

SN54ABT16540, SN74ABT16540A 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS208C – FEBRUARY 1991 – REVISED APRIL 1997

- Members of the Texas Instruments *Widebus™* Family
- State-of-the-Art *EPIC-II B™* BiCMOS Design Significantly Reduces Power Dissipation
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Typical V_{OLP} (Output Ground Bounce) < 1 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise
- Flow-Through Architecture Optimizes PCB Layout
- High-Drive Outputs ($-32\text{-mA } I_{OH}$, $64\text{-mA } I_{OL}$)
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL), Thin Shrink Small-Outline (DGG), and Thin Very Small-Outline (DGV) Packages, and 380-mil Fine-Pitch Ceramic Flat (WD) Package Using 25-mil Center-to-Center Spacings

description

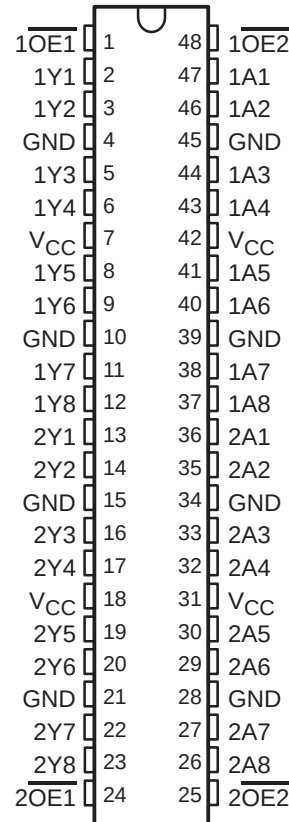
The SN54ABT16540 and SN74ABT16540A are inverting 16-bit buffers/drivers composed of two 8-bit sections with separate output-enable gates. These buffers and bus drivers provide a high-performance bus interface for wide data paths.

The 3-state control gate is a 2-input AND gate with active-low inputs so that if either output-enable ($\overline{OE1}$ or $\overline{OE2}$) input is high, all corresponding 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.

The SN54ABT16540 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABT16540A is characterized for operation from -40°C to 85°C .

SN54ABT16540 . . . WD PACKAGE
SN74ABT16540A . . . DGG, DGV, OR DL PACKAGE
(TOP VIEW)



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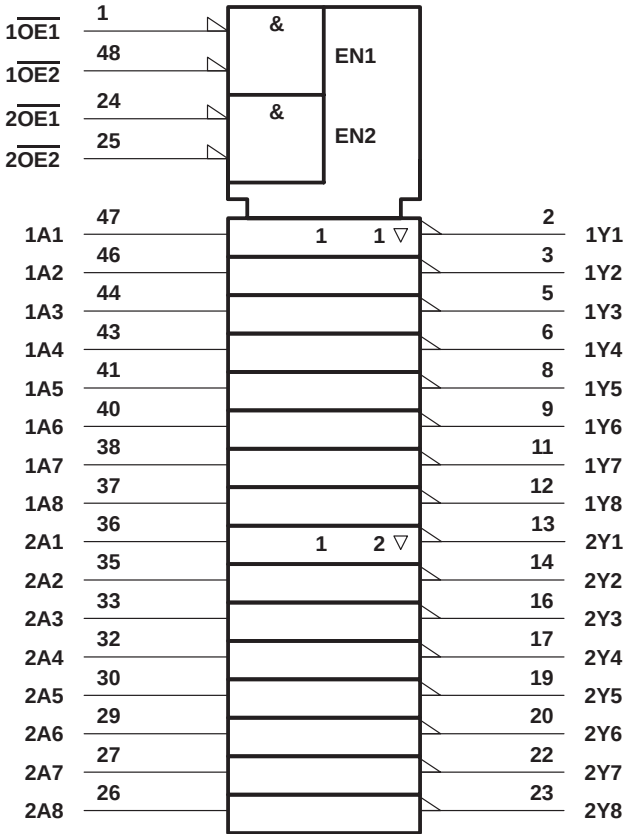
SN54ABT16540, SN74ABT16540A 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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FUNCTION TABLE
(each 8-bit section)

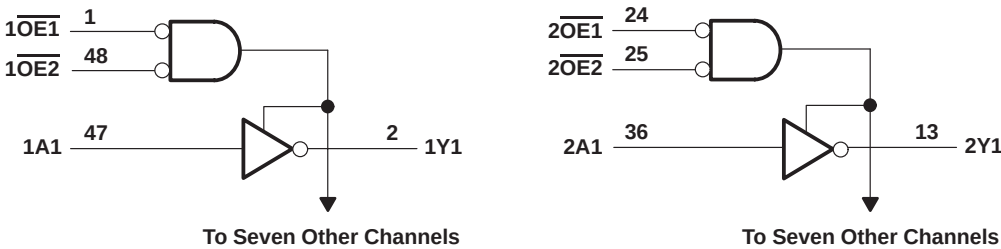
INPUTS			OUTPUT Y
OE1	OE2	A	
L	L	L	H
L	L	H	L
H	X	X	Z
X	H	X	Z

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



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

PARAMETER		TEST CONDITIONS		T _A = 25°C			SN54ABT16540		SN74ABT16540A		UNIT	
				MIN	TYP†	MAX	MIN	MAX	MIN	MAX		
V _{IK}		V _{CC} = 4.5 V, I _I = −18 mA		−1.2			−1.2		−1.2		V	
V _{OH}		V _{CC} = 4.5 V, I _{OH} = −3 mA		2.5			2.5		2.5		V	
		V _{CC} = 5 V, I _{OH} = −3 mA		3			3		3			
		V _{CC} = 4.5 V		I _{OH} = −24 mA			2					
				I _{OH} = −32 mA			2*		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			
V _{hys}				100							mV	
I _I		V _{CC} = 5.5 V, V _I = V _{CC} or GND		±1			±1		±1		μA	
I _{OZH}		V _{CC} = 5.5 V, V _O = 2.7 V		10			50		10		μA	
I _{OZL}		V _{CC} = 5.5 V, V _O = 0.5 V		−10			−50		−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	−180	−50	−180	mA	
I _{CC}		V _{CC} = 5.5 V, I _O = 0, V _I = V _{CC} or GND		Outputs high		3			2		3	mA
				Outputs low		34			32		34	
				Outputs disabled		3			2		3	
ΔI _{CC} §	Data inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND		Outputs enabled		1			1		1	mA
				Outputs disabled		0.05			0.05		0.05	
	Control inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND		1.5			1.5			1.5		
C _i		V _I = 2.5 V or 0.5 V		3.5							pF	
C _O		V _O = 2.5 V or 0.5 V		7.5							pF	

* On products compliant to MIL-PRF-38535, this parameter does not apply.

† All typical values are at V_{CC} = 5 V.

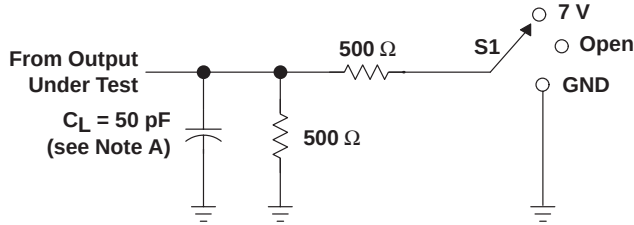
‡ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

§ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

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

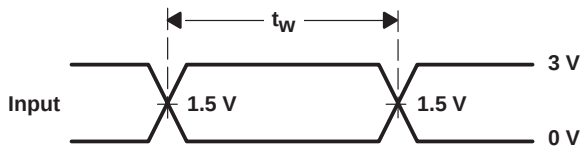
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 5 V, T _A = 25°C			SN54ABT16540		SN74ABT16540A		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	A	Y	1	2.3	3.3	1	4.2	1	4.1	ns
t _{PHL}			1.1	2.5	4.1	1.1	4.4	1.1	4.3	
t _{PZH}	$\overline{\text{OE}}$	Y	1.1	3.1	4.2	1.1	5.2	1.1	5.1	ns
t _{PZL}			1.6	3.7	4.8	1.6	6	1.6	5.9	
t _{PHZ}	$\overline{\text{OE}}$	Y	1.6	4	5	1.6	5.4	1.6	5.7	ns
t _{PLZ}			1.4	3.2	4.4	1.4	4.7	1.4	4.7	

PARAMETER MEASUREMENT INFORMATION

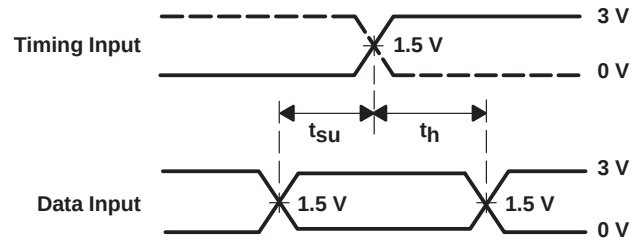


LOAD CIRCUIT

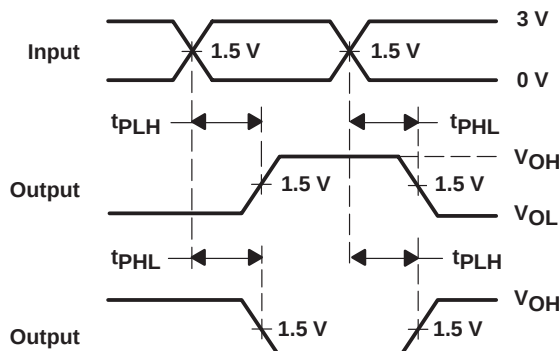
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



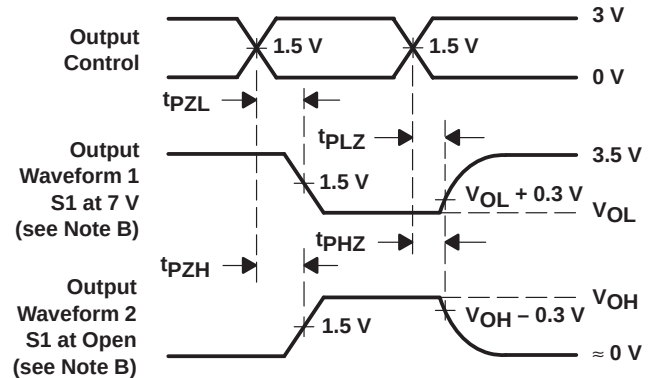
VOLTAGE WAVEFORMS
PULSE DURATION



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. 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.
C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN74ABT16540ADGGR	Active	Production	TSSOP (DGG) 48	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16540A
SN74ABT16540ADGGR.B	Active	Production	TSSOP (DGG) 48	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16540A
SN74ABT16540ADL	Active	Production	SSOP (DL) 48	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16540A
SN74ABT16540ADL.B	Active	Production	SSOP (DL) 48	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16540A
SN74ABT16540ADLR	Active	Production	SSOP (DL) 48	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16540A
SN74ABT16540ADLR.B	Active	Production	SSOP (DL) 48	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ABT16540A

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

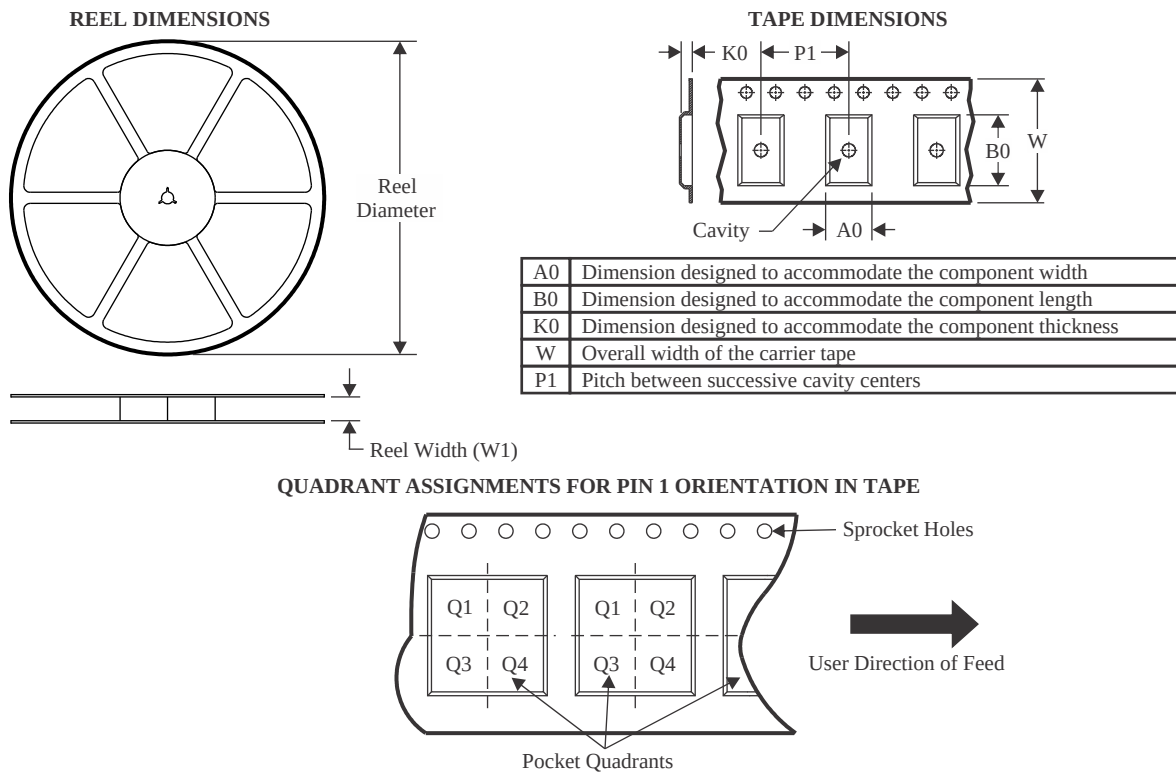
⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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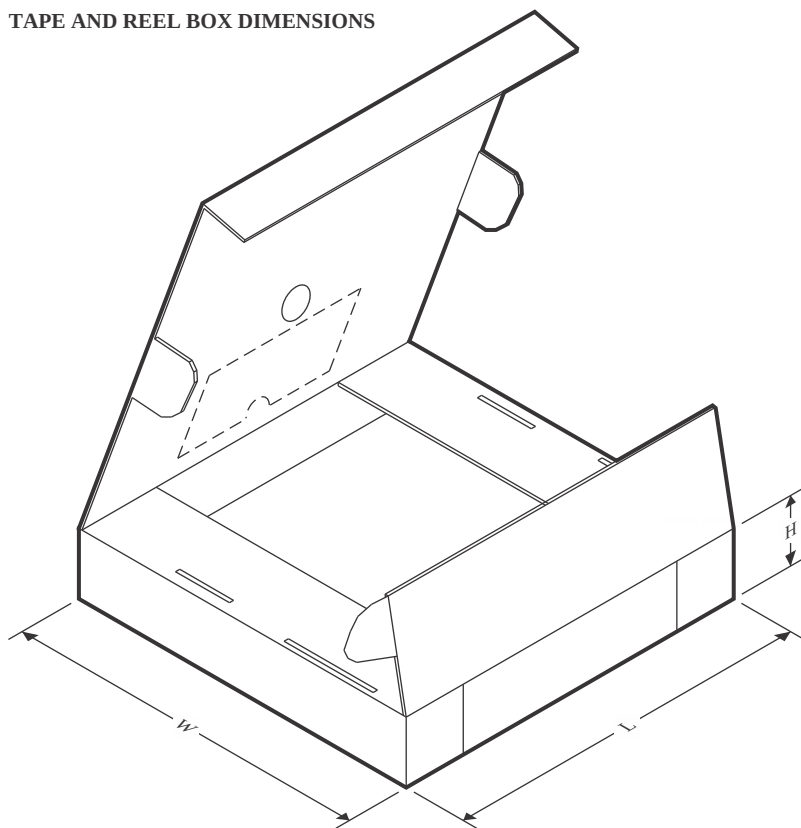
TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ABT16540ADGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1
SN74ABT16540ADLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1

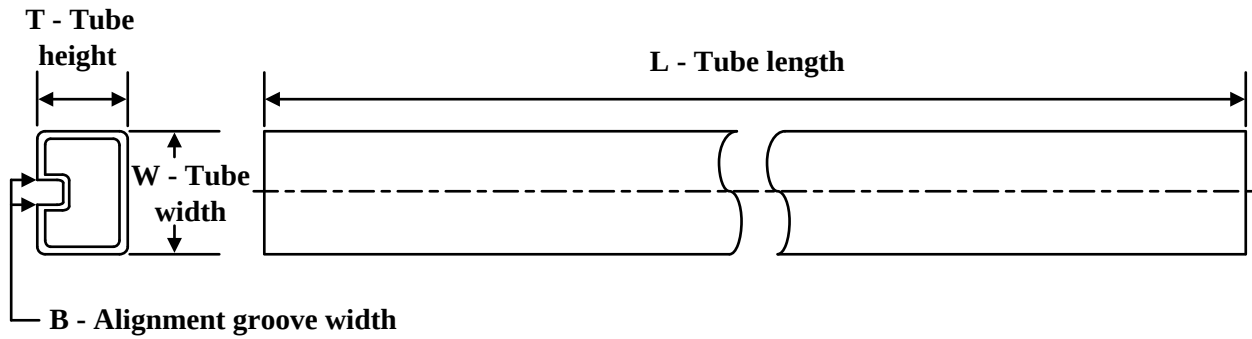
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ABT16540ADGGR	TSSOP	DGG	48	2000	356.0	356.0	45.0
SN74ABT16540ADLR	SSOP	DL	48	1000	356.0	356.0	53.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74ABT16540ADL	DL	SSOP	48	25	473.7	14.24	5110	7.87
SN74ABT16540ADL.B	DL	SSOP	48	25	473.7	14.24	5110	7.87

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