

16-bit transceiver/register, non-inverting (3-State)

74ABT16652 74ABTH16652

FEATURES

- Independent registers for A and B buses
- Multiple V_{CC} and GND pins minimize switching noise
- Power-up 3-State
- 74ABTH16652 incorporates bus-hold data inputs which eliminate the need for external pull-up resistors to hold unused inputs
- Power-up reset
- Live insertion/extraction permitted
- Multiplexed real-time and stored data
- Output capability: +64mA/-32mA
- Latch-up protection exceeds 500mA per JEDEC Std 17
- ESD protection exceeds 2000V per MIL STD 883 Method 3015 and 200V per Machine Model

DESCRIPTION

The 74ABT16652 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 74ABT16652 transceiver/register consists of two sets 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 (*n*OEAB, *n*OEBA) and Select (*n*SAB, *n*SBA) pins are provided for bus management.

Two options are available, 74ABT16652 which does not have the bus-hold feature and 74ABTH16652 which incorporates the bus-hold feature.

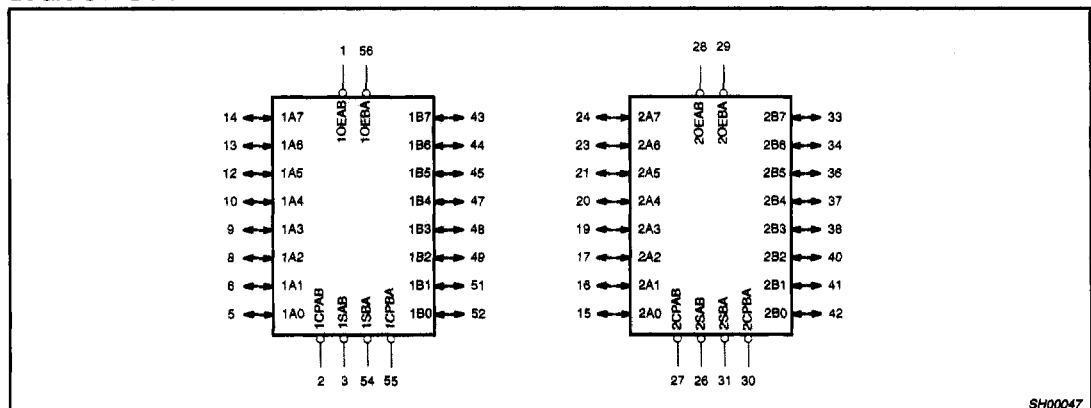
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS T _{amb} = 25°C; GND = 0V	TYPICAL	UNIT
t _{PLH} t _{PHL}	Propagation delay nAx to nBx	C _L = 50pF; V _{CC} = 5V	2.3 1.8	ns
C _{IN}	Input capacitance	V _I = 0V or V _{CC}	4	pF
C _{I/O}	I/O capacitance	V _O = 0V or V _{CC} ; 3-State	7	pF
I _{CCZ}	Quiescent supply current	Outputs disabled; V _{CC} = 5.5V	500	μA
I _{CCL}		Outputs low; V _{CC} = 5.5V	8	mA

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
56-Pin Plastic SSOP Type III	-40°C to +85°C	74ABT16652 DL	BT16652 DL	SOT371-1
56-Pin Plastic TSSOP Type II	-40°C to +85°C	74ABT16652 DGG	BT16652 DGG	SOT364-1
56-Pin Plastic SSOP Type III	-40°C to +85°C	74ABTH16652 DL	BH16652 DL	SOT371-1
56-Pin Plastic TSSOP Type II	-40°C to +85°C	74ABTH16652 DGG	BH16652 DGG	SOT364-1

LOGIC SYMBOL

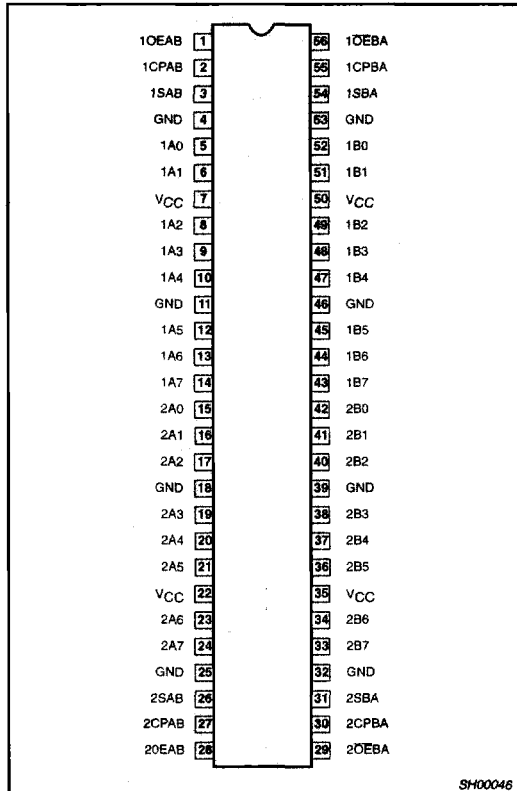


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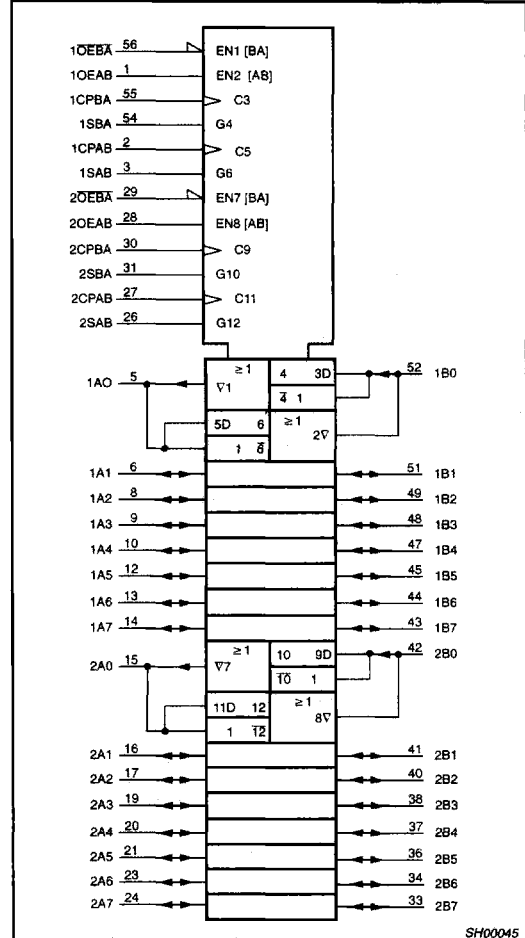
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PIN CONFIGURATION



SH00046

LOGIC SYMBOL (IEEE/IEC)



SH00045

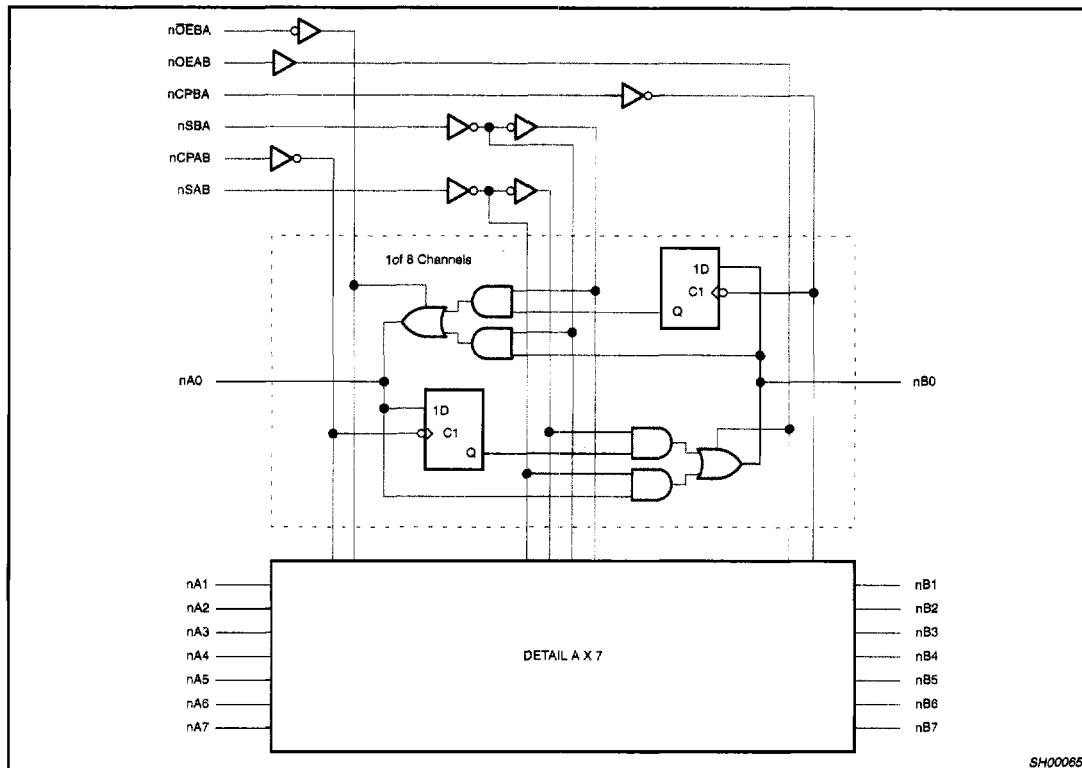
PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
2, 55, 27, 30	1CPAB, 1CPBA, 2CPAB, 2CPBA	Clock input A to B / Clock input B to A
3, 54, 26, 31	1SAB, 1SBA, 2SAB, 2SBA	Select input A to B / Select input B to A
5, 6, 8, 9, 10, 12, 13, 14 15, 16, 17, 19, 20, 21, 23, 24	1A0 – 1A7, 2A0 – 2A7	Data inputs/outputs (A side)
52, 51, 49, 48, 47, 45, 44, 43 42, 41, 40, 38, 37, 36, 34, 33	1B0 – 1B7, 2B0 – 2B7	Data inputs/outputs (B side)
1, 56, 28, 29	10EAB, 10EBA, 20EAB, 20EBA	Output enable inputs
4, 11, 18, 25, 32, 39, 46, 53	GND	Ground (0V)
7, 22, 35, 50	V _{CC}	Positive supply voltage

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LOGIC DIAGRAM



FUNCTION TABLE

INPUTS						DATA I/O		OPERATING MODE
nOEAB	nOEBA	nCPAB	nCPBA	nSAB	nSBA	nAx	nBx	
L	H	H or L	H or L	X	X	Input	Input	Isolation Store A and B data
L	H	↑	↑	X	X	Input	Input	Store A, Hold B Store A in both registers
X	H	↑	H or L	X	X	Input	Unspecified output*	Hold A, Store B Store B in both registers
H	H	↑	↑	**	X	Unspecified output*	Input	Real time B data to A bus Stored B data to A bus
L	X	H or L	↑	X	X	Input	Input	Real time A data to B bus Store A data to B bus
L	L	X	X	X	L	Output	Input	Stored A data to B bus Stored B data to A bus
L	L	X	H or L	X	H	Output	Input	
H	L	H or L	H or L	H	H	Output	Output	

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 nOEBA and nOEAB 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.

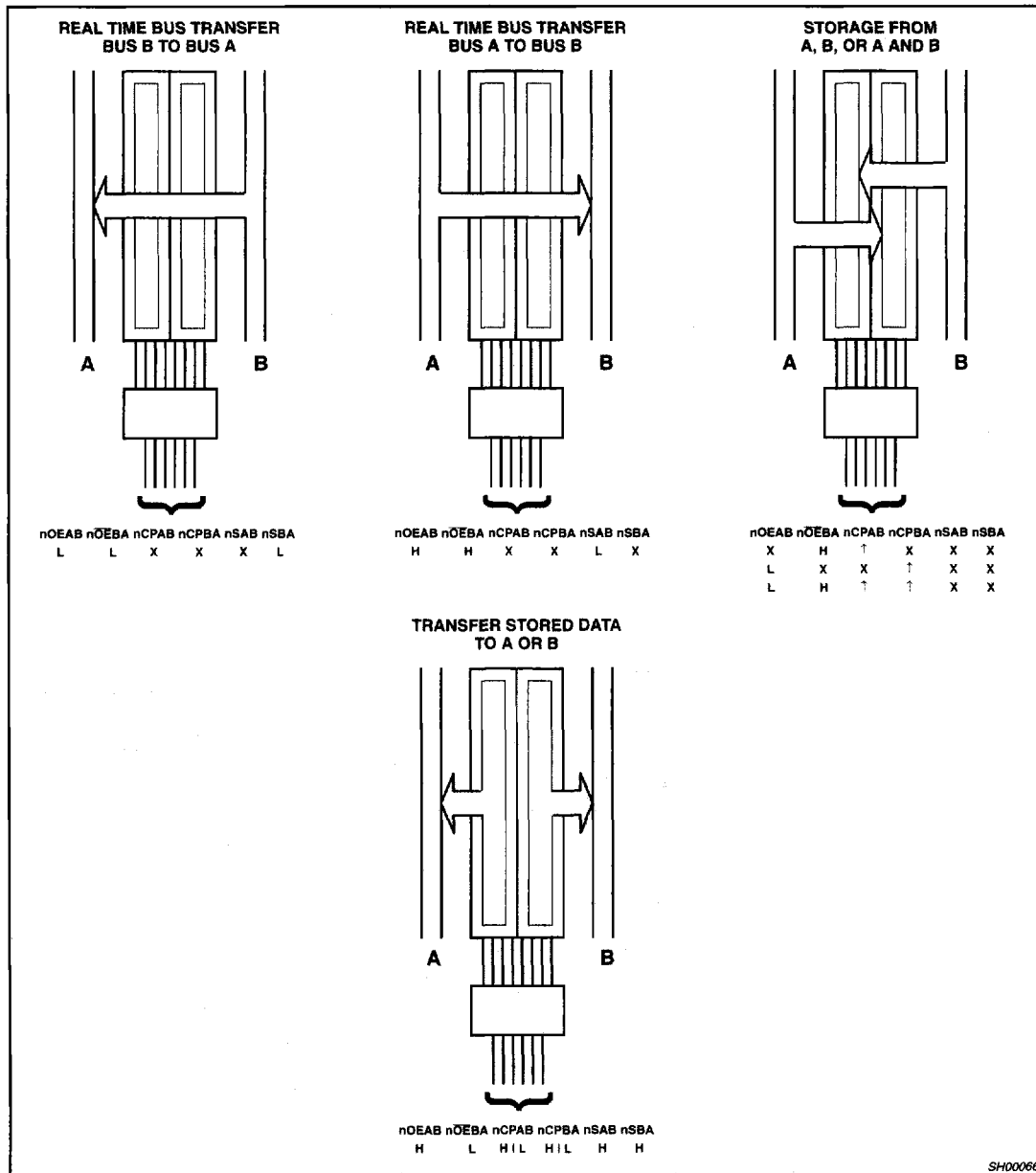
** If both Select controls (nSAB and nSBA) are Low, then clocks can occur simultaneously. If either Select control is High, the clocks must be staggered in order to load both registers.

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The following examples demonstrate the four fundamental bus-management functions that can be performed with the 74ABT16652. The select pins determine whether data is stored or

transferred through the device in real time. The output enable pins determine the direction of the data flow.



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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
		output in HIGH state	-64	
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.

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
$\Delta t/\Delta v$	Input transition rise or fall rate	0	10	ns/V
T_{amb}	Operating free-air temperature range	-40	+85	°C

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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	2.9		2.5		V	
		V _{CC} = 5.0V; I _{OH} = -3mA; V _I = V _{IL} or V _{IH}	3.0	4.0		3.0		V	
		V _{CC} = 4.5V; I _{OH} = -32mA; V _I = V _{IL} or V _{IH}	2.0	2.4		2.0		V	
V _{OL}	Low-level output voltage	V _{CC} = 4.5V; I _{OL} = 64mA; V _I = V _{IL} or V _{IH}		0.35	0.55		0.55	V	
V _{RST}	Power-up output low voltage ³	V _{CC} = 5.5V; I _{OL} = 1mA; V _I = GND or V _{CC}		0.13	0.55		0.55	V	
I _I	Input leakage current	V _{CC} = 5.5V; V _I = GND or V _{CC}	Control pins	±0.01	±1.0		±1.0	µA	
I _{HOLD}	Bus Hold current A or B Ports ⁴ 74ABTH16652	V _{CC} = 4.5V; V _I = 0.8V	35			35		µA	
		V _{CC} = 4.5V; V _I = 2.0V	-75			-75			
		V _{CC} = 5.5V; V _I = 0 to 5.5V	±800						
I _{OFF}	Power-off leakage current	V _{CC} = 0V; V _O = 4.5V; V _I = 0V or 5.5V		±1.0	±100		±100	µA	
I _{PU/PD}	Power-up/down 3-State output current ⁴	V _{CC} = 2.1V; V _O = 0.0V; V _I = GND or V _{CC}		±1.0	±50		±50	µA	
I _{IH} + I _{OZH}	3-State output High current	V _{CC} = 5.5V; V _O = 5.5V; V _I = V _{IL} or V _{IH}		1.0	10		10	µA	
I _{IL} + I _{OZL}	3-State output Low current	V _{CC} = 5.5V; V _O = 0.0V; V _I = V _{IL} or V _{IH}		-1.0	-10		-10	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	-80	-180	-50	-180	mA
I _{CCH}	Quiescent supply current	V _{CC} = 5.5V; Outputs High, V _I = GND or V _{CC}		0.5	2		2	mA	
I _{CCL}		V _{CC} = 5.5V; Outputs Low, V _I = GND or V _{CC}		8	19		19	mA	
I _{CCZ}		V _{CC} = 5.5V; Outputs 3-State; V _I = GND or V _{CC}		0.5	2		2	mA	
ΔI _{CC}	Additional supply current per input pin ² 74ABT16652	V _{CC} = 5.5V; one input at 3.4V, other inputs at V _{CC} or GND		5.0	50		50	µA	
ΔI _{CC}	Additional supply current per input pin ² 74ABTH16652	V _{CC} = 5.5V; one input at 3.4V, other inputs at V _{CC} or GND		200	500		500	µA	

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 0 and 2.1V. When the part enables with V_{CC} between 2.1V and 4.5V, the outputs will correctly function with respect to all input logic states.
- This is the bus hold overdrive current required to force the input to the opposite logic state.

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AC CHARACTERISTICS

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

SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			$T_{amb} = +25^{\circ}C$ $V_{CC} = +5.0V$			$T_{amb} = -40 \text{ to } +85^{\circ}C$ $V_{CC} = +5.0V \pm 0.5V$		
			MIN	TYP	MAX	MIN	MAX	
f_{MAX}	Maximum clock frequency	1	125			125		MHz
t_{PLH} t_{PHL}	Propagation delay nCPAB to nBx or nCPBA to nAx	1	1.5	3.3	4.0	1.5	4.9	ns
t_{PLH} t_{PHL}	Propagation delay nAx to nBx or nBx to nAx	2	1.0	2.3	3.2	1.0	3.9	ns
t_{PLH} t_{PHL}	Propagation delay nSAB to nBx or nSBA to nAx	3	1.0	3.4	4.3	1.0	5.0	ns
t_{PZH} t_{PZL}	Output enable time nOEBA to nAx	5	1.0	2.5	4.1	1.0	5.0	ns
t_{PHZ} t_{PLZ}	Output disable time nOEBA to nAx	6	1.5	3.6	4.4	1.5	5.3	ns
t_{PZH} t_{PZL}	Output enable time nOEAB to nBx	5	1.0	2.9	3.6	1.0	4.2	ns
t_{PHZ} t_{PLZ}	Output disable time nOEAB to nBx	6	1.5	3.0	3.9	1.5	4.6	ns
t_{PHZ} t_{PLZ}	Output disable time nOEAB to nBx	5	2.0	3.1	5.5	2.0	5.9	ns
t_{PHZ} t_{PLZ}	Output disable time nOEAB to nBx	6	1.5	2.3	4.5	1.5	5.2	ns

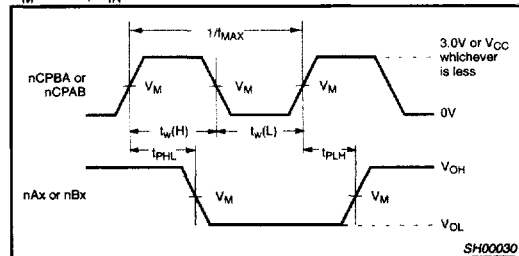
AC SETUP REQUIREMENTS

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

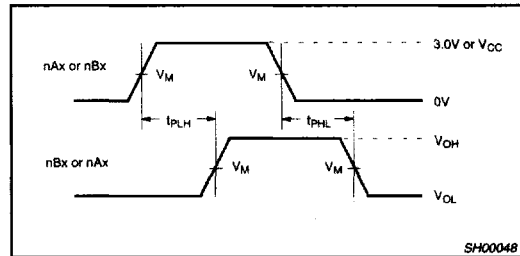
SYMBOL	PARAMETER	WAVEFORM	LIMITS			UNIT
			$T_{amb} = +25^{\circ}C$ $V_{CC} = +5.0V$		$T_{amb} = -40 \text{ to } +85^{\circ}C$ $V_{CC} = +5.0V \pm 0.5V$	
			MIN	TYP	MIN	
$t_s(H)$ $t_s(L)$	Setup time nAx to nCPBA, nBx to nCPAB	4	3.0	1.2	3.0	ns
$t_h(H)$ $t_h(L)$	Hold time nAx to nCPBA, nBx to nCPAB	4	1.0	-0.7	1.0	ns
$t_w(H)$ $t_w(L)$	Pulse width, High or Low nCPAB or nCPBA	1	4.3	1.0	4.3	ns

AC WAVEFORMS

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



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



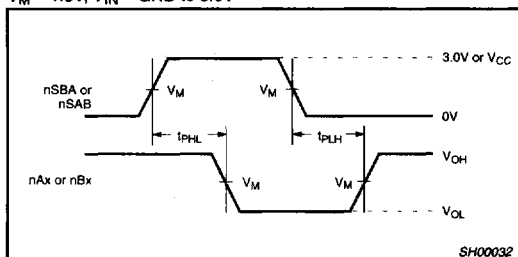
Waveform 2. Propagation Delay, nAx to nBx or nBx to nAx

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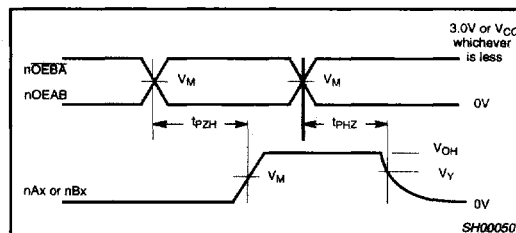
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AC WAVEFORMS (Continued)

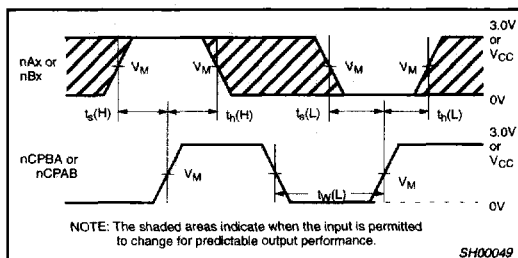
$V_M = 1.5V$, $V_{IN} = GND$ to $3.0V$



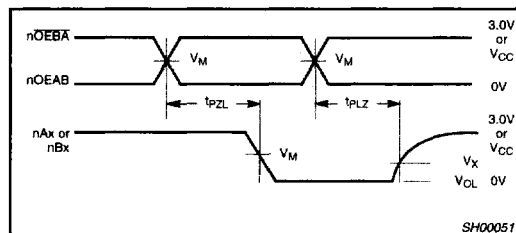
Waveform 3. Propagation Delay, SBA to nAx or SAB to nBx



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



Waveform 4. Data Setup and Hold Times



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

TEST CIRCUIT AND WAVEFORMS

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
74ABT16	3.0V	1MHz	500ns	2.5ns	2.5ns

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