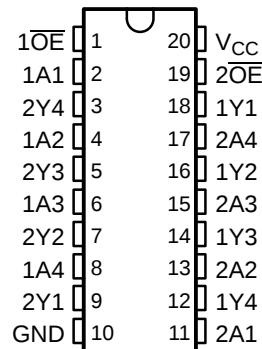


## FEATURES

- Operates From 2.7 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 6.5 ns at 3.3 V
- Typical  $V_{OLP}$  (Output Ground Bounce)  
< 0.8 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot)  
> 2 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- $I_{off}$  and Power-Up 3-State Support Hot Insertion
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V  $V_{CC}$ )
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

DB, DGV, DW, N, NS, OR PW PACKAGE  
(TOP VIEW)



## DESCRIPTION/ORDERING INFORMATION

This octal buffer/driver is designed for 2.7-V to 3.6-V  $V_{CC}$  operation.

The SN74LVCZ240A is designed specifically to improve the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

This device is organized as two 4-bit buffers/drivers with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the device passes data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of this device as a translator in a mixed 3.3-V/5-V system environment.

## ORDERING INFORMATION

| $T_A$         | PACKAGE <sup>(1)</sup> |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------------------|--------------|-----------------------|------------------|
| –40°C to 85°C | PDIP – N               | Tube of 20   | SN74LVCZ240AN         | SN74LVCZ240AN    |
|               | SOIC – DW              | Tube of 25   | SN74LVCZ240ADW        | LVCZ240A         |
|               |                        | Reel of 2000 | SN74LVCZ240ADWR       |                  |
|               | SOP – NS               | Reel of 2000 | SN74LVCZ240ANSR       | LVCZ240A         |
|               | SSOP – DB              | Reel of 2000 | SN74LVCZ240ADBR       | CV240A           |
|               | TSSOP – PW             | Tube of 70   | SN74LVCZ240APW        | CV240A           |
|               |                        | Reel of 2000 | SN74LVCZ240APWR       |                  |
|               |                        | Reel of 250  | SN74LVCZ240APWT       |                  |
|               | TVSOP – DGV            | Reel of 2000 | SN74LVCZ240ADGVR      | CV240A           |

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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.

## DESCRIPTION/ORDERING INFORMATION (CONTINUED)

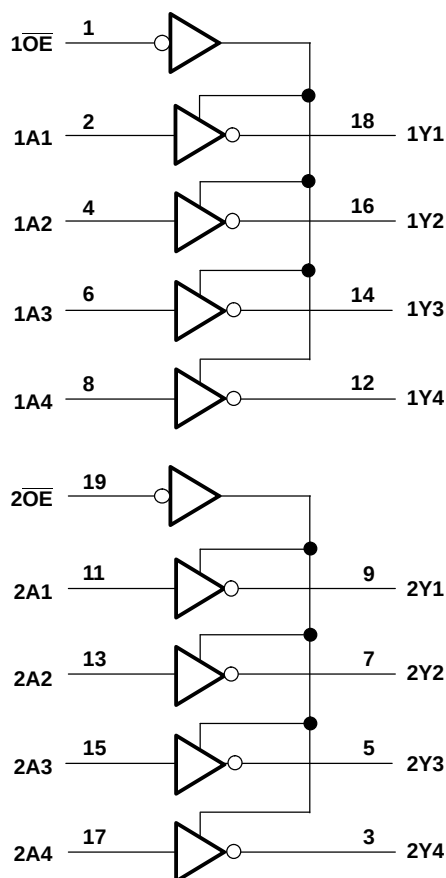
When  $V_{CC}$  is between 0 and 1.5 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

This device is fully specified for hot-insertion applications using  $I_{off}$  and power-up 3-state. The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

**FUNCTION TABLE**  
**(EACH BUFFER)**

| INPUTS          |   | OUTPUT<br>Y |
|-----------------|---|-------------|
| $\overline{OE}$ | A |             |
| L               | H | L           |
| L               | L | H           |
| H               | X | Z           |

## LOGIC DIAGRAM (POSITIVE LOGIC)



## Absolute Maximum Ratings<sup>(1)</sup>

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

|               |                                                                                             | MIN         | MAX            | UNIT |
|---------------|---------------------------------------------------------------------------------------------|-------------|----------------|------|
| $V_{CC}$      | Supply voltage range                                                                        | –0.5        | 6.5            | V    |
| $V_I$         | Input voltage range <sup>(2)</sup>                                                          | –0.5        | 6.5            | V    |
| $V_O$         | Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup> | –0.5        | 6.5            | V    |
| $V_O$         | Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>              | –0.5        | $V_{CC} + 0.5$ | V    |
| $I_{IK}$      | Input clamp current                                                                         | $V_I < 0$   | –50            | mA   |
| $I_{OK}$      | Output clamp current                                                                        | $V_O < 0$   | –50            | mA   |
| $I_O$         | Continuous output current                                                                   |             | ±50            | mA   |
|               | Continuous current through $V_{CC}$ or GND                                                  |             | ±100           | mA   |
| $\theta_{JA}$ | Package thermal impedance <sup>(4)</sup>                                                    | DB package  | 70             | °C/W |
|               |                                                                                             | DGV package | 92             |      |
|               |                                                                                             | DW package  | 58             |      |
|               |                                                                                             | N package   | 69             |      |
|               |                                                                                             | NS package  | 60             |      |
|               |                                                                                             | PW package  | 83             |      |
| $T_{stg}$     | Storage temperature range                                                                   | –65         | 150°C          | °C   |

- (1) 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.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of  $V_{CC}$  is provided in the recommended operating conditions table.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

## Recommended Operating Conditions<sup>(1)</sup>

|                          |                                    |                                            | MIN | MAX      | UNIT |
|--------------------------|------------------------------------|--------------------------------------------|-----|----------|------|
| $V_{CC}$                 | Supply voltage                     |                                            | 2.7 | 3.6      | V    |
| $V_{IH}$                 | High-level input voltage           | $V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$ | 2   |          | V    |
| $V_{IL}$                 | Low-level input voltage            | $V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$ |     | 0.8      | V    |
| $V_I$                    | Input voltage                      |                                            | 0   | 5.5      | V    |
| $V_O$                    | Output voltage                     | High or low state                          | 0   | $V_{CC}$ | V    |
|                          |                                    | 3-state                                    | 0   | 5.5      |      |
| $I_{OH}$                 | High-level output current          | $V_{CC} = 2.7 \text{ V}$                   |     | –12      | mA   |
|                          |                                    | $V_{CC} = 3 \text{ V}$                     |     | –24      |      |
| $I_{OL}$                 | Low-level output current           | $V_{CC} = 2.7 \text{ V}$                   |     | 12       | mA   |
|                          |                                    | $V_{CC} = 3 \text{ V}$                     |     | 24       |      |
| $\Delta t/\Delta v$      | Input transition rise or fall rate |                                            |     | 6        | ns/V |
| $\Delta t/\Delta V_{CC}$ | Power-up ramp rate                 |                                            | 150 |          | µs/V |
| $T_A$                    | Operating free-air temperature     |                                            | –40 | 85       | °C   |

- (1) All unused 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.

# SN74LVCZ240A

## OCTAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

SCES273H–JUNE 1999–REVISED APRIL 2005



### Electrical Characteristics

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

| PARAMETER         | TEST CONDITIONS                                                              | V <sub>CC</sub> | MIN                   | TYP <sup>(1)</sup> | MAX | UNIT |
|-------------------|------------------------------------------------------------------------------|-----------------|-----------------------|--------------------|-----|------|
| V <sub>OH</sub>   | I <sub>OH</sub> = –100 µA                                                    | 2.7 V to 3.6 V  | V <sub>CC</sub> – 0.2 |                    |     | V    |
|                   | I <sub>OH</sub> = –12 mA                                                     | 2.7 V           | 2.2                   |                    |     |      |
|                   |                                                                              | 3 V             | 2.4                   |                    |     |      |
|                   | I <sub>OH</sub> = –24 mA                                                     | 3 V             | 2.2                   |                    |     |      |
| V <sub>OL</sub>   | I <sub>OL</sub> = 100 µA                                                     | 2.7 V to 3.6 V  | 0.2                   |                    |     | V    |
|                   | I <sub>OL</sub> = 12 mA                                                      | 2.7 V           | 0.4                   |                    |     |      |
|                   | I <sub>OL</sub> = 24 mA                                                      | 3 V             | 0.55                  |                    |     |      |
| I <sub>I</sub>    | V <sub>I</sub> = 0 to 5.5 V                                                  | 3.6 V           | ±5                    |                    |     | µA   |
| I <sub>off</sub>  | V <sub>I</sub> or V <sub>O</sub> = 5.5 V                                     | 0               | ±5                    |                    |     | µA   |
| I <sub>OZ</sub>   | V <sub>O</sub> = 0 to 5.5 V                                                  | 3.6 V           | ±5                    |                    |     | µA   |
| I <sub>OZPU</sub> | V <sub>O</sub> = 0.5 to 2.5 V, $\overline{OE}$ = don't care                  | 0 to 1.5 V      | ±5                    |                    |     | µA   |
| I <sub>OZPD</sub> | V <sub>O</sub> = 0.5 to 2.5 V, $\overline{OE}$ = don't care                  | 1.5 V to 0      | ±5                    |                    |     | µA   |
| I <sub>CC</sub>   | V <sub>I</sub> = V <sub>CC</sub> or GND                                      | 3.6 V           | 100                   |                    |     | µA   |
|                   | 3.6 V ≤ V <sub>I</sub> ≤ 5.5 V <sup>(2)</sup>                                |                 | 100                   |                    |     |      |
| ΔI <sub>CC</sub>  | One input at V <sub>CC</sub> – 0.6 V, Other inputs at V <sub>CC</sub> or GND | 2.7 V to 3.6 V  | 100                   |                    |     | µA   |
| C <sub>i</sub>    | V <sub>I</sub> = V <sub>CC</sub> or GND                                      | 3.3 V           | 3.5                   |                    |     | pF   |
| C <sub>o</sub>    | V <sub>O</sub> = V <sub>CC</sub> or GND                                      | 3.3 V           | 5.5                   |                    |     | pF   |

(1) All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

(2) This applies in the disabled state only.

### Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | V <sub>CC</sub> = 2.7 V |     | V <sub>CC</sub> = 3.3 V<br>± 0.3 V |     | UNIT |
|------------------|-----------------|----------------|-------------------------|-----|------------------------------------|-----|------|
|                  |                 |                | MIN                     | MAX | MIN                                | MAX |      |
| t <sub>pd</sub>  | A or B          | B or A         | 7.5                     |     | 1.3                                | 6.5 | ns   |
| t <sub>en</sub>  | $\overline{OE}$ | A or B         | 9                       |     | 1.1                                | 8   | ns   |
| t <sub>dis</sub> | $\overline{OE}$ | A or B         | 8                       |     | 1.4                                | 7   | ns   |

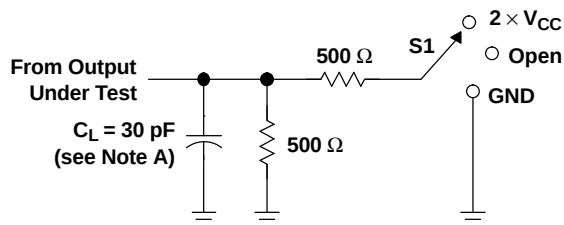
### Operating Characteristics

T<sub>A</sub> = 25°C

| PARAMETER       |                                                 | TEST<br>CONDITIONS | V <sub>CC</sub> = 3.3 V | UNIT |
|-----------------|-------------------------------------------------|--------------------|-------------------------|------|
|                 |                                                 |                    | TYP                     |      |
| C <sub>pd</sub> | Power dissipation capacitance per buffer/driver | Outputs enabled    | 37                      | pF   |
|                 |                                                 | Outputs disabled   | 3                       |      |

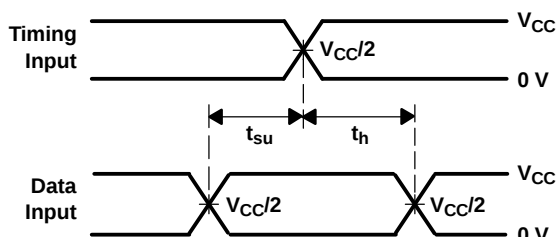
# PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.7\text{ V}$  and  $3.3\text{ V} \pm 0.3\text{ V}$

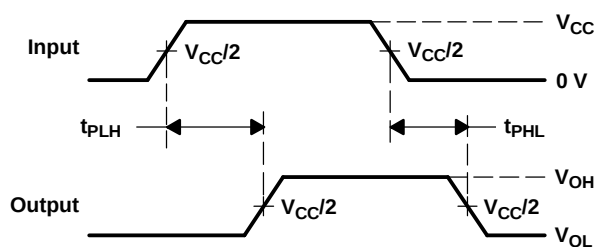


LOAD CIRCUIT

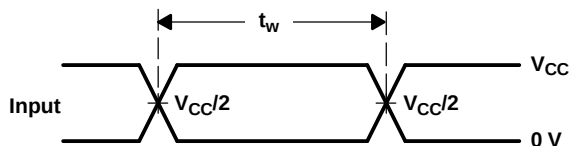
| TEST              | S1                |
|-------------------|-------------------|
| $t_{pd}$          | Open              |
| $t_{PLZ}/t_{PZL}$ | 2 $\times V_{CC}$ |
| $t_{PHZ}/t_{PZH}$ | GND               |



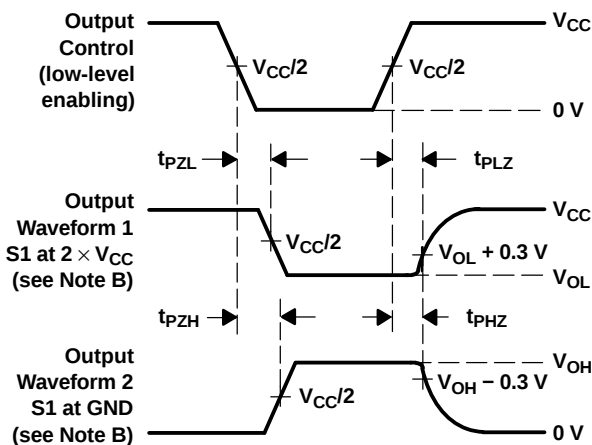
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES

- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics: PRR  $\leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 2\text{ ns}$ ,  $t_f \leq 2\text{ ns}$ .
  - The outputs are measured one at a time, with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - All parameters and waveforms are not applicable to all devices.

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                 |
|-------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74LVCZ240ADW    | ACTIVE        | SOIC         | DW                 | 20   | 25             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | LVCZ240A                | <a href="#">Samples</a> |
| SN74LVCZ240ADWR   | ACTIVE        | SOIC         | DW                 | 20   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | LVCZ240A                | <a href="#">Samples</a> |
| SN74LVCZ240ANSR   | ACTIVE        | SO           | NS                 | 20   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | LVCZ240A                | <a href="#">Samples</a> |
| SN74LVCZ240APW    | ACTIVE        | TSSOP        | PW                 | 20   | 70             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | CV240A                  | <a href="#">Samples</a> |
| SN74LVCZ240APWR   | ACTIVE        | TSSOP        | PW                 | 20   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | CV240A                  | <a href="#">Samples</a> |
| SN74LVCZ240APWRG4 | ACTIVE        | TSSOP        | PW                 | 20   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | CV240A                  | <a href="#">Samples</a> |
| SN74LVCZ240APWT   | ACTIVE        | TSSOP        | PW                 | 20   | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | CV240A                  | <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.

<sup>(5)</sup> 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.

<sup>(6)</sup> 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**


\*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 |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVCZ240ADWR | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.3    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74LVCZ240ANSR | SO           | NS              | 20   | 2000 | 330.0              | 24.4               | 8.2     | 13.0    | 2.5     | 12.0    | 24.0   | Q1            |
| SN74LVCZ240APWR | TSSOP        | PW              | 20   | 2000 | 330.0              | 16.4               | 6.95    | 7.1     | 1.6     | 8.0     | 16.0   | Q1            |
| SN74LVCZ240APWT | TSSOP        | PW              | 20   | 250  | 330.0              | 16.4               | 6.95    | 7.1     | 1.6     | 8.0     | 16.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

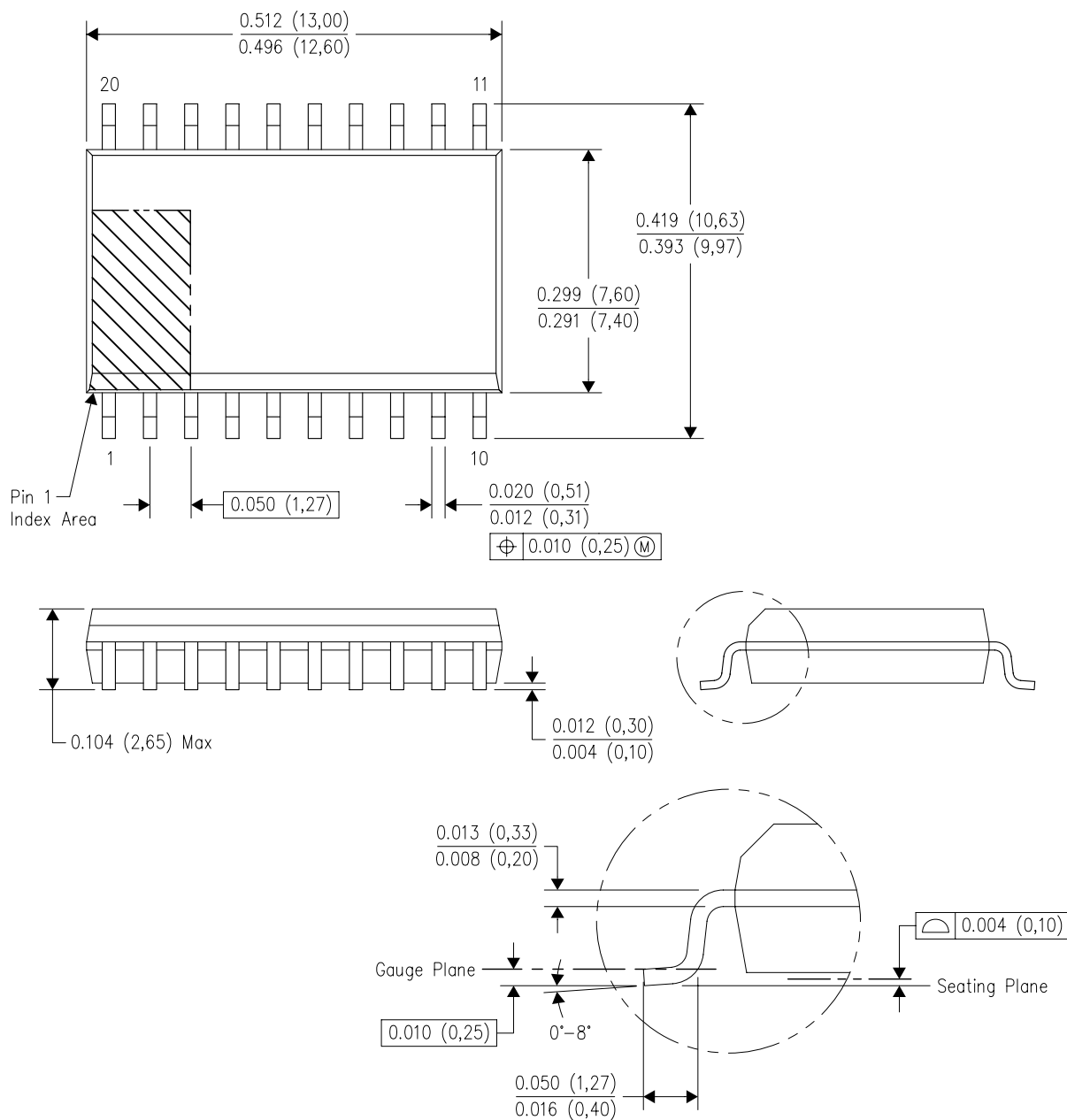


\*All dimensions are nominal

| Device          | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVCZ240ADWR | SOIC         | DW              | 20   | 2000 | 367.0       | 367.0      | 45.0        |
| SN74LVCZ240ANSR | SO           | NS              | 20   | 2000 | 367.0       | 367.0      | 45.0        |
| SN74LVCZ240APWR | TSSOP        | PW              | 20   | 2000 | 367.0       | 367.0      | 38.0        |
| SN74LVCZ240APWT | TSSOP        | PW              | 20   | 250  | 367.0       | 367.0      | 38.0        |

DW (R-PDSO-G20)

## PLASTIC SMALL OUTLINE

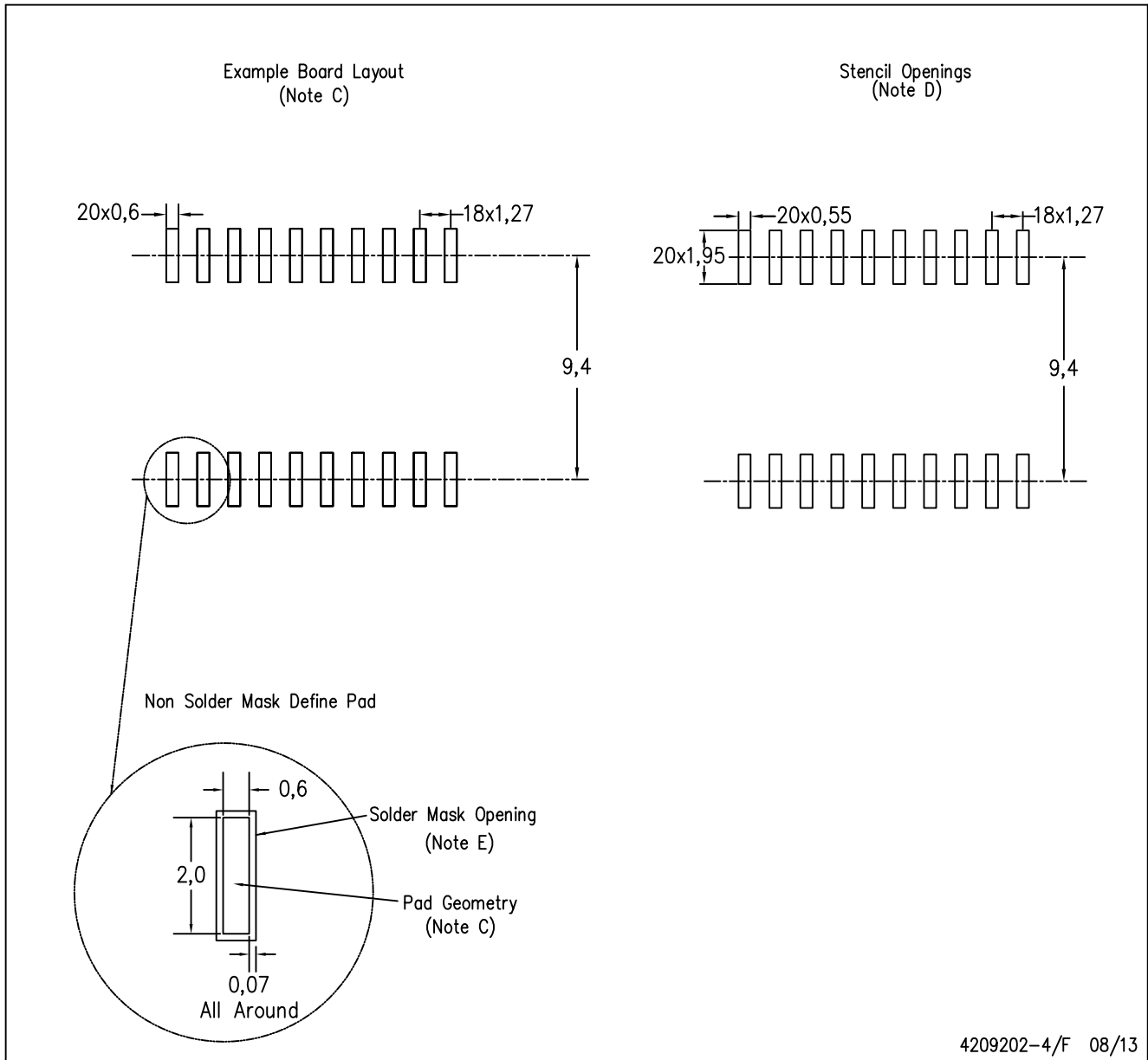


4040000-4/G 01/11

- 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 AC.

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Refer to IPC7351 for alternate board design.
  - 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
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



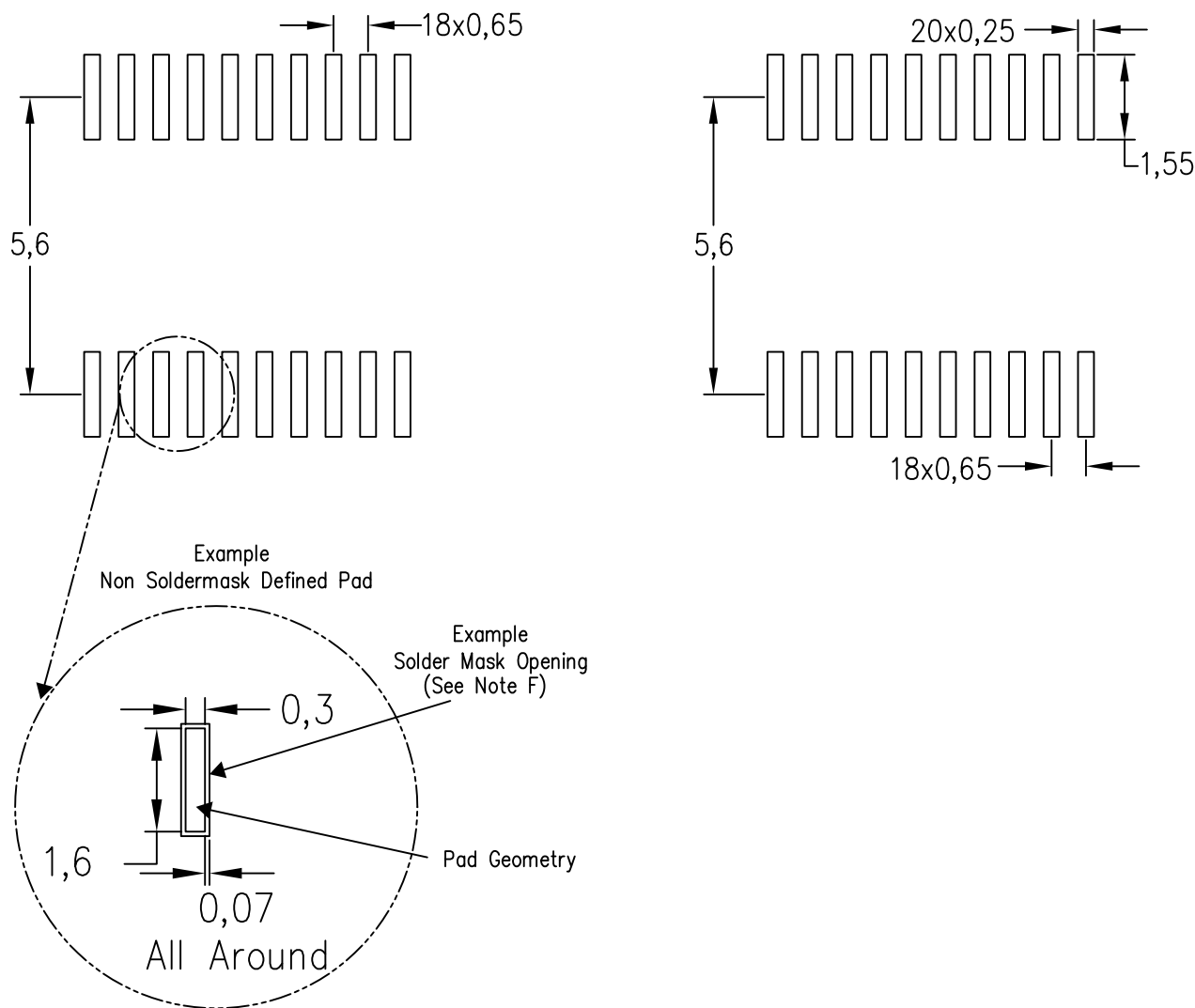
- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE

Example Board Layout

Based on a stencil thickness  
of .127mm (.005inch).



4211284-5/F 12/12

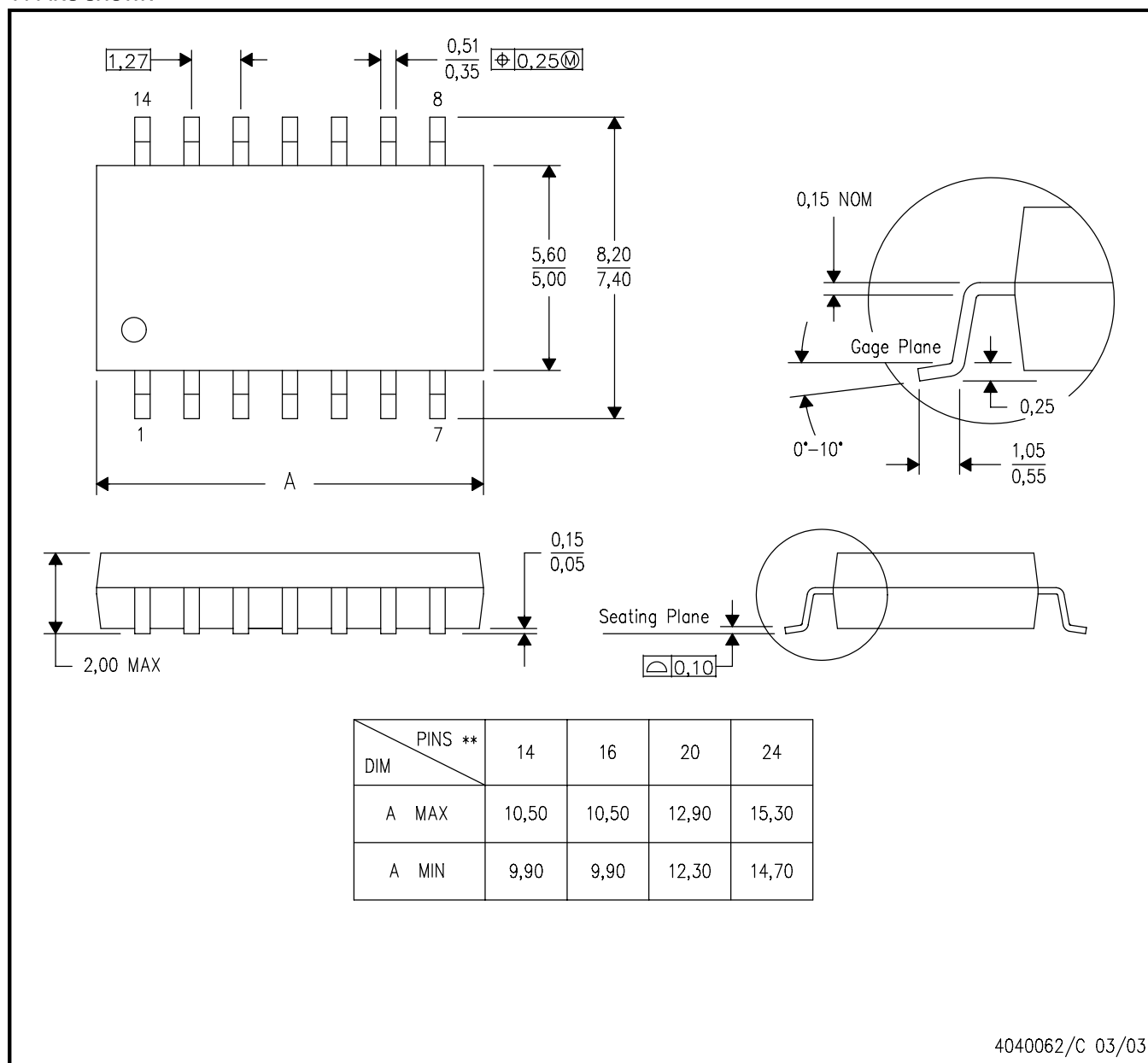
- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-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 flash or protrusion, not to exceed 0,15.

## IMPORTANT NOTICE

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