

SN54ABT646, SN74ABT646 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

SCBS068E – JULY 1991 – REVISED JULY 1994

- State-of-the-Art *EPIC-II B™* BiCMOS Design Significantly Reduces Power Dissipation
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Typical V_{OLP} (Output Ground Bounce) < 1 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- High-Drive Outputs (–32-mA I_{OH} , 64-mA I_{OL})
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK), and Plastic (NT) and Ceramic (JT) DIPs

description

These devices consist of bus transceiver circuits, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the input bus or from the internal registers. Data on the A or B bus is clocked into the registers on the low-to-high transition of the appropriate clock (CLKAB or CLKBA) input. Figure 1 illustrates the four fundamental bus-management functions that can be performed with the 'ABT646.

Output-enable (\overline{OE}) and direction-control (DIR) inputs are provided to control the transceiver functions. In the transceiver mode, data present at the high-impedance port may be stored in either register or in both.

The select-control (SAB and SBA) inputs can multiplex stored and real-time (transparent mode) data. The direction control (DIR) determines which bus will receive data when \overline{OE} is low. In the isolation mode (\overline{OE} high), A data may be stored in one register and/or B data may be stored in the other register.

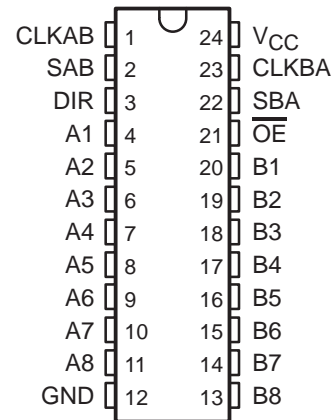
When an output function is disabled, the input function is still enabled and may be used to store and transmit data. Only one of the two buses, A or B, may be driven at a time.

To ensure the high-impedance state during power up or power down, \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.

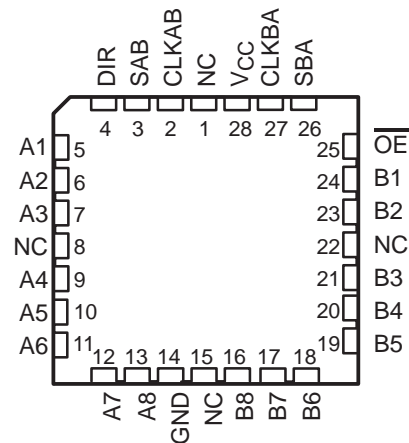
The SN74ABT646 is available in TI's shrink small-outline package (DB), which provides the same I/O pin count and functionality of standard small-outline packages in less than half the printed-circuit-board area.

The SN54ABT646 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABT646 is characterized for operation from -40°C to 85°C .

SN54ABT646 . . . JT PACKAGE
SN74ABT646 . . . DB, DW, NT, OR PW PACKAGE
(TOP VIEW)



SN54ABT646 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

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 **TEXAS
INSTRUMENTS**

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SN54ABT646, SN74ABT646 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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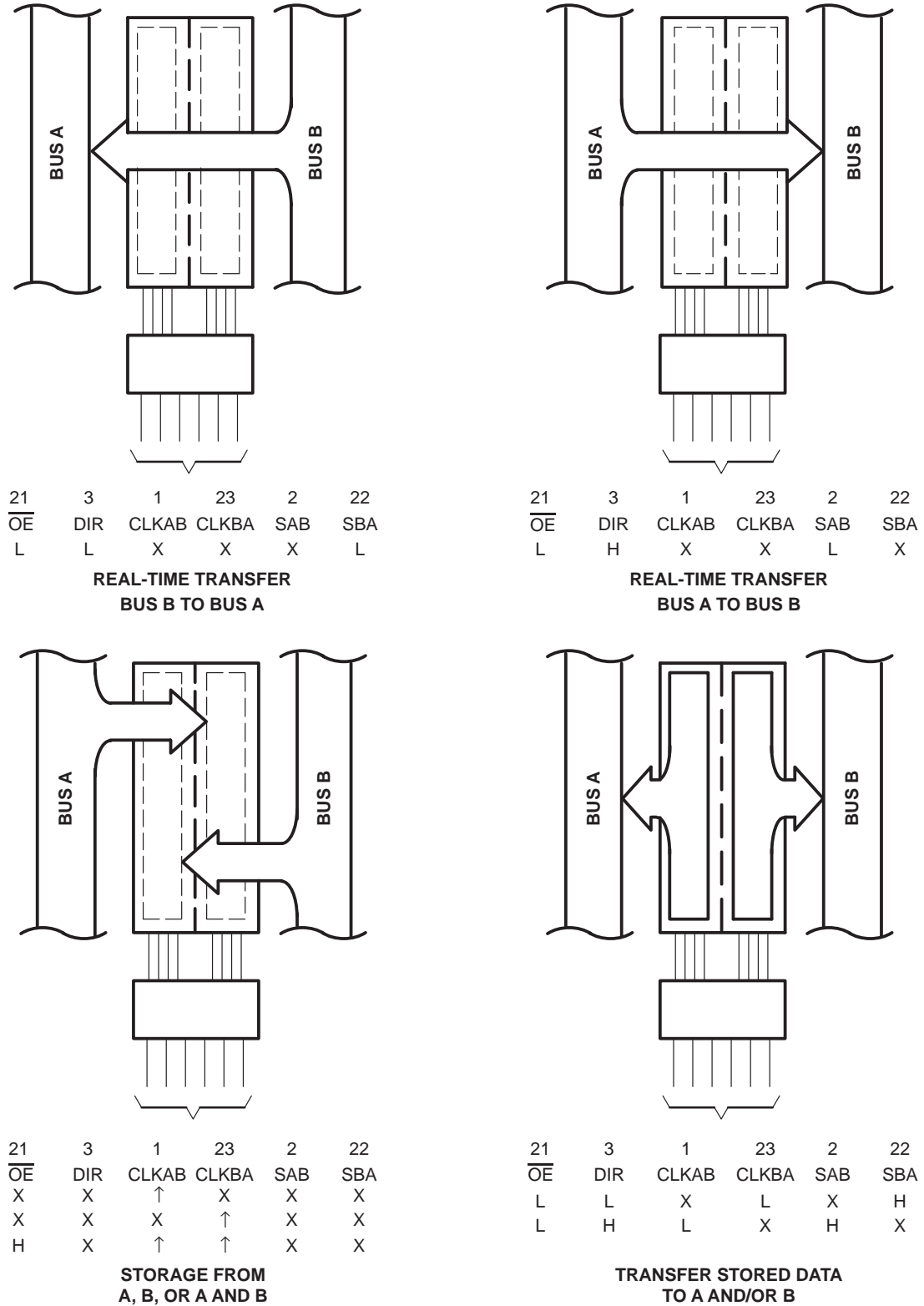


Figure 1. Bus-Management Functions

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

SN54ABT646, SN74ABT646

OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

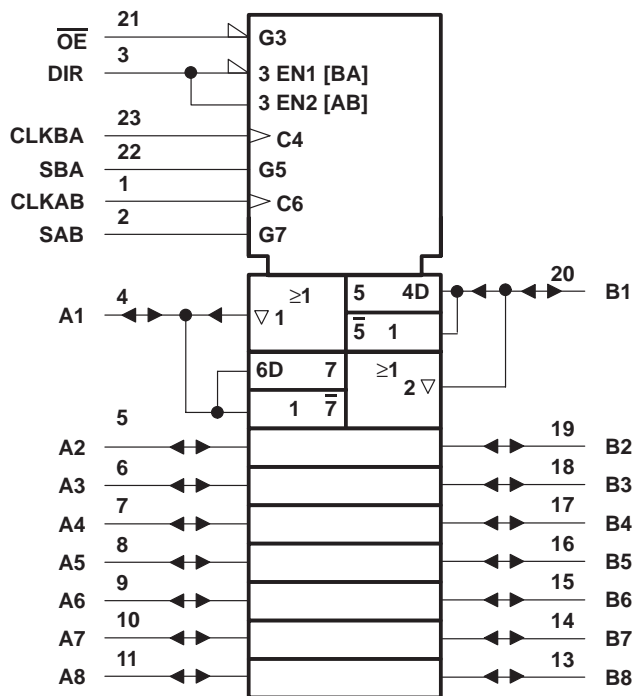
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FUNCTION TABLE

INPUTS						DATA I/Os		OPERATION OR FUNCTION
OE	DIR	CLKAB	CLKBA	SAB	SBA	A1 THRU A8	B1 THRU B8	
X	X	↑	X	X	X	Input	Unspecified†	Store A, B unspecified†
X	X	X	↑	X	X	Unspecified†	Input	Store B, A unspecified†
H	X	↑	↑	X	X	Input	Input	Store A and B data
H	X	H or L	H or L	X	X	Input disabled	Input disabled	Isolation, hold storage
L	L	X	X	X	L	Output	Input	Real-time B data to A bus
L	L	X	H or L	X	H	Output	Input	Stored B data to A bus
L	H	X	X	L	X	Input	Output	Real-time A data to B bus
L	H	H or L	X	H	X	Input	Output	Stored A data to B bus

† The data output functions may be enabled or disabled by various signals at the OE and DIR inputs. Data input functions are always enabled; i.e., data at the bus pins will be stored on every low-to-high transition of the clock inputs.

logic symbol‡

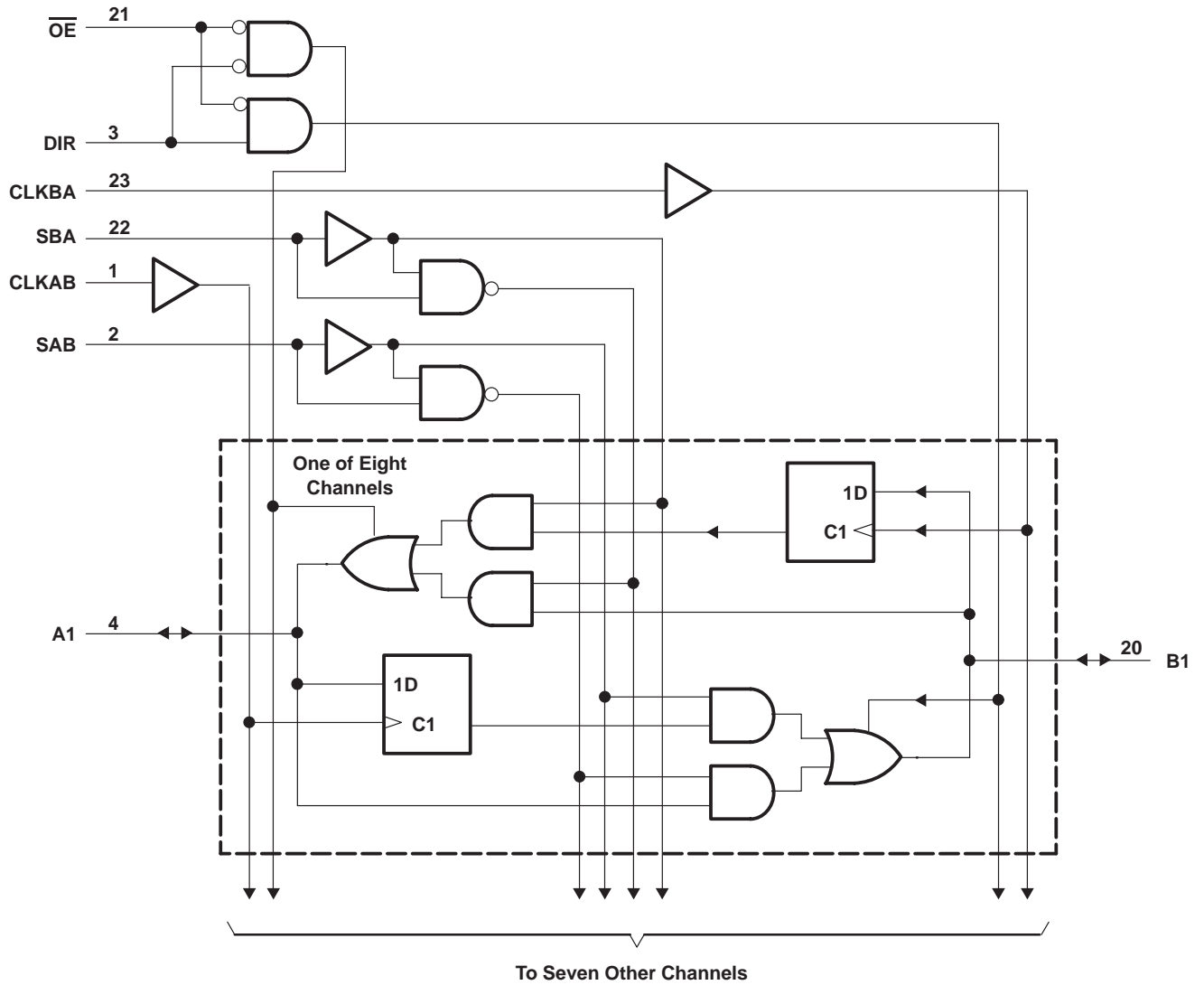


‡ This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the DB, DW, JT, NT, and PW packages.

SN54ABT646, SN74ABT646 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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logic diagram (positive logic)



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

SN54ABT646, SN74ABT646 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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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 (except I/O ports) (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high state or power-off state, V_O	–0.5 V to 5.5 V
Current into any output in the low state, I_O : SN54ABT646	96 mA
SN74ABT646	128 mA
Input clamp current, I_{IK} ($V_I < 0$)	–18 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2): DB package	0.65 W
DW package	1.7 W
NT package	1.3 W
PW package	0.7 W
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.

- NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
 2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils, except for the NT package, which has a trace length of zero. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

recommended operating conditions (see Note 3)

		SN54ABT646		SN74ABT646		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		5		5	ns/V
T_A	Operating free-air temperature	–55	125	–40	85	°C

NOTE 3: Unused or floating pins (input or I/O) must be held high or low.

SN54ABT646, SN74ABT646 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

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

PARAMETER	TEST CONDITIONS		T _A = 25°C			SN54ABT646		SN74ABT646		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} = -3 mA		2.5			2.5		2.5		V	
	V _{CC} = 5 V, I _{OH} = -3 mA		3			3		3			
	V _{CC} = 4.5 V	I _{OH} = -24 mA	2			2					
I _{OH} = -32 mA		2*					2				
V _{OL}	V _{CC} = 4.5 V		0.55			0.55				V	
	I _{OL} = 48 mA		0.55*					0.55			
I _I	V _{CC} = 5.5 V, V _I = V _{CC} or GND		Control inputs		±1			±1		μA	
			A or B ports		±100			±100			
I _{OZH} ‡	V _{CC} = 5.5 V, V _O = 2.7 V		10§			50		10§		μA	
I _{OZL} ‡	V _{CC} = 5.5 V, V _O = 0.5 V		-10§			-50		-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		μA	
I _O ¶	V _{CC} = 5.5 V, V _O = 2.5 V		-50	-100	-180	-50	-180	-50	-180	mA	
I _{CC}	V _{CC} = 5.5 V, I _O = 0, V _I = V _{CC} or GND		Outputs high		250			250		μA	
			Outputs low		30			30		30	mA
			Outputs disabled		250			250		250	
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		Control inputs		7					pF	
C _{io}	V _O = 2.5 V or 0.5 V		A or B ports		12					pF	

* On products compliant to MIL-STD-883, Class B, 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.

§ This data sheet limit may vary among suppliers.

¶ 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.

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 2)

		V _{CC} = 5 V, T _A = 25°C		SN54ABT646		SN74ABT646		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
f _{clock}	Clock frequency	0	125	0	125	0	125	MHz
t _w	Pulse duration, CLK high or low	4		4		4		ns
t _{su}	Setup time, A or B before CLKAB↑ or CLKBA↑	High		3.5		3.5		ns
		Low		3		3		
t _h	Hold time, A or B after CLKAB↑ or CLKBA↑	0		0		0		ns

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SN54ABT646, SN74ABT646
OCTAL BUS TRANSCEIVERS AND REGISTERS
WITH 3-STATE OUTPUTS

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switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 2)

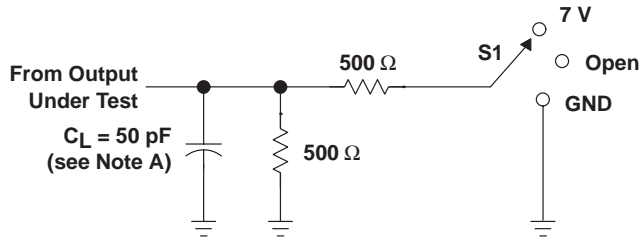
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5$ V, $T_A = 25^\circ$ C			SN54ABT646		SN74ABT646		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			125					125		MHz
t_{PLH}	CLKBA or CLKAB	A or B	2.2	4	6.8			2.2	7.8	ns
t_{PHL}			1.7	4	7.4			1.7	8.4	
t_{PLH}	A or B	B or A	1.5	3	5.9			1.5	6.9	ns
t_{PHL}			1.5	3.3	5.9			1.5	6.9	
t_{PLH}	SAB or SBA†	B or A	1.5	4	6.1			1.5	7.1	ns
t_{PHL}			1.5	3.6	6.9			1.5	7.9	
t_{PZH}	\overline{OE}	A or B	1	4.3	5.3			1	6.3	ns
t_{PZL}			2.1	5.8	7.4			2.1	8.8	
t_{PHZ}	\overline{OE}	A or B	1.5	3.5	7.3			1.5	8.3	ns
t_{PLZ}			1.5	3	7			1.5	7.5	
t_{PZH}	DIR	A or B	1.2	4.5	5.7			1.2	6.7	ns
t_{PZL}			2.5	6.5	9			2.5	9.5	
t_{PHZ}	DIR	A or B	1.5	3.8	6.7			1.5	7.7	ns
t_{PLZ}			1.5	3.8	7.2			1.5	8.2	

† These parameters are measured with the internal output state of the storage register opposite to that of the bus input.

SN54ABT646, SN74ABT646 OCTAL BUS TRANSCEIVERS AND REGISTERS WITH 3-STATE OUTPUTS

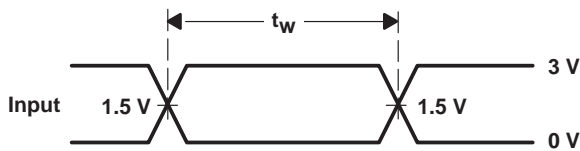
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PARAMETER MEASUREMENT INFORMATION

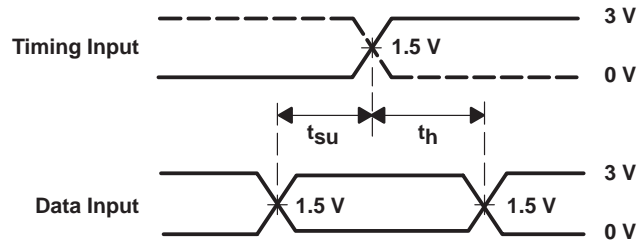


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open

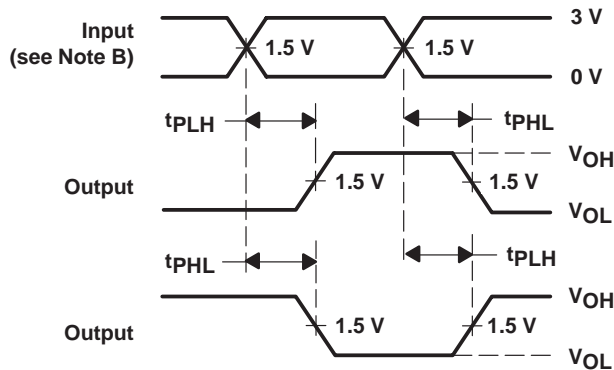
LOAD CIRCUIT FOR OUTPUTS



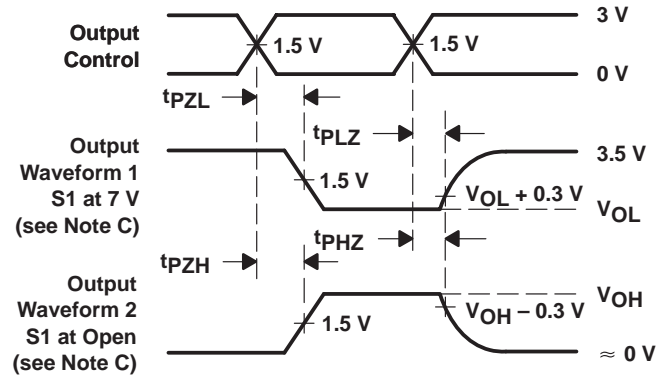
VOLTAGE WAVEFORMS
PULSE DURATION



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

Figure 2. Load Circuit and Voltage Waveforms

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| [APPLICATION NOTES](#) | [USER GUIDES](#) | [MORE LITERATURE](#)

PRODUCT SUPPORT: [TRAINING](#)

SN74ABT646, Octal Bus Transceivers And Registers With 3-State Outputs

DEVICE STATUS: **ACTIVE**

PARAMETER NAME	SN74ABT646
Voltage Nodes (V)	5

FEATURES

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EPIC-IIB is a trademark of Texas Instruments Incorporated.

DESCRIPTION

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These devices consist of bus transceiver circuits, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the input bus or from the internal registers. Data on the A or B bus is clocked into the registers on the low-to-high transition of the appropriate clock (CLKAB or CLKBA) input. Figure 1 illustrates the four fundamental bus-management functions that can be performed with the $\overline{\text{ABT646}}$.

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DATASHEET[▲Back to Top](#)Full datasheet in Acrobat PDF: [sn74abt646.pdf](#) (156 KB,Rev.E) (Updated: 07/01/1994)**APPLICATION NOTES**[▲Back to Top](#)View Application Notes for [Digital Logic](#)

- [Advanced BiCMOS Technology \(ABT\) Logic Characterization Information \(Rev. B\)](#) (SCBA008B - Updated: 06/01/1997)
- [Advanced BiCMOS Technology \(ABT\) Logic Enables Optimal System Design \(Rev. A\)](#) (SCBA001A - Updated: 03/01/1997)
- [Bus-Interface Devices With Output-Damping Resistors Or Reduced-Drive Outputs \(Rev. A\)](#) (SCBA012A - Updated: 08/01/1997)
- [Designing With Logic \(Rev. C\)](#) (SDYA009C - Updated: 06/01/1997)
- [Evaluation of Nickel/Palladium/Gold-Finished Surface-Mount Integrated Circuits](#) (SZZA026 - Updated: 06/20/2001)
- [Family of Curves Demonstrating Output Skews for Advanced BiCMOS Devices \(Rev. A\)](#) (SCBA006A - Updated: 12/01/1996)
- [Implications of Slow or Floating CMOS Inputs \(Rev. C\)](#) (SCBA004C - Updated: 02/01/1998)
- [Input and Output Characteristics of Digital Integrated Circuits](#) (SDYA010 - Updated: 10/01/1996)
- [Live Insertion](#) (SDYA012 - Updated: 10/01/1996)
- [Power-Up 3-State \(PU3S\) Circuits in TI Standard Logic Devices](#) (SZZA033 - Updated: 05/10/2002)
- [Quad Flatpack No-Lead Logic Packages \(Rev. C\)](#) (SCBA017C - Updated: 11/22/2002)
- [TI IBIS File Creation, Validation, and Distribution Processes](#) (SZZA034 - Updated: 08/29/2002)
- [Understanding Advanced Bus-Interface Products Design Guide](#) (SCAA029, 253 KB - Updated: 05/01/1996)
- [Understanding and Interpreting Texas Instruments Standard-Logic Products Data Sh \(Rev. A\)](#) (SZZA036A - Updated: 02/27/2003)

MORE LITERATURE[▲Back to Top](#)

- [Enhanced Plastic Portfolio Brochure](#) (SGZB004, 387 KB - Updated: 08/19/2002)
- [Logic Reference Guide](#) (SCYB004, 1032 KB - Updated: 10/23/2001)
- [MicroStar Junior BGA Design Summary](#) (SCET004, 167 KB - Updated: 07/28/2000)
- [Military Brief](#) (SGYN138, 803 KB - Updated: 10/10/2000)
- [Overview of IEEE Std 91-1984, Explanation of Logic Symbols Training Booklet \(Rev. A\)](#) (SDYZ001A, 138 KB - Updated: 07/01/1996)
- [Palladium Lead Finish User's Manual](#) (SDYV001, 2041 KB - Updated: 11/01/1996)
- [QML Class V Space Products Military Brief \(Rev. A\)](#) (SGZN001A, 257 KB - Updated: 10/07/2002)

USER GUIDES[▲Back to Top](#)

- [LOGIC Pocket Data Book](#) (SCYD013, 4837 KB - Updated: 12/05/2002)

SAMPLES[▲Back to Top](#)

ORDERABLE DEVICE	PACKAGE INDUSTRY (TI)	PINS	TEMP (°C)	STATUS	PRODUCT CONTENT	SAMPLES
SN74ABT646DBR	SSOP (DB)	24	-40 TO 85	ACTIVE	View Product Content	Request Samples
SN74ABT646DGVR	TVSOP (DGV)	24	-40 TO 85	ACTIVE	View Product Content	Request Samples
SN74ABT646DW	SOIC (DW)	24	-40 TO 85	ACTIVE	View Product Content	Request Samples
SN74ABT646NT	PDIP (NT)	24	-40 TO 85	ACTIVE	View Product Content	Request Samples
SN74ABT646PWR	TSSOP (PW)	24	-40 TO 85	ACTIVE	View Product Content	Request Samples

PRICING/AVAILABILITY/PKG[▲Back to Top](#)

DEVICE INFORMATION

Updated Daily

ORDERABLE DEVICE	STATUS	PACKAGE TYPE PINS	TEMP (°C)	PRODUCT CONTENT	BUDGETARY PRICING QTY SUS	STD PACK QTY
SN74ABT646DBLE	OBSOLETE	SSOP (DB) 24	-40 TO 85	View Contents	1KU	
SN74ABT646DBR	ACTIVE	SSOP (DB) 24	-40 TO 85	View Contents	1KU 3.30	2000
SN74ABT646DGVR	ACTIVE	TVSOP (DGV) 24	-40 TO 85	View Contents	1KU 3.30	2000
SN74ABT646DW	ACTIVE	SOIC (DW) 24	-40 TO 85	View Contents	1KU 3.30	25
SN74ABT646DWR	ACTIVE	SOIC (DW) 24	-40 TO 85	View Contents	1KU 3.34	2000
SN74ABT646NT	ACTIVE	PDIP (NT) 24	-40 TO 85	View Contents	1KU 3.30	15
SN74ABT646PW	ACTIVE	TSSOP (PW) 24	-40 TO 85	View Contents	1KU 2.10	60
SN74ABT646PWLE	OBSOLETE	TSSOP (PW) 24	-40 TO 85	View Contents	1KU	
SN74ABT646PWR	ACTIVE	TSSOP (PW) 24	-40 TO 85	View Contents	1KU 3.30	2000

TI INVENTORY STATUS

As Of 09:00 AM GMT, 17 Apr 2003

IN STOCK	IN PROGRESS QTY DATE	LEAD TIME
0*		Call**
0*	>10k 12 May	4 WKS
0*	3606 01 May	4 WKS
	>10k 08 May	
2975*	11 21 Apr	4 WKS
	>10k 12 May	
0*	>10k 12 May	4 WKS
0*	660 30 Apr	4 WKS
	3733 02 May	
	>10k 12 May	
0*	3847 01 May	4 WKS
	>10k 08 May	
0*		Call**
0*	>10k 08 May	4 WKS

REPORTED DISTRIBUTOR INVENTORY

As Of 09:00 AM GMT, 17 Apr 2003

DISTRIBUTOR COMPANY REGION	IN STOCK	PURCHASE
None Reported View Distributors		
DigiKey Americas	>1k	BUY NOW
DigiKey Americas	>1k	BUY NOW
DigiKey Americas	286	BUY NOW
Insight Americas	125	BUY NOW
None Reported View Distributors		
DigiKey Americas	219	BUY NOW
Arrow Americas	126	BUY NOW
Newark Electronics Americas	25	BUY NOW
Avnet Americas	5	BUY NOW
None Reported View Distributors		
None Reported View Distributors		
DigiKey Americas	>1k	BUY NOW

Table Data Updated on: 4/17/2003