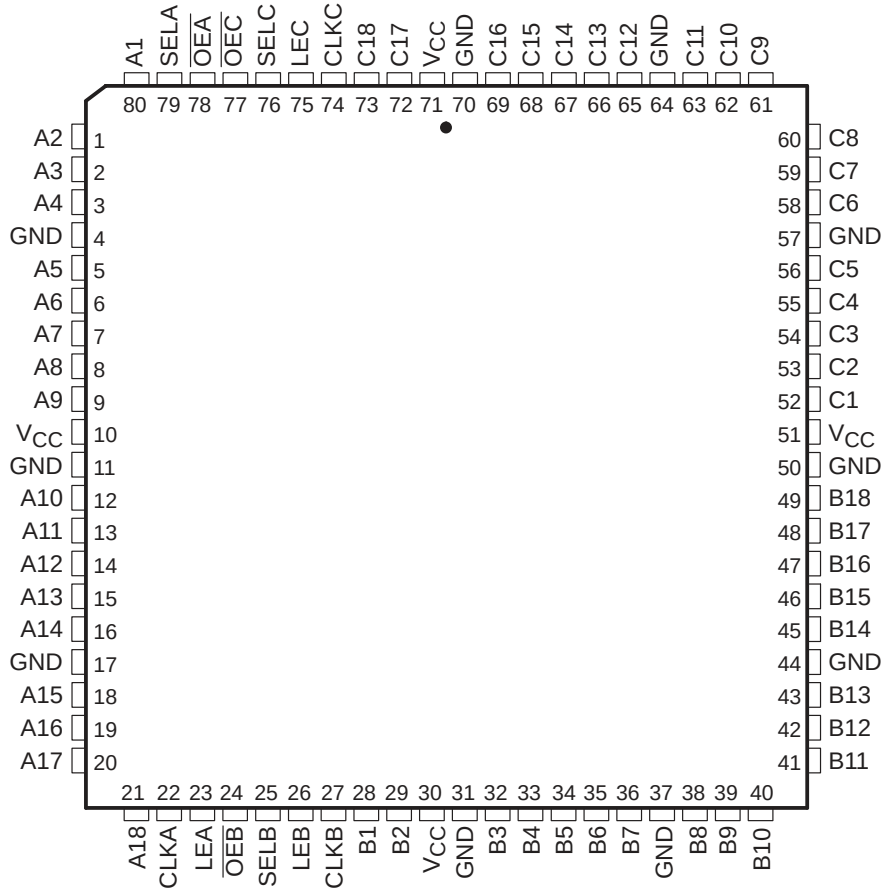
- **Members of the Texas Instruments *Widebus*+™ Family**
- **State-of-the-Art *EPIC*-II*B*™ BiCMOS Design Significantly Reduces Power Dissipation**
- ***UBE*™ (Universal Bus Exchanger) Combines D-Type Latches and D-Type Flip-Flops for Operation in Transparent, Latched, or Clocked Mode**
- **Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17**
- **Typical V_{OLP} (Output Ground Bounce) < 0.8 V at V_{CC} = 5 V, T_A = 25°C**
- **Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise**
- **High-Drive Outputs (−32-mA I_{OH}, 64-mA I_{OL})**
- **Bus Hold Inputs Eliminate the Need for External Pullup/Pulldown Resistors**
- **Packaged in 80-Pin Plastic Thin Quad Flat (PN) Package With 12 × 12-mm Body Using 0.5-mm Lead Pitch**

SN74ABT32318 . . . PN PACKAGE
(TOP VIEW)



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description

The ′ABT32318 consists of three 18-bit registered input/output (I/O) ports. These registers combine D-type latches and flip-flops to allow data flow in transparent, latch, and clock modes. Data from one input port can be exchanged to one or more of the other ports. Because of the universal storage element, multiple combinations of real-time and stored data can be exchanged among the three ports.

Data flow in each direction is controlled by the output-enable ($\overline{OEA}$, $\overline{OEB}$, and $\overline{OEC}$), select-control (SELA, SELB, and SELC), latch-enable (LEA, LEB, and LEC), and clock (CLKA, CLKB, and CLKC) inputs. The A data register operates in the transparent mode when LEA is high. When LEA is low, data is latched if CLKA is held at a high or low logic level. If LEA is low, data is stored on the low-to-high transition of CLKA. Output data selection is accomplished by the select-control pins. All three ports have active-low output enables, so when the output-enable input is low, the outputs are active; when the output-enable input is high, the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

The SN54ABT32318 is characterized for operation over the full military temperature range of −55°C to 125°C. The SN74ABT32318 is characterized for operation from −40°C to 85°C.

Function Tables

STORAGE†

INPUTS			OUTPUT
CLKA	LEA	A	
↑	L	L	L
↑	L	H	H
H	L	X	Q_0‡
L	L	X	Q_0‡
X	H	L	L
X	H	H	H

† A-port register shown. B and C ports are similar but use CLKB, CLKC, LEB, and LEC.

‡ Output level before the indicated steady-state input conditions were established.

A-PORT OUTPUT

INPUTS		OUTPUT A
$\overline{OEA}$	SELA	
H	X	Z
L	H	Output of C register
L	L	Output of B register

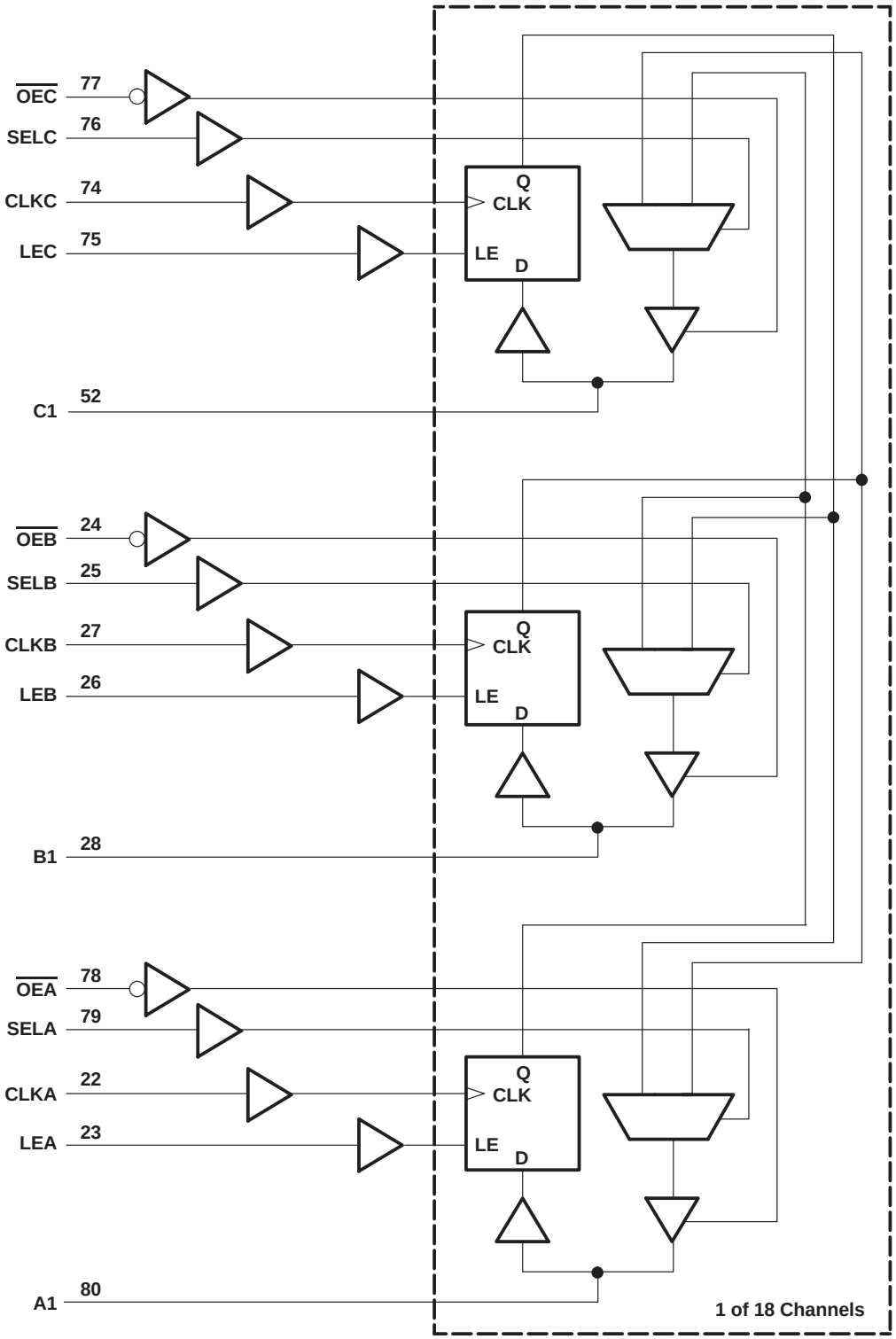
B-PORT OUTPUT

INPUTS		OUTPUT B
$\overline{OEB}$	SELB	
H	X	Z
L	H	Output of A register
L	L	Output of C register

C-PORT OUTPUT

INPUTS		OUTPUT C
$\overline{OEC}$	SELC	
H	X	Z
L	H	Output of B register
L	L	Output of A register

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} . . . . . −0.5 V to 7 V
Input voltage range, V_I (except I/O ports) (see Note 1) . . . . . −0.5 V to 7 V
Voltage range applied to any output in the high state or power-off state, V_O . . . . . −0.5 V to 5.5 V
Current into any output in the low state, I_O: SN54ABT32318 . . . . . 96 mA
SN74ABT32318 . . . . . 128 mA
Input clamp current, I_{IK} (V_I < 0) . . . . . −18 mA
Output clamp current, I_{OK} (V_O < 0) . . . . . −50 mA
Maximum power dissipation at T_A = 55°C (in still air) (see Note 2) . . . . . 1.1 W
Storage temperature range . . . . . −65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” 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.

NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 75 mils. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

recommended operating conditions (see Note 3)

			SN54ABT32318		SN74ABT32318		UNIT
			MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage		4.5	5.5	4.5	5.5	V
V_{IH}	High-level input voltage		2		2		V
V_{IL}	Low-level input voltage			0.8		0.8	V
V_I	Input voltage		0	V_{CC}	0	V_{CC}	V
I_{OH}	High-level output current			−24		−32	mA
I_{OL}	Low-level output current			48		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled		10		10	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate		200		200		μs/V
T_A	Operating free-air temperature		−55	125	−40	85	°C

NOTE 3: Unused or floating control pins must be held high or low.

PRODUCT PREVIEW

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electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS			SN54ABT32318			SN74ABT32318			UNIT
					MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}		V_{CC} = 4.5 V,	I_I = −18 mA				−1.2			−1.2	V
V_{OH}		V_{CC} = 4.5 V,	I_{OH} = −3 mA		2.5			2.5			V
		V_{CC} = 5 V,	I_{OH} = −3 mA		3			3			
		V_{CC} = 4.5 V	I_{OH} = −24 mA		2						
			I_{OH} = −32 mA					2			
V_{OL}		V_{CC} = 4.5 V	I_{OL} = 48 mA				0.55			0.55	V
			I_{OL} = 64 mA				0.55			0.55	
I_I	Control inputs	V_{CC} = 0 to 5.5 V,	V_I = V_{CC} or GND				±1			±1	µA
	A, B, or C ports	V_{CC} = 2.1 V to 5.5 V,	V_I = V_{CC} or GND				±20			±20	
$I_{I(hold)}$	A, B, or C ports	V_{CC} = 4.5 V	V_I = 0.8 V		100			100			µA
			V_I = 2 V		−100			−100			
I_{OZPU}‡		V_{CC} = 0 to 2.1 V, $\overline{OE}$ = X	V_O = 0.5 V to 2.7 V,				±50			±50	µA
I_{OZPD}‡		V_{CC} = 2.1 V to 0, $\overline{OE}$ = X	V_O = 0.5 V to 2.7 V,				±50			±50	µA
I_{OZH}§		V_{CC} = 2.1 V to 5.5 V,	V_O = 2.7 V,	$\overline{OE}$ ≥ 2 V			10			10	µA
I_{OZL}§		V_{CC} = 2.1 V to 5.5 V,	V_O = 0.5 V,	$\overline{OE}$ ≥ 2 V			−10			−10	µA
I_{off}		V_{CC} = 0,	V_I or V_O ≤ 4.5 V				±100			±100	µA
I_{CEX}		V_{CC} = 5.5 V,	V_O = 5.5 V	Outputs high			50			50	µA
I_O¶		V_{CC} = 5.5 V,	V_O = 2.5 V		−50	−100	−180	−50	−100	−180	mA
I_{CC}		V_{CC} = 5.5 V, I_O = 0, V_I = V_{CC} or GND	Outputs high				2			2	mA
			Outputs low				45			45	
			Outputs disabled				1			1	
ΔI_{CC}#		V_{CC} = 5.5 V, Other inputs at V_{CC} or GND	One input at 3.4 V,				0.5			0.5	mA
C_i	Control inputs	V_I = 2.5 V or 0.5 V				3			3		pF
C_{io}	A, B, or C ports	V_O = 2.5 V or 0.5 V				11.5			11.5		pF

PRODUCT PREVIEW

† All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡ This parameter is specified by characterization.
§ The parameters I_{OZH} and I_{OZL} include the input leakage current.
¶ 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 that is at the specified TTL voltage level rather than V_{CC} or GND.

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

			SN54ABT32318		SN74ABT32318		UNIT
			MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency			150		150	MHz
t_w	Pulse duration	LE high	3.3		3.3		ns
		CLK high or low	3.3		3.3		
t_{su}	Setup time	A, B, or C before CLK↑	2.4		2.4		ns
		A, B, or C before LE↓	2.1		2.1		
t_h	Hold time	A, B, or C after CLK↑	1.4		1.4		ns
		A, B, or C after LE↓	2.1		2.1		

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ABT32318		SN74ABT32318		UNIT
			MIN	MAX	MIN	MAX	
f_{max}			150		150		MHz
t_{PLH}	A, B, or C	C, B, or A	1.4	6.5	1.4	6.1	ns
t_{PHL}			1.1	6.8	1.1	6.6	
t_{PLH}	SEL	C, B, or A	1.4	6.7	1.4	6.5	ns
t_{PHL}			1.8	6.8	1.8	6.5	
t_{PLH}	LE	C, B, or A	2.6	8	2.6	7.5	ns
t_{PHL}			2.6	7.4	2.6	6.9	
t_{PLH}	CLK	C, B, or A	2.5	8	2.5	7.4	ns
t_{PHL}			2.5	7.2	2.5	6.7	
t_{PZH}	$\overline{OE}$	C, B, or A	1.4	6.9	1.4	6.8	ns
t_{PZL}			2.4	7.2	2.4	7.1	
t_{PHZ}	$\overline{OE}$	C, B, or A	1	6.4	1	6.2	ns
t_{PLZ}			2	6.4	2	6	

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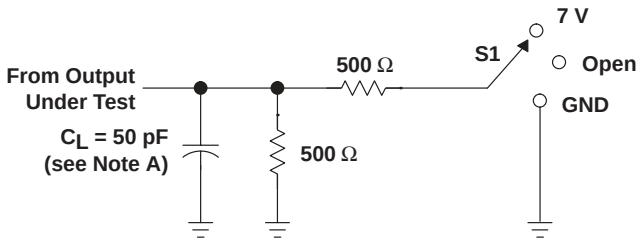
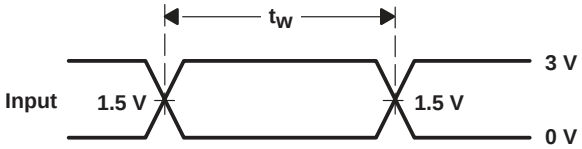
PARAMETER MEASUREMENT INFORMATION

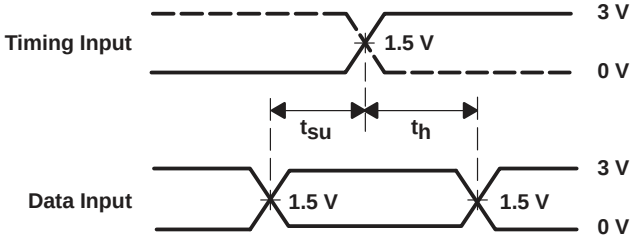


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open

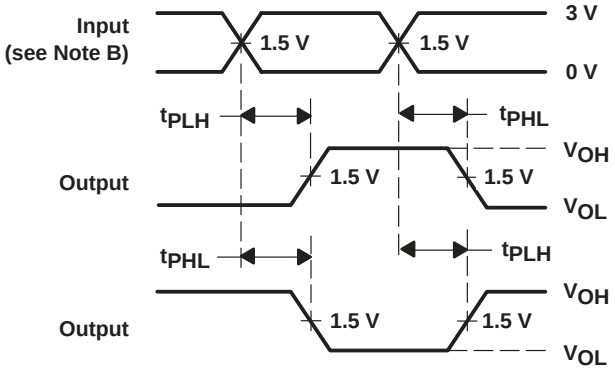
LOAD CIRCUIT FOR OUTPUTS



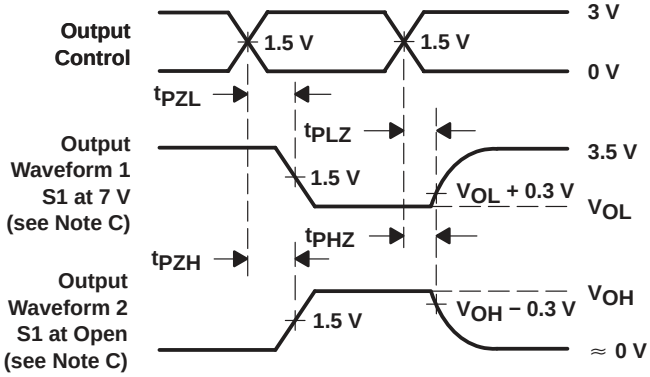
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

NOTES: A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.
C. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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