



**THE DATASHEET OF
SN74ABT16540ADGGR**

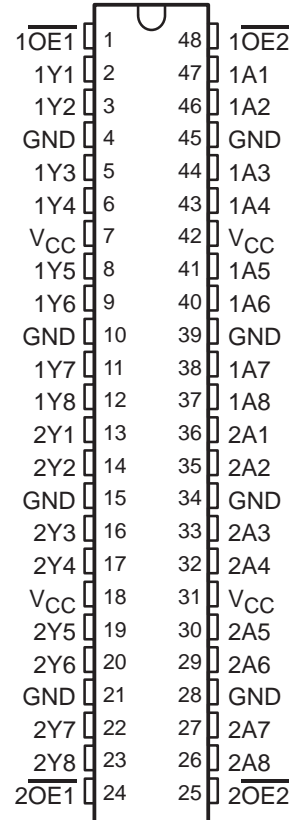


SN54ABT16540, SN74ABT16540A 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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- 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 -mA I_{OH} , 64 -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

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



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 .



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 **TEXAS
INSTRUMENTS**

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SN54ABT16540, SN74ABT16540A

16-BIT BUFFERS/DRIVERS

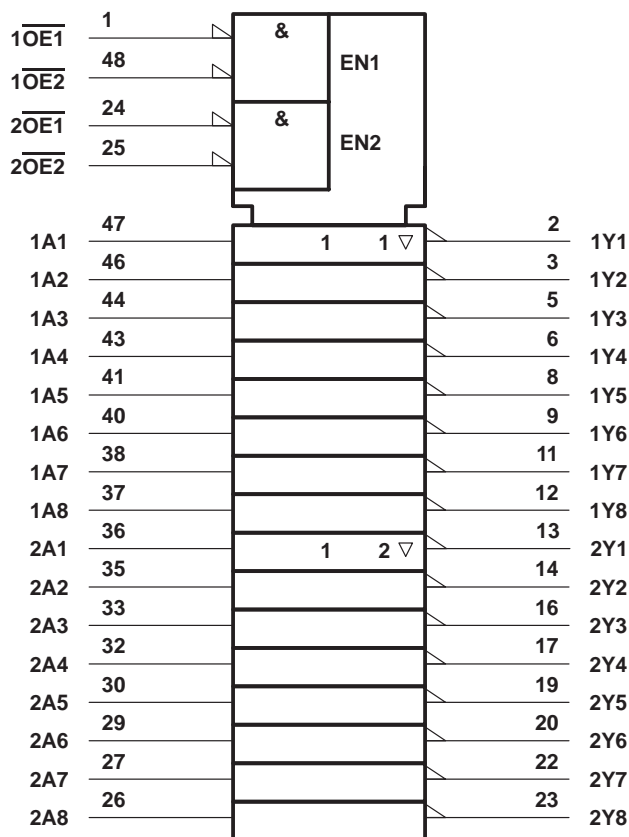
WITH 3-STATE OUTPUTS

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FUNCTION TABLE
(each 8-bit section)

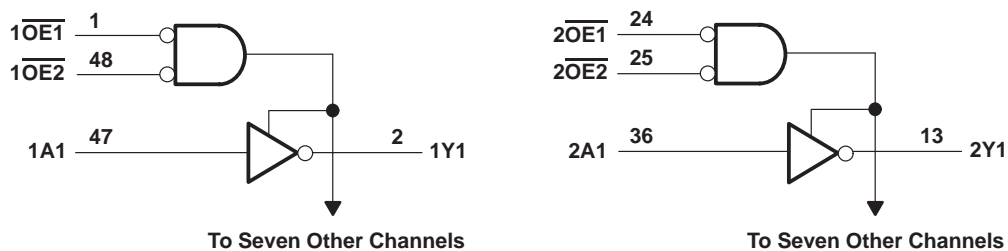
| INPUTS | | | OUTPUT |
|------------------|------------------|---|--------|
| $\overline{OE1}$ | $\overline{OE2}$ | A | Y |
| L | L | L | H |
| L | L | H | L |
| H | X | X | Z |
| X | H | X | Z |

logic symbol†



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

logic diagram (positive logic)



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

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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 (see Note 1) | –0.5 V to 7 V |
| Voltage range applied to any output in the high or power-off state, V_O | –0.5 V to 5.5 V |
| Current into any output in the low state, I_O : SN54ABT16540 | 96 mA |
| SN74ABT16540A | 128 mA |
| Input clamp current, I_{IK} ($V_I < 0$) | –18 mA |
| Output clamp current, I_{OK} ($V_O < 0$) | –50 mA |
| Package thermal impedance, θ_{JA} (see Note 2): DGG package | 89°C/W |
| DGV package | 93°C/W |
| DL package | 94°C/W |
| Storage temperature range, T_{stg} | –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 package thermal impedance is calculated in accordance with EIA/JEDEC Std JESD51.

recommended operating conditions (see Note 3)

| | | SN54ABT16540 | | SN74ABT16540A | | 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 | ns/V |
| T_A | Operating free-air temperature | –55 | 125 | –40 | 85 | °C |

NOTE 3: Unused inputs must be held high or low to prevent them from floating.

SN54ABT16540, SN74ABT16540A

16-BIT BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

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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 | | | 2 | | | 2 | |
| V _{OL} | V _{CC} = 4.5 V, I _{OL} = 48 mA | | | 0.55 | | 0.55 | | | V |
| | | | | 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 | | 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)

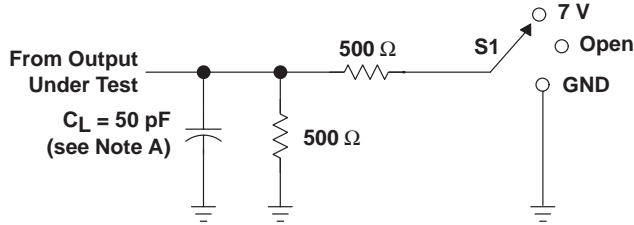
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} = 5 V, T _A = 25°C | | | SN54ABT16540 | | SN74ABT16540A | | UNIT |
|------------------|------------------------|-------------|--|-----|-----|--------------|-----|---------------|-----|------|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| t _{PLH} | 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 | |

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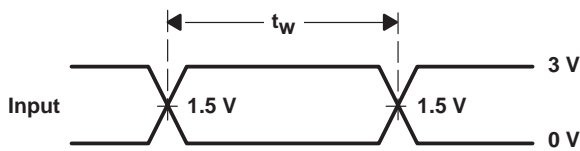
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PARAMETER MEASUREMENT INFORMATION

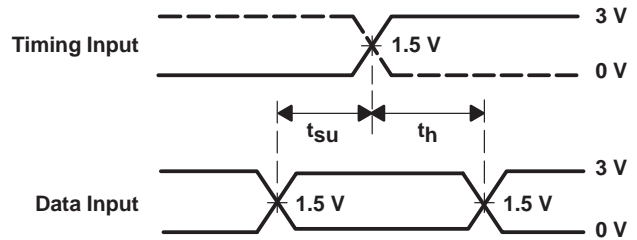


LOAD CIRCUIT

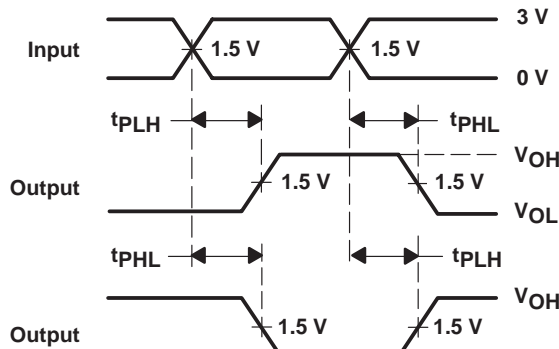
| TEST | S1 |
|-------------------|------|
| t_{PLH}/t_{PHL} | Open |
| t_{PLZ}/t_{PZL} | 7 V |
| t_{PHZ}/t_{PZH} | Open |



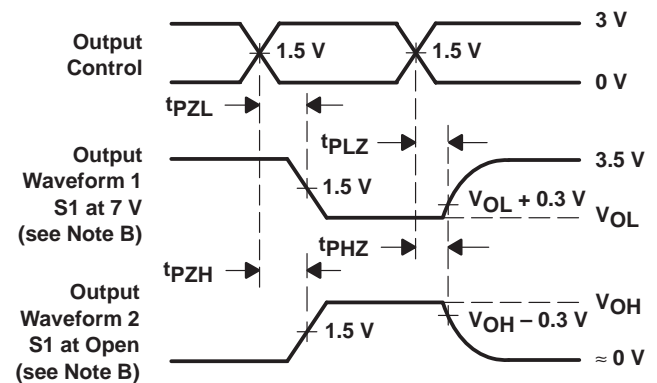
VOLTAGE WAVEFORMS
PULSE DURATION



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 Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|-------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74ABT16540ADGGR | ACTIVE | TSSOP | DGG | 48 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | ABT16540A | Samples |
| SN74ABT16540ADL | ACTIVE | SSOP | DL | 48 | 25 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | ABT16540A | Samples |
| SN74ABT16540ADLR | ACTIVE | SSOP | DL | 48 | 1000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | ABT16540A | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

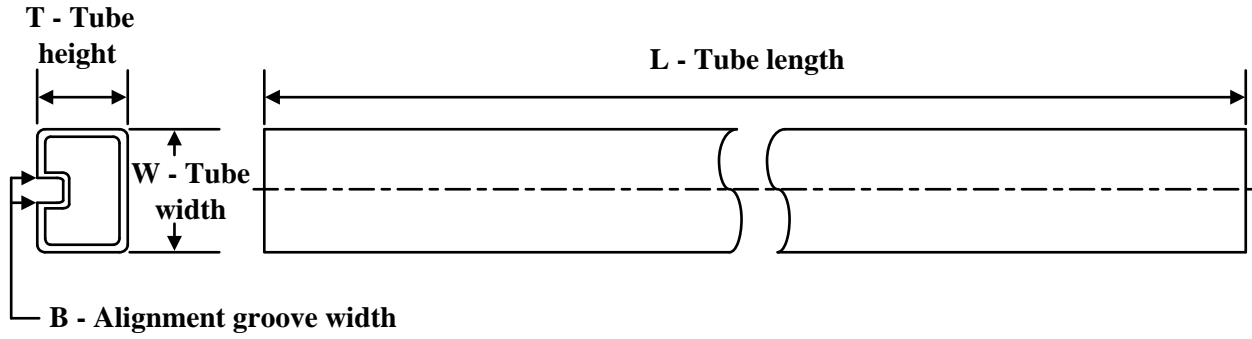

*All dimensions are nominal

| 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 | 367.0 | 367.0 | 45.0 |
| SN74ABT16540ADLR | SSOP | DL | 48 | 1000 | 367.0 | 367.0 | 55.0 |

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 |

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