National Semiconductor

August 1998

54ABT16245
16-Bit Transceiver with TRI-STATE® Outputs

General Description

The 'ABT16245 contains sixteen non-inverting bidirectional buffers with TRI-STATE outputs and is intended for bus oriented applications. The device is byte controlled. Each byte has separate control inputs which can be shorted together for full 16-bit operation. The T/$\overline{R}$ inputs determine the direction of data flow through the device. The $\overline{OE}$ inputs disable both the A and B ports by placing them in a high impedance state.

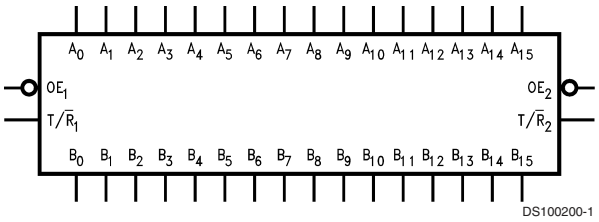
- Separate control logic for each byte
- 16-bit version of the 'ABT245
- A and B output sink capability of 48 mA, source capability of 24 mA
- Guaranteed latchup protection
- High impedance glitch free bus loading during entire power up and power down cycle
- Non-destructive hot insertion capability
- Standard Microcircuit Drawing (SMD) 5962-9317501

Features

- Bidirectional non-inverting buffers

Military	Package Number	Package Description
54ABT16245W-QML	WA48A	48-Lead Cerpack

Logic Symbol



DS100200-1

Pin Description

Pin Names	Description
$\overline{OE}_n$	Output Enable Input (Active Low)
T/$\overline{R}_n$	Transmit/Receive Input
A_0–A_{15}	Side A Inputs/Outputs
B_0–B_{15}	Side B Inputs/Outputs

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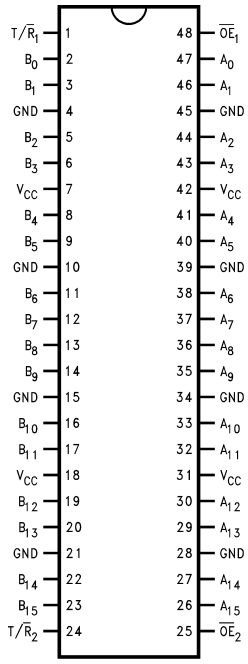
Connection Diagram

Pin Assignment for Cerpack



DS100200-2

Functional Description

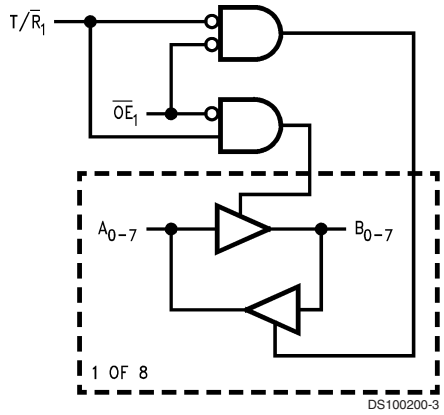
The ’ABT16245 contains sixteen non-inverting bidirectional buffers with TRI-STATE outputs. The device is byte controlled with each byte functioning identically, but independent of the other. The control pins can be shorted together to obtain full 16-bit operation.

Inputs		Outputs
$\overline{OE}_1$	$T/\overline{R}_1$	
L	L	Bus B_0–B_7 Data to Bus A_0–A_7
L	H	Bus A_0–A_7 Data to Bus B_0–B_7
H	X	HIGH-Z State on A_0–A_7, B_0–B_7

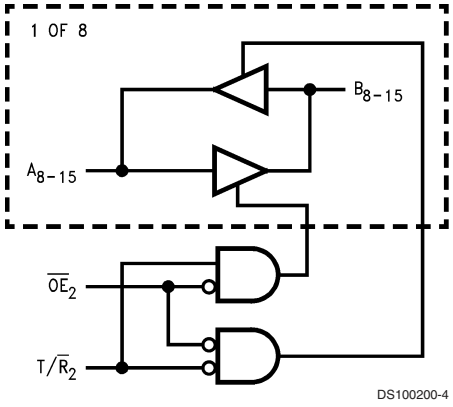
Inputs		Outputs
$\overline{OE}_2$	$T/\overline{R}_2$	
L	L	Bus B_8–B_{15} Data to Bus A_8–A_{15}
L	H	Bus A_8–A_{15} Data to Bus B_8–B_{15}
H	X	HIGH-Z State on A_8–A_{15}, B_8–B_{15}

H = High Voltage Level
L = Low Voltage Level
X = Immaterial
Z = High Impedance

Logic Diagrams



DS100200-3



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Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Storage Temperature	−65˚C to +150˚C
Ambient Temperature under Bias	−55˚C to +125˚C
Junction Temperature under Bias	
Ceramic	−55˚C to +175˚C
V_{CC} Pin Potential to	
Ground Pin	−0.5V to +7.0V
Input Voltage (Note 2)	−0.5V to +7.0V
Input Current (Note 2)	−30 mA to +5.0 mA
Voltage Applied to Any Output	
in the Disabled or	
Power-off State	−0.5V to 5.5V
in the HIGH State	−0.5V to V_{CC}
Current Applied to Output	
in LOW State (Max)	twice the rated I_{OL} (mA)
DC Latchup Source Current	−500 mA
Over Voltage Latchup (I/O)	10V

Recommended Operating Conditions

Free Air Ambient Temperature	
Military	−55˚C to +125˚C
Supply Voltage	
Military	+4.5V to +5.5V
Minimum Input Edge Rate	(ΔV/Δt)
Data Input	50 mV/ns
Enable Input	20 mV/ns

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

DC Electrical Characteristics

Symbol	Parameter		ABT16245 Min	Typ	Max	Units	V_{CC}	Conditions
V_{IH}	Input HIGH Voltage		2.0			V		Recognized HIGH Signal
V_{IL}	Input LOW Voltage				0.8	V		Recognized LOW Signal
V_{CD}	Input Clamp Diode Voltage				−1.2	V	Min	I_{IN} = −18 mA ($\overline{OE}_n$, T/$\overline{R}_n$)
V_{OH}	Output HIGH Voltage	54ABT	2.5			V	Min	I_{OH} = −3 mA (A_n, B_n)
		54ABT	2.0			V	Min	I_{OH} = −24 mA (A_n, B_n)
V_{OL}	Output LOW Voltage	54ABT			0.55	V	Min	I_{OL} = 48 mA (A_n, B_n)
I_{IH}	Input HIGH Current				5	μA	Max	V_{IN} = 2.7V ($\overline{OE}_n$, T/$\overline{R}_n$) (Note 3)
					5			V_{IN} = V_{CC} ($\overline{OE}_n$, T/$\overline{R}_n$)
I_{BVI}	Input HIGH Current Breakdown Test				7	μA	Max	V_{IN} = 7.0V ($\overline{OE}_n$, T/$\overline{R}_n$)
I_{BVIT}	Input HIGH Current Breakdown Test (I/O)				100	μA	Max	V_{IN} = 5.5V (A_n, B_n)
I_{IL}	Input LOW Current				−5	μA	Max	V_{IN} = 0.5V ($\overline{OE}_n$, T/$\overline{R}_n$) (Note 3)
					−5			V_{IN} = 0.0V ($\overline{OE}_n$, T/$\overline{R}_n$)
V_{ID}	Input Leakage Test		4.75			V	0.0	I_{ID} = 1.9 μA ($\overline{OE}_n$, T/$\overline{R}_n$) All Other Pins Grounded
I_{IH} + I_{OZH}	Output Leakage Current				50	μA	0 − 5.5V	V_{OUT} = 2.7V (A_n, B_n); $\overline{OE}$ = 2.0V
I_{IL} + I_{OZL}	Output Leakage Current				−50	μA	0 − 5.5V	V_{OUT} = 0.5V (A_n, B_n); $\overline{OE}$ = 2.0V
I_{OS}	Output Short-Circuit Current		−100		−275	mA	Max	V_{OUT} = 0.0V (A_n, B_n)
I_{CEX}	Output High Leakage Current				50	μA	Max	V_{OUT} = V_{CC} (A_n, B_n)
I_{ZZ}	Bus Drainage Test				100	μA	0.0	V_{OUT} = 5.50V (A_n, B_n); All Others GND
I_{CCH}	Power Supply Current				100	μA	Max	All Outputs HIGH
I_{CCL}	Power Supply Current				60	mA	Max	All Outputs LOW
I_{CCZ}	Power Supply Current				100	μA	Max	$\overline{OE}_n$ = V_{CC}, T/$\overline{R}_n$ = GND or V_{CC} All others at V_{CC} or GND
I_{CCT}	Additional I_{CC}/Input	Outputs Enabled			2.5	mA	Max	V_I = V_{CC} − 2.1V
		Outputs TRI-STATE			2.5	mA		$\overline{OE}_n$, T/$\overline{R}_n$ V_I = V_{CC} − 2.1V
		Outputs TRI-STATE			50	μA		Data Input V_I = V_{CC} − 2.1V All others at V_{CC} or GND

DC Electrical Characteristics (Continued)

Symbol	Parameter	ABT16245			Units	V_{CC}	Conditions
		Min	Typ	Max			
I_{CCD}	Dynamic I_{CC} No Load			0.1	mA/ MHz	Max	Outputs Open $\overline{OE}_n$ = GND, T/$\overline{R}_n$ = GND or V_{CC} One Bit Toggling, 50% Duty Cycle

Note 3: Guaranteed, but not tested.

AC Electrical Characteristics

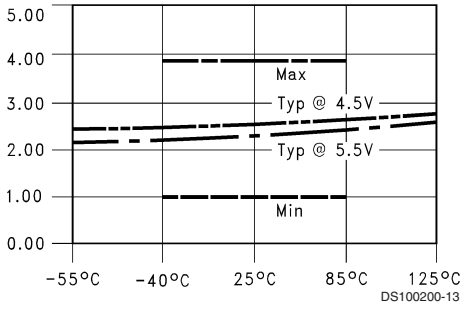
Symbol	Parameter	54ABT T_A = –55˚C to +125˚C V_{CC} = 4.5V–5.5V C_L = 50 pF		Units	Fig. No.
		Min	Max		
t_{PLH} t_{PHL}	Propagation Delay Data to Outputs	0.5 0.5	4.5 5.2	ns	*Figure 5*
t_{PZH} t_{PZL}	Output Enable Time	0.8 0.9	6.4 6.9	ns	*Figure 4*
t_{PHZ} t_{PLZ}	Output Disable Time	1.3 1.0	6.9 6.9	ns	*Figure 4*

Capacitance

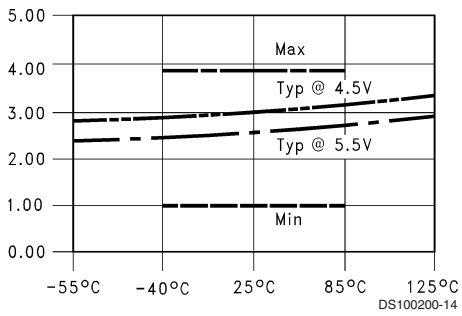
Symbol	Parameter	Typ	Units	Conditions, T_A = 25˚C
C_{IN}	Input Capacitance	5	pF	V_{CC} = 0.0V ($\overline{OE}_n$, T/$\overline{R}_n$)
$C_{I/O}$ (Note 4)	Output Capacitance	11	pF	V_{CC} = 5.0V (A_n, B_n)

Note 4: $C_{I/O}$ is measured at frequency f = 1 MHz, per MIL-STD-883B, Method 3012.

t_{PLH} vs Temperature (T_A)
C_L = 50 pF, 1 Output Switching

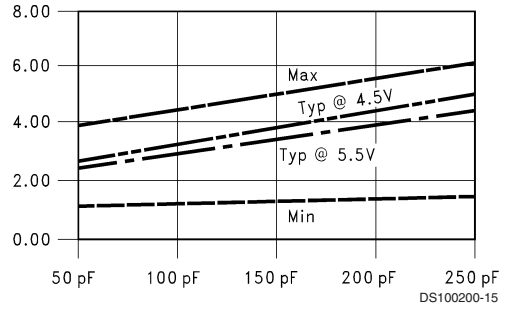


t_{PHL} vs Temperature (T_A)
C_L = 50 pF, 1 Output Switching

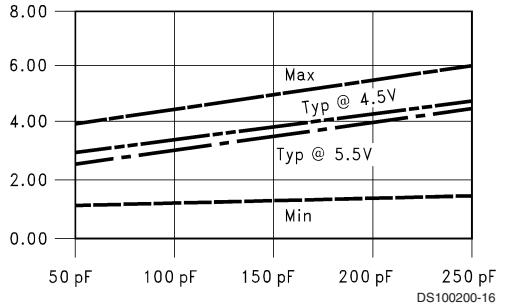


Capacitance (Continued)

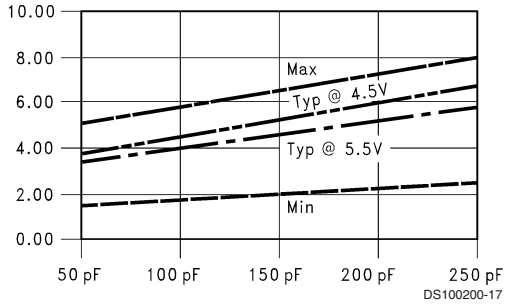
t_{PLH} vs Load Capacitance
1 Output Switching, $T_A = 25^\circ C$



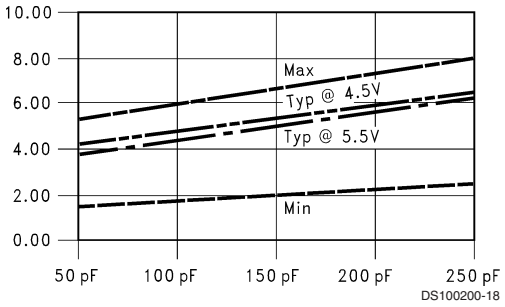
t_{PHL} vs Load Capacitance
1 Output Switching, $T_A = 25^\circ C$



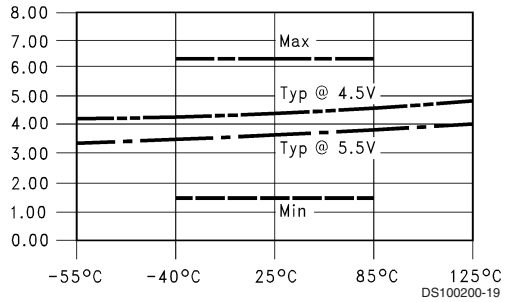
t_{PLH} vs Load Capacitance
16 Outputs Switching, $T_A = 25^\circ C$



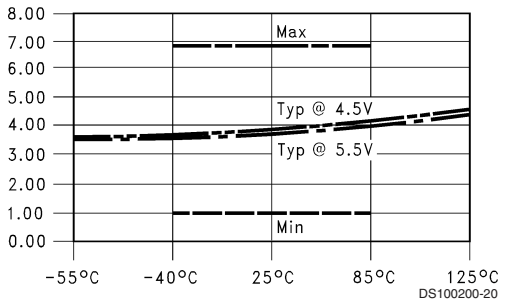
t_{PHL} vs Load Capacitance
16 Outputs Switching, $T_A = 25^\circ C$



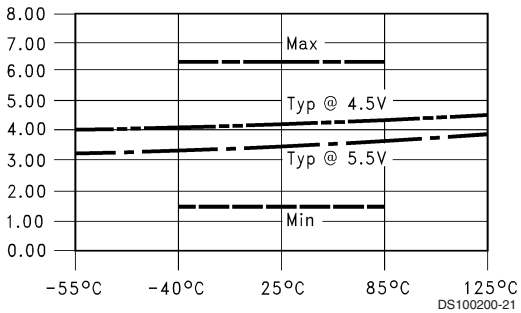
t_{PZL} vs Temperature (T_A)
C_L = 50 pF, 1 Output Switching



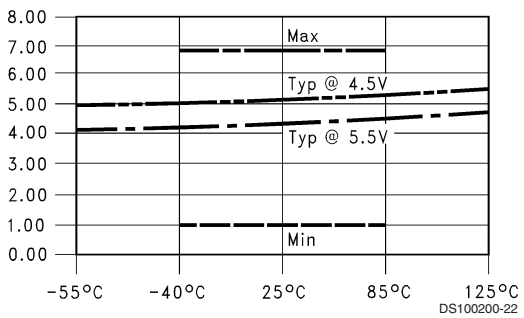
t_{PLZ} vs Temperature (T_A)
C_L = 50 pF, 1 Output Switching



t_{PZH} vs Temperature (T_A)
C_L = 50 pF, 1 Output Switching



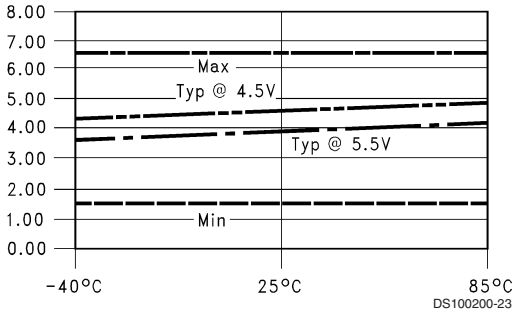
t_{PHZ} vs Temperature (T_A)
C_L = 50 pF, 1 Output Switching



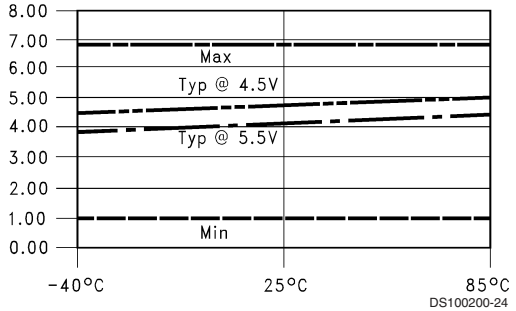
Dashed lines represent design characteristics; for specified guarantees, refer to AC Characteristics Table.

Capacitance (Continued)

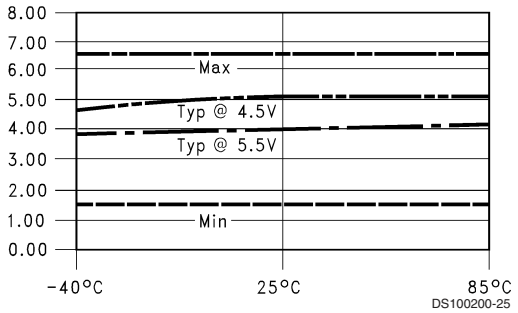
t_{PZH} vs Temperature (T_A)
C_L = 50 pF, 16 Outputs Switching



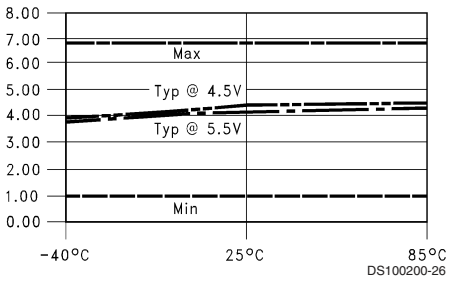
t_{PHZ} vs Temperature (T_A)
C_L = 50 pF, 16 Outputs Switching



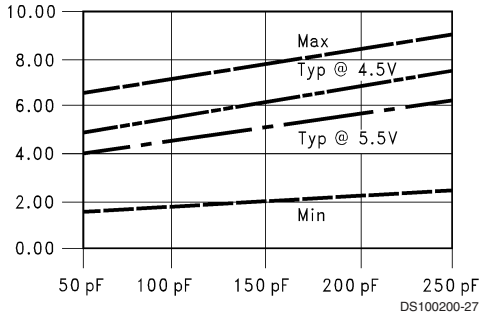
t_{PZL} vs Temperature (T_A)
C_L = 50 pF, 16 Outputs Switching



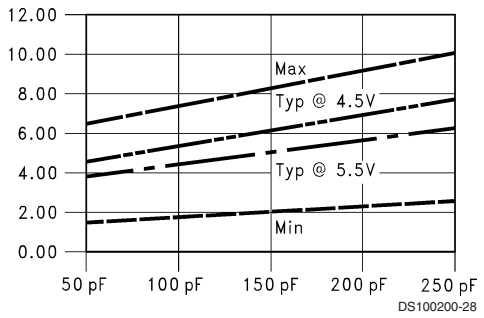
t_{PLZ} vs Temperature (T_A)
C_L = 50 pF, 16 Outputs Switching



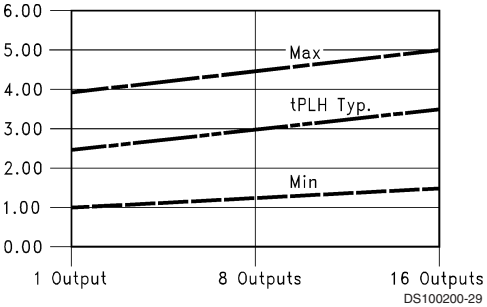
t_{PZL} vs Load Capacitance
16 Outputs Switching T_A = 25˚C



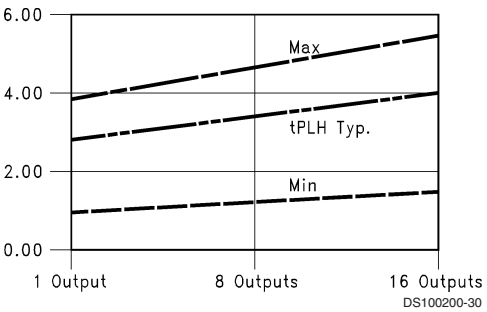
t_{PZH} vs Load Capacitance
16 Outputs Switching T_A = 25˚C



t_{PLH} vs Number Output Switching
V_{CC} = 5.0V, T_A = 25˚C, C_L = 50 pF



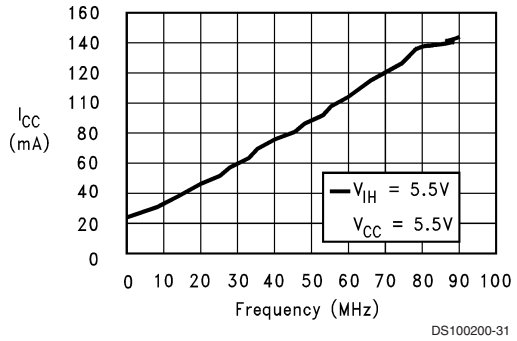
t_{PHL} vs Number Output Switching
V_{CC} = 5.0V, T_A = 25˚C, C_L = 50 pF



Dashed lines represent design characteristics; for specified guarantees, refer to AC Characteristics Table.

Capacitance (Continued)

I_{CC} vs Frequency
Average, $T_A = 25^{\circ}C$, $V_{CC} = 5.5V$
All Outputs Unloaded/Unterminated;
16 Outputs Switching In-Phase at 50% Duty Cycle



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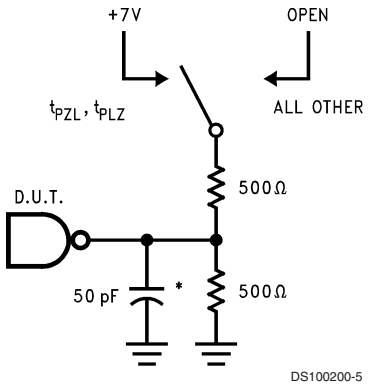
Dashed lines represent design characteristics; for specified guarantees, refer to AC Characteristics Table.

AC Loading



*Includes jig and probe capacitance

FIGURE 1. Standard AC Test Load

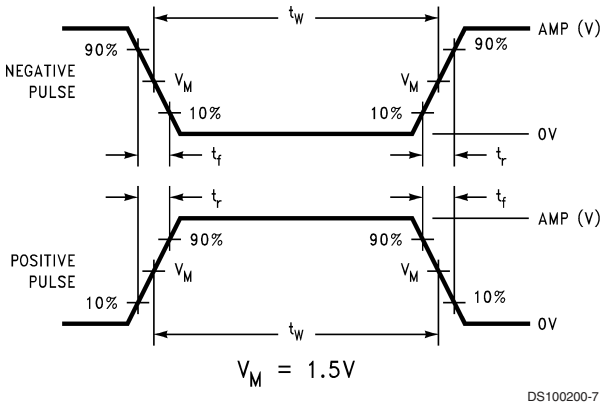


FIGURE 2. Input Pulse Requirements

Amplitude	Rep. Rate	t_w	t_r	t_f
3.0V	1 MHz	500 ns	2.5 ns	2.5 ns

FIGURE 3. Test Input Signal Requirements

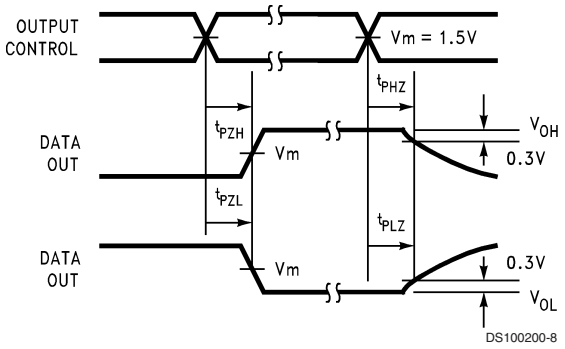


FIGURE 4. TRI-STATE Output HIGH and LOW Enable and Disable Times

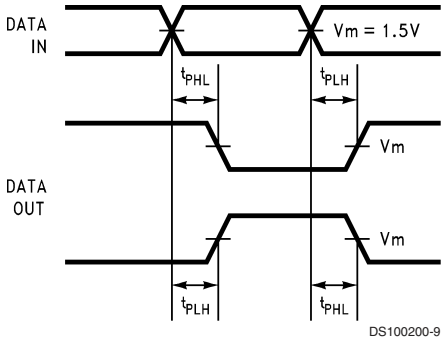
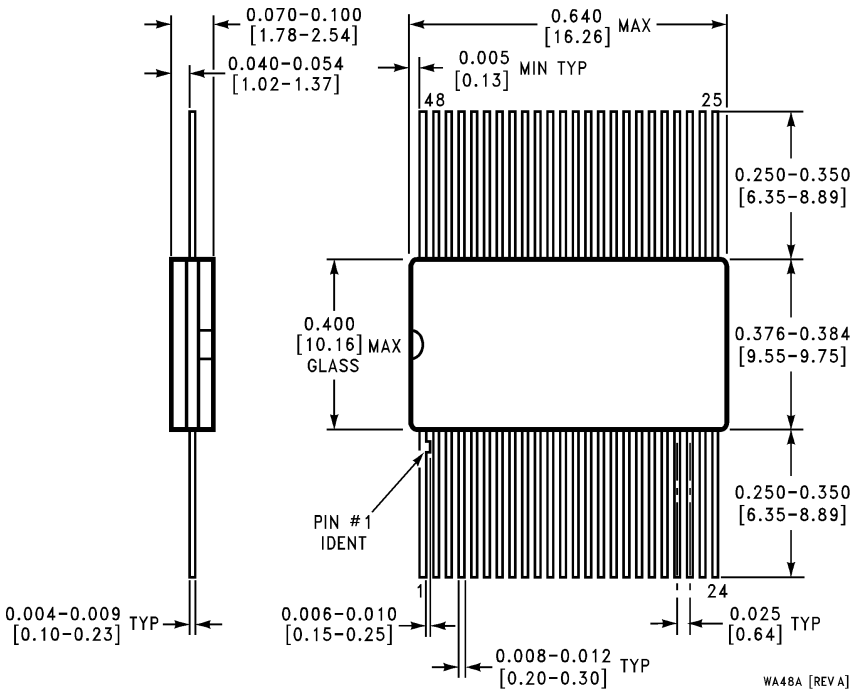


FIGURE 5. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

Physical Dimensions inches (millimeters) unless otherwise noted



48-Lead Cerpack
NS Package Number WA48A

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