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.

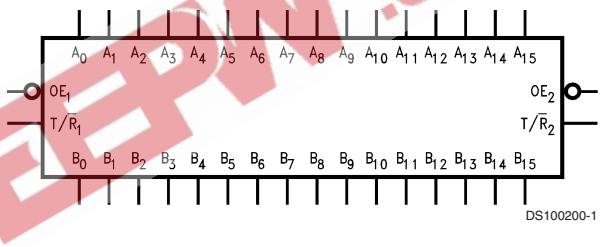
- Separate control logic for each byte
- 16-bit version of the 'ABT245
- A and B output sink capability of 48 mA, source capability of 24 mA
- Guaranteed latchup protection
- High impedance glitch free bus loading during entire power up and power down cycle
- Non-destructive hot insertion capability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

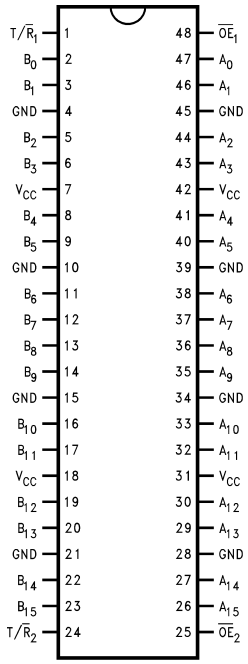
Pin Description

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

TRI-STATE® is a registered trademark of National Semiconductor Corporation.

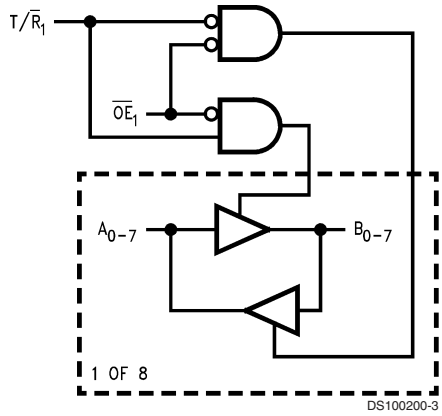
Connection Diagram

Pin Assignment for Cerpack

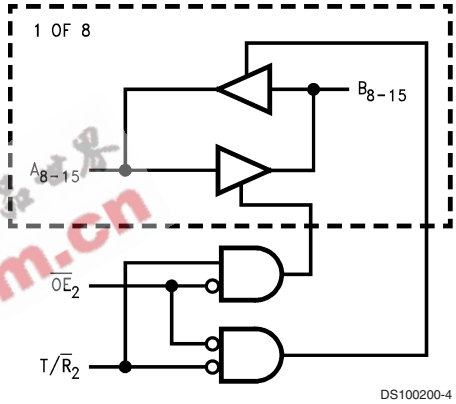


DS100200-2

Logic Diagrams



DS100200-3



DS100200-4

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

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	ABT16245 Typ	ABT16245 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 Min	ABT16245 Typ	ABT16245 Max	Units	V_{CC}	Conditions
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

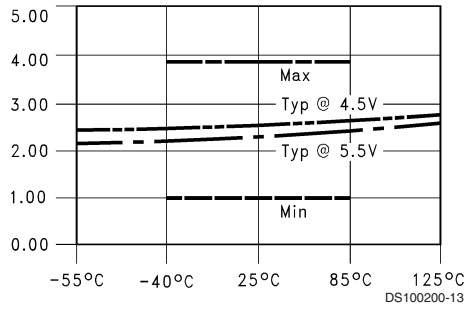
Symbol	Parameter	54ABT T_A = −55˚C to +125˚C, V_{CC} = 4.5V–5.5V, C_L = 50 pF Min	54ABT Max	Units	Fig. No.
t_{PLH} t_{PHL}	Propagation Delay Data to Outputs	0.5 0.5	4.5 5.2	ns	*Figure 5*
t_{PZH} t_{PZL}	Output Enable Time	0.8 0.9	6.4 6.9	ns	*Figure 4*
t_{PHZ} t_{PLZ}	Output Disable Time	1.3 1.0	6.9 6.9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

Capacitance

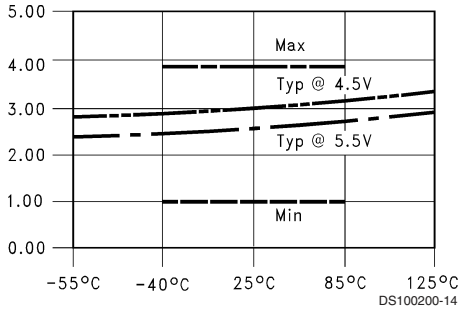
Symbol	Parameter	Typ	Units	Conditions, T_A = 25˚C
C_{IN}	Input Capacitance	5	pF	V_{CC} = 0.0V ($\overline{OE}_n$, T/$\overline{R}_n$)
$C_{I/O}$ (Note 4)	Output Capacitance	11	pF	V_{CC} = 5.0V (A_n, B_n)

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

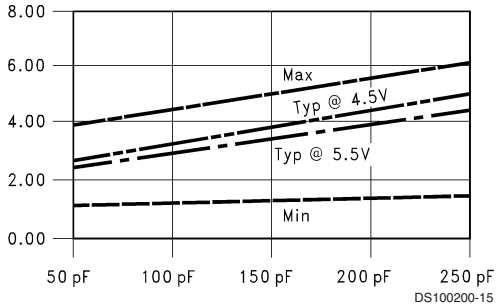


t_{PHL} vs Temperature (T_A)
C_L = 50 pF, 1 Output Switching

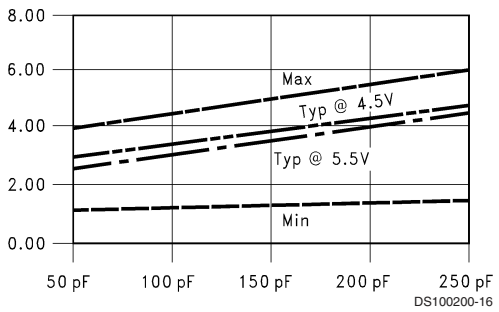


Capacitance (Continued)

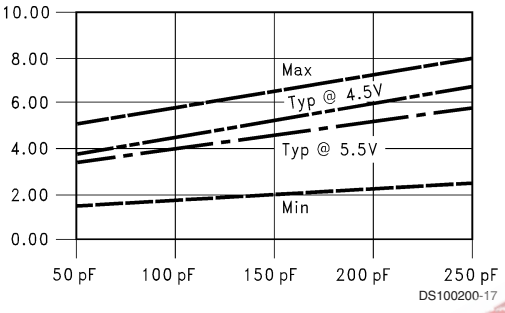
t_{PLH} vs Load Capacitance
1 Output Switching, $T_A = 25^\circ C$



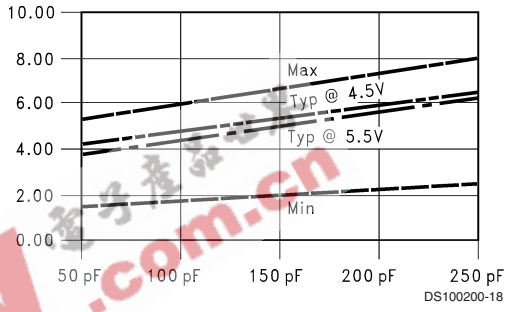
t_{PHL} vs Load Capacitance
1 Output Switching, $T_A = 25^\circ C$



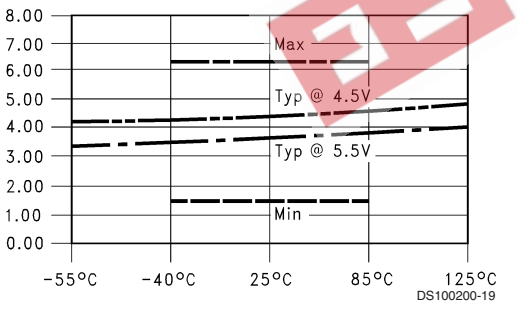
t_{PLH} vs Load Capacitance
16 Outputs Switching, $T_A = 25^\circ C$



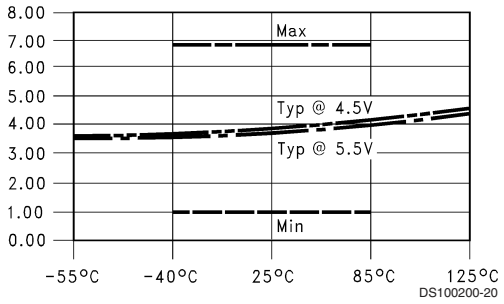
t_{PHL} vs Load Capacitance
16 Outputs Switching, $T_A = 25^\circ C$



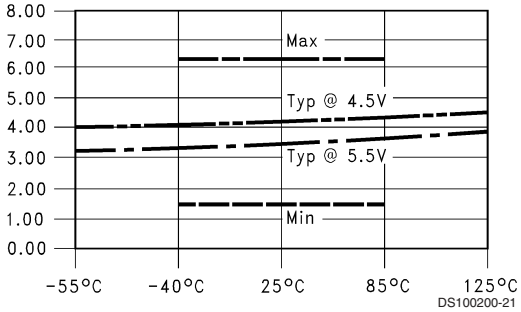
t_{PZL} vs Temperature (T_A)
$C_L = 50$ pF, 1 Output Switching



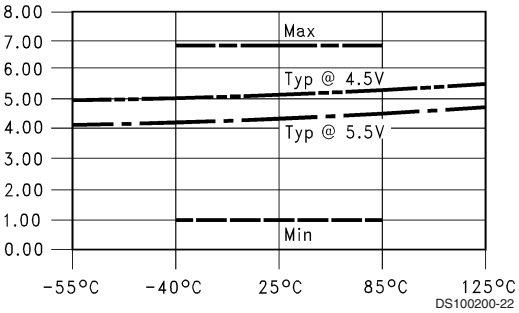
t_{PLZ} vs Temperature (T_A)
$C_L = 50$ pF, 1 Output Switching



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



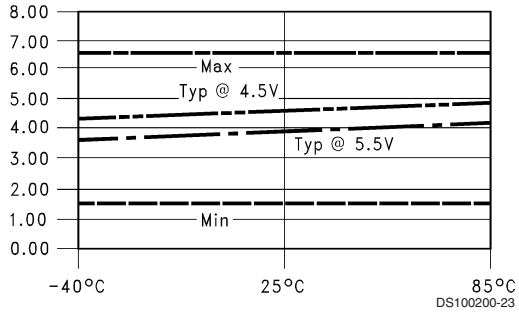
t_{PHZ} vs Temperature (T_A)
$C_L = 50$ pF, 1 Output Switching



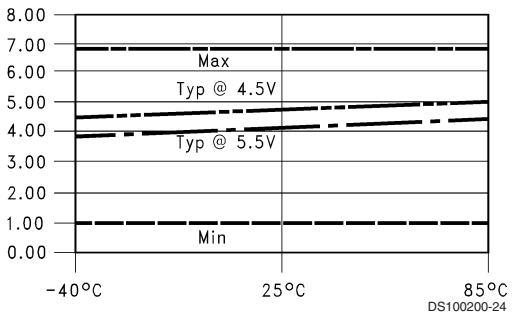
Dashed lines represent design characteristics; for specified guarantees, refer to AC Characteristics Table.

Capacitance (Continued)

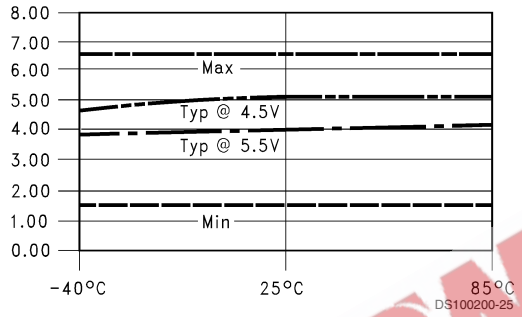
t_{PZH} vs Temperature (T_A)
C_L = 50 pF, 16 Outputs Switching



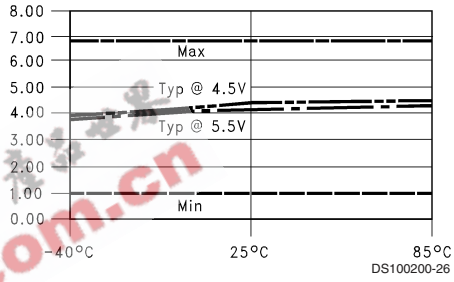
t_{PHZ} vs Temperature (T_A)
C_L = 50 pF, 16 Outputs Switching



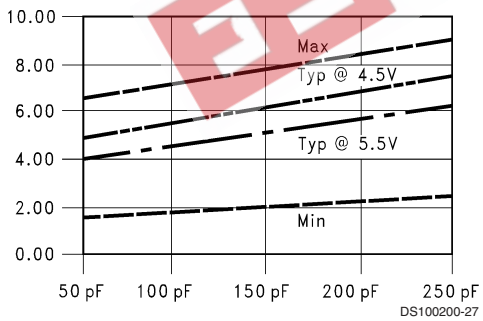
t_{PZL} vs Temperature (T_A)
C_L = 50 pF, 16 Outputs Switching



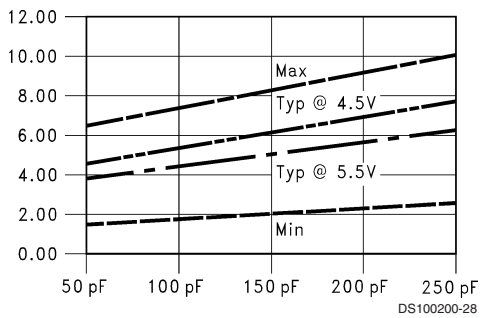
t_{PLZ} vs Temperature (T_A)
C_L = 50 pF, 16 Outputs Switching



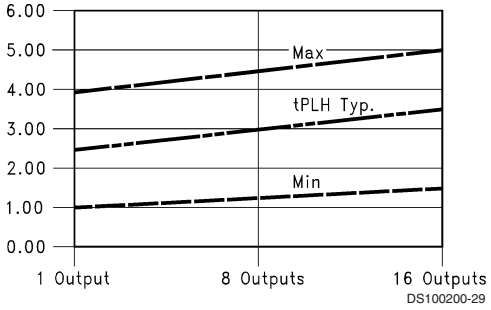
t_{PZL} vs Load Capacitance
16 Outputs Switching T_A = 25˚C



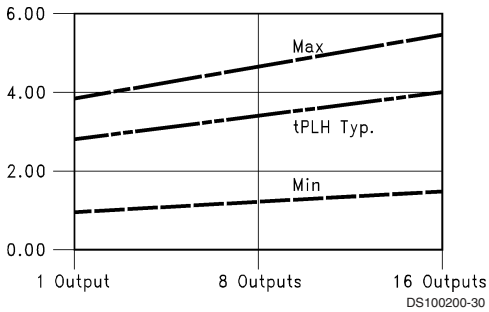
t_{PZH} vs Load Capacitance
16 Outputs Switching T_A = 25˚C



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



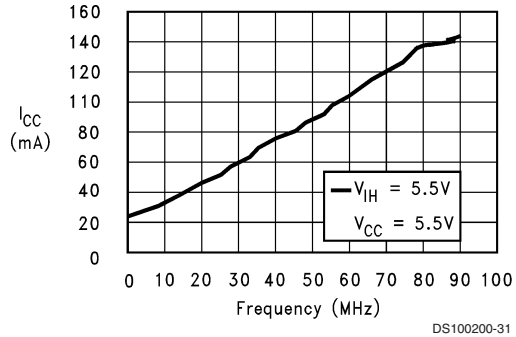
t_{PHL} vs Number Output Switching
V_{CC} = 5.0V, T_A = 25˚C, C_L = 50 pF



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

Capacitance (Continued)

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



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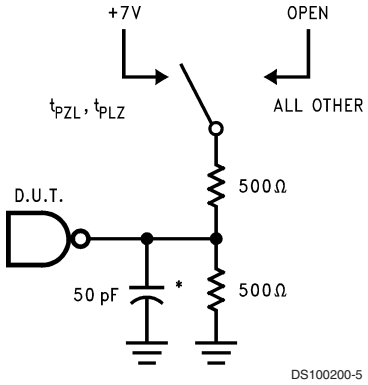
Dashed lines represent design characteristics; for specified guarantees, refer to AC Characteristics Table.

AC Loading



*Includes jig and probe capacitance

FIGURE 1. Standard AC Test Load

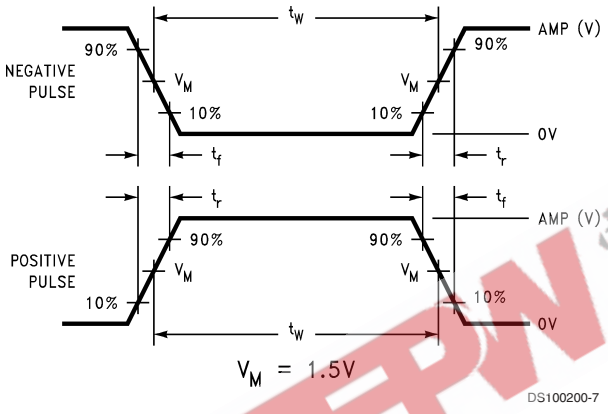


FIGURE 2. Input Pulse Requirements

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

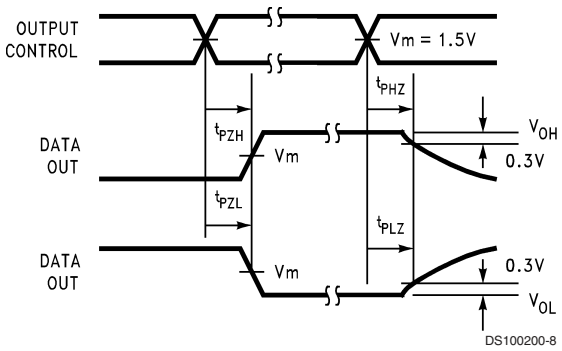


FIGURE 4. TRI-STATE Output HIGH and LOW Enable and Disable Times

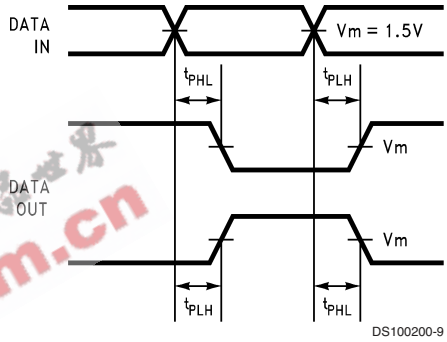
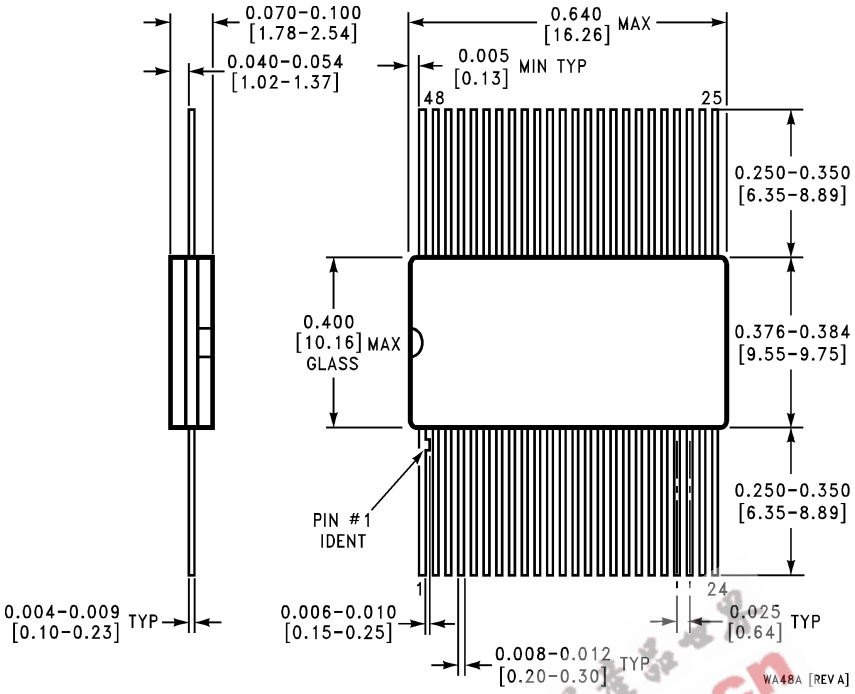


FIGURE 5. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

Physical Dimensions inches (millimeters) unless otherwise noted



48-Lead Cerpack
NS Package Number WA48A

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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