

DATA SHEET

74ABT16543

16-bit octal latched transceivers with
dual enable (3-State)

Product specification

1995 Feb 17

IC23 Data Handbook

Philips Semiconductors



PHILIPS

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16-bit octal latched transceivers with dual enable (3-State)

74ABT16543

FEATURES

- Two 8-bit octal transceivers with D-type latch
- Live insertion/extraction permitted
- Power-up 3-State
- Power-up reset
- Multiple V_{CC} and GND pins minimize switching noise
- Back-to-back registers for storage
- Separate controls for data flow in each direction
- Bus hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Output capability: +64mA/-32mA

- Latch-up protection exceeds 500mA per Jedec JC40.2 Std 17
- ESD protection exceeds 2000V per MIL STD 883 Method 3015 and 200V per Machine Model

DESCRIPTION

The 74ABT16543 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 74ABT16543 dual octal registered transceiver contains two sets of D-type latches for temporary storage of data flowing in either direction. Separate Latch Enable ($nLEAB$, $nLEBA$) and Output Enable ($nOEAB$, $nOEBA$) inputs are provided for each register to permit independent control of data transfer in either direction. The outputs are guaranteed to sink 64mA.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS $T_{amb} = 25^{\circ}C$; GND = 0V	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay nAx to nBx	$C_L = 50pF$; $V_{CC} = 5V$	2.5 2.2	ns
C_{IN}	Input capacitance	$V_I = 0V$ or V_{CC}	3	pF
C_{IO}	I/O capacitance	$V_O = 0V$ or V_{CC} ; 3-State	7	pF
I_{CCZ}	Total supply current	Outputs disabled; $V_{CC} = 5.5V$	550	μA

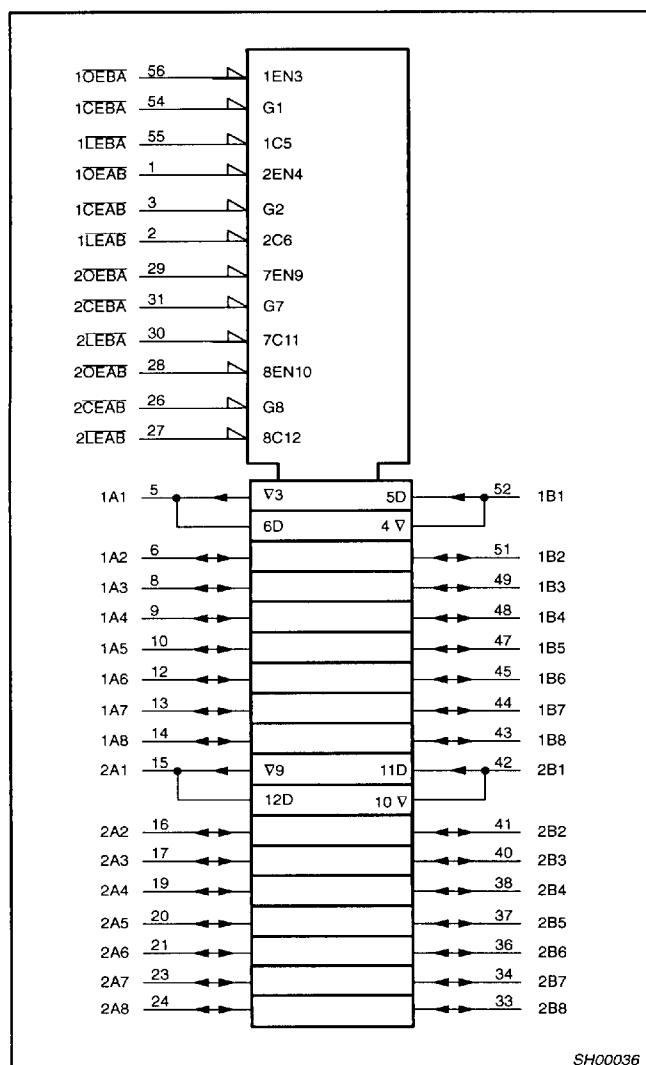
ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE	DRAWING NUMBER
56-pin plastic SSOP Type I	$-40^{\circ}C$ to $+85^{\circ}C$	BT16543DL	SOT371-1
56-pin plastic TSSOP Type II	$-40^{\circ}C$ to $+85^{\circ}C$	BT16543DGG	SOT364-1

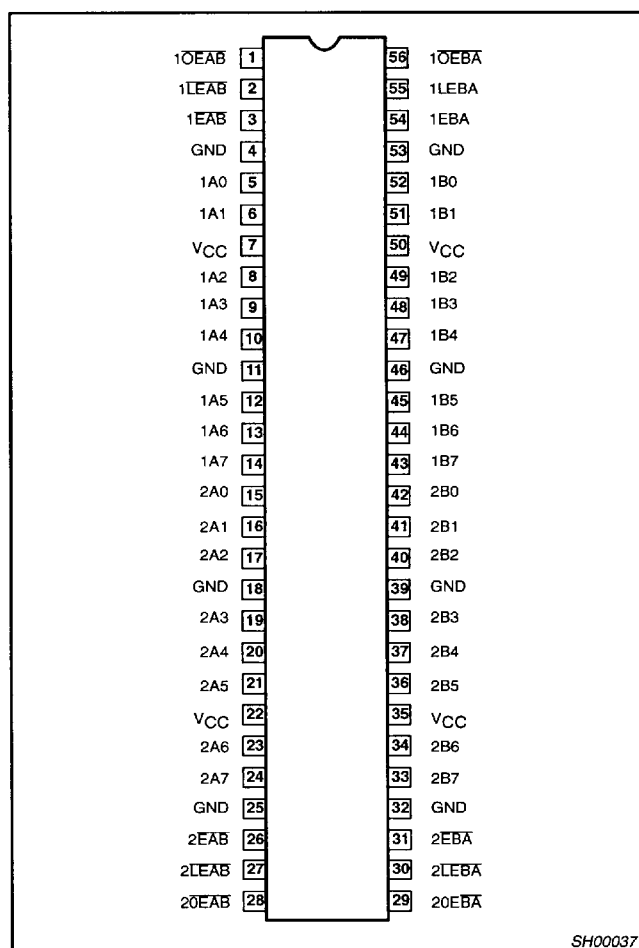
16-bit octal latched transceivers with dual enable (3-State)

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LOGIC SYMBOL (IEEE/IEC)



PIN CONFIGURATION



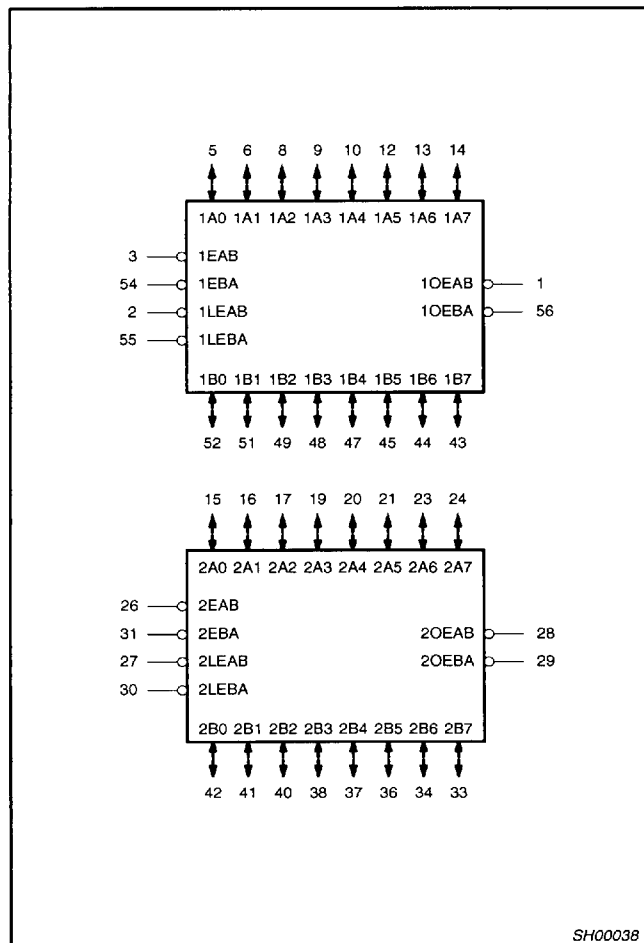
PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
5, 6, 8, 9, 10, 12, 13, 14 15, 16, 17, 19, 20, 21, 23, 24	1A0 – 1A7, 2A0 – 2A7	Data inputs/outputs
52, 51, 49, 48, 47, 45, 44, 43 42, 41, 40, 38, 37, 36, 34, 33	1B0 – 1B7, 2B0 – 2B7	Data inputs/outputs
1, 56 28, 29	1OEAB, 1OEB A, 2OEAB, 2OEB A	A to B / B to A Output Enable inputs (active-Low)
3, 54 26, 31	1EAB, 1EB A, 2EAB, 2EB A	A to B / B to A Enable inputs (active-Low)
2, 55 27, 30	1LEAB, 1LEB A, 2LEAB, 2LEB A	A to B / B to A Latch Enable inputs (active-Low)
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 SYMBOL



FUNCTIONAL DESCRIPTION

The 74ABT16543 contains two sets of eight D-type latches, with separate control pins for each set. Using data flow from A to B as an example, when the A-to-B Enable ($\overline{nEAB}$) input and the A-to-B Latch Enable ($\overline{nLEAB}$) input are Low the A-to-B path is transparent.

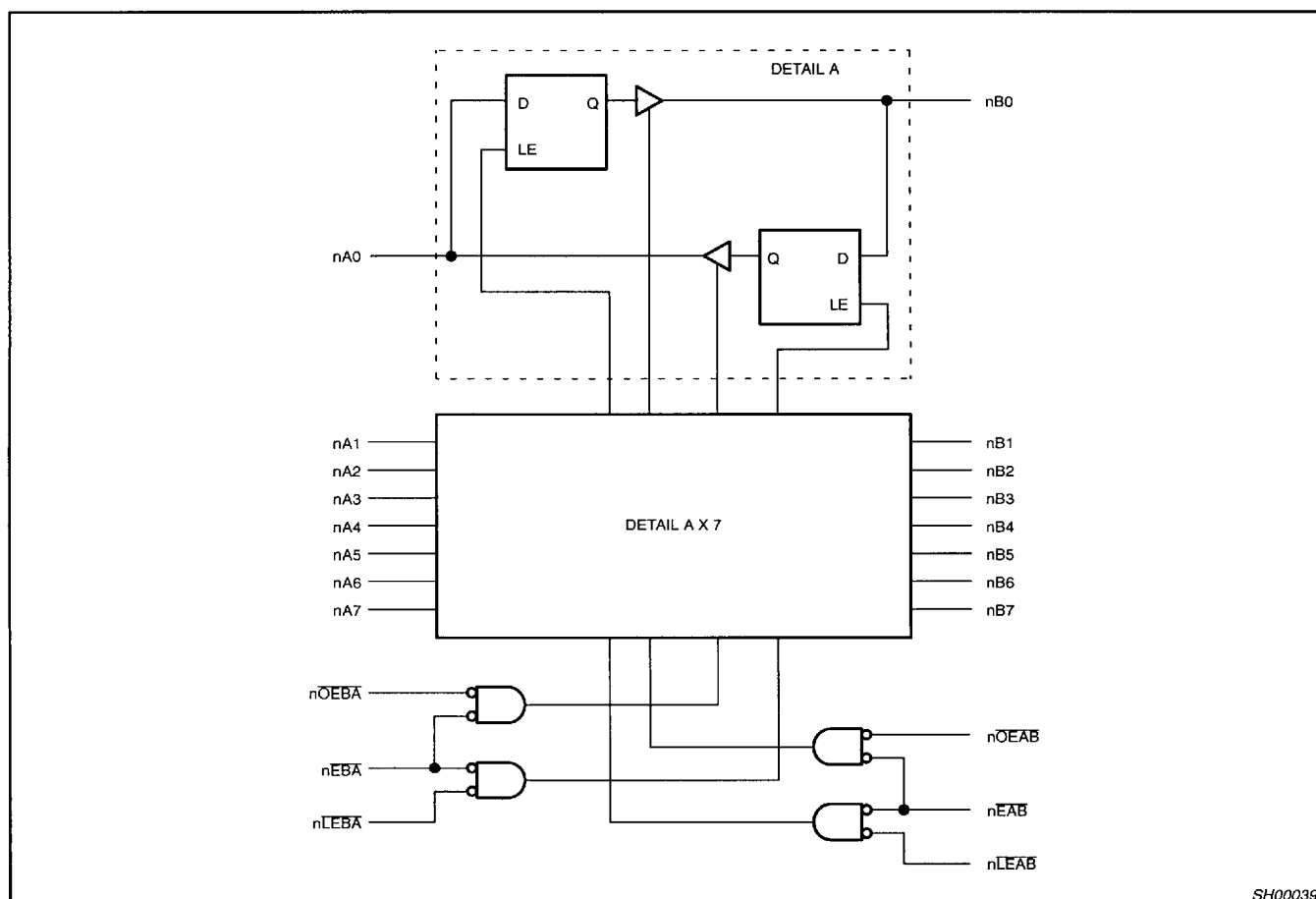
A subsequent Low-to-High transition of the $\overline{nLEAB}$ signal puts the A data into the latches where it is stored and the B outputs no longer change with the A inputs. With $\overline{EAB}$ and $\overline{nOEAB}$ both Low, the 3-State B output buffers are active and display the data present at the outputs of the A latches.

Control of data flow from B to A is similar, but using the $\overline{nEBA}$, $\overline{nLEBA}$, and $\overline{nOEBA}$ inputs.

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LOGIC DIAGRAM



FUNCTION TABLE

INPUTS				OUTPUTS	STATUS
nOEXX	nEXX	nLEXX	nAx or nBx	nBx or nAx	
H	X	X	X	Z	Disabled
X	H	X	X	Z	Disabled
L	↑	L	h	Z	Disabled + Latch
L	L	↑	h	H	Latch + Display
L	L	L	H	H	Transparent
L	L	H	X	NC	Hold

H = High voltage level

h = High voltage level one set-up time prior to the Low-to-High transition of nLEXX or nEXX (XX = AB or BA)

L = Low voltage level

l = Low voltage level one set-up time prior to the Low-to-High transition of nLEXX or nEXX (XX = AB or BA)

X = Don't care

↑ = Low-to-High transition of nLEXX or nEXX (XX = AB or BA)

NC = No change

Z = High impedance or "off" state

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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	125	mA
		output in High state	-68	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.

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			−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	3.4		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}		0.36	0.55		0.55	V
V _{RST}	Power-up output 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		± 1.0	±100		±100	μA
I _{OFF}	Power-off leakage current		V _{CC} = 0.0V; V _O or V _I ≤ 4.5V		± 2.0	±100		±100	μA
I _{PU/PD}	Power-up/down 3-State output current ⁴		V _{CC} = 2.1V; V _O = 0.0V or V _{CC} ; V _I = GND or V _{CC} ; V _{OE} = Don't care		± 1.0	±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}		1.0	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}		−1.0	−50		−50	μA
I _{CEX}	Output High leakage current		V _{CC} = 5.5V; V _O = 5.5V; V _I = GND or V _{CC}		1.0	50		50	μA
I _O	Output current ¹		V _{CC} = 5.5V; V _O = 2.5V	−50	−100	−200	−50	−200	mA
I _{CCH}	Quiescent supply current		V _{CC} = 5.5V; Outputs High, V _I = GND or V _{CC}		0.55	2		2	mA
I _{CCL}			V _{CC} = 5.5V; Outputs Low, V _I = GND or V _{CC}		9	35		35	mA
I _{CCZ}			V _{CC} = 5.5V; Outputs 3-State; V _I = GND or V _{CC}		0.55	2		2	mA
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		0.2	0.5		1.5	mA
I _{HOLD}	Bus Hold current A or B outputs		V _{CC} = 5.5V; V _I = 0.8 V	35			35		μA
			V _{CC} = 5.5V; V _I = 2.0 V	−75			−75		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 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	
t _{PLH} t _{PHL}	Propagation delay nAx to nBx, nBx to nAx	2	1.0 1.0	2.5 2.2	3.3 4.4	1.0 1.0	3.8 5.1	ns
t _{PLH} t _{PHL}	Propagation delay LEBA to nAx, LEAB to nBx	1, 2	1.0 1.2	3.1 3.0	4.3 4.8	1.0 1.2	5.2 5.6	ns
t _{PZH} t _{PZL}	Output enable time OEBA to nAx, OEAB to nBx	4 5	1.0 1.1	3.3 3.3	4.3 5.9	1.0 1.1	5.2 7.0	ns
t _{PHZ} t _{PLZ}	Output disable time OEBA to nAx, OEAB to nBx	4 5	1.9 1.6	3.5 2.6	5.0 4.2	1.9 1.6	5.7 4.6	ns
t _{PZH} t _{PZL}	Output enable time EBA to nAx, EAB to nBx	4 5	1.0 1.2	3.4 3.4	4.9 6.5	1.0 1.2	6.2 7.8	ns
t _{PHZ} t _{PLZ}	Output disable time EBA to nAx, EAB to nBx	4 5	2.0 1.7	3.4 2.6	5.6 5.1	2.0 1.7	6.6 5.4	ns

AC SETUP REQUIREMENTS

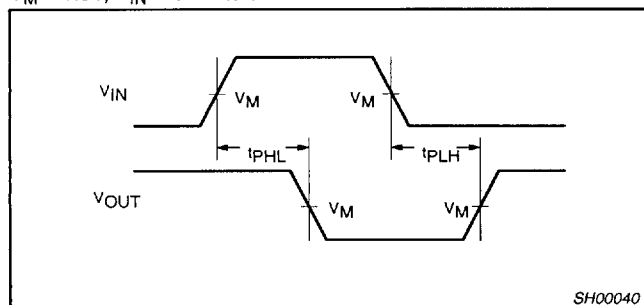
GND = 0V, $t_R = t_F = 2.5\text{ns}$, $C_L = 50\text{pF}$, $R_L = 500\Omega$

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	
$t_{\text{s}}(\text{H})$ $t_{\text{s}}(\text{L})$	Setup time nAx to $\overline{\text{LEAB}}$, nBx to $\overline{\text{LEBA}}$	3	1.5 3.5	0.4 -0.1	1.5 3.5	ns
$t_{\text{h}}(\text{H})$ $t_{\text{h}}(\text{L})$	Hold time nAx to $\overline{\text{LEAB}}$, nBx to $\overline{\text{LEBA}}$	3	1.5 2.0	0.2 -0.3	1.5 2.0	ns
$t_{\text{s}}(\text{H})$ $t_{\text{s}}(\text{L})$	Setup time nAx to $\overline{\text{EAB}}$, nBx to $\overline{\text{EBA}}$	3	1.5 3.5	0.2 -0.3	1.5 3.5	ns
$t_{\text{h}}(\text{H})$ $t_{\text{h}}(\text{L})$	Hold time nAx to $\overline{\text{EAB}}$, nBx to $\overline{\text{EBA}}$	3	1.5 2.0	0.3 -0.2	1.5 2.0	ns
$t_{\text{w}}(\text{L})$	Latch enable pulse width, Low	3	4.0	3.1	4.0	ns

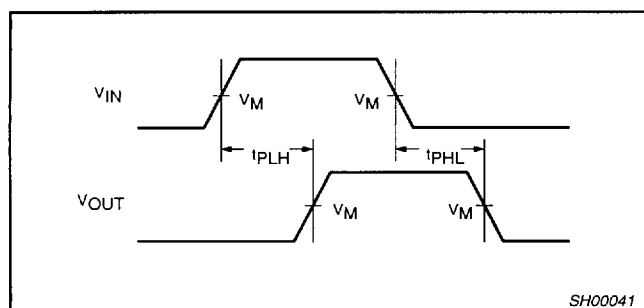
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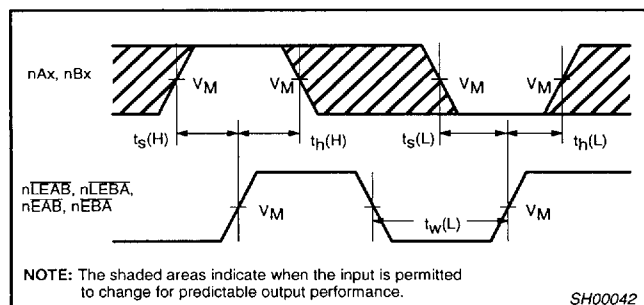
AC WAVEFORMS

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


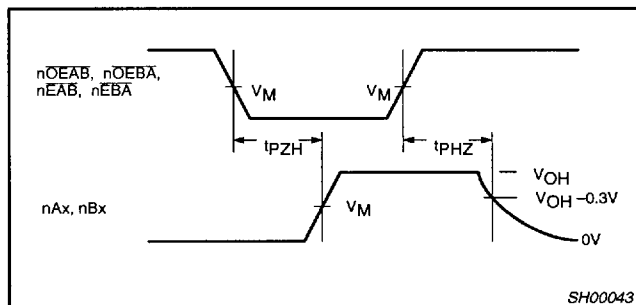
Waveform 1. Propagation Delay For Inverting Output



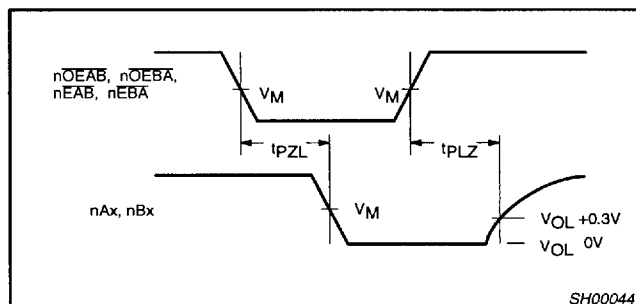
Waveform 2. Propagation Delay For Non-Inverting Output



Waveform 3. Data Setup and Hold Times and Latch Enable Pulse Width



Waveform 4. 3-State Output Enable Time to High Level and Output Disable Time from High Level

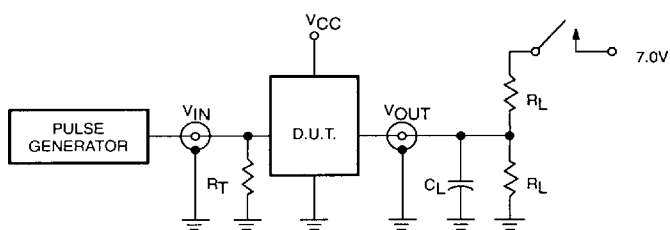


Waveform 5. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

16-bit octal latched transceivers with dual enable (3-State)

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TEST CIRCUIT AND WAVEFORMS



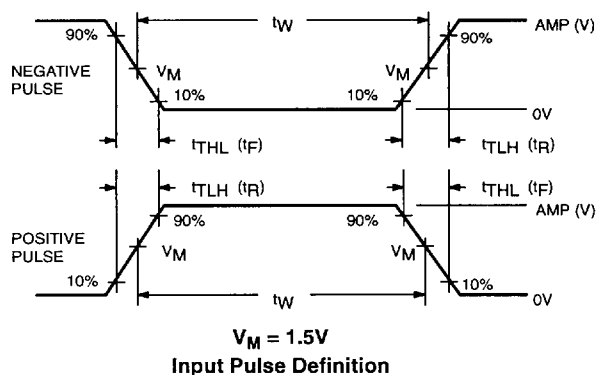
Test Circuit for 3-State Outputs

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.



FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_W	t_R	t_F
74ABT16	3.0V	1MHz	500ns	2.5ns	2.5ns

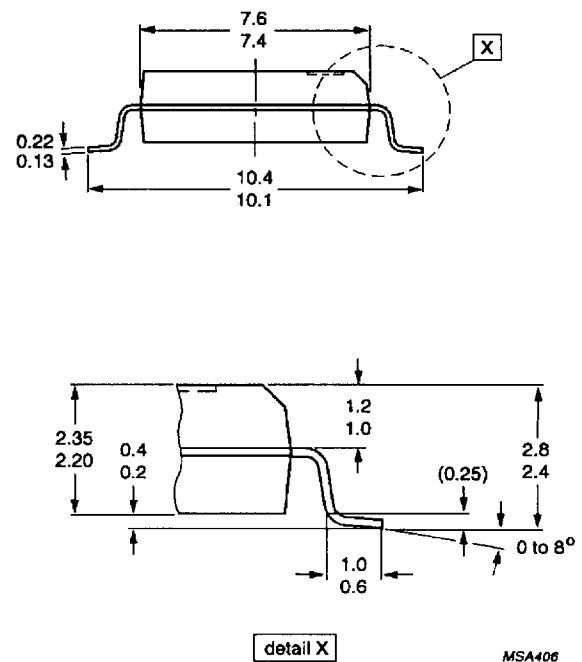
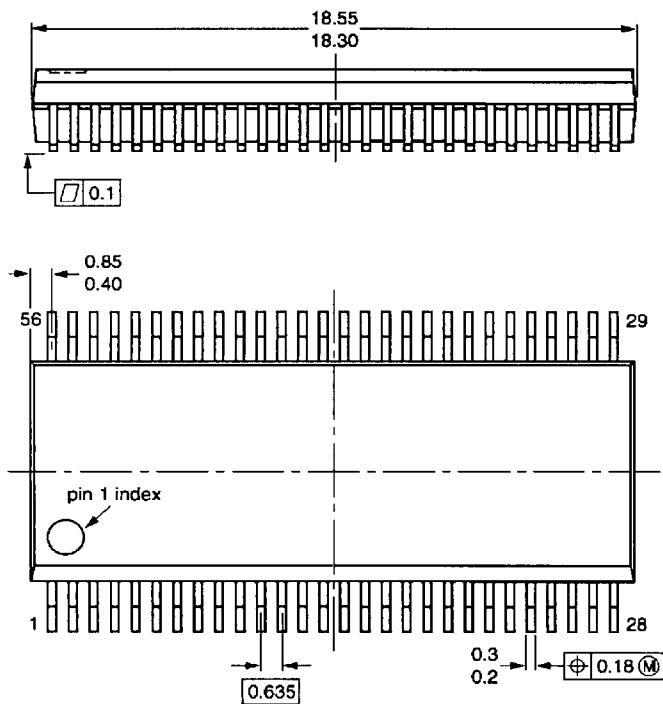
SA00018

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SSOP56: plastic shrink small outline package; 56 leads; body width 7.5mm

SOT371-1



Dimensions in mm.

16-bit octal latched transceivers with dual enable (3-State)

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TSSOP56: plastic thin shrink small outline package; 56 leads; body width 6.1mm

SOT364-1

