

# 9-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS231A – JUNE 1984 – REVISED AUGUST 1995

- Functionally Equivalent to AMD's AM29823 and AM29824
- Provide Extra Data Width Necessary for Wider Address/Data Paths or Buses With Parity
- Outputs Have Undershoot-Protection Circuitry
- Power-Up High-Impedance State
- Buffered Control Inputs to Reduce dc Loading Effects
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (NT) and Ceramic (JT) 300-mil DIPs

## description

These 9-bit flip-flops feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. These devices are particularly suitable for implementing wider buffer registers, I/O ports, bidirectional bus drivers, parity bus interfacing, and working registers.

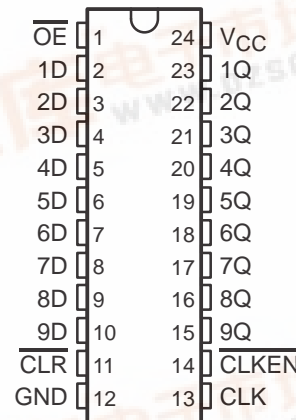
With the clock-enable ( $\overline{\text{CLKEN}}$ ) input low, the nine D-type edge-triggered flip-flops enter data on the low-to-high transitions of the clock (CLK) input. Taking  $\overline{\text{CLKEN}}$  high disables the clock buffer, latching the outputs. The SN54AS823A and SN74AS823A have noninverting data (D) inputs and the SN74AS824A has inverting ( $\overline{\text{D}}$ ) inputs. Taking the clear (CLR) input low causes the nine Q outputs to go low independently of the clock.

A buffered output-enable ( $\overline{\text{OE}}$ ) input can be used to place the nine outputs in either a normal logic state (high or low logic level) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without interface or pullup components.

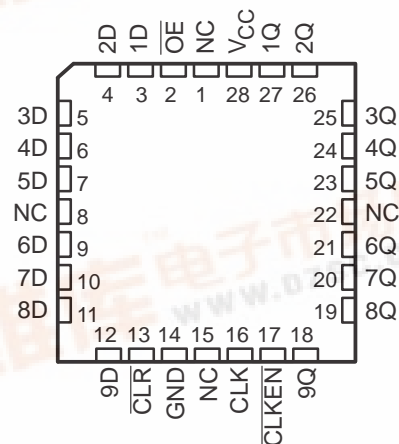
$\overline{\text{OE}}$  does not affect the internal operation of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54AS823A is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74AS823A and SN74AS824A are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

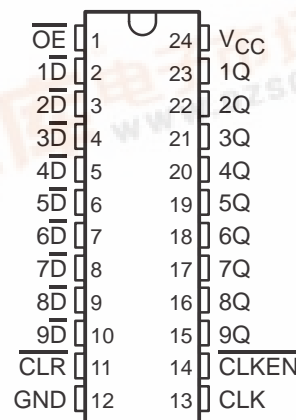
SN54AS823A ... JT PACKAGE  
SN74AS823A ... DW OR NT PACKAGE  
(TOP VIEW)



SN54AS823A ... FK PACKAGE  
(TOP VIEW)



SN74AS824A ... DW OR NT PACKAGE  
(TOP VIEW)



NC – No internal connection



# SN54AS823A, SN74AS823A, SN74AS824A

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#### Function Tables

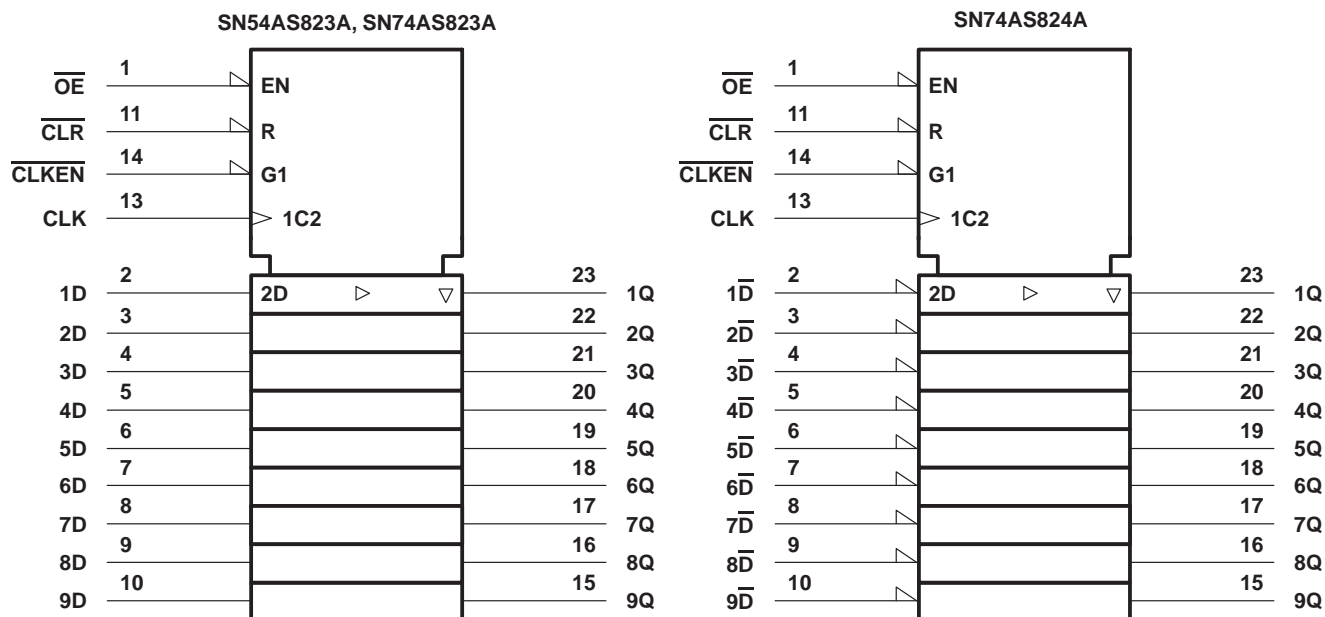
SN54AS823A, SN74AS823A  
(each flip-flop)

INPUTS					OUTPUT Q
$\overline{\text{OE}}$	$\overline{\text{CLR}}$	$\overline{\text{CLKEN}}$	CLK	D	
L	L	X	X	X	L
L	H	L	$\uparrow$	H	H
L	H	L	$\uparrow$	L	L
L	H	H	X	X	$Q_0$
H	X	X	X	X	Z

SN74AS824A  
(each flip-flop)

INPUTS					OUTPUT Q
$\overline{\text{OE}}$	$\overline{\text{CLR}}$	$\overline{\text{CLKEN}}$	CLK	$\overline{\text{D}}$	
L	L	X	X	X	L
L	H	L	$\uparrow$	H	L
L	H	L	$\uparrow$	L	H
L	H	H	X	X	$Q_0$
H	X	X	X	X	Z

#### logic symbols†



† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.  
Pin numbers shown are for the DW, JT, and NT packages.

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Pin numbers shown are for the DW, JT, and NT packages.



# SN54AS823A, SN74AS823A, SN74AS824A

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#### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Supply voltage, $V_{CC}$	7 V
Input voltage, $V_I$	7 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, $T_A$ : SN54AS823A	–55°C to 125°C
SN74AS823A, SN74AS824A	0°C to 70°C
Storage temperature range	–65°C to 150°C

<sup>†</sup> 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

			SN54AS823A			SN74AS823A SN74AS824A			UNIT		
			MIN	NOM	MAX	MIN	NOM	MAX			
V <sub>CC</sub>	Supply voltage		4.5	5	5.5	4.5	5	5.5	V		
V <sub>IH</sub>	High-level input voltage		2			2			V		
V <sub>IL</sub>	Low-level input voltage		0.8			0.8			V		
I <sub>OH</sub>	High-level output current		−24			−24			mA		
I <sub>OL</sub>	Low-level output current		32			48			mA		
t <sub>w</sub> <sup>*</sup>	Pulse duration	CL <sub>R</sub> low	7.5			6.5			ns		
		CLK high or low	9.5			8					
t <sub>su</sub> <sup>*</sup>	Setup time before CLK↑	CL <sub>R</sub> high	8			8			ns		
		Data	7			6					
		CL <sub>KEN</sub> high or low	8.5			7.5					
t <sub>h</sub> <sup>*</sup>	Hold time after CLK↑	CL <sub>KEN</sub> low	0			0			ns		
T <sub>A</sub>	Operating free-air temperature		−55			125			0	70	°C

\* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.

# SN54AS823A, SN74AS823A, SN74AS824A

## 9-BIT BUS-INTERFACE FLIP-FLOPS

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

PARAMETER		TEST CONDITIONS	SN54AS823A			SN74AS823A SN74AS824A			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
$V_{IK}$		$V_{CC} = 4.5 \text{ V}$ , $I_I = -18 \text{ mA}$			-1.2			-1.2	V
$V_{OH}$		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$ , $I_{OH} = -2 \text{ mA}$	$V_{CC} - 2$			$V_{CC} - 2$			V
		$V_{CC} = 4.5 \text{ V}$ , $I_{OH} = -15 \text{ mA}$	2.4	3.2		2.4	3.2		
		$V_{CC} = 4.5 \text{ V}$ , $I_{OH} = -24 \text{ mA}$	2			2			
$V_{OL}$		$V_{CC} = 4.5 \text{ V}$ , $I_{OL} = 32 \text{ mA}$		0.3	0.5				V
		$V_{CC} = 4.5 \text{ V}$ , $I_{OL} = 48 \text{ mA}$				0.35	0.5		
$I_{OZH}$		$V_{CC} = 5.5 \text{ V}$ , $V_O = 2.7 \text{ V}$			50			50	$\mu\text{A}$
$I_{OZL}$		$V_{CC} = 5.5 \text{ V}$ , $V_I = 0.4 \text{ V}$			-50			-50	$\mu\text{A}$
$I_I$		$V_{CC} = 5.5 \text{ V}$ , $V_I = 7 \text{ V}$			0.1			0.1	mA
$I_{IH}$		$V_{CC} = 5.5 \text{ V}$ , $V_I = 2.7 \text{ V}$			20			20	$\mu\text{A}$
$I_{IL}$		$V_{CC} = 5.5 \text{ V}$ , $V_I = 0.4 \text{ V}$			-0.5			-0.5	mA
$I_{O\ddagger}$		$V_{CC} = 5.5 \text{ V}$ , $V_O = 2.25 \text{ V}$	-30		-112	-30		-112	mA
$I_{CC}$	SN54AS823A, SN74AS823A	$V_{CC} = 5.5 \text{ V}$	Outputs high		49	80	49	80	mA
			Outputs low		61	100	61	100	
			Outputs disabled		64	103	64	103	
	SN74AS824A	$V_{CC} = 5.5 \text{ V}$	Outputs high		49	80	49	80	
			Outputs low		61	100	61	100	
			Outputs disabled		64	103	64	103	

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

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

switching characteristics (see Figure 1)

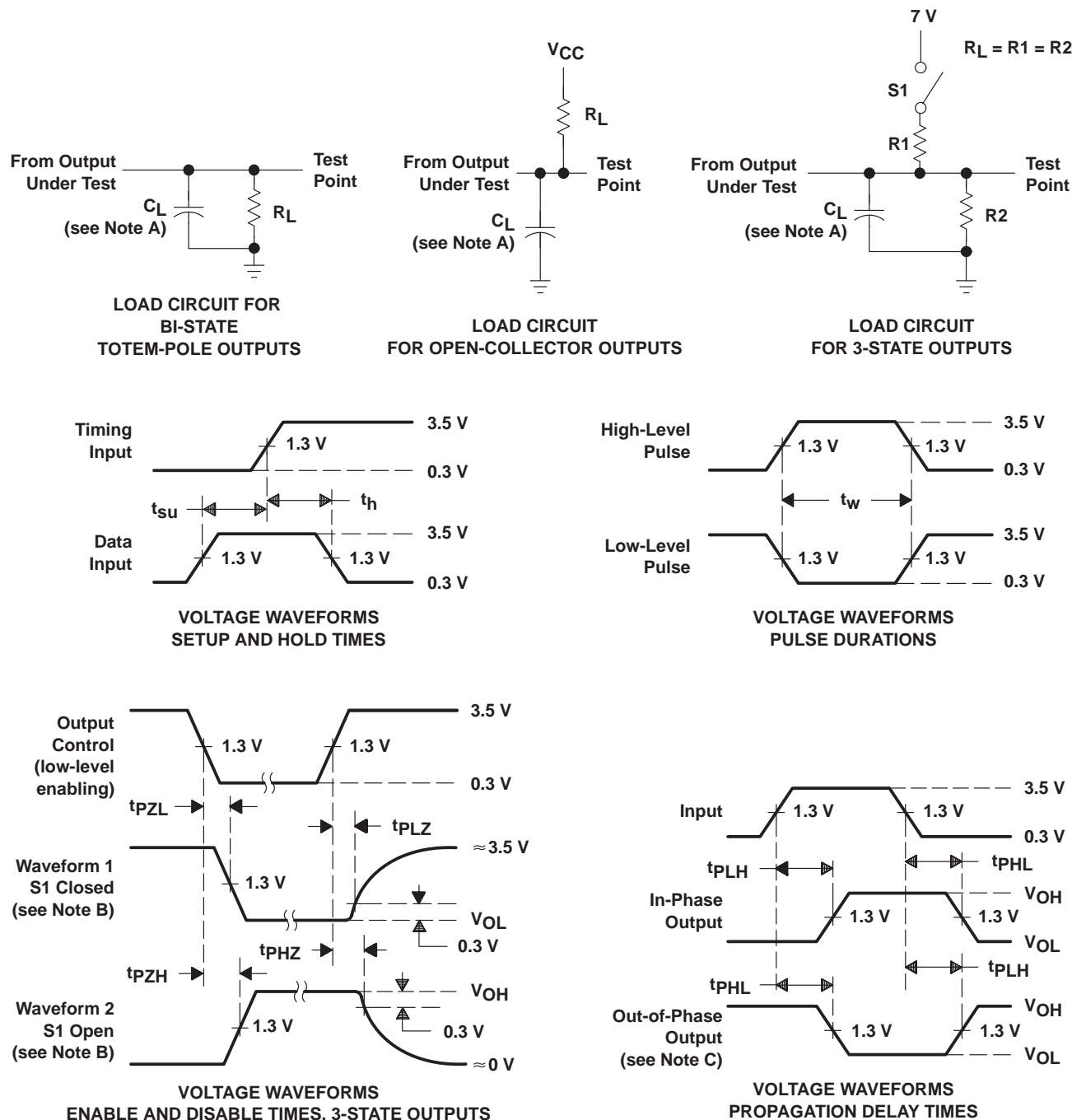
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>1</sub> = 500 Ω, R <sub>2</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX§				UNIT
			SN54AS823A		SN74AS823A SN74AS824A		
			MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	CLK	Any Q	3.5	9	3.5	7.5	ns
t <sub>PHL</sub>			3.5	14	3.5	13	
t <sub>PHL</sub>	CLR	Any Q	3.5	16.5	3.5	15.5	ns
t <sub>PZH</sub>	OE	Any Q	4	12	4	11	ns
t <sub>PZL</sub>			4	13	4	12	
t <sub>PHZ</sub>	OE	Any Q	1	10	1	8	ns
t <sub>PLZ</sub>			1	10	1.5	8	

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

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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

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