

# SN54ABT16843, SN74ABT16843 18-BIT BUS-INTERFACE D-TYPE LATCHES WITH 3-STATE OUTPUTS

SCBS223E – OCTOBER 1992 – REVISED MAY 1997

- Members of the Texas Instruments *Widebus™* Family
- State-of-the-Art *EPIC-II B™* BiCMOS Design Significantly Reduces Power Dissipation
- Distributed  $V_{CC}$  and GND Pin Configuration Minimizes High-Speed Switching Noise
- Flow-Through Architecture Optimizes PCB Layout
- High-Impedance State During Power Up and Power Down
- High-Drive Outputs ( $-32\text{-mA } I_{OH}$ ,  $64\text{-mA } I_{OL}$ )
- Package Options Include Plastic Thin Shrink Small-Outline (DGG), 300-mil Shrink Small-Outline (DL) Packages and 380-mil Fine-Pitch Ceramic Flat (WD) Package Using 25-mil Center-to-Center Spacings

## description

The 'ABT16843 18-bit bus-interface D-type latches are designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The 'ABT16843 can be used as two 9-bit latches or one 18-bit latch. The 18 latches are transparent D-type latches. The device provides true data at its outputs.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the nine outputs in either a normal logic state (high or low logic levels) or a high-impedance state. The outputs are in the high-impedance state during power up and power down. The outputs remain in the high-impedance state while the device is powered down. 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 need for interface or pullup components.

SN54ABT16843 . . . WD PACKAGE  
SN74ABT16843 . . . DGG OR DL PACKAGE  
(TOP VIEW)

1CLR	1	56	1LE
1OE	2	55	1PRE
1Q1	3	54	1D1
GND	4	53	GND
1Q2	5	52	1D2
1Q3	6	51	1D3
V <sub>CC</sub>	7	50	V <sub>CC</sub>
1Q4	8	49	1D4
1Q5	9	48	1D5
1Q6	10	47	1D6
GND	11	46	GND
1Q7	12	45	1D7
1Q8	13	44	1D8
1Q9	14	43	1D9
2Q1	15	42	2D1
2Q2	16	41	2D2
2Q3	17	40	2D3
GND	18	39	GND
2Q4	19	38	2D4
2Q5	20	37	2D5
2Q6	21	36	2D6
V <sub>CC</sub>	22	35	V <sub>CC</sub>
2Q7	23	34	2D7
2Q8	24	33	2D8
GND	25	32	GND
2Q9	26	31	2D9
2OE	27	30	2PRE
2CLR	28	29	2LE



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**TEXAS  
INSTRUMENTS**

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## 18-BIT BUS-INTERFACE D-TYPE LATCHES

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#### description (continued)

$\overline{OE}$  does not affect the internal operations of the latch. Previously stored data can be retained or new data can be entered while the outputs are in the high-impedance state.

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 SN54ABT16843 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ABT16843 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

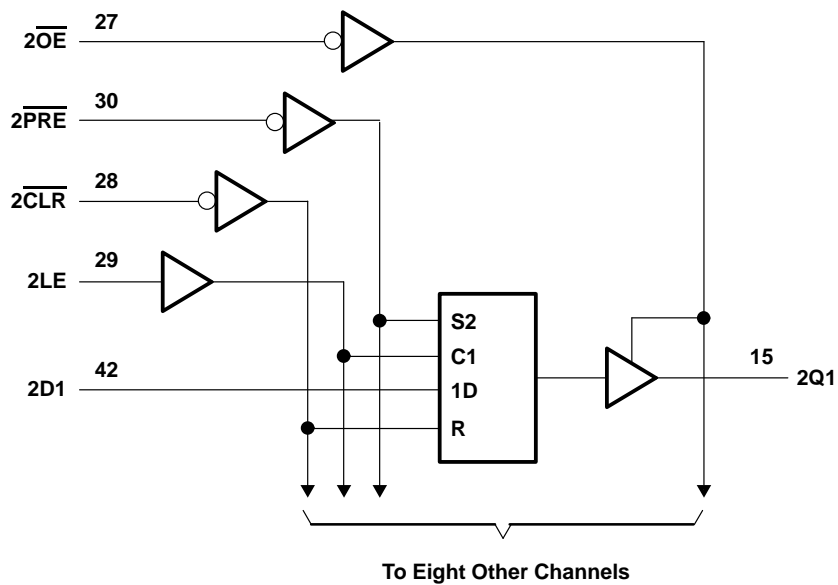
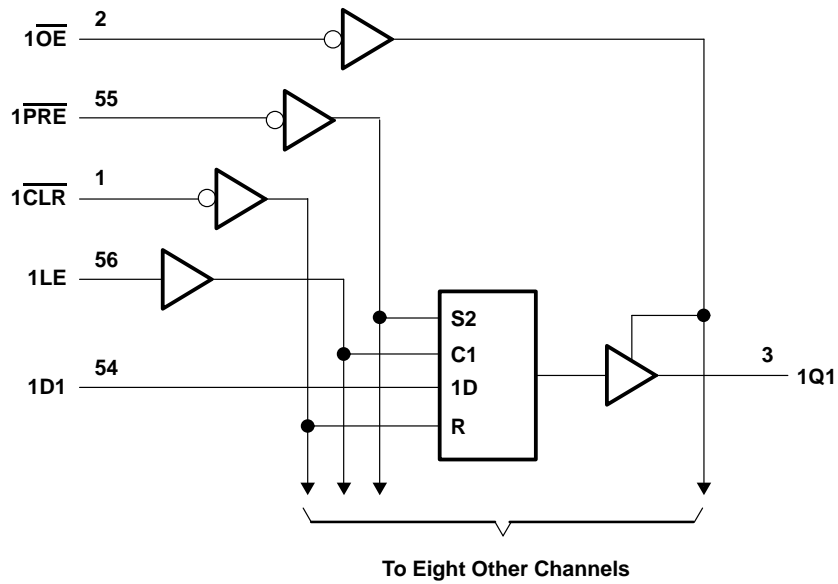
FUNCTION TABLE  
(each 9-bit latch)

INPUTS					OUTPUT Q
$\overline{PRE}$	$\overline{CLR}$	$\overline{OE}$	LE	D	
L	X	L	X	X	H
H	L	L	X	X	L
H	H	L	H	L	L
H	H	L	H	H	H
H	H	L	L	X	$Q_0$
X	X	H	X	X	Z

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logic diagram (positive logic)



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

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, $I_O$ : SN54ABT16843	96 mA
SN74ABT16843	128 mA
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	–18 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	–50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): DGG package	81°C/W
DL package	74°C/W
Storage temperature range, $T_{stg}$	–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.

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 EIA/JEDEC Std JESD51.

#### recommended operating conditions (see Note 3)

		SN54ABT16843		SN74ABT16843		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		–24		–32	mA
$I_{OL}$	Low-level output current		48		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled			10	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp 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 from floating.

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

PARAMETER	TEST CONDITIONS	T <sub>A</sub> = 25°C			SN54ABT16843		SN74ABT16843		UNIT
		MIN	TYP†	MAX	MIN	MAX	MIN	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = -18 mA			-1.2		-1.2		-1.2	V
V <sub>OH</sub>	V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = -3 mA	2.5			2.5		2.5		V
	V <sub>CC</sub> = 5 V, I <sub>OH</sub> = -3 mA	3			3		3		
	V <sub>CC</sub> = 4.5 V	I <sub>OH</sub> = -24 mA	2		2				
		I <sub>OH</sub> = -32 mA	2*				2		
V <sub>OL</sub>	V <sub>CC</sub> = 4.5 V	I <sub>OL</sub> = 48 mA		0.55		0.55			V
		I <sub>OL</sub> = 64 mA		0.55*				0.55	
V <sub>hys</sub>			100						mV
I <sub>I</sub>	V <sub>CC</sub> = 0 to 5.5 V, V <sub>I</sub> = V <sub>CC</sub> or GND			±1		±1		±1	μA
I <sub>OZPU</sub> ‡	V <sub>CC</sub> = 0 to 2.1 V, V <sub>O</sub> = 0.5 V to 2.7 V, $\overline{OE} = X$			±50		±50		±50	μA
I <sub>OZPD</sub> ‡	V <sub>CC</sub> = 2.1 V to 0, V <sub>O</sub> = 0.5 V to 2.7 V, $\overline{OE} = X$			±50		±50		±50	μA
I <sub>OZH</sub>	V <sub>CC</sub> = 2.1 V to 5.5 V, V <sub>O</sub> = 2.7 V, $\overline{OE} \geq 2$ V			10		10		10	μA
I <sub>OZL</sub>	V <sub>CC</sub> = 2.1 V to 5.5 V, V <sub>O</sub> = 0.5 V, $\overline{OE} \geq 2$ V			-10		-10		-10	μA
I <sub>off</sub>	V <sub>CC</sub> = 0, V <sub>I</sub> or V <sub>O</sub> ≤ 4.5 V			±100				±100	μA
I <sub>CEX</sub>	Outputs high	V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 5.5 V		50		50		50	μA
I <sub>O</sub> §	V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.5 V	-50	-100	-180	-50	-180	-50	-180	mA
I <sub>CC</sub>	Outputs high	V <sub>CC</sub> = 5.5 V, I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND		0.5		0.5		0.5	mA
	Outputs low			85		85		85	
	Outputs disabled			0.5		0.5		0.5	
ΔI <sub>CC</sub> ¶	V <sub>CC</sub> = 5.5 V, One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND			1.5		1.5		1.5	mA
C <sub>i</sub>	V <sub>I</sub> = 2.5 V or 0.5 V			3.5					pF
C <sub>o</sub>	V <sub>O</sub> = 2.5 V or 0.5 V			8					pF

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

† All typical values are at V<sub>CC</sub> = 5 V.

‡ This parameter is characterized, but not production tested.

§ 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<sub>CC</sub> 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)

		$V_{CC} = 5\text{ V},$ $T_A = 25^{\circ}\text{C}$		SN54ABT16843		SN74ABT16843		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
$t_w$	Pulse duration	$\overline{\text{CLR}}$ low	3.3	3.3	3.3	3.3	ns	
		$\overline{\text{PRE}}$ low	3.3	3.3	3.3			
		LE high	3.3	3.3	3.3			
$t_{su}$	Setup time, data before LE↓	High	0.9	0.9	0.9	ns		
		Low	0.6	0.6	0.6			
$t_h$	Hold time, data after LE↓	High	1.7	1.7	1.7	ns		
		Low	1.8	1.8	1.8			

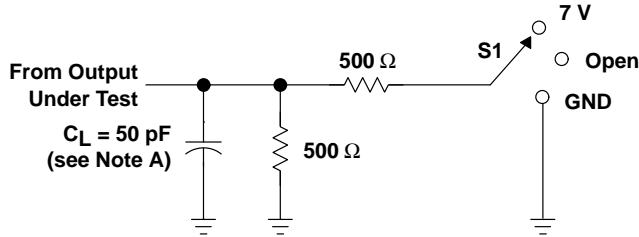
switching characteristics over recommended ranges of supply voltage and operating free-air temperature,  $C_L = 50\text{ pF}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$			SN54ABT16843		SN74ABT16843		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	D	Q	1.6	3.1	4.2	1.6	5.1	1.6	4.8	ns
$t_{PHL}$			1.6	3.2	4.2	1.6	5	1.6	4.8	
$t_{PLH}$	LE	Q	2.3	4	5	2.3	6.3	2.3	5.9	ns
$t_{PHL}$			2.5	3.9	4.8	2.5	5.6	2.5	5.3	
$t_{PLH}$	$\overline{\text{PRE}}$	Q	2.1	4	5.1	2.1	6.3	2.1	6.1	ns
$t_{PHL}$			2.2	3.7	4.6	2.2	5.3	2.2	5	
$t_{PLH}$	$\overline{\text{CLR}}$	Q	1.9	3.7	4.8	1.9	5.7	1.9	5.4	ns
$t_{PHL}$			2.2	4.2	5.3	2.2	6.1	2.2	6	
$t_{PZH}$	$\overline{\text{OE}}$	Q	1.6	3.3	4.3	1.6	5.5	1.6	5.4	ns
$t_{PZL}$			2	3.2	4.6	2	5.9	2	5.8	
$t_{PHZ}$	$\overline{\text{OE}}$	Q	1.7	4	5.5	1.7	6.4	1.7	6.3	ns
$t_{PLZ}$			1.7	3.7	4.4	1.7	5.3	1.7	5.2	

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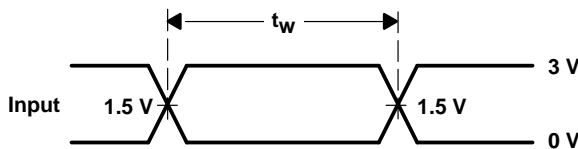
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## PARAMETER MEASUREMENT INFORMATION

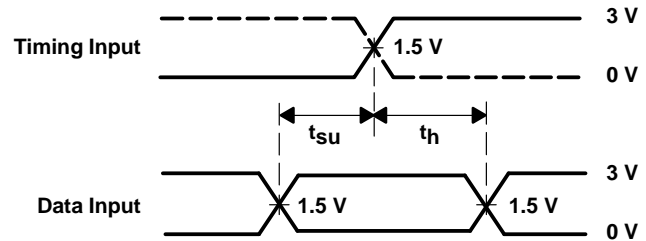


LOAD CIRCUIT

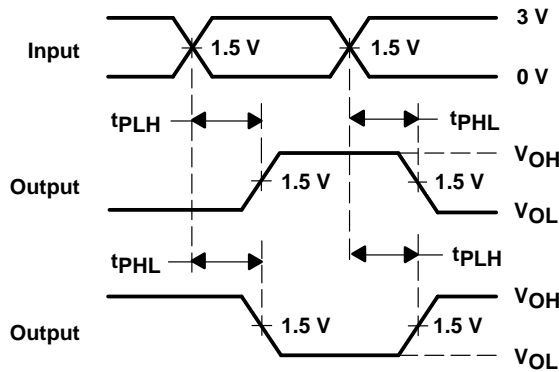
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	7 V
$t_{PHZ}/t_{PZH}$	Open



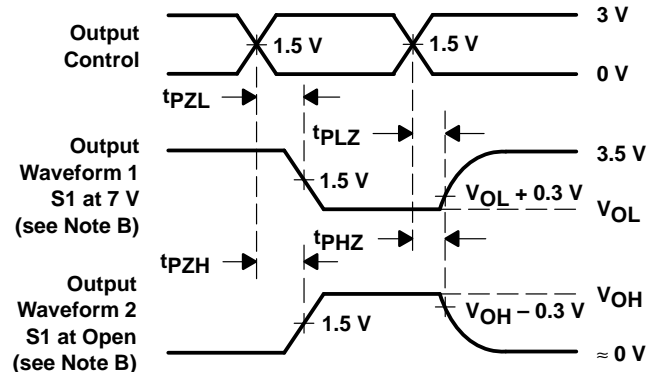
VOLTAGE WAVEFORMS  
PULSE DURATION



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

Figure 1. Load Circuit and Voltage Waveforms

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