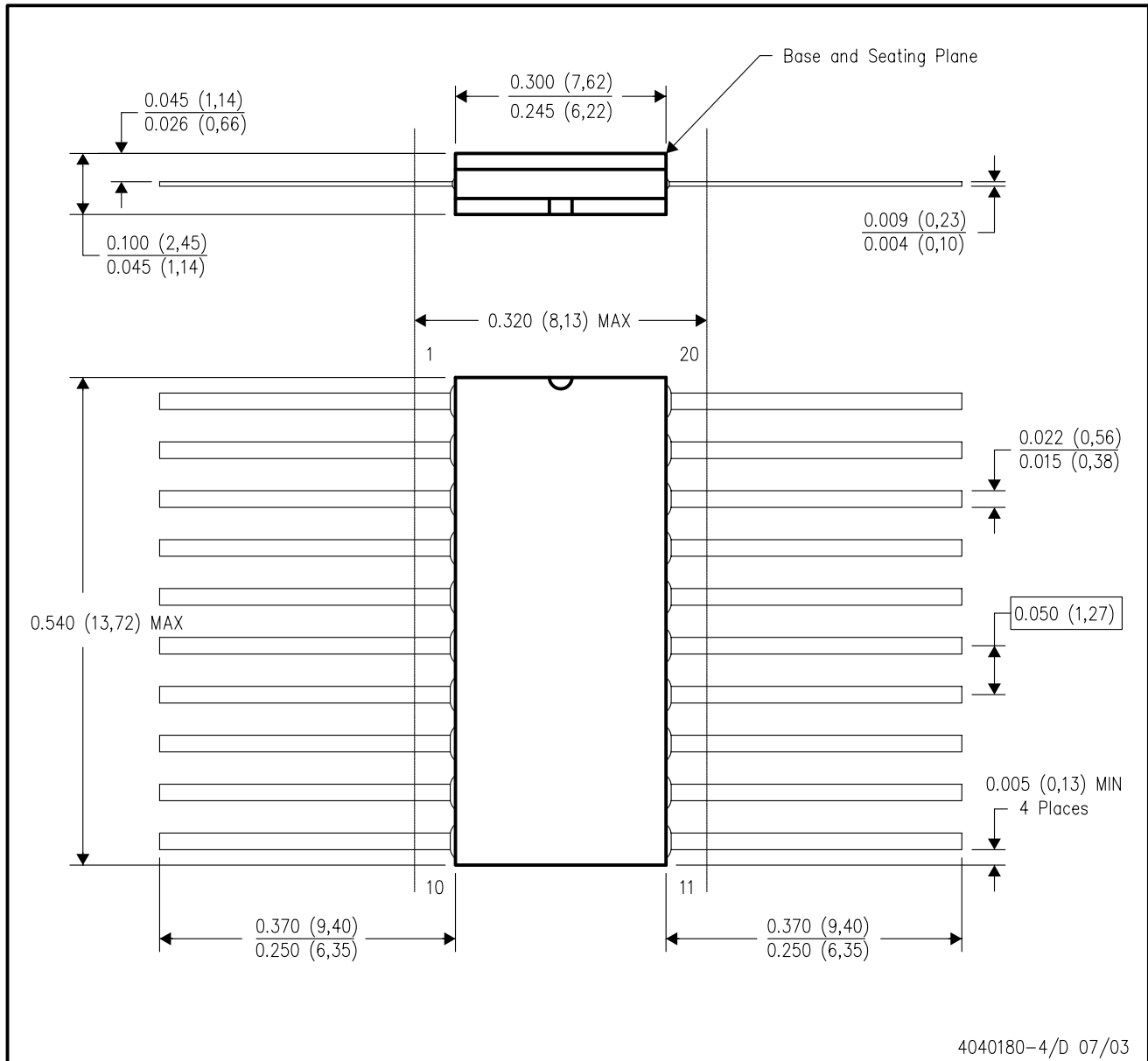


4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package is hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F20)

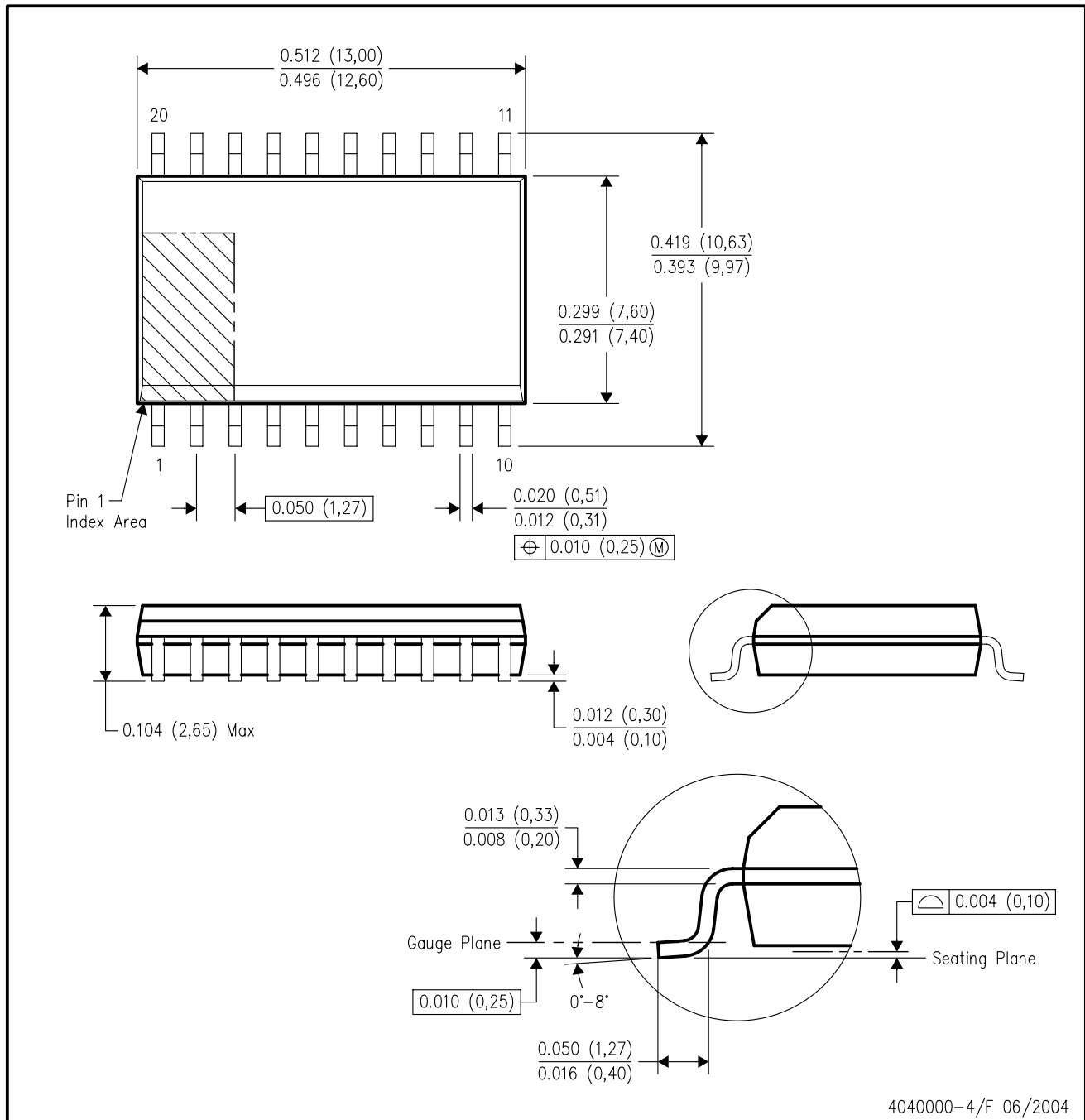
CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within Mil-Std 1835 GDFP2-F20

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AC.

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - D The 20 pin end lead shoulder width is a vendor option, either half or full width.



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