

Octal bus transceiver/register (3-State)

74ABT646

FEATURES

- Combines 74ABT245 and 74ABT374 type functions in one device
- Independent registers for A and B buses
- Live insertion/extraction permitted
- Power-up 3-State
- Power-up reset
- Multiplexed real-time and stored data
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per Jedec JC40.2 Std 17
- ESD protection exceeds 2000 V per MIL STD 883 Method 3015 and 200 V per Machine Model

DESCRIPTION

The 74ABT646 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 74ABT646 transceiver/register consists of bus transceiver circuits with 3-State outputs, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the input bus or the internal registers. Data on the A or B bus will be clocked into the registers as the appropriate clock pin goes High. Output Enable (OE) and DIR pins are provided to control the transceiver function. In the

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{amb} = 25^{\circ}\text{C}$; $GND = 0V$	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay An to Bn or Bn to An	$C_L = 50pF$; $V_{CC} = 5V$	4.4	ns
C_{IN}	Input capacitance CP, S, OE, DIR	$V_I = 0V$ or V_{CC}	4	pF
C_{VO}	I/O capacitance	Outputs disabled; $V_O = 0V$ or V_{CC}	7	pF
I_{CCZ}	Total supply current	Outputs disabled; $V_{CC} = 5.5V$	110	μA

ORDERING INFORMATION

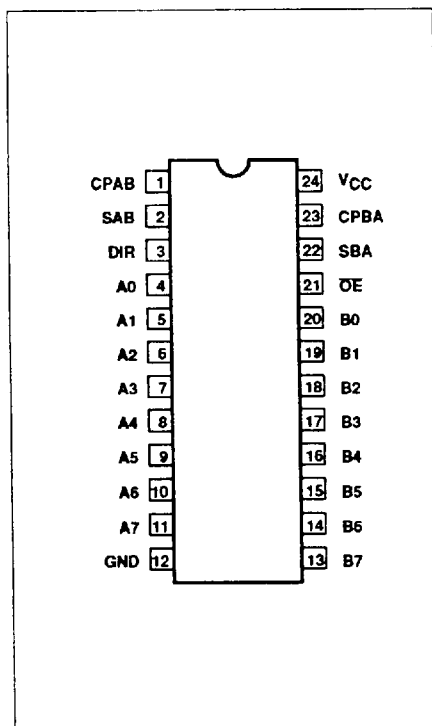
PACKAGES	TEMPERATURE RANGE	ORDER CODE	DRAWING NUMBER
24-pin plastic DIP	-40°C to $+85^{\circ}\text{C}$	74ABT646N	0410D
24-pin plastic SOL	-40°C to $+85^{\circ}\text{C}$	74ABT646D	0173D
24-pin plastic SSOP	-40°C to $+85^{\circ}\text{C}$	74ABT646DB	1641A

transceiver mode, data present at the high impedance port may be stored in either the A or B register or both.

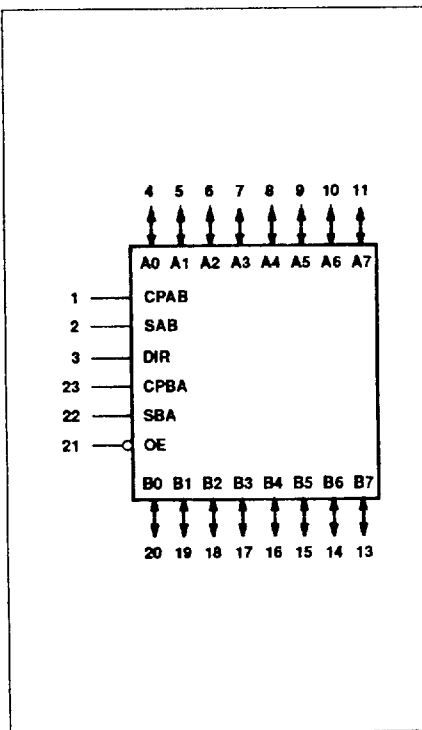
The Select (SAB, SBA) pins determine whether data is stored or transferred through the device in real-time. The DIR determines which bus will receive data when the OE is active (Low). In the isolation mode (OE = High), data from Bus A may be stored in the B register and/or data from Bus B may be

stored in the A 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 examples on the next page demonstrate the four fundamental bus management functions that can be performed with the 74ABT646.

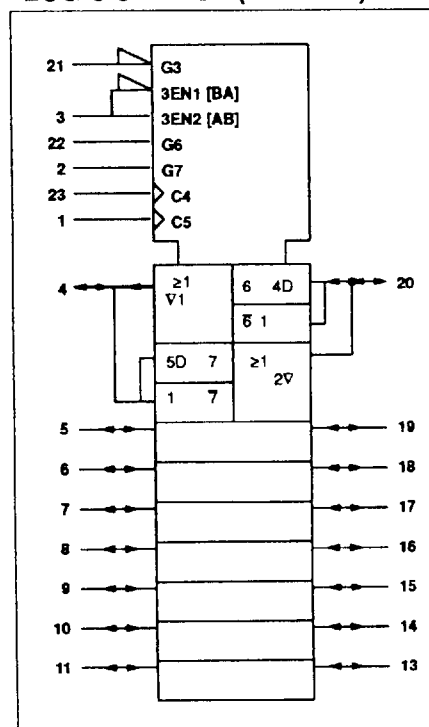
PIN CONFIGURATION



LOGIC SYMBOL

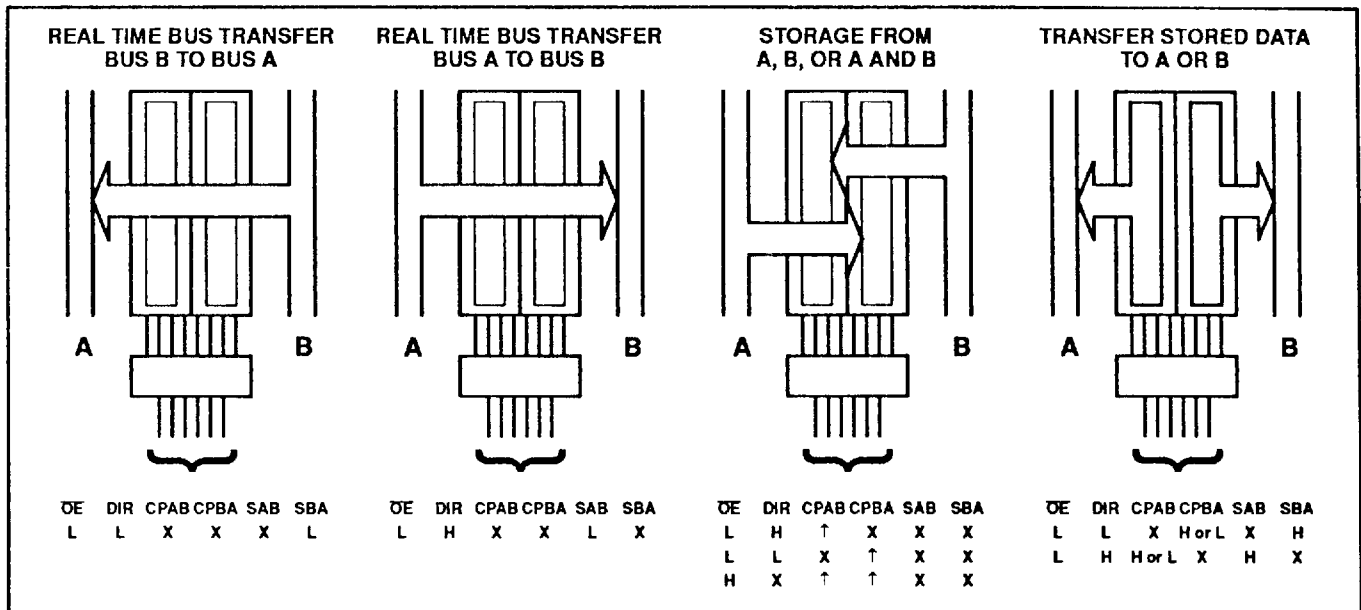


LOGIC SYMBOL (IEEE/IEC)



Octal bus transceiver/register (3-State)

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PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
1, 23	CPAB / CPBA	A to B clock input / B to A clock input
2, 22	SAB / SBA	A to B select input / B to A select input
3	DIR	Direction control input
4, 5, 6, 7, 8, 9, 10, 11	A0 – A7	Data inputs/outputs (A side)
20, 19, 18, 17, 16, 15, 14, 13	B0 – B7	Data inputs/outputs (B side)
21	OE	Output enable input (active-Low)
12	GND	Ground (0V)
24	V _{CC}	Positive supply voltage

FUNCTION TABLE

INPUTS						DATA I/O		OPERATING MODE
OE	DIR	CPAB	CPBA	SAB	SBA	A _n	B _n	
X	X	↑	X	X	X	Input	Unspecified output*	Store A, B unspecified
X	X	X	↑	X	X	Unspecified output*	Input	Store B, A unspecified
H H	X X	↑ H or L	↑ H or L	X X	X X	Input	Input	Store A and B data Isolation, hold storage
L L	L L	X X	X H or L	X X	L H	Output	Input	Real time B data to A bus Stored B data to A bus
L L	H H	X H or L	X X	L H	X X	Input	Output	Real time A data to B bus Stored A data to B bus

H = High voltage level

L = Low voltage level

X = Don't care

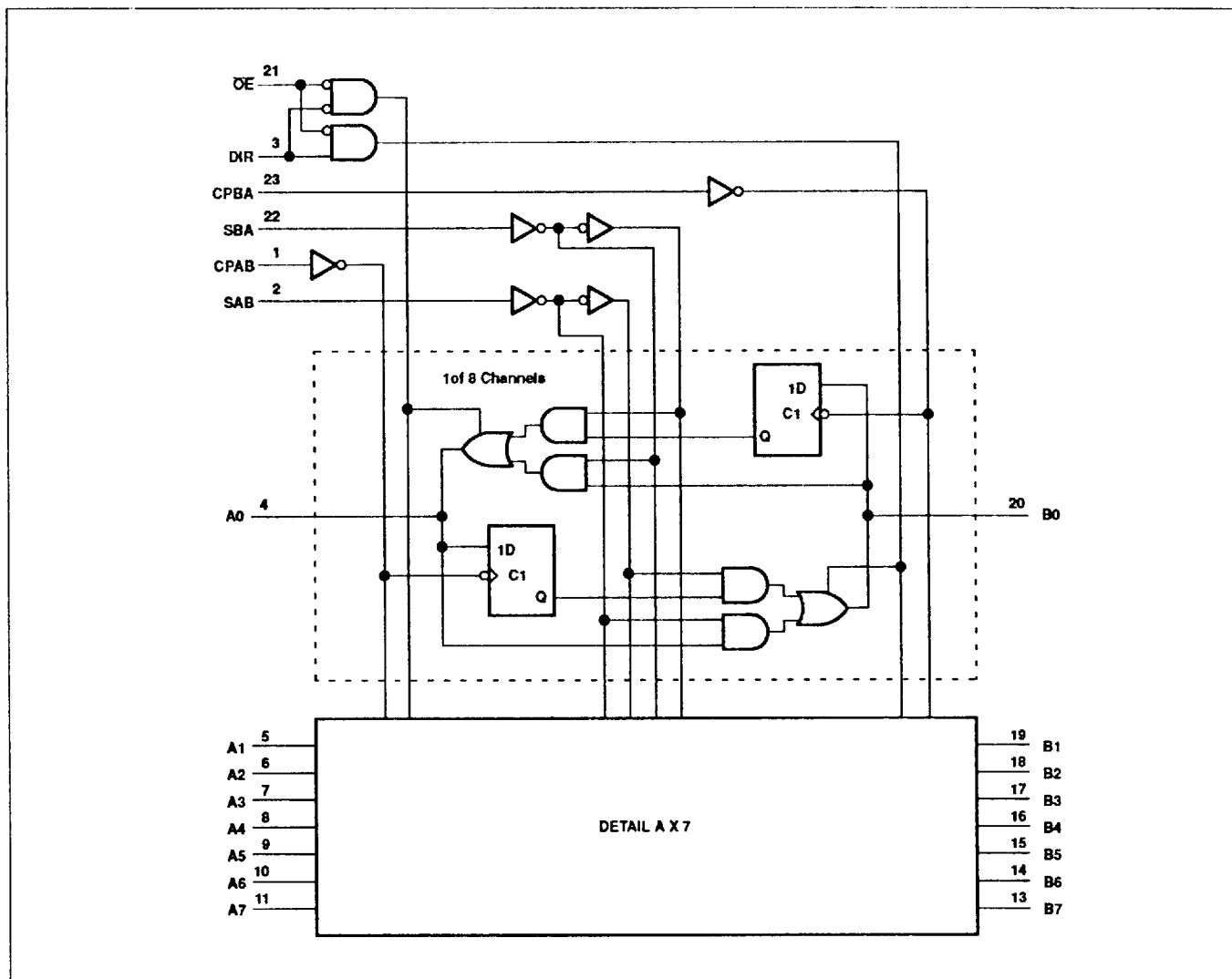
↑ = Low-to-High clock transition

* The data output function may be enabled or disabled by various signals at the OE input. 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.

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LOGIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS^{1, 2}

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		-0.5 to +7.0	V
I_{IK}	DC input diode current	$V_I < 0$	-18	mA
V_I	DC input voltage ³		-1.2 to +7.0	V
I_{OK}	DC output diode current	$V_O < 0$	-50	mA
V_{OUT}	DC output voltage ³	output in Off or High state	-0.5 to +5.5	V
I_{OUT}	DC output current	output in Low state	128	mA
T_{stg}	Storage temperature range		-65 to 150	°C

NOTES:

- Stresses beyond those listed 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.
- The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.
- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

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RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		Min	Max	
V_{CC}	DC supply voltage	4.5	5.5	V
V_I	Input voltage	0	V_{CC}	V
V_{IH}	High-level input voltage	2.0		V
V_{IL}	Low-level input voltage		0.8	V
I_{OH}	High-level output current		-32	mA
I_{OL}	Low-level output current		64	mA
$\Delta V/\Delta t$	Input transition rise or fall rate	0	10	ns/V
T_{amb}	Operating free-air temperature range	-40	+85	°C

DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER		TEST CONDITIONS	LIMITS					UNIT
				T _{amb} = +25°C			T _{amb} = -40°C to +85°C		
				Min	Typ	Max	Min	Max	
V _{IK}	Input clamp voltage		V _{CC} = 4.5V; I _{IK} = -18mA		-0.9	-1.2		-1.2	V
V _{OH}	High-level output voltage		V _{CC} = 4.5V; I _{OH} = -3mA; V _I = V _{IL} or V _{IH}	2.5	3.2		2.5		V
			V _{CC} = 5.0V; I _{OH} = -3mA; V _I = V _{IL} or V _{IH}	3.0	3.7		3.0		V
			V _{CC} = 4.5V; I _{OH} = -32mA; V _I = V _{IL} or V _{IH}	2.0	2.3		2.0		V
V _{OL}	Low-level output voltage		V _{CC} = 4.5V; I _{OL} = 64mA; V _I = V _{IL} or V _{IH}		0.42	0.55		0.55	V
V _{RST}	Power-up output low voltage ³		V _{CC} = 5.5V; I _O = 1mA; V _I = GND or V _{CC}		0.13	0.55		0.55	V
I _I	Input leakage current	Control pins	V _{CC} = 5.5V; V _I = GND or 5.5V		±0.01	±1.0		±1.0	μA
		Data pins	V _{CC} = 5.5V; V _I = GND or 5.5V		±5	±100		±100	μA
I _{OFF}	Power-off leakage current		V _{CC} = 0.0V; V _O or V _I ≤ 4.5V		±5.0	±100		±100	μA
I _{PU} /I _{PD}	Power-up/down 3-State output current ⁴		V _{CC} = 2.1V; V _O = 0.5V; V _I = GND or V _{CC} ; V _{OE} = Don't care		±5.0	±50		±50	μA
I _{IH} + I _{OZH}	3-State output High current		V _{CC} = 5.5V; V _O = 2.7V; V _I = V _{IL} or V _{IH}		5.0	50		50	μA
I _{IL} + I _{OZL}	3-State output Low current		V _{CC} = 5.5V; V _O = 0.5V; V _I = V _{IL} or V _{IH}		-5.0	-50		-50	μA
I _{CEX}	Output High leakage current		V _{CC} = 5.5V; V _O = 5.5V; V _I = GND or V _{CC}		5.0	50		50	μA
I _O	Output current ¹		V _{CC} = 5.5V; V _O = 2.5V	-50	-65	-180	-50	-180	mA
I _{CCH}	Quiescent supply current		V _{CC} = 5.5V; Outputs High, V _I = GND or V _{CC}		110	250		250	μA
I _{CCL}			V _{CC} = 5.5V; Outputs Low, V _I = GND or V _{CC}		20	30		30	mA
I _{CCZ}			V _{CC} = 5.5V; Outputs 3-State; V _I = GND or V _{CC}		110	250		250	μA
ΔI _{CC}	Additional supply current per input pin ²		V _{CC} = 5.5V; one input at 3.4V, other inputs at V _{CC} or GND; V _{CC} = 5.5V		0.3	1.5		1.5	mA

NOTES:

- 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 at 3.4V.
- For valid test results, data must not be loaded into the flip-flops (or latches) after applying the power.
- This parameter is valid for any V_{CC} between 0V and 2.1V, with a transition time of up to 10msec. From $V_{CC} = 2.1\text{V}$ to $V_{CC} = 5\text{V} \pm 10\%$, a transition time of up to 100 μsec is permitted.

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AC CHARACTERISTICS

GND = 0V, $t_R = t_F = 2.5\text{ns}$, $C_L = 50\text{pF}$, $R_L = 500\Omega$

SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			T _{amb} = +25°C V _{CC} = +5.0V			T _{amb} = -40 to +85°C V _{CC} = +5.0V ±0.5V		
			Min	Typ	Max	Min	Max	
f _{MAX}	Maximum clock frequency	1	125	180		125		MHz
t _{PLH} t _{PHL}	Propagation delay CPAB to Bn or CPBA to An	1	2.2 1.7	5.6 5.9	6.8 7.4	2.2 1.7	7.8 8.4	ns
t _{PLH} t _{PHL}	Propagation delay An to Bn or Bn to An	2	1.5 1.5	4.8 4.4	5.9 5.9	1.5 1.5	6.9 6.9	ns
t _{PLH} t _{PHL}	Propagation delay SAB to Bn or SBA to An	2, 3	1.5 1.5	4.6 5.4	6.1 6.9	1.5 1.5	7.1 7.9	ns
t _{PZH} t _{PZL}	Output enable time OE to An or Bn	5 6	1.0 2.1	4.4 5.7	5.3 7.4	1.0 2.1	6.3 8.8	ns
t _{PHZ} t _{PLZ}	Output disable time OE to An or Bn	5 6	1.5 1.5	5.2 5.2	7.3 7.0	1.5 1.5	8.3 7.5	ns
t _{PZH} t _{PZL}	Output enable time DIR to An or Bn	5 6	1.2 2.5	5.0 6.2	5.7 9.0	1.2 2.5	6.7 9.5	ns
t _{PHZ} t _{PLZ}	Output disable time DIR to An or Bn	5 6	1.5 1.5	4.9 4.5	6.7 7.2	1.5 1.5	7.7 8.2	ns

AC SETUP REQUIREMENTS

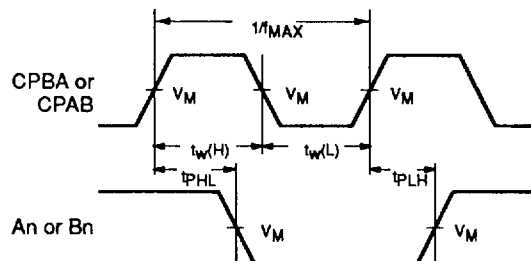
GND = 0V, $t_R = t_F = 2.5\text{ns}$, $C_L = 50\text{pF}$, $R_L = 500\Omega$

SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			$T_{\text{amb}} = +25^\circ\text{C}$ $V_{\text{CC}} = +5.0\text{V}$		$T_{\text{amb}} = -40 \text{ to } +85^\circ\text{C}$ $V_{\text{CC}} = +5.0\text{V} \pm 0.5\text{V}$	
			Min	Typ	Min	
$t_s(\text{H})$ $t_s(\text{L})$	Setup time An to CPAB, Bn to CPBA	4	3.5 3.0	2.4 1.2	3.5 3.0	ns
$t_h(\text{H})$ $t_h(\text{L})$	Hold time An to CPAB, Bn to CPBA	4	0.0 0.0	-0.6 -2.0	0.0 0.0	ns
$t_w(\text{H})$ $t_w(\text{L})$	Pulse width, High or Low CPAB or CPBA	1	4.0 4.0	2.3 1.1	4.0 4.0	ns

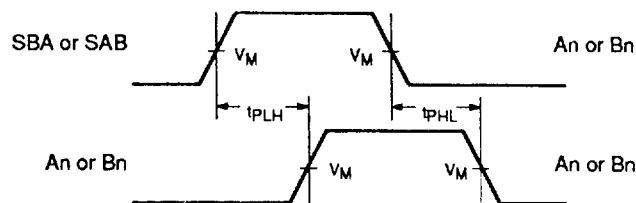
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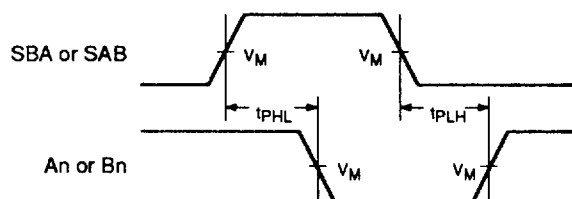
AC WAVEFORMS

 $V_M = 1.5V$, $V_{IN} = GND$ to $3.0V$ 

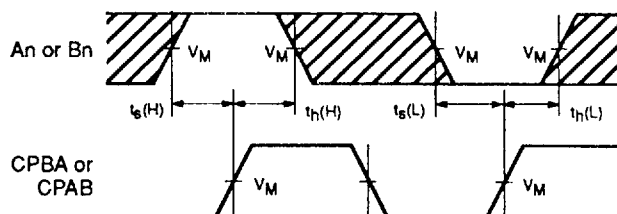
Waveform 1. Propagation Delay, Clock Input to Output, Clock Pulse Width, and Maximum Clock Frequency



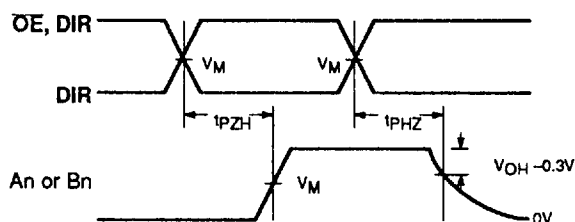
Waveform 2. Propagation Delay, SAB to Bn or SBA to An, An to Bn or Bn to An



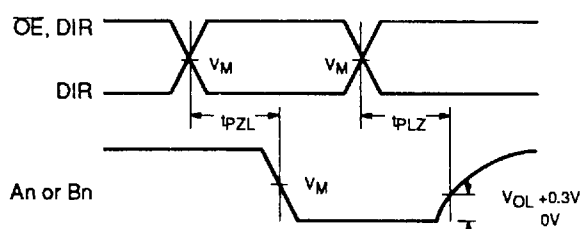
Waveform 3. Propagation Delay, SBA to An or SAB to Bn



Waveform 4. Data Setup and Hold Times



Waveform 5. 3-State Output Enable Time to High Level and Output Disable Time from High Level



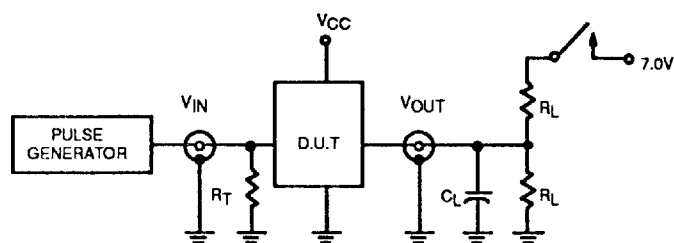
Waveform 6. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

NOTE: The shaded areas indicate when the input is permitted to change for predictable output performance.

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TEST CIRCUIT AND WAVEFORM



Test Circuit for 3-State Outputs

SWITCH POSITION

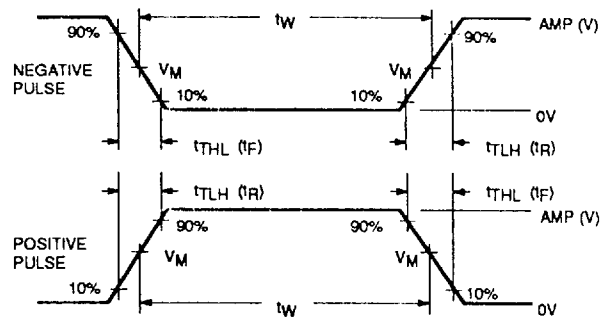
TEST	SWITCH
t_{PLZ}	closed
t_{pZL}	closed
All other	open

DEFINITIONS

R_L = Load resistor; see AC CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.



$V_M = 1.5V$
Input Pulse Definition

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_W	t_R	t_F
74ABT	3.0V	1MHz	500ns	2.5ns	2.5ns