

# 74AC11646

## OCTAL BUS TRANSCEIVER AND REGISTER WITH 3-STATE OUTPUTS

SCAS079A – JULY 1987 – REVISED APRIL 1993

- Independent Registers for A and B Buses
- Multiplexed Real-Time and Stored Data
- Flow-Through Architecture Optimizes PCB Layout
- Center-Pin  $V_{CC}$  and GND Configurations Minimize High-Speed Switching Noise
- EPIC™ (Enhanced-Performance Implanted CMOS) 1- $\mu$ m Process
- 500-mA Typical Latch-Up Immunity at 125°C

### description

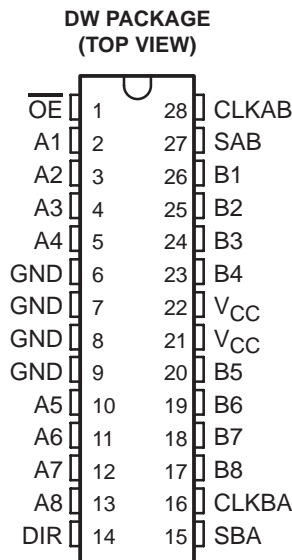
The 74AC11646 consists of bus transceiver circuits, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the input bus or from the internal registers. Data on the A or B bus is clocked into the registers on the low-to-high transition of the appropriate clock (CLKAB or CLKBA) input. Figure 1 illustrates the four fundamental bus-management functions that can be performed with the 74AC11646.

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.

The 74AC11646 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .



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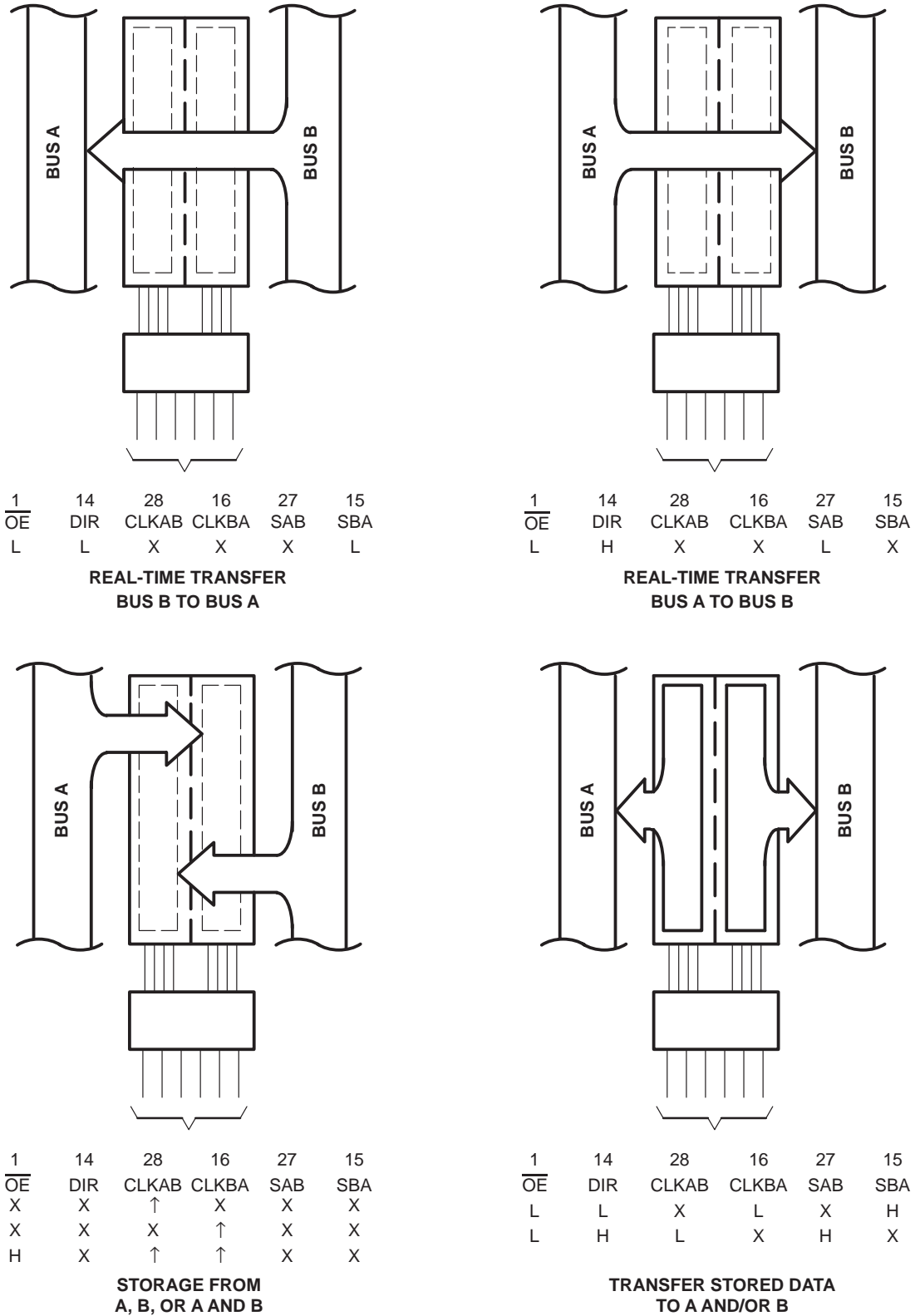


Figure 1. Bus-Management Functions

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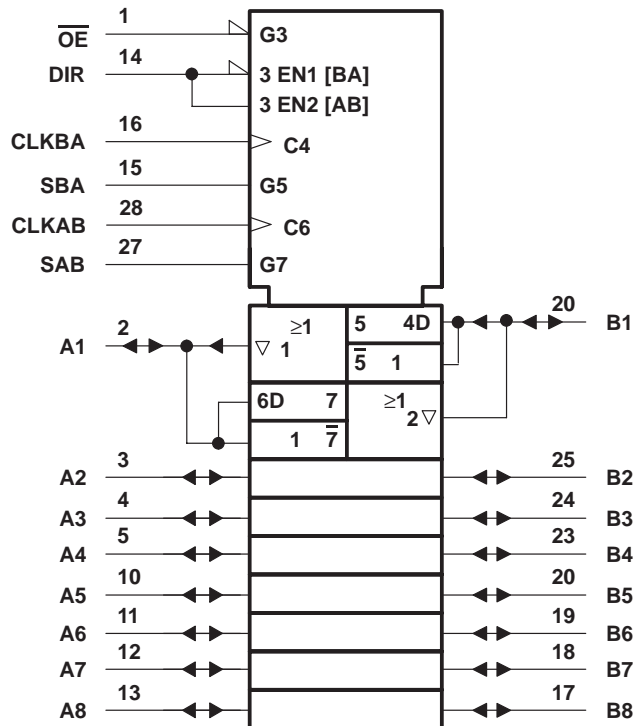
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FUNCTION TABLE

INPUTS						DATA I/O		OPERATION OR FUNCTION
$\overline{OE}$	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	L	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	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	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  $\overline{OE}$  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‡

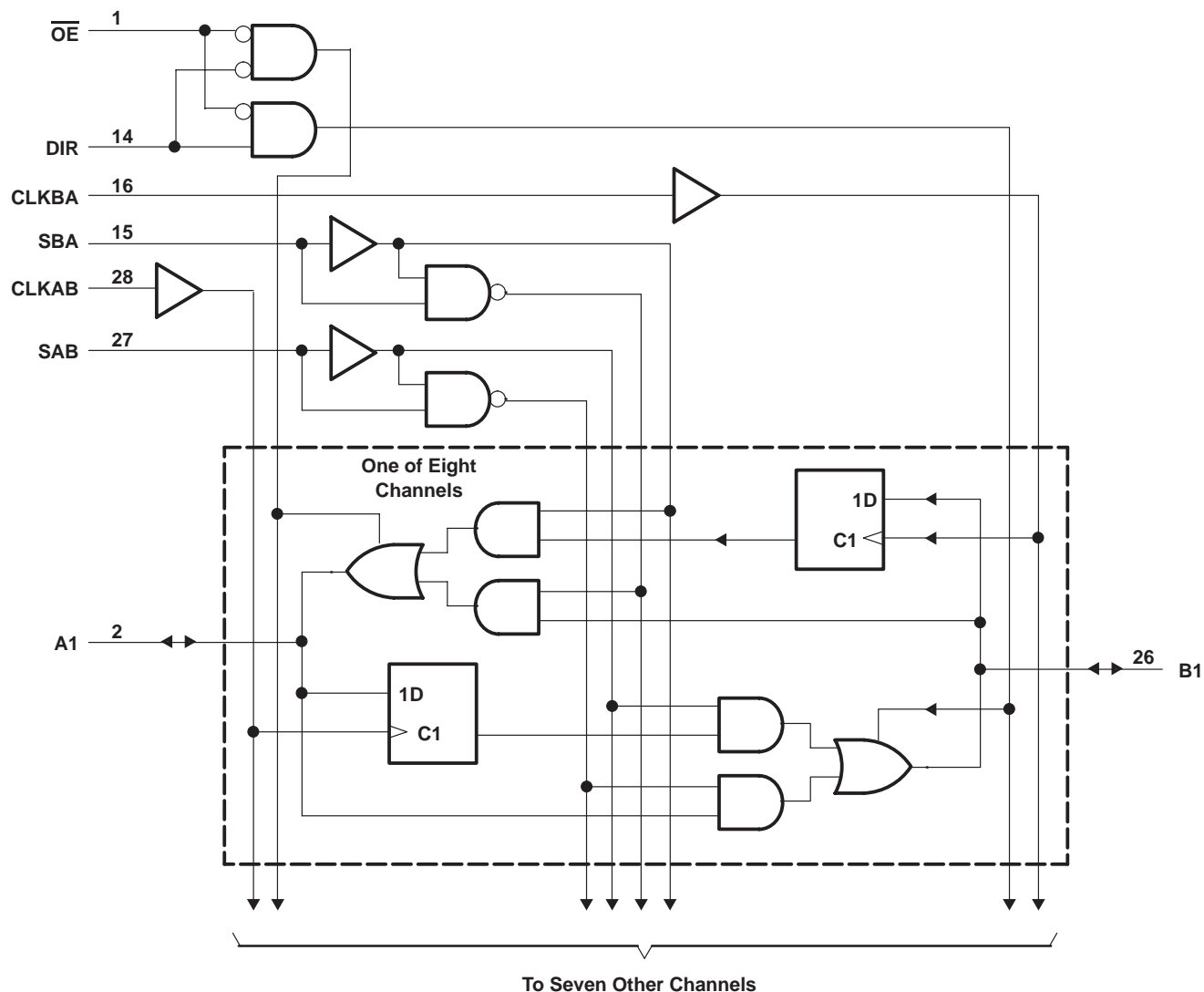


‡ This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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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 $V_{CC} + 0.5$ V
Output voltage range, $V_O$ (see Note 1) .....	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) .....	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) .....	$\pm 50$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....	$\pm 50$ mA
Continuous current through $V_{CC}$ or GND .....	$\pm 200$ mA
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.

NOTE 1: The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

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**recommended operating conditions**

		MIN	NOM	MAX	UNIT
V <sub>CC</sub>	Supply voltage	3	5	5.5	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 3 V	2.1		V
		V <sub>CC</sub> = 4.5 V	3.15		
		V <sub>CC</sub> = 5.5 V	3.85		
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 3 V	0.9		V
		V <sub>CC</sub> = 4.5 V	1.35		
		V <sub>CC</sub> = 5.5 V	1.65		
V <sub>I</sub>	Input voltage	0	V <sub>CC</sub>		V
V <sub>O</sub>	Output voltage	0	V <sub>CC</sub>		V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 3 V	-4		mA
		V <sub>CC</sub> = 4.5 V	-24		
		V <sub>CC</sub> = 5.5 V	-24		
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 3 V	12		mA
		V <sub>CC</sub> = 4.5 V	24		
		V <sub>CC</sub> = 5.5 V	24		
Δt/Δv	Input transition rise or fall rate	0	10		ns/V
T <sub>A</sub>	Operating free-air temperature	-40	85		°C

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
V <sub>OH</sub>	I <sub>OH</sub> = -50 μA	3 V	2.9		2.9		V	
		4.5 V	4.4		4.4			
		5.5 V	5.4		5.4			
	I <sub>OH</sub> = -4 mA	3 V	2.58		2.48			
		4.5 V	3.94		3.8			
		5.5 V	4.94		4.8			
I <sub>OH</sub> = -75 mA†	5.5 V			3.85				
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	3 V			0.1		V	
		4.5 V			0.1			
		5.5 V			0.1			
	I <sub>OL</sub> = 12 mA	3 V			0.36			
		4.5 V			0.36			
		5.5 V			0.36			
I <sub>OL</sub> = 75 mA†	5.5 V			1.65				
I <sub>I</sub>	Control pins	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5 V			±0.1	±1	μA
I <sub>OZ</sub> ‡	A or B ports	V <sub>O</sub> = V <sub>CC</sub> or GND	5.5 V			±0.5	±5	μA
I <sub>CC</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V			8	80	μA
C <sub>i</sub>	$\overline{\text{OE}}$ or DIR	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V			4.5		pF
C <sub>io</sub>	A or B ports	V <sub>O</sub> = V <sub>CC</sub> or GND	5 V			12		pF

† Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

‡ For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.



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timing requirements over recommended operating free-air temperature range,  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted) (see Figure 2)

		$T_A = 25^\circ\text{C}$		MIN	MAX	UNIT
		MIN	MAX			
$f_{\text{clock}}$	Clock frequency	0	65	0	65	MHz
$t_w$	Pulse duration, CLK high or low	7.7		7.7		ns
$t_{\text{su}}$	Setup time, A or B before CLKAB $\uparrow$ or CLKBA $\uparrow$	6.5		6.5		ns
$t_h$	Hold time, A or B after CLKAB $\uparrow$ or CLKBA $\uparrow$	1		1		ns

timing requirements over recommended operating free-air temperature range,  $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 2)

		$T_A = 25^\circ\text{C}$		MIN	MAX	UNIT
		MIN	MAX			
$f_{\text{clock}}$	Clock frequency	0	100	0	100	MHz
$t_w$	Pulse duration, CLK high or low	5		5		ns
$t_{\text{su}}$	Setup time, A or B before CLKAB $\uparrow$ or CLKBA $\uparrow$	4.5		4.5		ns
$t_h$	Hold time, A or B after CLKAB $\uparrow$ or CLKBA $\uparrow$	1		1		ns

switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted) (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			MIN	MAX	UNIT
			MIN	TYP	MAX			
$f_{\text{max}}$			65			65		MHz
$t_{\text{PLH}}$	A or B	B or A	1.5	9.1	12.1	1.5	13.8	ns
$t_{\text{PHL}}$			1.5	10.7	13.4	1.5	14.5	
$t_{\text{PZH}}$	$\overline{\text{OE}}$	A or B	1.5	13	16.4	1.5	18.7	ns
$t_{\text{PZL}}$			1.5	16.1	20.4	1.5	21.8	
$t_{\text{PHZ}}$	$\overline{\text{OE}}$	A or B	1.5	7.9	9.6	1.5	10.3	ns
$t_{\text{PLZ}}$			1.5	7.2	8.9	1.5	9.6	
$t_{\text{PLH}}$	CLKBA or CLKAB	A or B	1.5	11.8	15	1.5	17	ns
$t_{\text{PHL}}$			1.5	13.7	16.8	1.5	18.3	
$t_{\text{PLH}}$	SBA or SAB $\uparrow$ (A or B high)	A or B	1.5	9.8	12.9	1.5	14.4	ns
$t_{\text{PHL}}$			1.5	12	14.5	1.5	15.8	
$t_{\text{PLH}}$	SBA or SAB $\uparrow$ (A or B low)	A or B	1.5	10.7	13.8	1.5	15.4	ns
$t_{\text{PHL}}$			1.5	12.4	15	1.5	16.4	
$t_{\text{PZH}}$	DIR	A or B	1.5	13.7	17.1	1.5	19.4	ns
$t_{\text{PZL}}$			1.5	16.8	21	1.5	23.6	
$t_{\text{PHZ}}$	DIR	A or B	1.5	7.9	9.7	1.5	10.5	ns
$t_{\text{PLZ}}$			1.5	7.3	9.1	1.5	9.9	

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

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switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			MIN	MAX	UNIT
			MIN	TYP	MAX			
$f_{\text{max}}$			100			100		MHz
$t_{\text{PLH}}$	A or B	B or A	1.5	5.5	7.9	1.5	8.8	ns
$t_{\text{PHL}}$			1.5	6.3	8.9	1.5	9.8	
$t_{\text{PZH}}$	$\overline{\text{OE}}$	A or B	1.5	7.8	10.7	1.5	12	ns
$t_{\text{PZL}}$			1.5	8.5	11.9	1.5	13.1	
$t_{\text{PHZ}}$	$\overline{\text{OE}}$	A or B	1.5	5.9	8.4	1.5	8.9	ns
$t_{\text{PLZ}}$			1.5	5.9	7.7	1.5	8.3	
$t_{\text{PLH}}$	CLKBA or CLKAB	A or B	1.5	7	9.7	1.5	11	ns
$t_{\text{PHL}}$			1.5	8.2	11	1.5	12.2	
$t_{\text{PLH}}$	SBA or SAB $\dagger$ (A or B high)	A or B	1.5	5.9	8.4	1.5	9.4	ns
$t_{\text{PHL}}$			1.5	7.2	9.8	1.5	10.7	
$t_{\text{PLH}}$	SBA or SAB $\dagger$ (A or B low)	A or B	1.5	6.3	8.9	1.5	9.9	ns
$t_{\text{PHL}}$			1.5	7.3	9.9	1.5	11	
$t_{\text{PZH}}$	DIR	A or B	1.5	8.4	11.2	1.5	12.6	ns
$t_{\text{PZL}}$			1.5	9.1	12.3	1.5	13.7	
$t_{\text{PHZ}}$	DIR	A or B	1.5	6.3	8.2	1.5	8.7	ns
$t_{\text{PLZ}}$			1.5	5.7	7.5	1.5	8.1	

operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

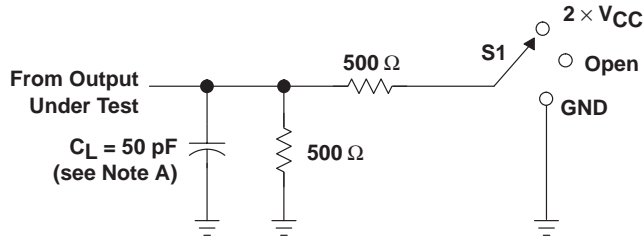
PARAMETER		TEST CONDITIONS	TYP	UNIT
$C_{\text{pd}}$	Power dissipation capacitance per transceiver	Outputs enabled	59	pF
		Outputs disabled	15	



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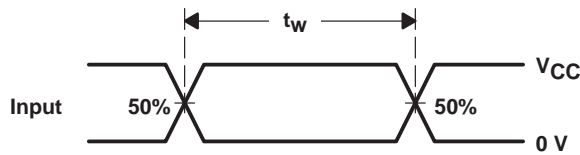
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**PARAMETER MEASUREMENT INFORMATION**

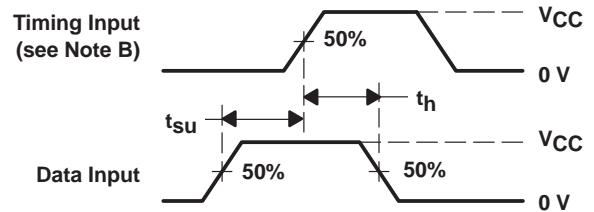


**LOAD CIRCUIT**

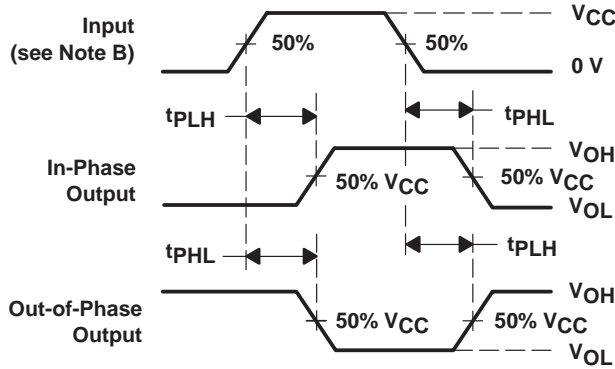
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	GND



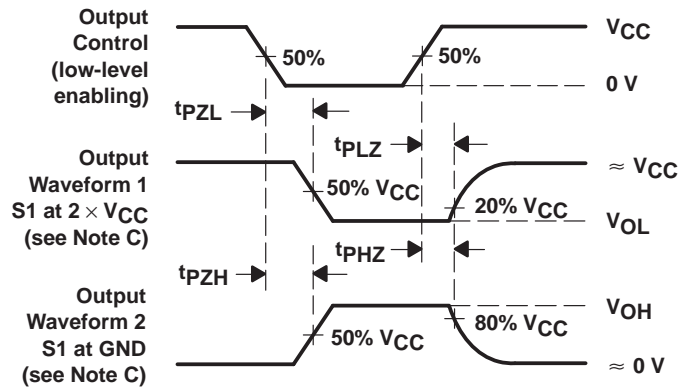
**VOLTAGE WAVEFORMS**



**VOLTAGE WAVEFORMS**



**VOLTAGE WAVEFORMS**



**VOLTAGE WAVEFORMS**

- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r = 3 \text{ ns}$ ,  $t_f = 3 \text{ ns}$ .  
 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 input transition per measurement.

**Figure 2. Load Circuit and Voltage Waveforms**



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Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
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