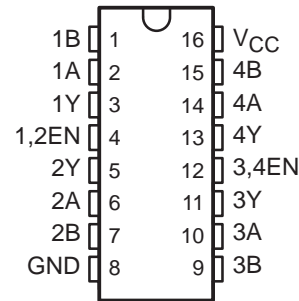


# SN75ALS175 QUADRUPLE DIFFERENTIAL LINE RECEIVER

SLLS131C – SEPTEMBER 1991 – REVISED MAY 1995

- Meets or Exceeds the Requirements of ANSI EIA/TIA-422-B, EIA/TIA-423-B, and RS-485
- Meets ITU Recommendations V.10, V.11, X.26, and X.27
- Designed for Multipoint Bus Transmission on Long Bus Lines in Noisy Environments
- Low Supply Current Requirement  
27 mA Max
- Common-Mode Input Voltage Range of -12 V to 12 V
- Input Sensitivity . . .  $\pm 200$  mV
- Input Hysteresis . . . 50 mV Typ
- High Input Impedance . . . 12 k $\Omega$  Min
- Operates From Single 5-V Supply

N OR NS† PACKAGE  
(TOP VIEW)



† The NS package is only available left-ended taped and reeled (order device SN75ALS175NSLE).

## description

The SN75ALS175 is a monolithic quadruple differential line receiver with 3-state outputs. It is designed to meet the requirements of ANSI Standards EIA/TIA-422-B, EIA/TIA-423-B, and RS-485 and several ITU recommendations. Advanced low-power Schottky technology provides high speed without the usual power penalty. Each of the two pairs of receivers has a common active-high enable. The device features high input impedance, input hysteresis for increased noise immunity, and input sensitivity of  $\pm 200$  mV over a common-mode input voltage range of -12 V to 12 V.

The SN75ALS175 is characterized for operation from 0°C to 70°C.

FUNCTION TABLE  
(each receiver)

| DIFFERENTIAL INPUTS<br>A – B | ENABLES<br>EN | OUTPUT<br>Y |
|------------------------------|---------------|-------------|
| $V_{ID} \geq 0.2$ V          | H             | H           |
| $-0.2$ V < $V_{ID} < 0.2$ V  | H             | ?           |
| $V_{ID} \leq -0.2$ V         | H             | L           |
| X                            | L             | Z           |
| Open Circuit                 | H             | H           |

H = high level, L = low level, ? = indeterminate,  
X = irrelevant, Z = high impedance (off)



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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**

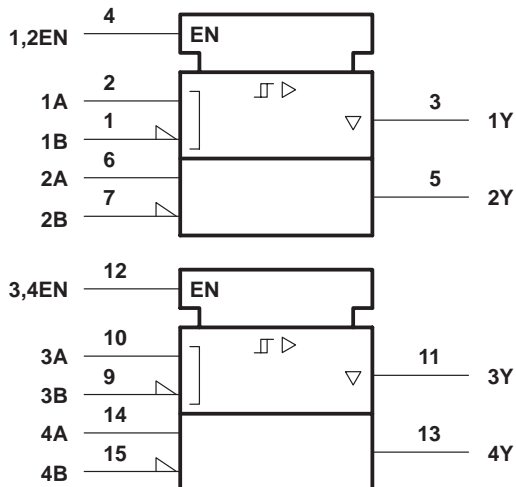
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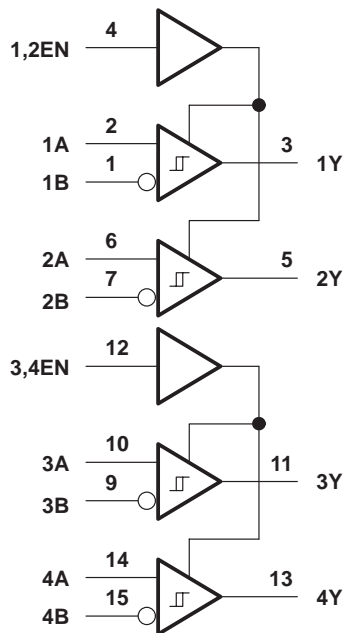
# SN75ALS175 QUADRUPLE DIFFERENTIAL LINE RECEIVER

SLLS131C – SEPTEMBER 1991 – REVISED MAY 1995

## logic symbol†

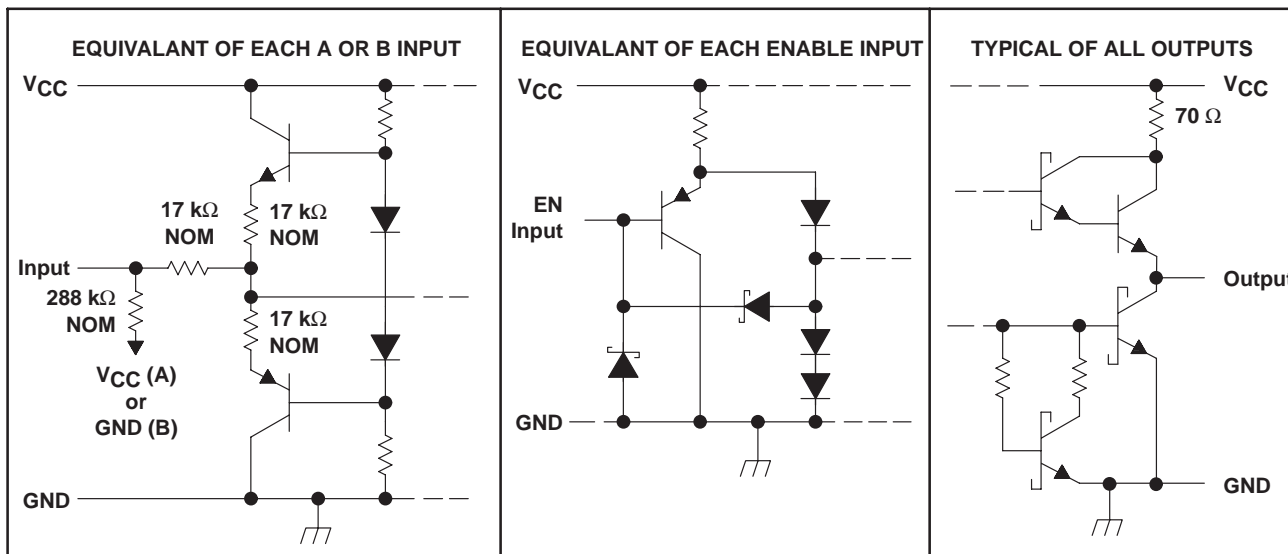


## logic diagram (positive logic)



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

## schematics of inputs and outputs



# SN75ALS175 QUADRUPLE DIFFERENTIAL LINE RECEIVER

SLLS131C – SEPTEMBER 1991 – REVISED MAY 1995

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

|  |  |
|--|--|
| Supply voltage, $V_{CC}$ (see Note 1) .....                        | 7 V  |
| Input voltage, $V_I$ (A or B inputs) .....                         | $\pm 14$ V                                 |
| Differential input voltage, $V_{ID}$ (see Note 2) .....            | $\pm 14$ V                                 |
| Enable input voltage, $V_I$ .....                                  | 7 V  |
| Low-level output current, $I_{OL}$ .....                           | 50 mA                                      |
| Continuous total dissipation .....                                 | See Dissipation Rating Table               |
| Operating free-air temperature range, $T_A$ .....                  | $0^\circ\text{C}$ to $70^\circ\text{C}$    |
| Storage temperature range, $T_{stg}$ .....                         | $-65^\circ\text{C}$ to $150^\circ\text{C}$ |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds ..... | $260^\circ\text{C}$                        |

† 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. All voltage values, except differential input voltage, are with respect to network ground terminal.  
 2. Differential-input voltage is measured at the noninverting input with respect to the corresponding inverting input.

**DISSIPATION RATING TABLE**

| PACKAGE | $T_A \leq 25^\circ\text{C}$<br>POWER RATING | DERATING FACTOR<br>ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$<br>POWER RATING |
|---------|---|---|--|
| N       | 1150 mW                                     | 9.2 mW/ $^\circ\text{C}$                          | 736 mW                                   |
| NS      | 625 mW                                      | 5.0 mW/ $^\circ\text{C}$                          | 400 mW                                   |

## recommended operating conditions

|   | MIN  | NOM | MAX      | UNIT             |
|---|------|-----|----------|------------------|
| Supply voltage, $V_{CC}$                  | 4.75 | 5   | 5.25     | V                |
| Common-mode input voltage, $V_{IC}$       |      |     | $\pm 12$ | V                |
| Differential input voltage, $V_{ID}$      |      |     | $\pm 12$ | V                |
| High-level enable-input voltage, $V_{IH}$ | 2    |     |          | V                |
| Low-level enable-input voltage, $V_{IL}$  |      |     | 0.8      | V                |
| High-level output current, $I_{OH}$       |      |     | -400     | $\mu\text{A}$    |
| Low-level output current, $I_{OL}$        |      |     | 8        | mA               |
| Operating free-air temperature, $T_A$     | 0    |     | 70       | $^\circ\text{C}$ |

# SN75ALS175

## QUADRUPLE DIFFERENTIAL LINE RECEIVER

SLLS131C – SEPTEMBER 1991 – REVISED MAY 1995

**electrical characteristics over recommended ranges of common-mode input voltage, supply voltage and operating free-air temperature (unless otherwise noted) (see Note 3)**

| PARAMETER |  | TEST CONDITIONS  | MIN   | TYP† | MAX      | UNIT       |
|-----------|--|--|-------|------|----------|------------|
| $V_{IT+}$ | Positive-going input threshold voltage     |  |       |      | 200      | mV         |
| $V_{IT-}$ | Negative-going input threshold voltage     |  | -200‡ |      |          | mV         |
| $V_{hys}$ | Hysteresis voltage ( $V_{IT+} - V_{IT-}$ ) |  |       | 50   |          | mV         |
| $V_{IK}$  | Enable-input clamp voltage                 | $I_I = -18$ mA   |       |      | -1.5     | V          |
| $V_{OH}$  | High-level output voltage                  | $V_{ID} = 200$ mV, $I_{OH} = -400$ $\mu$ A, See Figure 1 | 2.7   |      |          | V          |
| $V_{OL}$  | Low-level output voltage                   | $V_{ID} = -200$ mV, $I_{OL} = 8$ mA, See Figure 1        |       |      | 0.45     | V          |
| $I_{OZ}$  | High-impedance-state output current        | $V_O = 0.4$ V to 2.4 V                                   |       |      | $\pm 20$ | $\mu$ A    |
| $I_I$     | Line input current                         | Other input at 0 V, See Note 3                           |       |      | 1        | mA         |
|           |  |  |       |      | -0.8     |            |
| $I_{IH}$  | High-level enable-input current            | $V_{IH(E)} = 2.7$ V                                      |       |      | 20       | $\mu$ A    |
| $I_{IL}$  | Low-level enable-input current             | $V_{IL(E)} = 0.4$ V                                      |       |      | -100     | $\mu$ A    |
| $r_i$     | Input resistance                           |  | 12    |      |          | k $\Omega$ |
| $I_{OS}$  | Short-circuit output current               | $V_O = 0$  | -15   |      | -85      | mA         |
| $I_{CC}$  | Supply current (total package)             | No load, Outputs enabled                                 |       | 16   | 24       | mA         |
|           |  | No load, Outputs disabled                                |       | 18   | 27       |            |

† All typical values are at  $V_{CC} = 5$  V,  $T_A = 25^\circ$ C.

‡ The algebraic convention, in which the less positive (more negative) limit is designated as minimum, is used in this data sheet for threshold voltage levels only.

NOTE 3: Refer to ANSI Standard RS-485 for exact conditions.

### switching characteristics, $V_{CC} = 5$ V, $T_A = 25^\circ$ C

| PARAMETER |   | TEST CONDITIONS             | MIN | TYP† | MAX | UNIT |
|-----------|---|-----------------------------|-----|------|-----|------|
| $t_{PHL}$ | Propagation delay time, high- to low-level output | $V_{ID} = -2.5$ V to 2.5 V, | 9   | 18   | 27  | ns   |
| $t_{PLH}$ | Propagation delay time, low- to high-level output | $C_L = 15$ pF, See Figure 2 | 9   | 18   | 27  | ns   |
| $t_{PZH}$ | Output enable time to high level                  | $C_L = 15$ pF, See Figure 3 | 4   | 12   | 18  | ns   |
| $t_{PZL}$ | Output enable time to low level                   |                             | 6   | 13   | 21  | ns   |
| $t_{PHZ}$ | Output disable time from high level               | $C_L = 15$ pF, See Figure 3 | 10  | 21   | 27  | ns   |
| $t_{PLZ}$ | Output disable time from low level                |                             | 8   | 15   | 25  | ns   |

† All typical values are at  $V_{CC} = 5$  V,  $T_A = 25^\circ$ C.



PARAMETER MEASUREMENT INFORMATION

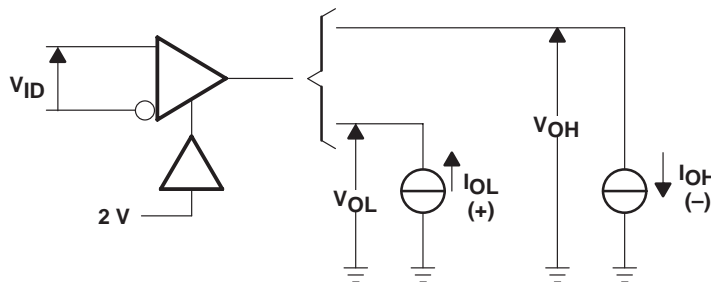
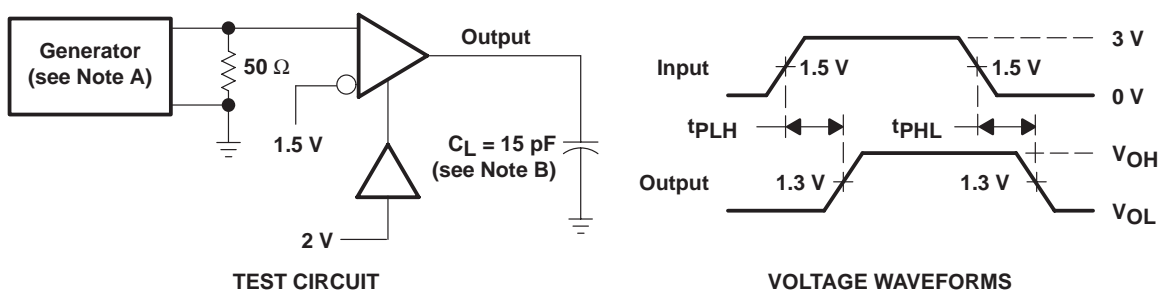


Figure 1.  $V_{OH}$ ,  $V_{OL}$



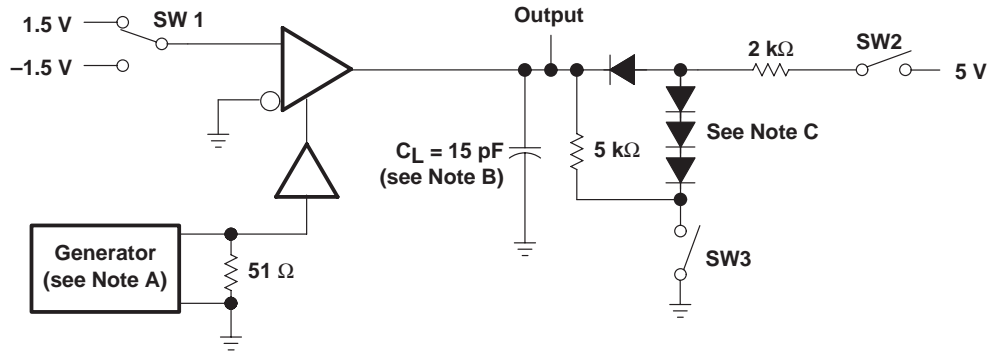
NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%,  $t_r = t_f = 6$  ns.  
 B.  $C_L$  includes probe and jig capacitance.

Figure 2. Propagation Delay Times

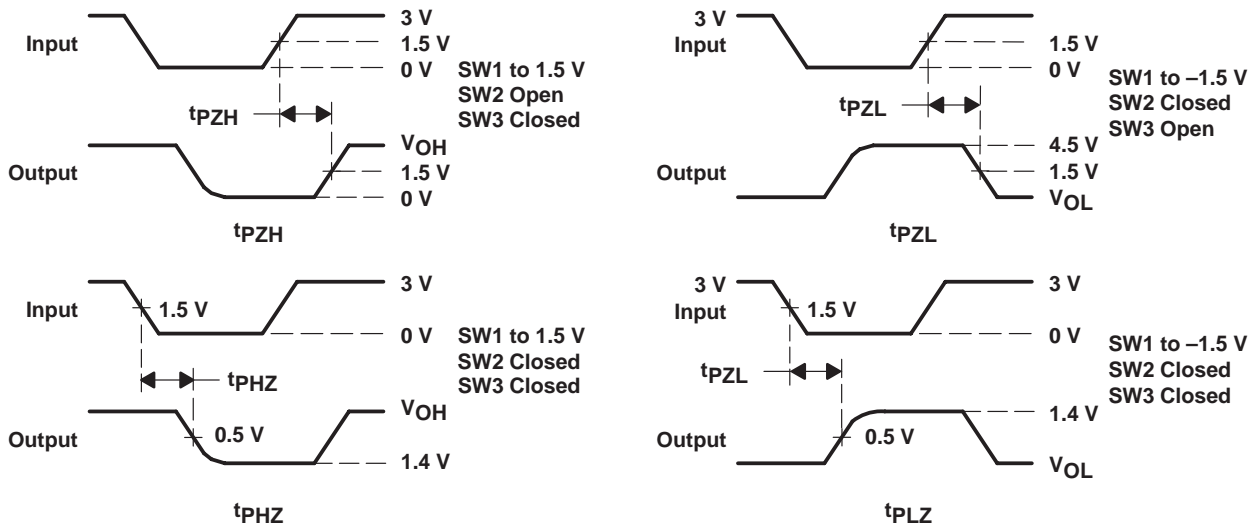
# SN75ALS175 QUADRUPLE DIFFERENTIAL LINE RECEIVER

SLLS131C – SEPTEMBER 1991 – REVISED MAY 1995

## PARAMETER MEASUREMENT INFORMATION



### TEST CIRCUIT



### VOLTAGE WAVEFORMS

- NOTES: A. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%,  $t_r = t_f = 6$  ns.  
 B.  $C_L$  includes probe and jig capacitance.  
 C. All diodes are 1N916 or equivalent.

Figure 3. Enable and Disable Times

**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN75ALS175N      | ACTIVE        | PDIP         | N               | 16   | 25          | RoHS & Green    | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN75ALS175N             | <a href="#">Samples</a> |
| SN75ALS175NSR    | ACTIVE        | SO           | NS              | 16   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | 75ALS175                | <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.

**OBSELETE:** 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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN75ALS175NSR | SO           | NS              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 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) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN75ALS175NSR | SO           | NS              | 16   | 2000 | 356.0       | 356.0      | 35.0        |

**TUBE**


\*All dimensions are nominal

| Device      | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN75ALS175N | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.



# PACKAGE OUTLINE

## NS0016A

### SOP - 2.00 mm max height

SOP



#### NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.

# EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:7X

4220735/A 12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

# 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.



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