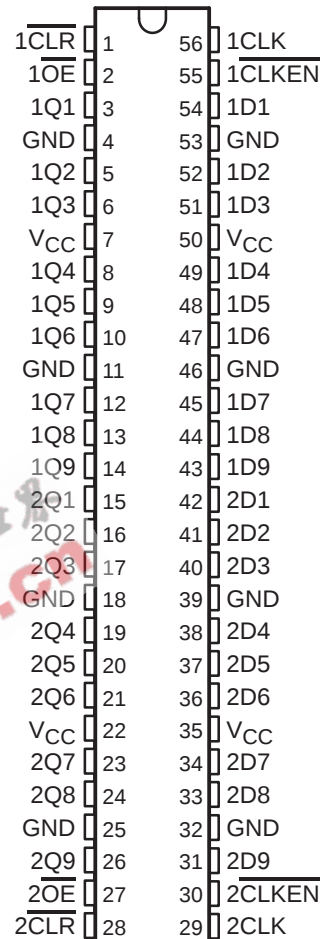


SN54ABT162823A, SN74ABT162823A 18-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

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- Members of the Texas Instruments *Widebus™* Family
- Output Ports Have Equivalent 25-Ω Series Resistors So No External Resistors Are Required
- State-of-the-Art *EPIC-II[™]* BiCMOS Design Significantly Reduces Power Dissipation
- High-Impedance State During Power Up and Power Down
- Typical V_{OLP} (Output Ground Bounce) < 1 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise
- Flow-Through Architecture Optimizes PCB Layout
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) Package and 380-mil Fine-Pitch Ceramic Flat (WD) Package Using 25-mil Center-to-Center Spacings

SN54ABT162823A ... WD PACKAGE
SN74ABT162823A ... DL PACKAGE
(TOP VIEW)



description

These 18-bit bus-interface flip-flops feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing wider buffer registers, I/O ports, bidirectional bus drivers with parity, and working registers.

The 'ABT162823A can be used as two 9-bit flip-flops or one 18-bit flip-flop. With the clock-enable ($\overline{\text{CLKEN}}$) input low, the D-type flip-flops enter data on the low-to-high transitions of the clock. Taking $\overline{\text{CLKEN}}$ high disables the clock buffer, thus latching the outputs. Taking the clear ($\overline{\text{CLR}}$) input low causes the Q outputs to go low independently of the clock.

A buffered output-enable ($\overline{\text{OE}}$) input places the nine outputs in either a normal logic state (high or low level) or a 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 outputs, which are designed to source or sink up to 12 mA, include equivalent 25-Ω series resistors to reduce overshoot and undershoot.



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SN54ABT162823A, SN74ABT162823A

18-BIT BUS-INTERFACE FLIP-FLOPS

WITH 3-STATE OUTPUTS

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description (continued)

When V_{CC} is between 0 and 2.1 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 2.1 V, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The SN54ABT162823A is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABT162823A is characterized for operation from -40°C to 85°C .

FUNCTION TABLE
(each 9-bit flip-flop)

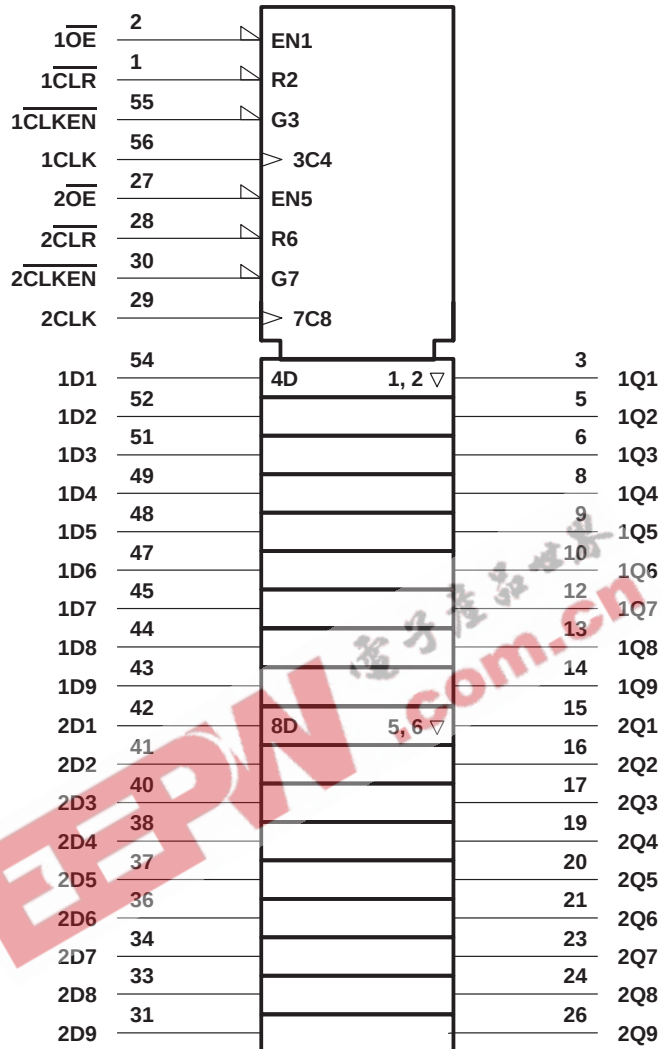
INPUTS					OUTPUT
$\overline{OE}$	$\overline{CLR}$	$\overline{CLKEN}$	CLK	D	Q
L	L	X	X	X	L
L	H	L	$\uparrow$	H	H
L	H	L	$\uparrow$	L	L
L	H	L	L	X	Q_0
L	H	H	X	X	Q_0
H	X	X	X	X	Z

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logic symbol[†]



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

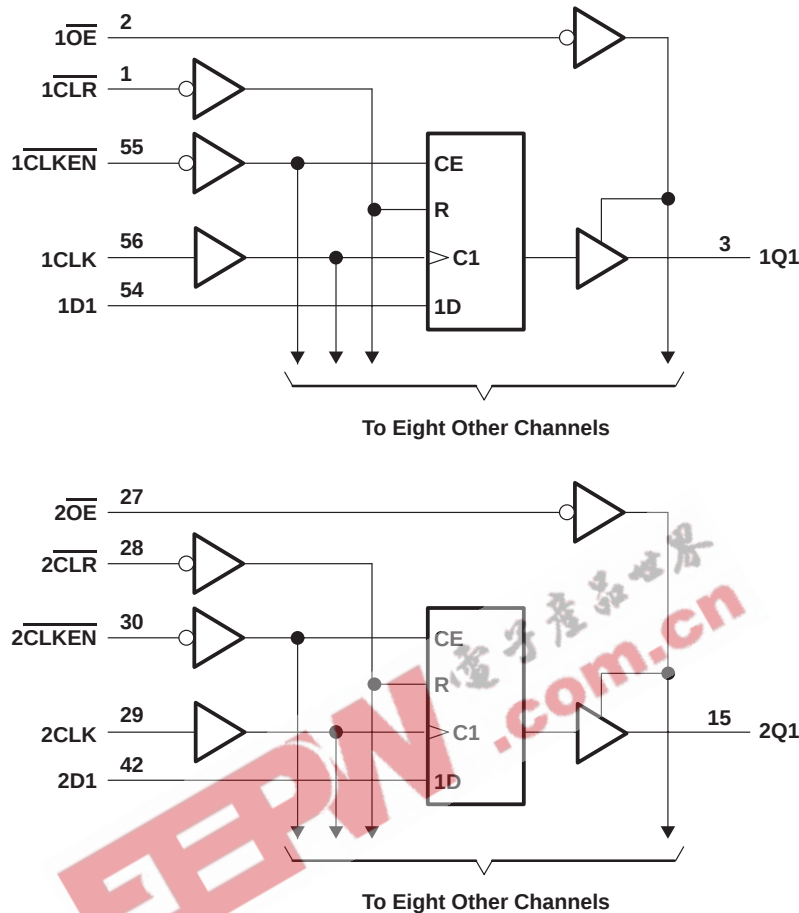
SN54ABT162823A, SN74ABT162823A

18-BIT BUS-INTERFACE FLIP-FLOPS

WITH 3-STATE OUTPUTS

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logic diagram (positive logic)



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

Supply voltage range, V_{CC}	–0.5 V to 7 V
Input voltage range, V_I (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high or power-off state, V_O	–0.5 V to 5.5 V
Current into any output in the low state, I_O	30 mA
Input clamp current, I_{IK} ($V_I < 0$)	–18 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Package thermal impedance, θ_{JA} (see Note 2): DL package	74°C/W
Storage temperature range, T_{Stg}	–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.

- NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. The package thermal impedance is calculated in accordance with JEDEC 51, except through-hole packages, which use a trace length of zero.

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18-BIT BUS-INTERFACE FLIP-FLOPS

WITH 3-STATE OUTPUTS

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recommended operating conditions (see Note 3)

		SN54ABT162823A		SN74ABT162823A		UNIT
		MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage	4.5	5.5	4.5	5.5	V
V _{IH}	High-level input voltage	2		2		V
V _{IL}	Low-level input voltage		0.8		0.8	V
V _I	Input voltage	0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current		–12		–12	mA
I _{OL}	Low-level output current		12		12	mA
Δt/Δv	Input transition rise or fall rate	Outputs enabled		10	10	ns/V
Δt/ΔV _{CC}	Input transition rise or fall rate	200		200		μs/V
T _A	Operating free-air temperature	–55	125	–40	85	°C

NOTE 3: Unused inputs must be held high or low to prevent them floating.

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

PARAMETER	TEST CONDITIONS		T _A = 25°C			SN54ABT162823A		SN74ABT162823A		UNIT
			MIN	TYP†	MAX	MIN	MAX	MIN	MAX	
V _{IK}	V _{CC} = 4.5 V, I _I = –18 mA		–1.2			–1.2		–1.2		V
V _{OH}	V _{CC} = 4.5 V, I _{OH} = –1 mA		2.5			2.5		2.5		V
	V _{CC} = 5 V, I _{OH} = –1 mA		3			3		3		
	V _{CC} = 4.5 V	I _{OH} = –3 mA	2.4			2.4		2.4		
		I _{OH} = –12 mA	2*					2		
V _{OL}	V _{CC} = 4.5 V		0.4 0.8			0.8		0.65		V
								0.8		
I _I	V _{CC} = 5.5 V, V _I = V _{CC} or GND		±1			±1		±1		μA
I _{OZPU}	V _{CC} = 0 to 2.1 V, V _O = 0.5 V to 2.7 V, $\overline{OE}$ = X		±50			±50		±50		μA
I _{OZPD}	V _{CC} = 2.1 V to 0, V _O = 0.5 V to 2.7 V, $\overline{OE}$ = X		±50			±50		±50		μA
I _{OZH} ‡	V _{CC} = 5.5 V, V _O = 2.7 V		10			10		10		μA
I _{OZL} ‡	V _{CC} = 5.5 V, V _O = 0.5 V		–10			–10		–10		μA
I _{off}	V _{CC} = 0, V _I or V _O ≤ 4.5 V		±100					±100		μA
I _{CEX}	V _{CC} = 5.5 V, V _O = 5.5 V	Outputs high	50			50		50		μA
I _O §	V _{CC} = 5.5 V, V _O = 2.5 V		–25	–55	–100	–25	–100	–25	–100	mA
I _{CC}	V _{CC} = 5.5 V, I _O = 0, V _I = V _{CC} or GND	Outputs high	0.5			0.5		0.5		mA
		Outputs low	80			80		80		
		Outputs disabled	0.5			0.5		0.5		
ΔI _{CC} ¶	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND		1.5			1.5		1.5		mA
C _i	V _I = 2.5 V or 0.5 V		3.5							pF
C _O	V _O = 2.5 V or 0.5 V		9							pF

* On products compliant to MIL-PRF-38535, this parameter does not apply.

† All typical values are at V_{CC} = 5 V.

‡ The parameters I_{OZH} and I_{OZL} include the input leakage current.

§ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

¶ This is the increase in supply current for each input that is at the specified TTL-voltage level rather than V_{CC} or GND.

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timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

			V _{CC} = 5 V, T _A = 25°C		SN54ABT162823A		SN74ABT162823A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency		0	150	0	150	0	150	MHz
t _w	Pulse duration	CLR low	3.3		3.3		3.3		ns
		CLK high or low	3.3		3.3		3.3		
t _{su}	Setup time before CLK↑	CLR inactive	1.6		2		1.6		ns
		Data	2		2		2		
		CLKEN low	2.8		2.8		2.8		
t _h	Hold time after CLK↑	Data	1.2		1.2		1.2		ns
		CLKEN low	0.6		0.6		0.6		

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 5 V, T _A = 25°C			SN54ABT162823A		SN74ABT162823A		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f _{max}			150			150		150		MHz
t _{PLH}	CLK	Q	2.3	4.6	6.2	2.3	8.4	2.3	7.5	ns
t _{PHL}			2.8	4.6	6.1	2.8	7.1	2.8	6.7	
t _{PHL}	CLR	Q	2.8	5	6.3	2.8	7.2	2.8	7	ns
t _{PZH}	OE	Q	1.7	3.8	5	1.7	5.8	1.7	5.9	ns
t _{PZL}			3	5	6.1	3	7.2	3	7	
t _{PHZ}	OE	Q	2.6	4.8	6.1	2.6	7.3	2.6	6.6	ns
t _{PLZ}			1.9	4.6	6.7	1.9	10.2	1.9	9	

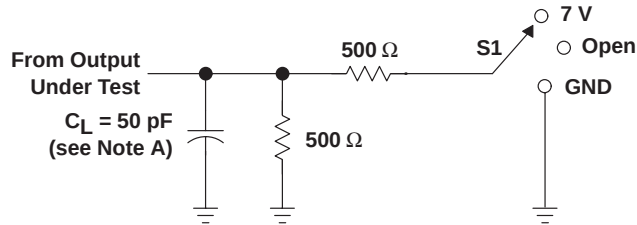
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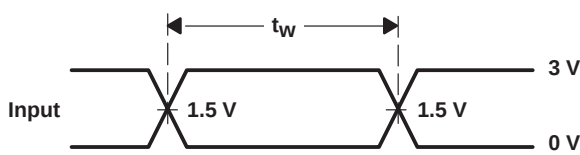
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PARAMETER MEASUREMENT INFORMATION

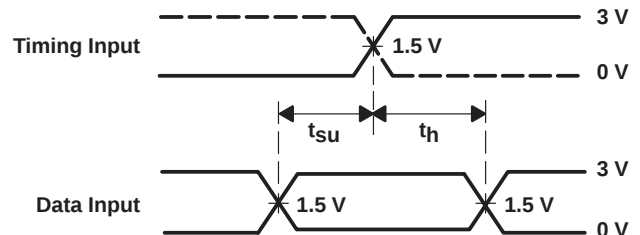


LOAD CIRCUIT

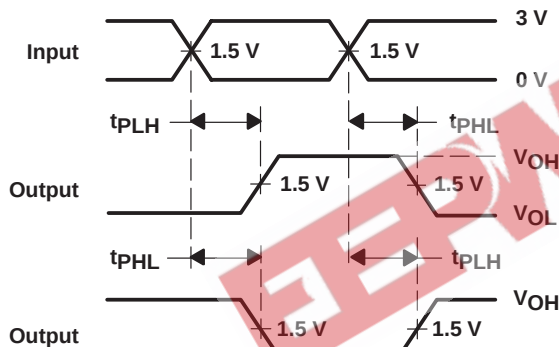
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



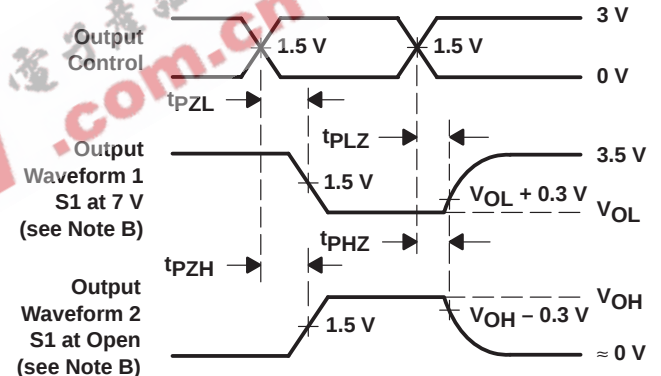
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- 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. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
- D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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