FAIRCHILD SEMICONDUCTOR™

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74ABT16501
18-Bit Universal Bus Transceivers with 3-STATE Outputs

General Description

The ABT16501 18-bit universal bus transceiver combines D-type latches and D-type flip-flops to allow data flow in transparent, latched, and clocked modes.

Data flow in each direction is controlled by output-enable (OEAB and $\overline{OEBA}$), latch-enable (LEAB and LEBA), and clock (CLKAB and CLKBA) inputs. For A-to-B data flow, the device operates in the transparent mode when LEAB is HIGH. When LEAB is LOW, the A data is latched if CLKAB is held at a HIGH or LOW logic level. If LEAB is LOW, the A bus data is stored in the latch/flip-flop on the LOW-to-HIGH transition of CLKAB. Output-enable OEAB is active-high. When OEAB is HIGH, the outputs are active. When OEAB is LOW, the outputs are in the high-impedance state.

Data flow for B to A is similar to that of A to B but uses $\overline{OEBA}$, LEBA, and CLKBA. The output enables are complementary (OEAB is active HIGH and $\overline{OEBA}$ is active LOW).

To ensure the high-impedance state during power up or power down, OE inputs should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

Features

- Combines D-Type latches and D-Type flip-flops for operation in transparent, latched, or clocked mode
- Flow-through architecture optimizes PCB layout
- Guaranteed latch-up protection
- High impedance glitch free bus loading during entire power up and power down cycle
- Non-destructive hot insertion capability

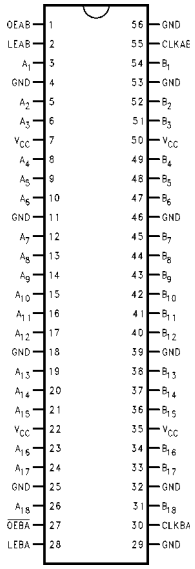
Ordering Code:

Order Number	Package Number	Package Description
74ABT16501CSSC	MS56A	56-Lead Shrink Small Outline Package (SSOP), JEDEC MO-118, 0.300" Wide
74ABT16501CMTD	MTD56	56-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

Devices also available in Tape or Reel. Specify by appending the suffix letter "X" to the ordering code.

Connection Diagram

Pin Assignment for SSOP



Function Table (Note 1)

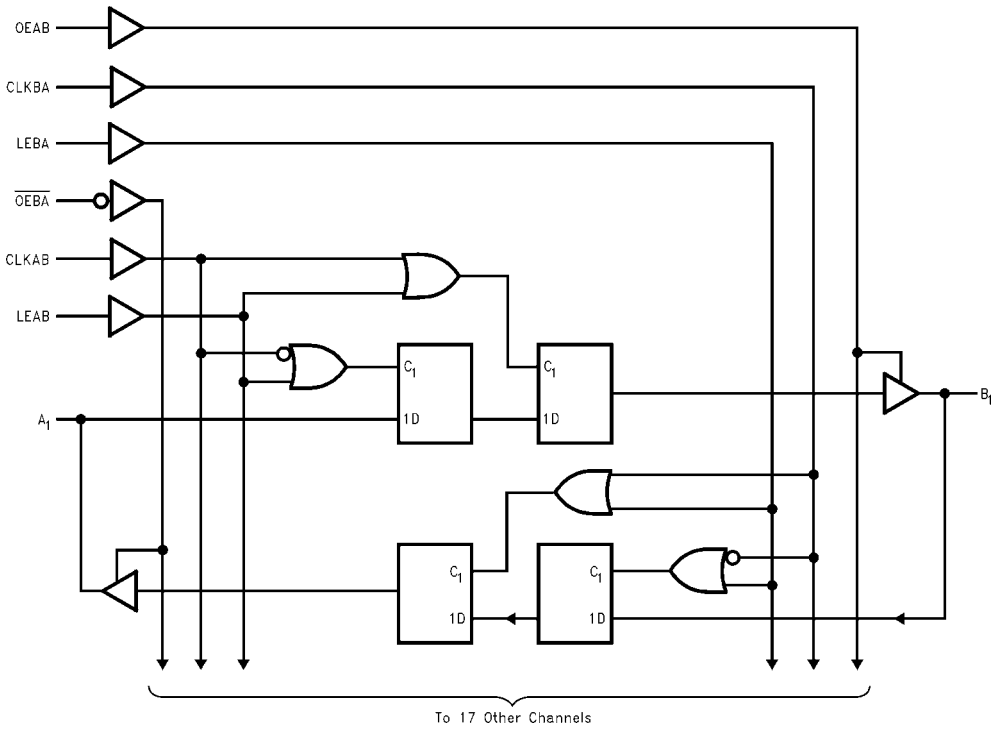
Inputs				Output
OEAB	LEAB	CLKAB	A	B
L	X	X	X	Z
H	H	X	L	L
H	H	X	H	H
H	L	↑	L	L
H	L	↑	H	H
H	L	H	X	B_0 (Note 2)
H	L	L	X	B_0 (Note 3)

Note 1: A-to-B data flow is shown: B-to-A flow is similar but uses $\overline{OEBA}$, LEBA, and CLKBA.

Note 2: Output level before the indicated steady-state input conditions were established.

Note 3: Output level before the indicated steady-state input conditions were established, provided that CLKAB was HIGH before LEAB went LOW.

Logic Diagram



Absolute Maximum Ratings(Note 4)

Storage Temperature	−65°C to +150°C
Ambient Temperature under Bias	−55°C to +125°C
Junction Temperature under Bias	−55°C to +150°C
V_{CC} Pin Potential to Ground Pin	−0.5V to +7.0V
Input Voltage (Note 5)	−0.5V to +7.0V
Input Current (Note 5)	−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	−40°C to +85°C
Supply Voltage	+4.5V to +5.5V
Minimum Input Edge Rate (ΔV/Δt)	
Data Input	50 mV/ns
Enable Input	20 mV/ns

Note 4: 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 5: Either voltage limit or current limit is sufficient to protect inputs.

DC Electrical Characteristics

Symbol	Parameter	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
V_{OH}	Output HIGH Voltage	2.5			V	Min	I_{OH} = −3 mA
		2.0			V	Min	I_{OH} = −32 mA
V_{OL}	Output LOW Voltage			0.55	V	Min	I_{OL} = 64 mA
I_{IH}	Input HIGH Current			1	μA	Max	V_{IN} = 2.7V (Note 6)
				1			V_{IN} = V_{CC}
I_{BVI}	Input HIGH Current Breakdown Test			7	μA	Max	V_{IN} = 7.0V
I_{IL}	Input LOW Current			−1	μA	Max	V_{IN} = 0.5V (Note 6)
				−1			V_{IN} = 0.0V
V_{ID}	Input Leakage Test	4.75			V	0.0	I_{ID} = 1.9 μA All Other Pins Grounded
I_{IH} + I_{OZH}	Output Leakage Current			10	μA	0 − 5.5V	V_{OUT} = 2.7V; $\overline{OE}$, OE = 2.0V
I_{IL} + I_{OZL}	Output Leakage Current			−10	μA	0 − 5.5V	V_{OUT} = 0.5V; $\overline{OE}$, OE = 2.0V
I_{OS}	Output Short-Circuit Current	−100		−275	mA	Max	V_{OUT} = 0V
I_{CEX}	Output HIGH Leakage Current			50	μA	Max	V_{OUT} = V_{CC}
I_{ZZ}	Bus Drainage Test			100	μA	0.0	V_{OUT} = 5.5V; All Others GND
I_{CCH}	Power Supply Current			1.0	mA	Max	All Outputs HIGH
I_{CCL}	Power Supply Current			68	mA	Max	An or Bn Outputs LOW
I_{CCZ}	Power Supply Current			1.0	mA	Max	$\overline{OE}_n$ = V_{CC}, All Others at V_{CC} or GND
I_{CCT}	Additional I_{CC}/Input			2.5	mA	Max	V_I = V_{CC} − 2.1V All Others at V_{CC} or GND
I_{CCD}	Dynamic I_{CC} No Load (Note 6)			0.23	mA/MHz	Max	Outputs Open Transparent Mode One Bit Toggling, 50% Duty Cycle

Note 6: Guaranteed, but not tested.

DC Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Units	V_{CC}	Conditions C_L = 50 pF; R_L = 500Ω
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}		0.7	1.2	V	5.0	T_A = 25°C (Note 7)
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	–1.5	–1.0		V	5.0	T_A = 25°C (Note 7)
V_{OHV}	Minimum HIGH Level Dynamic Output Voltage	2.5	3.0		V	5.0	T_A = 25°C (Note 8)
V_{IHD}	Minimum HIGH Level Dynamic Input Voltage	2.2	1.8		V	5.0	T_A = 25°C (Note 9)
V_{ILD}	Maximum LOW Level Dynamic Input Voltage		1.2	0.8	V	5.0	T_A = 25°C (Note 9)

Note 7: Max number of outputs defined as (n). n – 1 data inputs are driven 0V to 3V. One output at LOW. Guaranteed, but not tested.

Note 8: Max number of outputs defined as (n). n – 1 data inputs are driven 0V to 3V. One output HIGH. Guaranteed, but not tested.

Note 9: Max number of data inputs (n) switching. n – 1 inputs switching 0V to 3V. Input-under-test switching: 3V to threshold (V_{ILD}), 0V to threshold (V_{IHD}). Guaranteed, but not tested.

AC Electrical Characteristics

Symbol	Parameter	T_A = +25°C, V_{CC} = +5V, C_L = 50 pF			T_A = –40°C to +85°C, V_{CC} = 4.5V–5.5V, C_L = 50 pF		Units
		Min	Typ	Max	Min	Max	
f_{max}	Maximum Clock Frequency	150	200		150		MHz
t_{PLH}	Propagation Delay	1.0	2.7	4.6	1.0	4.6	ns
t_{PHL}	A or B to B or A	1.0	3.2	4.6	1.0	4.6	
t_{PLH}	Propagation Delay	1.0	3.1	5.0	1.0	5.0	ns
t_{PHL}	LEAB or LEBA to B or A	1.0	3.6	5.5	1.0	5.5	
t_{PLH}	Propagation Delay	1.0	3.4	5.3	1.0	5.3	ns
t_{PHL}	CLKAB or CLKBA to B or A	1.0	3.7	5.3	1.0	5.3	
t_{PZH}	Propagation Delay	1.5	2.7	5.6	1.5	5.6	ns
t_{PZL}	OEAB or $\overline{OEBA}$ to B or A	1.5	3.0	5.6	1.5	5.6	
t_{PHZ}	Propagation Delay	1.5	3.7	6.0	1.5	6.0	ns
t_{PLZ}	OEAB or $\overline{OEBA}$ to B or A	1.5	3.2	6.0	1.5	6.0	

AC Operating Requirements

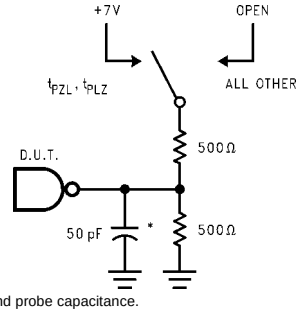
Symbol	Parameter	T_A = +25°C, V_{CC} = +5V, C_L = 50 pF		T_A = –40°C to +85°C, V_{CC} = 4.5V–5.5V, C_L = 50 pF		Units
		Min	Max	Min	Max	
t_S(H)	Setup Time,	4.0		4.0		ns
t_S(L)	A to CLKAB, B to CLKBA	4.0		4.0		
t_H(H)	Hold Time,	0		0		ns
t_H(L)	A to CLKAB, B to CLKBA	0		0		
t_S(H)	Setup Time, A to LEAB	4.0		4.0		ns
t_S(L)	or B to LEBA, $\overline{CLK}$ HIGH	4.0		4.0		
t_H(H)	Hold Time, A to LEAB	1.5		1.5		ns
t_H(L)	or B to LEBA, $\overline{CLK}$ HIGH	1.5		1.5		
t_S(H)	Setup Time, A to LEAB	1.5		1.5		ns
t_s(L)	or B to LEBA, $\overline{CLK}$ LOW	1.5		1.5		
t_H(H)	Hold Time, A to LEAB	1.5		1.5		ns
t_H(L)	or B to LEBA, $\overline{CLK}$ LOW	1.5		1.5		
t_W(H)	Pulse Width,	3.3		3.3		ns
t_W(L)	LEAB or LEBA, HIGH	3.3		3.3		
t_W(H)	Pulse Width, CLKAB	3.3		3.3		ns
t_W(L)	or CLKBA, HIGH or LOW	3.3		3.3		

Capacitance

Symbol	Parameter	Typ	Units	Conditions $T_A = 25°C$
C_{IN}	Input Capacitance	5.0	pF	$V_{CC} = 0.0V$
$C_{I/O}$ (Note 10)	Output Capacitance	11.0	pF	$V_{CC} = 5.0V$

Note 10: $C_{I/O}$ is measured at frequency f = 1 MHz per MIL-STD-883, Method 3012.

AC Loading



*Includes jig and probe capacitance.

FIGURE 1. Standard AC Test Load

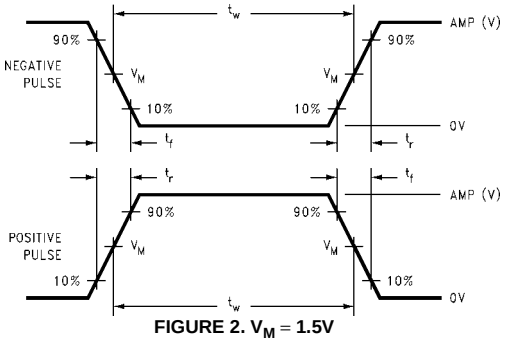


FIGURE 2. V_M = 1.5V

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

AC Waveforms

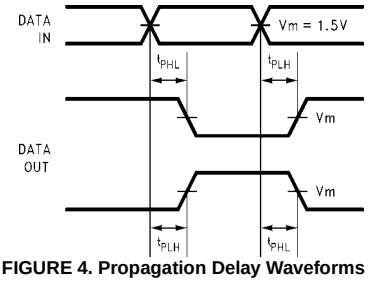


FIGURE 4. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

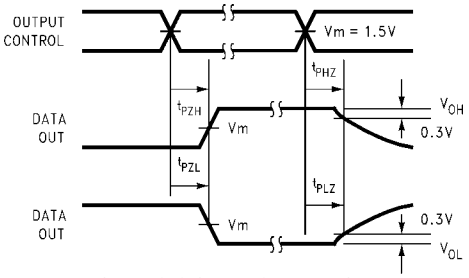


FIGURE 6. 3-STATE Output HIGH and LOW Enable and Disable Times

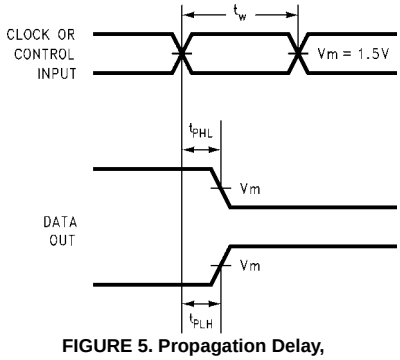


FIGURE 5. Propagation Delay, Pulse Width Waveforms

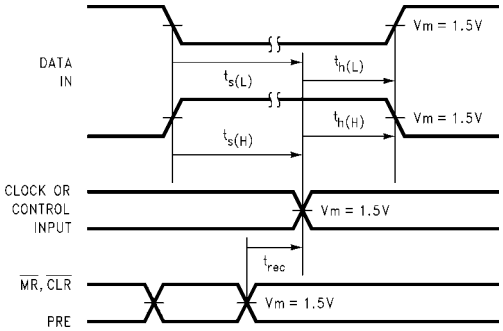
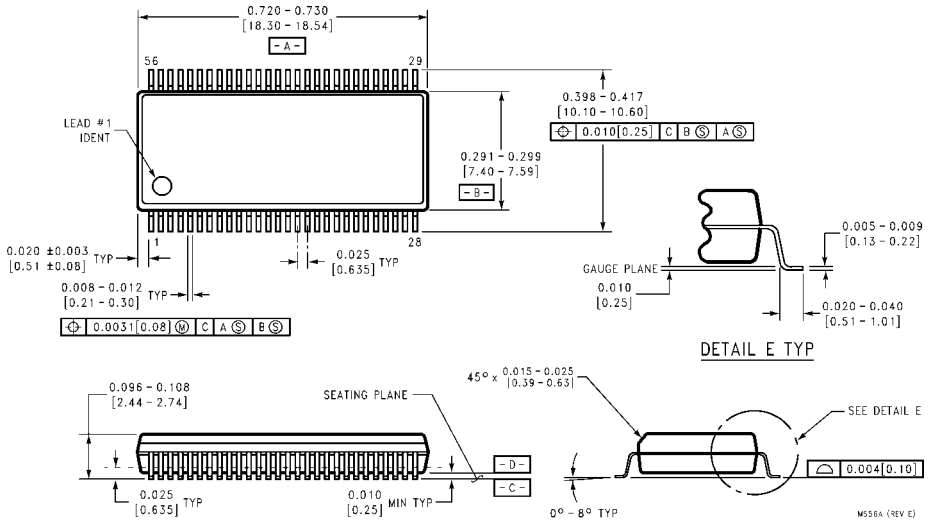


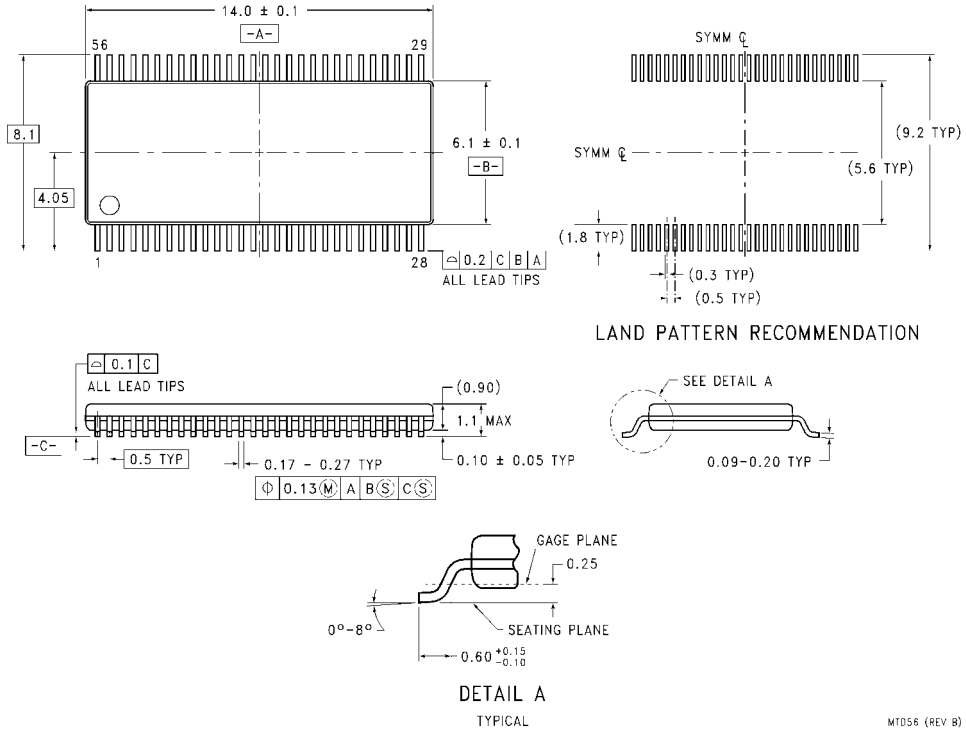
FIGURE 7. Setup Time, Hold Time and Recovery Time Waveforms

Physical Dimensions inches (millimeters) unless otherwise noted



56-Lead Shrink Small Outline Package (SSOP), JEDEC MO-118, 0.300" Wide
Package Number MS56A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



56-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide
Package Number MTD56

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