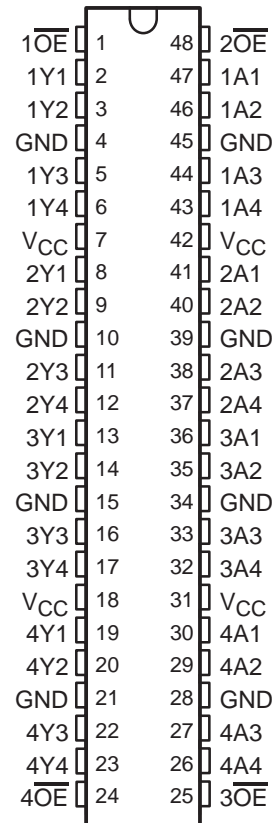


SN54ABTH16244, SN74ABTH16244 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS677D – SEPTEMBER 1996 – REVISED MARCH 2000

- 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 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 Pins Minimize High-Speed Switching Noise
- Flow-Through Architecture Optimizes PCB Layout
- High-Drive Outputs ($-32\text{-mA } I_{OH}$, $64\text{-mA } I_{OL}$)
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model ($C = 200$ pF, $R = 0$)
- Package Options Include Plastic Shrink Small-Outline (DL), Thin Shrink Small-Outline (DGG), Thin Very Small-Outline (DGV) Packages, and 380-mil Fine-Pitch Ceramic Flat (WD) Packages

SN54ABTH16244 . . . WD PACKAGE
SN74ABTH16244 . . . DGG, DGV, OR DL PACKAGE
(TOP VIEW)



description

The 'ABTH16244 devices are 16-bit buffers and line drivers designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. These devices can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. These devices provide true outputs and symmetrical active-low output-enable (\overline{OE}) inputs.

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 SN54ABTH16244 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABTH16244 is characterized for operation from -40°C to 85°C .



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54ABTH16244, SN74ABTH16244

16-BIT BUFFERS/DRIVERS

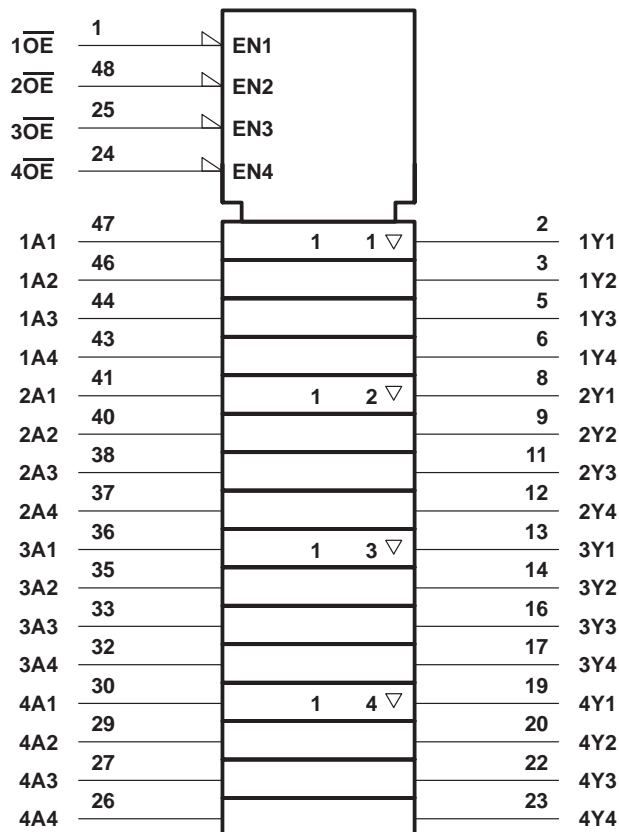
WITH 3-STATE OUTPUTS

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FUNCTION TABLE
(each buffer)

| INPUTS | | OUTPUT |
|-----------------|---|--------|
| \overline{OE} | A | Y |
| L | H | H |
| L | L | L |
| H | X | Z |

logic symbol†



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

SN54ABTH16244, SN74ABTH16244

16-BIT BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

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recommended operating conditions (see Note 3)

| | | SN54ABTH16244 | | SN74ABTH16244 | | 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 |
| Δt/Δv | Input transition rise or fall rate | Outputs enabled | | 10 | 10 | ns/V |
| T _A | Operating free-air temperature | -55 | 125 | -40 | 85 | °C |

NOTE 3: All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

| PARAMETER | TEST CONDITIONS | T _A = 25°C | | | SN54ABTH16244 | | SN74ABTH16244 | | 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 | | | |
| 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 _I (hold) | V _{CC} = 4.5 V | V _I = 0.8 V | 100 | | 100 | | 100 | | μA |
| | | V _I = 2 V | -40 | | -40 | | -40 | | |
| I _{OZH} | V _{CC} = 5.5 V, V _O = 2.7 V | | | 10 | | 10 | | 10 | μA |
| I _{OZL} | V _{CC} = 5.5 V, V _O = 0.5 V | | | -10 | | -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 | | 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 | | 3 | | 3 | mA |
| | | Outputs low | | 32 | | 32 | | 32 | |
| | | Outputs disabled | | 3 | | 3 | | 3 | |
| ΔI _{CC} § | V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND | | | 1.5 | | 1.5 | | 1.5 | mA |
| C _i | V _I = 2.5 V or 0.5 V | | 3 | | | | | | pF |
| C _o | V _O = 2.5 V or 0.5 V | | 8 | | | | | | 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.



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16-BIT BUFFERS/DRIVERS
WITH 3-STATE OUTPUTS

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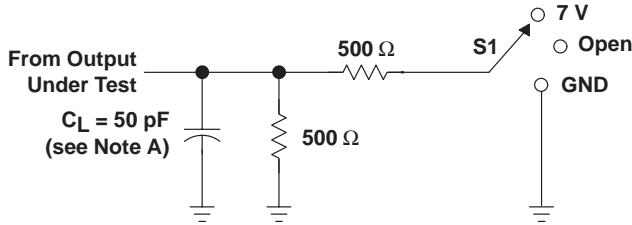
switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC} = 5$ V, $T_A = 25^\circ$ C | | | SN54ABTH16244 | | SN74ABTH16244 | | UNIT |
|-----------|-----------------|-------------|---------------------------------------|-----|-----|---------------|-----|---------------|-----|------|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| t_{PLH} | A | Y | 1 | 2.3 | 3.2 | 0.7 | 3.6 | 1 | 3.5 | ns |
| t_{PHL} | | | 1 | 2.6 | 3.7 | 0.5 | 4.2 | 1 | 4.1 | |
| t_{PZH} | \overline{OE} | Y | 1 | 3 | 3.8 | 0.7 | 4.9 | 1 | 4.8 | ns |
| t_{PZL} | | | 1 | 3.2 | 4 | 0.9 | 5.3 | 1 | 4.8 | |
| t_{PHZ} | \overline{OE} | Y | 1 | 3.6 | 4.4 | 0.7 | 5.3 | 1 | 4.8 | ns |
| t_{PLZ} | | | 1 | 2.9 | 3.7 | 1 | 4.6 | 1 | 4.1 | |

SN54ABTH16244, SN74ABTH16244
16-BIT BUFFERS/DRIVERS
WITH 3-STATE OUTPUTS

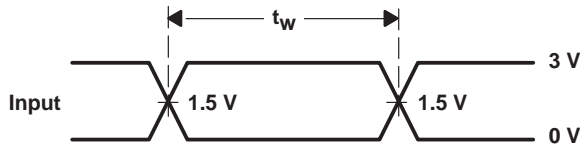
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PARAMETER MEASUREMENT INFORMATION

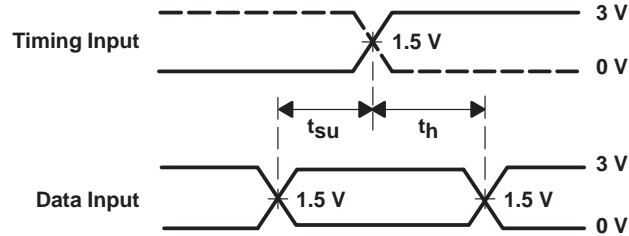


LOAD CIRCUIT

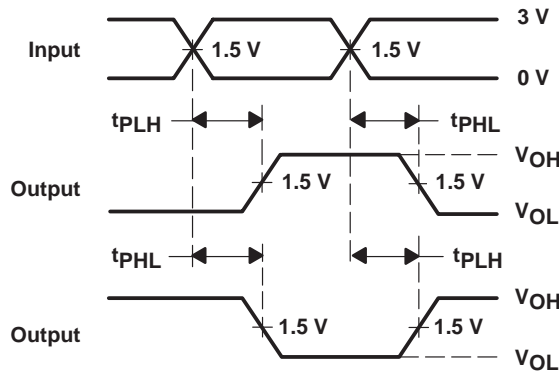
| TEST | S1 |
|-------------------|------|
| t_{PLH}/t_{PHL} | Open |
| t_{PLZ}/t_{PZL} | 7 V |
| t_{PHZ}/t_{PZH} | Open |



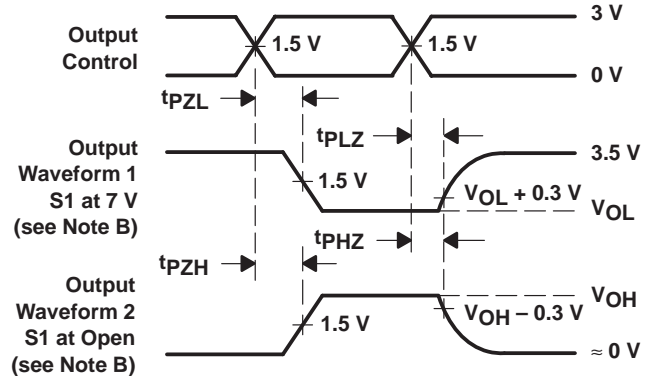
VOLTAGE WAVEFORMS
PULSE DURATION



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/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|-------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74ABTH16244DGGR | ACTIVE | TSSOP | DGG | 48 | 2000 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | ABTH16244 | Samples |
| SN74ABTH16244DL | ACTIVE | SSOP | DL | 48 | 25 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | ABTH16244 | Samples |
| SN74ABTH16244DLG4 | ACTIVE | SSOP | DL | 48 | 25 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | ABTH16244 | Samples |
| SN74ABTH16244DLR | ACTIVE | SSOP | DL | 48 | 1000 | Green (RoHS & no Sb/Br) | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | ABTH16244 | 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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish 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 |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74ABTH16244DGGR | TSSOP | DGG | 48 | 2000 | 330.0 | 24.4 | 8.6 | 13.0 | 1.8 | 12.0 | 24.0 | Q1 |
| SN74ABTH16244DLR | SSOP | DL | 48 | 1000 | 330.0 | 32.4 | 11.35 | 16.2 | 3.1 | 16.0 | 32.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS

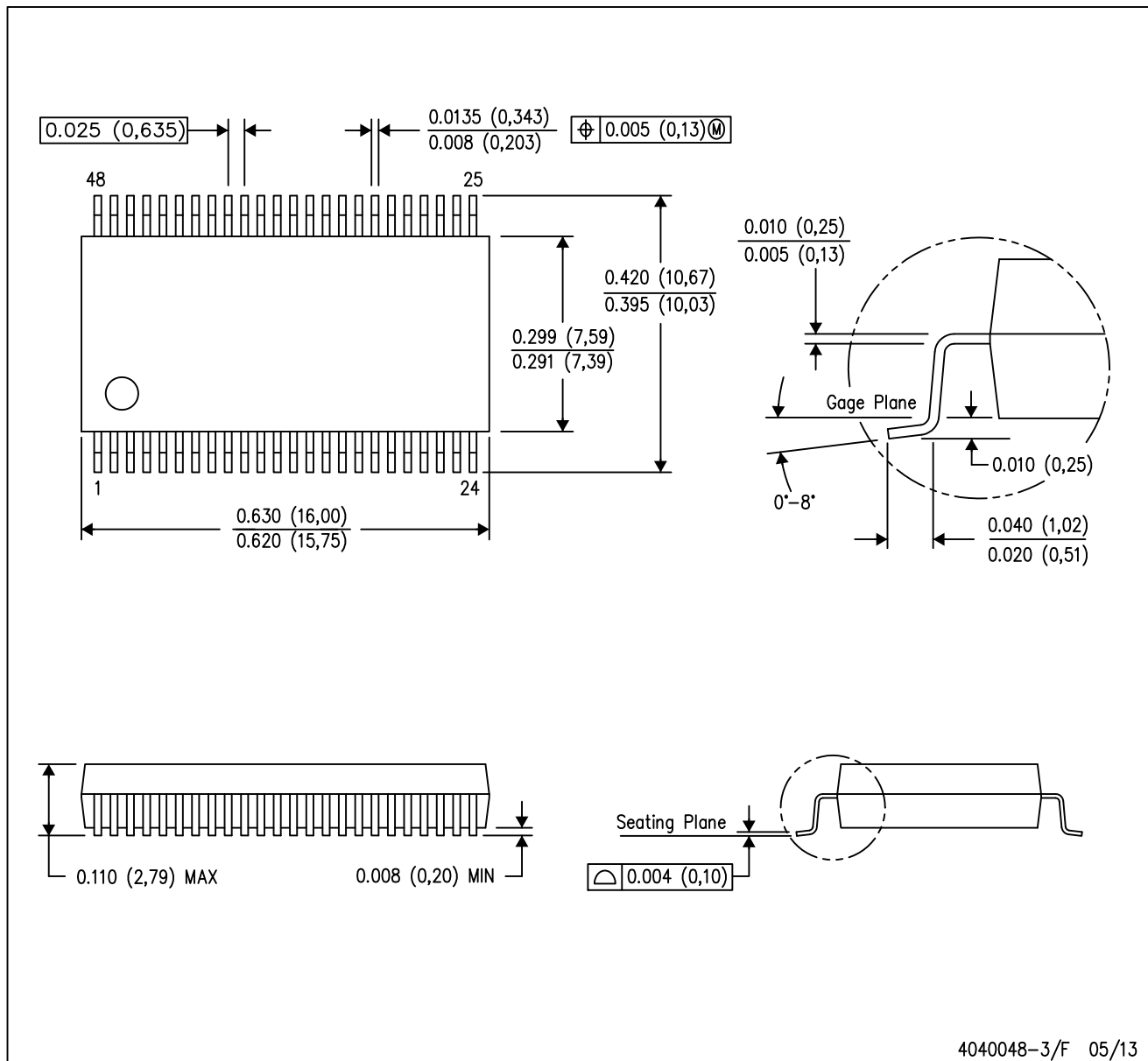

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74ABTH16244DGGR | TSSOP | DGG | 48 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74ABTH16244DLR | SSOP | DL | 48 | 1000 | 367.0 | 367.0 | 55.0 |

MECHANICAL DATA

DL (R-PDSO-G48)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MO-118

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DGG (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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