

# SN54ABT5400A, SN74ABT5400A 11-BIT LINE/MEMORY DRIVERS WITH 3-STATE OUTPUTS

SCBS661B – FEBRUARY 1996 – REVISED MAY 1997

- Output Ports Have Equivalent 25- $\Omega$  Series Resistors, So No External Resistors Are Required
- State-of-the-Art *EPIC-II B*<sup>™</sup> 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,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OLV}$  (Output Undershoot) < 0.5 V at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$
- Package Options Include Plastic Small-Outline (DW) Package and Ceramic Chip Carriers (FK) and DIPs (JT)

## description

These 11-bit buffers and line drivers are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

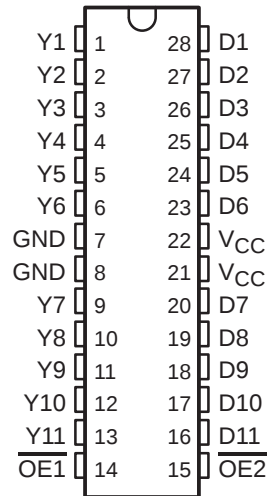
The 3-state control gate is a 2-input AND gate with active-low inputs so that if either output-enable ( $\overline{OE1}$  or  $\overline{OE2}$ ) input is high, all 11 outputs are in the high-impedance state.

The outputs, which are designed to source or sink up to 12 mA, include equivalent 25- $\Omega$  series resistors to reduce overshoot and undershoot.

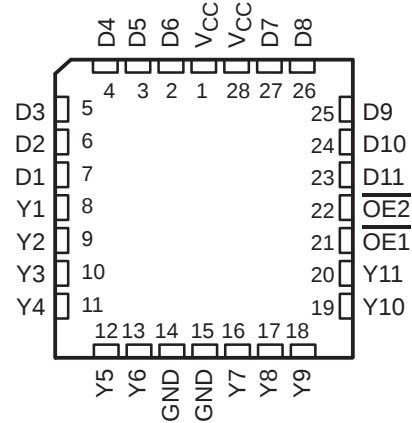
To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The SN54ABT5400A is characterized for operation over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74ABT5400A is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

SN54ABT5400A . . . JT PACKAGE  
SN74ABT5400A . . . DW PACKAGE  
(TOP VIEW)



SN54ABT5400A . . . FK PACKAGE  
(TOP VIEW)



FUNCTION TABLE

| INPUTS           |                  |   | OUTPUT<br>Y |
|------------------|------------------|---|-------------|
| $\overline{OE1}$ | $\overline{OE2}$ | D |             |
| L                | L                | L | L           |
| L                | L                | H | H           |
| H                | X                | X | Z           |
| X                | H                | X | Z           |



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**TEXAS  
INSTRUMENTS**

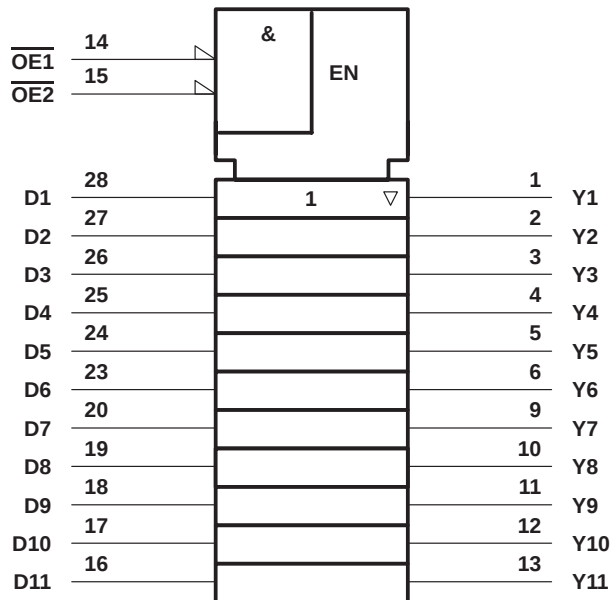
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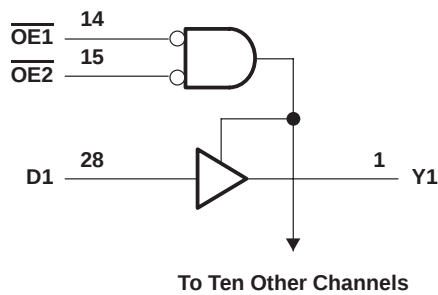
SN54ABT5400A, SN74ABT5400A  
11-BIT LINE/MEMORY DRIVERS  
WITH 3-STATE OUTPUTS

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logic symbol†



logic diagram (positive logic)



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

Pin numbers shown are for the DW and JT packages.

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, $I_O$                           | 30 mA           |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ )                               | –18 mA          |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ )                              | –50 mA          |
| Package thermal impedance, $\theta_{JA}$ (see Note 2): DW package         | 78°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.

**SN54ABT5400A, SN74ABT5400A**  
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**recommended operating conditions (see Note 3)**

|                 |                                    |                 | SN54ABT5400A |                 | SN74ABT5400A |                 | UNIT |
|-----------------|------------------------------------|-----------------|--------------|-----------------|--------------|-----------------|------|
|                 |                                    |                 | MIN          | MAX             | MIN          | MAX             |      |
| V <sub>CC</sub> | Supply voltage                     |                 | 4.5          | 5.5             | 4.5          | 5.5             | V    |
| V <sub>IH</sub> | High-level input voltage           |                 | 2            |                 | 2            |                 | V    |
| V <sub>IL</sub> | Low-level input voltage            |                 |              | 0.8             |              | 0.8             | V    |
| V <sub>I</sub>  | Input voltage                      |                 | 0            | V <sub>CC</sub> | 0            | V <sub>CC</sub> | V    |
| I <sub>OH</sub> | High-level output current          |                 |              | –12             |              | –12             | mA   |
| I <sub>OL</sub> | Low-level output current           |                 |              | 12              |              | 12              | mA   |
| Δt/Δv           | Input transition rise or fall rate | Outputs enabled |              | 10              |              | 10              | ns/V |
| T <sub>A</sub>  | Operating free-air temperature     |                 | –55          | 125             | –40          | 85              | °C   |

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

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

| PARAMETER          |                | TEST CONDITIONS                                                                                        | T <sub>A</sub> = 25°C |      |      | SN54ABT5400A |      | SN74ABT5400A |      | UNIT |
|--------------------|----------------|--------------------------------------------------------------------------------------------------------|-----------------------|------|------|--------------|------|--------------|------|------|
|                    |                |                                                                                                        | MIN                   | TYP† | MAX  | MIN          | MAX  | MIN          | MAX  |      |
| V <sub>IK</sub>    |                | V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = –18 mA                                                       |                       |      | –1.2 |              | –1.2 |              | –1.2 | V    |
| V <sub>OH</sub>    |                | V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = –1 mA                                                       | 3.35                  | 3.7  |      | 3.3          |      | 3.35         |      | V    |
|                    |                | V <sub>CC</sub> = 5 V, I <sub>OH</sub> = –1 mA                                                         | 3.85                  | 4.2  |      | 3.8          |      | 3.85         |      |      |
|                    |                | V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = –3 mA                                                       |                       |      |      | 3            |      | 3.1          |      |      |
|                    |                | V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = –12 mA                                                      | 2.6                   |      |      |              |      | 2.6          |      |      |
| V <sub>OL</sub>    |                | V <sub>CC</sub> = 4.5 V, I <sub>OL</sub> = 8 mA                                                        |                       |      |      | 0.8          |      | 0.65         |      | V    |
|                    |                | V <sub>CC</sub> = 4.5 V, I <sub>OL</sub> = 12 mA                                                       |                       |      |      |              |      | 0.8          |      |      |
| V <sub>hys</sub>   |                |                                                                                                        |                       | 100  |      |              |      |              |      | mV   |
| I <sub>I</sub>     |                | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = V <sub>CC</sub> or GND                                       |                       |      | ±1   |              | ±1   |              | ±1   | μA   |
| I <sub>OZH</sub>   |                | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.7 V                                                        |                       |      | 10   |              | 10   |              | 10   | μA   |
| I <sub>OZL</sub>   |                | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0.5 V                                                        |                       |      | –10  |              | –10  |              | –10  | μA   |
| I <sub>off</sub>   |                | V <sub>CC</sub> = 0, V <sub>I</sub> or V <sub>O</sub> ≤ 4.5 V                                          |                       |      | ±100 |              |      |              | ±100 | μA   |
| I <sub>CEX</sub>   |                | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 5.5 V, Outputs high                                          |                       |      | 50   |              | 50   |              | 50   | μA   |
| I <sub>O</sub>     |                | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.5 V                                                        | –25                   | –45  | –100 | –25          | –100 | –25          | –100 | mA   |
| I <sub>OS</sub> ‡  |                | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0                                                            | –50                   |      | –200 | –50          | –200 | –50          | –200 | mA   |
| I <sub>CC</sub>    |                | V <sub>CC</sub> = 5.5 V, I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND, Outputs high     |                       | 5    | 50   |              | 50   |              | 50   | μA   |
|                    |                | V <sub>CC</sub> = 5.5 V, I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND, Outputs low      |                       | 36   | 45   |              | 45   |              | 45   | mA   |
|                    |                | V <sub>CC</sub> = 5.5 V, I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND, Outputs disabled |                       | 1    | 50   |              | 50   |              | 50   | μA   |
| ΔI <sub>CC</sub> § | Data inputs    | V <sub>CC</sub> = 5.5 V, One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND, Outputs enabled   |                       |      | 1.5  |              | 1.5  |              | 1.5  | mA   |
|                    |                | V <sub>CC</sub> = 5.5 V, One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND, Outputs disabled  |                       |      | 0.05 |              | 0.05 |              | 0.05 |      |
|                    | Control inputs | V <sub>CC</sub> = 5.5 V, One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND                    |                       |      | 1.5  |              | 1.5  |              | 1.5  |      |
| C <sub>i</sub>     |                | V <sub>I</sub> = 2.5 V or 0.5 V                                                                        |                       | 3    |      |              |      |              |      | pF   |
| C <sub>O</sub>     |                | V <sub>O</sub> = 2.5 V or 0.5 V                                                                        |                       | 8    |      |              |      |              |      | pF   |

† All typical values are at V<sub>CC</sub> = 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<sub>CC</sub> or GND.

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# SN54ABT5400A, SN74ABT5400A

## 11-BIT LINE/MEMORY 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)

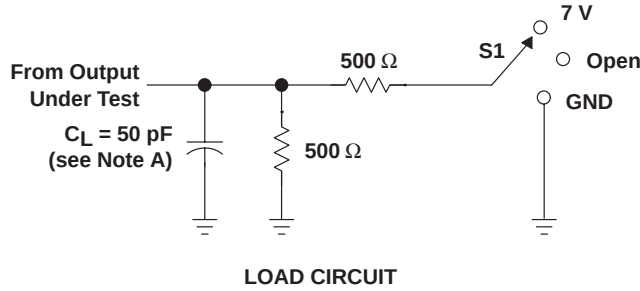
| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CC} = 5$ V,<br>$T_A = 25^\circ\text{C}$ |     |     | SN54ABT5400A |     | SN74ABT5400A |     | UNIT |
|-----------|-----------------|----------------|---------------------------------------------|-----|-----|--------------|-----|--------------|-----|------|
|           |                 |                | MIN                                         | TYP | MAX | MIN          | MAX | MIN          | MAX |      |
| $t_{PLH}$ | D               | Y              | 2                                           | 4.5 | 5.2 | 2            | 6.3 | 2            | 6.2 | ns   |
| $t_{PHL}$ |                 |                | 1.5                                         | 3.7 | 5   | 1.5          | 5.7 | 1.5          | 5.6 |      |
| $t_{PZH}$ | $\overline{OE}$ | Y              | 2.5                                         | 5.7 | 7.6 | 2.5          | 8.8 | 2.5          | 8.7 | ns   |
| $t_{PZL}$ |                 |                | 2                                           | 4.4 | 6.3 | 2            | 7.6 | 2            | 7.5 |      |
| $t_{PHZ}$ | $\overline{OE}$ | Y              | 1.5                                         | 3.6 | 4.4 | 1.5          | 5.5 | 1.5          | 5.2 | ns   |
| $t_{PLZ}$ |                 |                | 1.5                                         | 4.2 | 5.4 | 1.5          | 7.4 | 1.5          | 6.9 |      |

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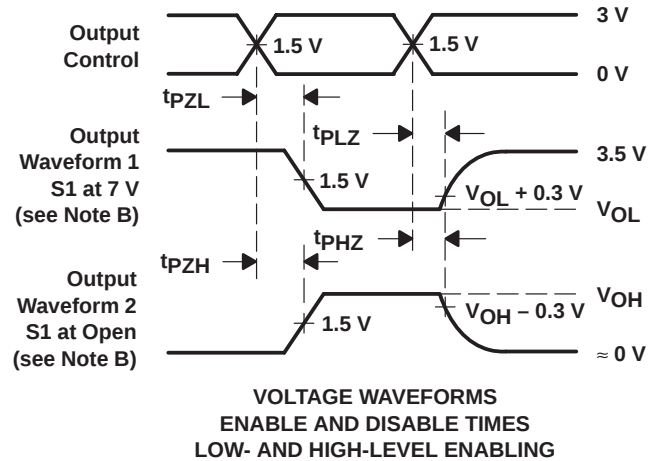
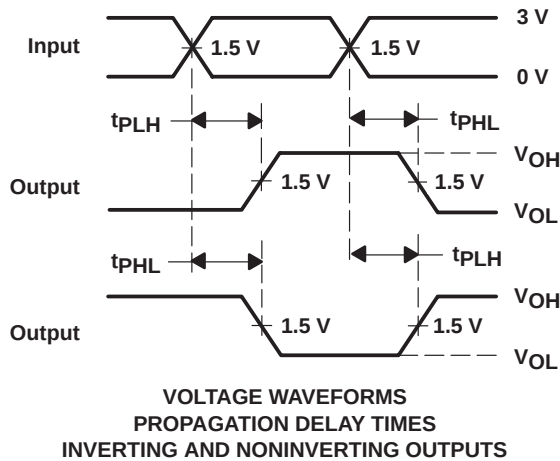
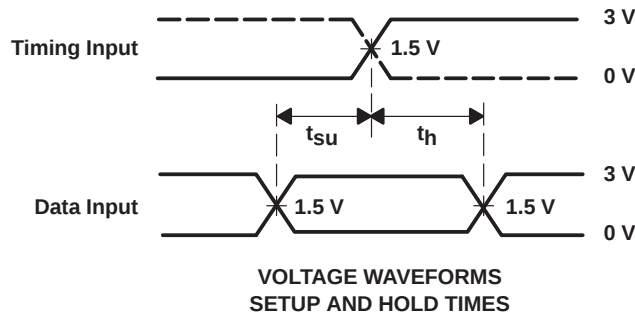


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## PARAMETER MEASUREMENT INFORMATION



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



- 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<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74ABT5400ADWR  | ACTIVE        | SOIC         | DW                 | 28   | 1000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | ABT5400A                | <a href="#">Samples</a> |

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(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.

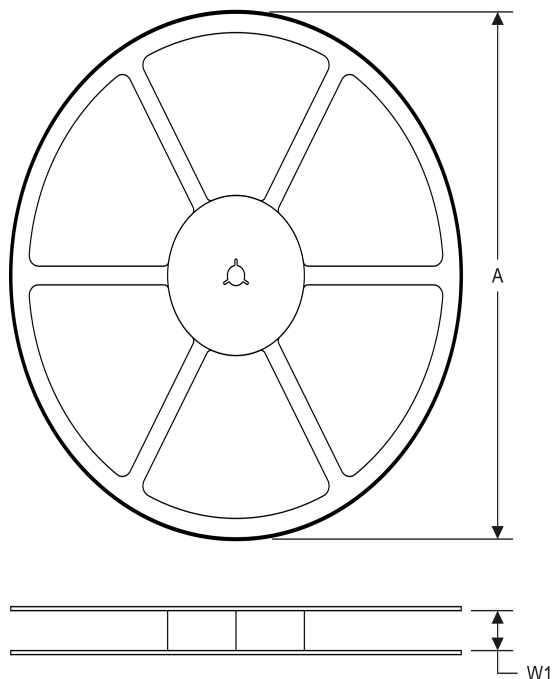
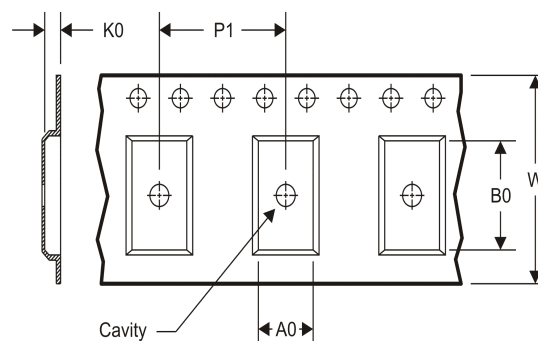
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(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**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


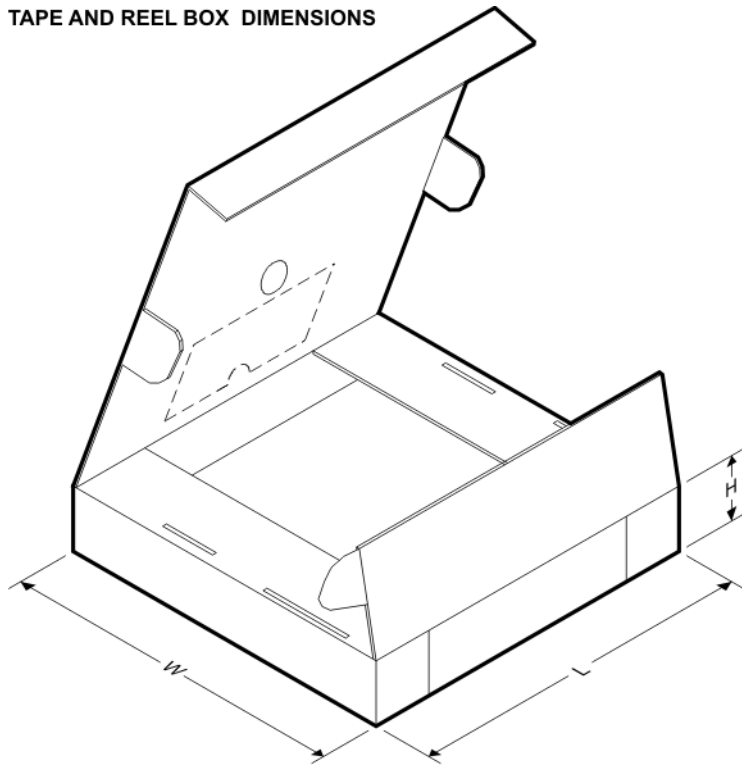
|    |                                                           |
|----|-----------------------------------------------------------|
| A0 | Dimension designed to accommodate the component width     |
| B0 | Dimension designed to accommodate the component length    |
| K0 | Dimension designed to accommodate the component thickness |
| W  | Overall width of the carrier tape                         |
| P1 | Pitch between successive cavity centers                   |

**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 |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74ABT5400ADWR | SOIC         | DW              | 28   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

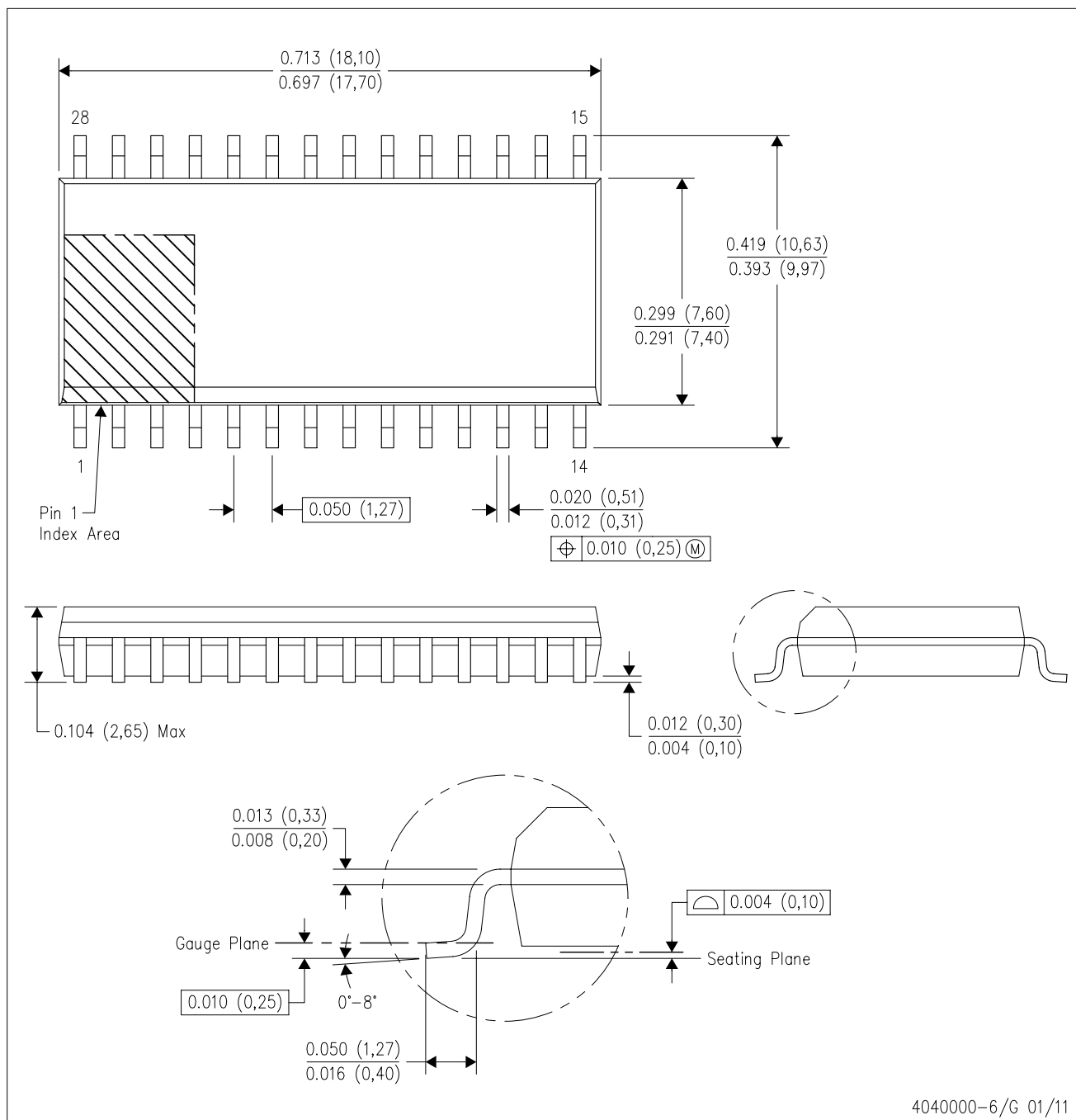


\*All dimensions are nominal

| Device          | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74ABT5400ADWR | SOIC         | DW              | 28   | 1000 | 367.0       | 367.0      | 55.0        |

DW (R-PDSO-G28)

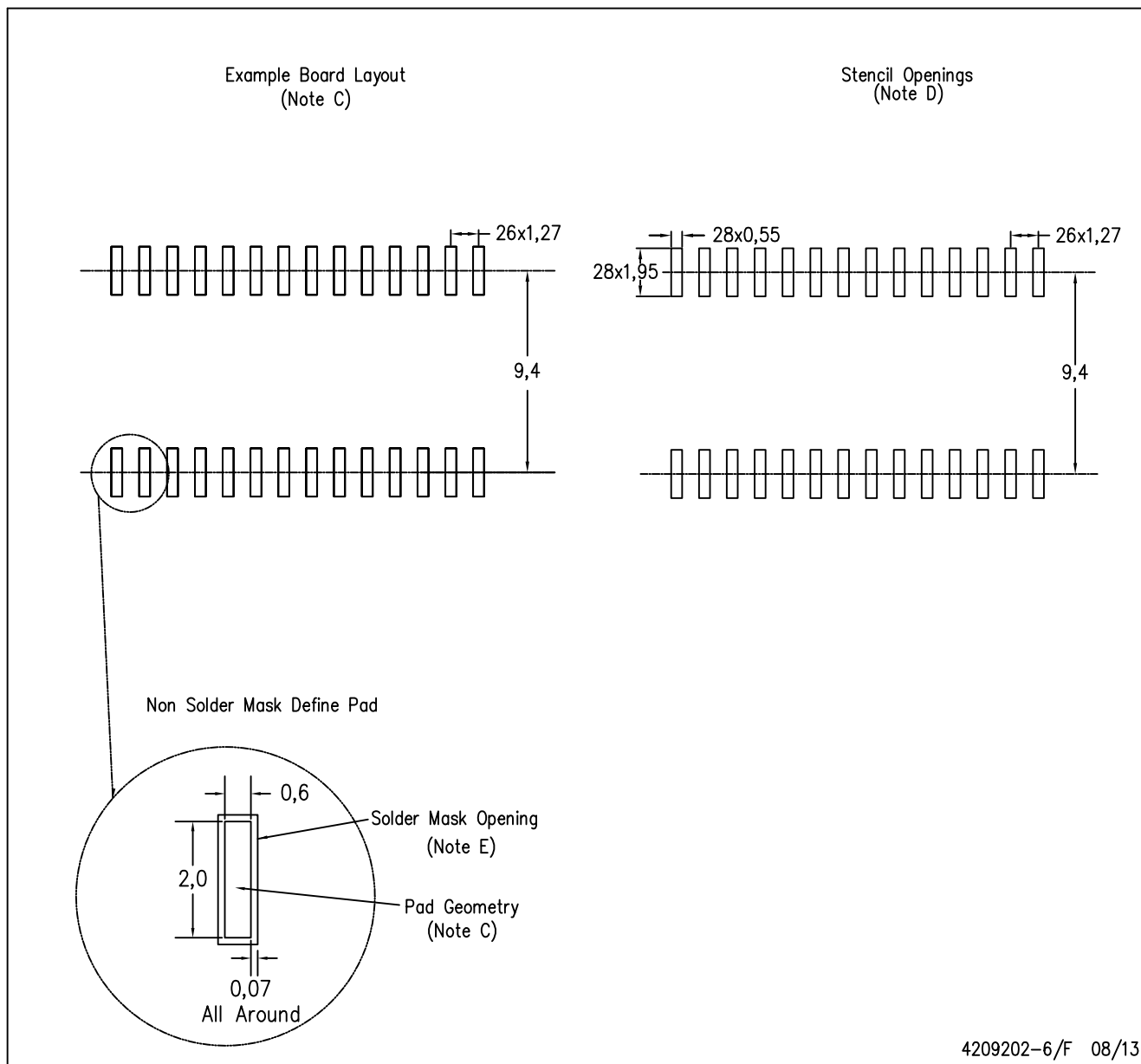
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AE.

DW (R-PDSO-G28)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Refer to IPC7351 for alternate board design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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| Data Converters              | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>                       |
| DLP® Products                | <a href="http://www.dlp.com">www.dlp.com</a>                                         |
| DSP                          | <a href="http://dsp.ti.com">dsp.ti.com</a>                                           |
| Clocks and Timers            | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>                             |
| Interface                    | <a href="http://interface.ti.com">interface.ti.com</a>                               |
| Logic                        | <a href="http://logic.ti.com">logic.ti.com</a>                                       |
| Power Mgmt                   | <a href="http://power.ti.com">power.ti.com</a>                                       |
| Microcontrollers             | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a>                   |
| RFID                         | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Applications Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
| Wireless Connectivity        | <a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a> |

### Applications

|                               |                                                                                          |
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| Consumer Electronics          | <a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>                   |
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