

# SN751177, SN751178 Dual Differential Drivers and Receivers

## 1 Features

- Meet or exceed the requirements of ANSI standards TIA/EIA-422-B and TIA/EIA-485-A and ITU recommendations V.10 and V.11
- Designed for multipoint bus transmission on long bus lines in noise environments
- Driver positive- and negative-current limiting
- Thermal shutdown protection
- Driver 3-state outputs
- Receiver common-mode input voltage range of  $-12\text{V}$  to  $12\text{V}$
- Receiver input sensitivity:  $\pm 200\text{mV}$
- Receiver hysteresis:  $50\text{mV}$  typical
- Receiver input impedance:  $12\text{ k}\Omega$  minimum
- Receiver 3-state outputs (SN751177 only)
- Operate from single  $5\text{V}$  supply

## 2 Applications

- [Motor Drives](#)
- [Factory Automation](#)
- [Building Automation](#)

## 3 Description

The SN751177 and SN751178 dual differential drivers and receivers are monolithic integrated circuits that are designed for balanced multipoint bus transmission at rates up to  $10\text{ Mbits}$ . The devices are designed to improve the performance of full-duplex data communications over long bus lines and meet ANSI Standards TIA/EIA-422-B and TIA/EIA-485-A and ITU Recommendations V.10 and V.11.

The SN751177 and SN751178 driver outputs provide limiting for both positive and negative currents and thermal-shutdown protection from line-fault conditions on the transmission bus line.

The receiver features high input impedance of at least  $12\text{ k}\Omega$ , an input sensitivity of  $\pm 200\text{mV}$  over a common-mode input voltage range of  $-12\text{V}$  to  $12\text{V}$ , and typical input hysteresis of  $50\text{mV}$ . Fail-safe design makes sure the receiver inputs are open, the receiver outputs are always high.

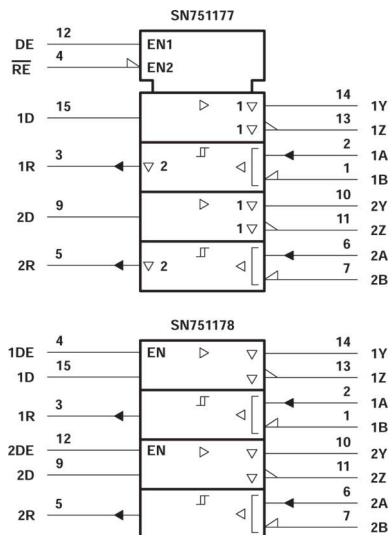
The SN751177 and SN751178 are characterized for operation from  $-20^\circ\text{C}$  to  $85^\circ\text{C}$ .

### Package Information

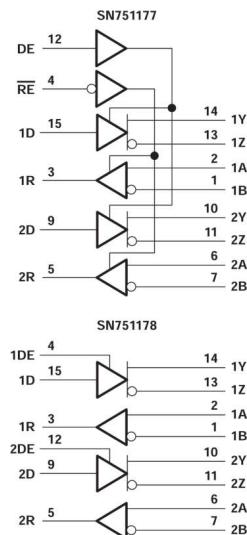
| PART NUMBER | PACKAGE <sup>(1)</sup> | PACKAGE SIZE <sup>(2)</sup>         |
|-------------|------------------------|-------------------------------------|
| SN751177    | PDIP (N, 16)           | $19.3\text{mm} \times 9.4\text{mm}$ |
| SN751178    | SO (NS, 16)            | $10.2\text{mm} \times 7.8\text{mm}$ |

(1) For more information, see [Section 10](#).

(2) The package size (length  $\times$  width) is a nominal value and includes pins, where applicable.



Logic Symbols<sup>†</sup>



Logic Diagrams (Positive Logic)

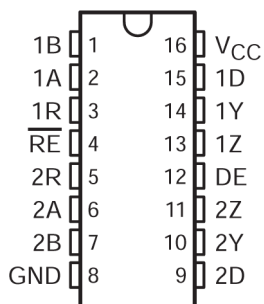
<sup>†</sup> These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.



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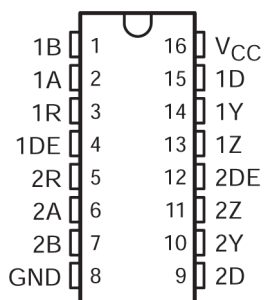
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## 4 Pin Configuration and Functions



**Figure 4-1. SN751177: N or NS Package  
(Top View)**

| PIN             |      |    | TYPE | DESCRIPTION                                            |
|-----------------|------|----|------|--------------------------------------------------------|
| NAME            | PDIP | SO |      |                                                        |
| 1A              | 2    | 2  | I    | RS422 differential input (non-inverting) to receiver 1 |
| 2A              | 6    | 6  | I    | RS422 differential input (non-inverting) to receiver 2 |
| 1B              | 1    | 1  | I    | RS422 differential input (inverting) to receiver 1     |
| 2B              | 7    | 7  | I    | RS422 differential input (inverting) to receiver 2     |
| 1D              | 15   | 15 | I    | Logic data input to RS422 driver 1                     |
| 2D              | 9    | 9  | I    | Logic data input to RS422 driver 2                     |
| DE              | 12   | 12 | I    | Driver enable (active high)                            |
| GND             | 8    | 8  | —    | Device ground pin                                      |
| 1R              | 3    | 3  | O    | Logic data output of RS422 receiver 1                  |
| 2R              | 5    | 5  | O    | Logic data output of RS422 receiver 2                  |
| RE              | 4    | 4  | I    | Receiver enable pin (active low)                       |
| V <sub>CC</sub> | 16   | 16 | —    | Power supply                                           |
| 1Y              | 14   | 14 | O    | RS-422 differential (non-inverting) driver output 1    |
| 2Y              | 10   | 10 | O    | RS-422 differential (non-inverting) driver output 2    |
| 1Z              | 13   | 13 | O    | RS-422 differential (inverting) driver output 1        |
| 2Z              | 11   | 11 | O    | RS-422 differential (inverting) driver output 2        |



**Figure 4-2. SN751178: N or NS Package  
(Top View)**

| PIN             |      |    | TYPE | DESCRIPTION                                            |
|-----------------|------|----|------|--------------------------------------------------------|
| NAME            | PDIP | SO |      |                                                        |
| 1A              | 2    | 2  | I    | RS422 differential input (non-inverting) to receiver 1 |
| 2A              | 6    | 6  | I    | RS422 differential input (non-inverting) to receiver 2 |
| 1B              | 1    | 1  | I    | RS422 differential input (inverting) to receiver 1     |
| 2B              | 7    | 7  | I    | RS422 differential input (inverting) to receiver 2     |
| 1D              | 15   | 15 | I    | Logic data input to RS422 driver 1                     |
| 2D              | 9    | 9  | I    | Logic data input to RS422 driver 2                     |
| 1DE             | 4    | 4  | I    | Driver 1 enable (active high)                          |
| 2DE             | 12   | 12 | I    | Driver 2 enable (active high)                          |
| GND             | 8    | 8  | —    | Device ground                                          |
| 1R              | 3    | 3  | O    | Logic data output of RS422 receiver 1                  |
| 2R              | 5    | 5  | O    | Logic data output of RS422 receiver 2                  |
| V <sub>CC</sub> | 16   | 16 | —    | Power supply                                           |
| 1Y              | 14   | 14 | O    | RS-422 differential (non-inverting) driver output 1    |
| 2Y              | 10   | 10 | O    | RS-422 differential (non-inverting) driver output 2    |
| 1Z              | 13   | 13 | O    | RS-422 differential (non inverting) driver output 1    |
| 2Z              | 11   | 11 | O    | RS-422 differential (non inverting) driver output 2    |

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                  |                                                                       | MIN | MAX | UNIT |
|------------------|-----------------------------------------------------------------------|-----|-----|------|
| V <sub>CC</sub>  | Supply voltage, (see note <sup>(2)</sup> )                            |     | 7   | V    |
| V <sub>I</sub>   | Input voltage, (DE, $\overline{RE}$ , and D inputs)                   |     | 7   | V    |
| V <sub>I</sub>   | Receiver input voltage range, (A or B inputs)                         | –25 | 25  | V    |
| V <sub>ID</sub>  | Receiver differential input voltage range, (see note <sup>(3)</sup> ) | –25 | 25  | V    |
| V <sub>O</sub>   | Driver output voltage range                                           | –10 | 15  | V    |
| I <sub>OL</sub>  | Receiver low-level output current                                     |     | 50  | mA   |
| T <sub>stg</sub> | Storage temperature range                                             | –65 | 150 | °C   |
|                  | Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds          |     | 260 | °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) All voltage values, except differential input voltage, are with respect to the network ground terminal.
- (3) Differential input voltage is measured at the noninverting terminal with respect to the inverting terminal.

### 5.2 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |                                                       | N       | NS      | UNIT |
|-------------------------------|-------------------------------------------------------|---------|---------|------|
|                               |                                                       | 16-PINS | 16-PINS |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance <sup>(2)</sup> | 60.6    | 88.5    | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance             | 48.1    | 46.2    | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance                  | 40.6    | 50.7    | °C/W |
| Ψ <sub>JT</sub>               | Junction-to-top characterization parameter            | 27.5    | 13.5    | °C/W |
| Ψ <sub>JB</sub>               | Junction-to-board characterization parameter          | 40.3    | 50.3    | °C/W |
| R <sub>θJC(bot)</sub>         | Junction-to-case (bottom) thermal resistance          | N/A     | N/A     | °C/W |

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC package thermal metrics](#) application report.
- (2) The package thermal impedance is calculated in accordance with JEDEC 51, except for through-hole packages, which use a trace length of zero.

### 5.3 Recommended Operating Conditions

|                                                |                                    | MIN               | NOM | MAX  | UNIT |
|------------------------------------------------|------------------------------------|-------------------|-----|------|------|
| Supply voltage, V <sub>CC</sub>                |                                    | 4.75              | 5   | 5.25 | V    |
| High-level input voltage, V <sub>IH</sub>      | DE, $\overline{RE}$ , and D inputs | 2                 |     |      | V    |
| Low-level input voltage, V <sub>IL</sub>       |                                    |                   |     | 0.8  | V    |
| Common-mode output voltage, V <sub>OC</sub>    | Driver                             | –7 <sup>(1)</sup> |     | 12   | V    |
| High-level output current, I <sub>OH</sub>     |                                    |                   |     | –60  | mA   |
| Low-level output current, I <sub>OL</sub>      |                                    |                   |     | 60   | mA   |
| Common-mode input voltage, V <sub>IC</sub>     | Receiver                           |                   |     | ±12  | V    |
| Differential input voltage, V <sub>ID</sub>    |                                    |                   |     | ±12  | V    |
| High-level output current, I <sub>OH</sub>     |                                    |                   |     | –400 | μA   |
| Low-level output current, I <sub>OL</sub>      |                                    |                   |     | 16   | mA   |
| Operating free-air temperature, T <sub>A</sub> |                                    | –20               |     | 85   | °C   |

- (1) The algebraic convention, where the less positive (more negative) limit is designated as minimum, is used in this data sheet for common-mode output and threshold voltage levels only.

## 5.4 Driver Sections

### 5.4.1 Electrical Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

| PARAMETER        |                                                                                  | TEST CONDITIONS                                                               |                  |  | MIN                                  | TYP <sup>(1)</sup> | MAX       | UNIT          |
|------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------|--|--------------------------------------|--------------------|-----------|---------------|
| $V_{IK}$         | Input clamp voltage                                                              | $I_I = -18\text{mA}$                                                          |                  |  |                                      |                    | -1.5      | V             |
| $V_{OH}$         | High-level output voltage                                                        | $V_{IH} = 2\text{V}$ ,<br>$V_{IL} = 0.8\text{V}$ ,<br>$I_{OH} = -33\text{mA}$ |                  |  |                                      | 3.7                |           | V             |
| $V_{OL}$         | Low-level output voltage                                                         | $V_{IH} = 2\text{V}$ ,<br>$V_{IL} = 0.8\text{V}$ ,<br>$I_{OH} = 33\text{mA}$  |                  |  |                                      | 1.1                |           | V             |
| $ V_{OD1} $      | Differential output voltage                                                      | $I_O = 0$                                                                     |                  |  | 1.5                                  |                    | 6         | V             |
| $ V_{OD2} $      | Differential output voltage                                                      | $R_L = 100\Omega$ ,<br>See <a href="#">Figure 6-1</a>                         |                  |  | 2 or 1/2<br>$V_{OD1}$ <sup>(2)</sup> |                    |           | V             |
|                  |                                                                                  | $R_L = 54\Omega$ ,<br>See <a href="#">Figure 6-1</a>                          |                  |  | 1.5                                  |                    | 5         |               |
| $V_{OD3}$        | Differential output voltage                                                      | See <a href="#">Note 4</a>                                                    |                  |  | 1.5                                  |                    | 5         | V             |
| $\Delta V_{OD} $ | Change in magnitude of differential output voltage (see <a href="#">Note 5</a> ) |                                                                               |                  |  |                                      |                    | $\pm 0.2$ | V             |
| $V_{OC}$         | Common-mode output voltage                                                       | $R_L = 54\Omega$ or $100\Omega$ ,<br>See <a href="#">Figure 6-1</a>           |                  |  | -1 <sup>(3)</sup>                    |                    | 3         | V             |
| $\Delta V_{OC} $ | Change in magnitude of common-mode output voltage (see <a href="#">Note 5</a> )  |                                                                               |                  |  |                                      |                    | $\pm 0.2$ | V             |
| $I_O$            | Output current with power off                                                    | $V_{CC} = 0$ ,<br>$V_O = -7\text{V}$ to $12\text{V}$                          |                  |  |                                      |                    | $\pm 100$ | $\mu\text{A}$ |
| $I_{OZ}$         | High-impedance-state output current                                              | $V_O = -7\text{V}$ to $12\text{V}$                                            |                  |  |                                      |                    | $\pm 100$ | $\mu\text{A}$ |
| $I_{IH}$         | High-level input current                                                         | $V_{IH} = 2.7\text{V}$                                                        |                  |  |                                      |                    | 20        | $\mu\text{A}$ |
| $I_{IL}$         | Low-level input current                                                          | $V_{IL} = 0.4\text{V}$                                                        |                  |  |                                      |                    | -100      | $\mu\text{A}$ |
|                  |                                                                                  | $V_O = -7\text{V}$                                                            |                  |  |                                      |                    | -250      | mA            |
| $I_{OS}$         | Short-circuit output current (see <a href="#">Note 6</a> )                       | $V_O = V_{CC}$                                                                |                  |  |                                      |                    | 250       |               |
|                  |                                                                                  | $V_O = 12\text{V}$                                                            |                  |  |                                      |                    | 250       |               |
| $I_{CC}$         | Supply current                                                                   | No load                                                                       | Outputs enabled  |  |                                      | 80                 | 110       | mA            |
|                  |                                                                                  |                                                                               | Outputs disabled |  |                                      | 50                 | 80        |               |

(1) All typical values are at  $V_{CC} = 5\text{V}$  and  $T_A = 25^\circ\text{C}$ .

(2) The minimum  $V_{OD2}$  with a  $100\Omega$  load is either  $1/2 V_{OD1}$  or  $2\text{V}$ , whichever is greater.

(3) The algebraic convention, where the less positive (more negative) limit is designated as minimum, is used in this data sheet for common-mode output and threshold voltage levels only.

(4) See TIA/EIA-485-A [Figure 6-3.5](#), Test Termination Measurement 2

(5)  $\Delta|V_{OD}|$  and  $\Delta|V_{OC}|$  are the changes in magnitude of  $V_{OD}$  and  $V_{OC}$ , respectively, that occur when the input is changed from a high level to a low level.

(6) Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

### 5.4.2 Switching Characteristics

at  $V_{CC} = 5\text{V}$ ,  $C_L = 50\text{pF}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER   |                                                   | TEST CONDITIONS                                       |  | MIN | TYP | MAX | UNIT |
|-------------|---------------------------------------------------|-------------------------------------------------------|--|-----|-----|-----|------|
| $t_{d(OD)}$ | Differential output delay time                    | $R_L = 54\Omega$ ,<br>See <a href="#">Figure 6-3</a>  |  |     | 20  | 25  | ns   |
| $t_{t(OD)}$ | Differential output transition time               |                                                       |  |     | 27  | 35  | ns   |
| $t_{PLH}$   | Propagation delay time, low- to high-level output | $R_L = 27\Omega$ ,<br>See <a href="#">Figure 6-4</a>  |  |     | 20  | 25  | ns   |
| $t_{PHL}$   | Propagation delay time, high- to low-level output |                                                       |  |     | 20  | 25  | ns   |
| $t_{PZH}$   | Output enable time to high level                  | $R_L = 110\Omega$ ,<br>See <a href="#">Figure 6-5</a> |  |     | 80  | 120 | ns   |
| $t_{PZL}$   | Output enable time to low level                   | $R_L = 110\Omega$ ,<br>See <a href="#">Figure 6-6</a> |  |     | 40  | 60  | ns   |
| $t_{PHZ}$   | Output disable time from high level               | $R_L = 110\Omega$ ,<br>See <a href="#">Figure 6-5</a> |  |     | 90  | 120 | ns   |
| $t_{PLZ}$   | Output disable time from low level                | $R_L = 110\Omega$ ,<br>See <a href="#">Figure 6-6</a> |  |     | 30  | 45  | ns   |

### 5.4.3 Symbol Equivalents

| DATA-SHEET PARAMETER | TIA/EIA-422-B             | TIA/EIA-485-A                          |
|----------------------|---------------------------|----------------------------------------|
| $ V_{OD1} $          | $V_O$                     | $V_O$                                  |
| $ V_{OD2} $          | $V_t (R_L = 100\Omega)$   | $V_t (R_L = 54\Omega)$                 |
| $ V_{OD3} $          |                           | $V_t$ (Test Termination Measurement 2) |
| $\Delta V_{OD} $     | $  V_t  -  \bar{V}_t  $   | $  V_t  -  \bar{V}_t  $                |
| $V_{OC}$             | $ V_{OS} $                | $ V_{OS} $                             |
| $\Delta V_{OC} $     | $ V_{OS} - \bar{V}_{OS} $ | $ V_{OS} - \bar{V}_{OS} $              |
| $I_{OS}$             | $ I_{sa} ,  I_{sb} $      |                                        |
| $I_O$                | $ I_{xa} ,  I_{xb} $      | $I_{ia}, I_{ib}$                       |

## 5.5 Receiver Sections

### 5.5.1 Electrical Characteristics

over recommended ranges of common-mode input voltage, supply voltage, and operating free-air temperature (unless otherwise noted)

| PARAMETER |                                                  |          | TEST CONDITIONS        |                      | MIN                 | TYP <sup>(1)</sup> | MAX      | UNIT       |
|-----------|--------------------------------------------------|----------|------------------------|----------------------|---------------------|--------------------|----------|------------|
| $V_{IT+}$ | Positive-going input threshold voltage           |          | $V_O = 2.7V$ ,         | $I_O = -0.4mA$       |                     |                    | 0.2      | V          |
| $V_{IT-}$ | Negative-going input threshold voltage           |          | $V_O = 0.5V$ ,         | $I_O = 16mA$         | -0.2 <sup>(2)</sup> |                    |          | V          |
| $V_{hys}$ | Input hysteresis voltage ( $V_{IT+} - V_{IT-}$ ) |          |                        |                      |                     | 50                 |          | mV         |
| $V_{IK}$  | Enable clamp voltage                             | SN751177 | $I_I = -18mA$          |                      |                     |                    | -1.5     | V          |
| $V_{OH}$  | High-level output voltage                        |          | $V_{ID} = 200mV$ ,     | $I_{OH} = -400\mu A$ | 2.7                 |                    |          | V          |
| $V_{OL}$  | Low-level output voltage                         |          | $V_{ID} = -200mV$      | $I_{OL} = 8mA$       |                     |                    | 0.45     | V          |
|           |                                                  |          |                        | $I_{OL} = 16mA$      |                     |                    | 0.5      |            |
| $I_{OZ}$  | High-impedance-state output current              | SN751177 | $V_O = 0.4V$ to $2.4V$ |                      |                     |                    | $\pm 20$ | $\mu A$    |
| $I_I$     | Line input current (see Note 7)                  |          | Other input at 0V      | $V_I = 12V$          |                     |                    | 1        | mA         |
|           |                                                  |          |                        | $V_I = -7V$          |                     |                    | -0.8     |            |
| $I_{IH}$  | High-level enable input current                  | SN751177 | $V_{IH} = 2.7V$        |                      |                     |                    | 20       | $\mu A$    |
| $I_{IL}$  | Low-level enable input current                   | SN751177 | $V_{IL} = 0.4V$        |                      |                     |                    | -100     | $\mu A$    |
| $I_{OS}$  | Short-circuit output current (see Note 6)        |          |                        |                      | -15                 |                    | -85      | $\mu A$    |
| $I_{CC}$  | Supply current                                   |          | No load,               | outputs enabled      |                     | 80                 | 110      | mA         |
| $r_i$     | Input resistance                                 |          |                        |                      | 12                  |                    |          | k $\Omega$ |

(1) All typical values are at  $V_{CC} = 5V$  and  $T_A = 25^\circ C$ .

(2) The algebraic convention, where the less positive (more negative) limit is designated as minimum, is used in this data sheet for common-mode output and threshold voltage levels only.

(3) Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

(4) Refer to ANSI Standards TIA/EIA-422-B, TIA/EIA-423-A, and TIA/EIA-485-A for exact conditions.

### 5.5.2 Switching Characteristics

at  $V_{CC} = 5V$ ,  $C_L = 15pF$ ,  $T_A = 25^\circ C$

| PARAMETER        |                                                   |          | TEST CONDITIONS                  |                | MIN | TYP | MAX | UNIT |
|------------------|---------------------------------------------------|----------|----------------------------------|----------------|-----|-----|-----|------|
| t <sub>PLH</sub> | Propagation delay time, low- to high-level output |          | V <sub>ID</sub> = −1.5V to 1.5V, | See Figure 6-7 |     | 20  | 35  | ns   |
| t <sub>PHL</sub> | Propagation delay time, high- to low-level output |          |                                  |                |     | 22  | 35  | ns   |
| t <sub>PZH</sub> | Output enable time to high level                  | SN751177 | See Figure 6-8                   |                |     | 17  | 25  | ns   |
| t <sub>PZL</sub> | Output enable time to low level                   |          |                                  |                |     | 20  | 27  | ns   |
| t <sub>PHZ</sub> | Output disable time from high level               |          |                                  |                |     | 25  | 40  | ns   |
| t <sub>PLZ</sub> | Output disable time from low level                |          |                                  |                |     | 30  | 40  | ns   |

## 6 Parameter Measurement Information

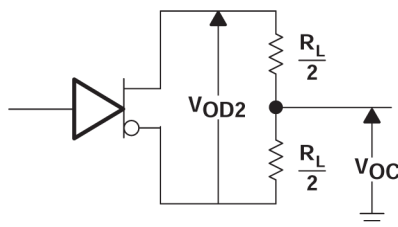


Figure 6-1. Driver Test Circuit,  $v_{OD}$  And  $v_{OC}$

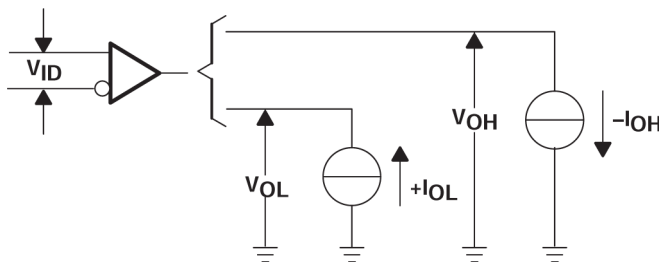
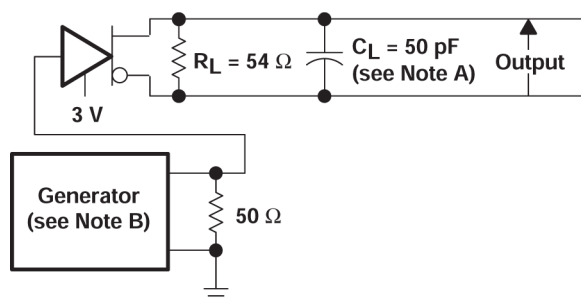
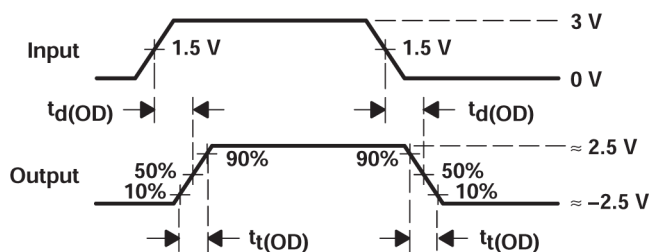


Figure 6-2. Receiver Test Circuit,  $v_{OH}$  And  $v_{OL}$



TEST CIRCUIT

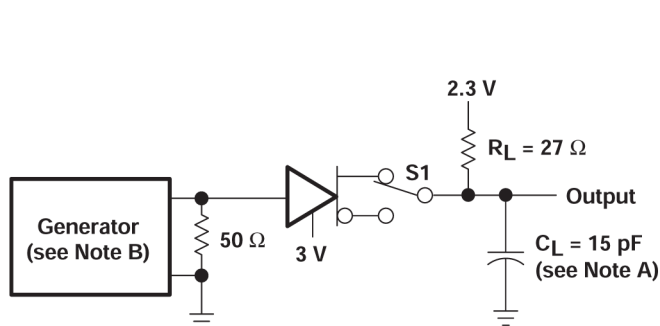


VOLTAGE WAVEFORMS

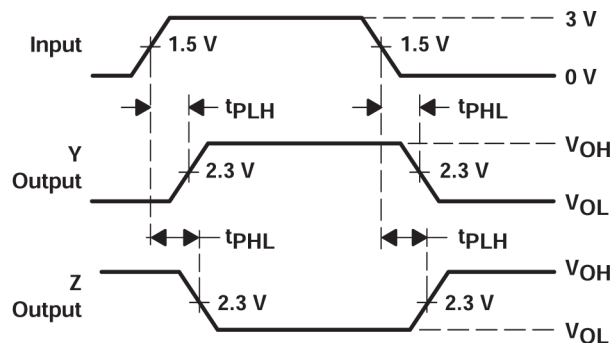
A.  $C_L$  includes probe and jig capacitance.

B. The pulse generator has the following characteristics:  $PRR \leq 1\text{MHz}$ , 50% duty cycle,  $Z_O = 50\Omega$ ,  $t_r \leq 6\text{ns}$ ,  $t_f \leq 6\text{ns}$ .

Figure 6-3. Driver Differential Output-Delay and Transition-Time Test Circuit and Voltage Waveforms



TEST CIRCUIT



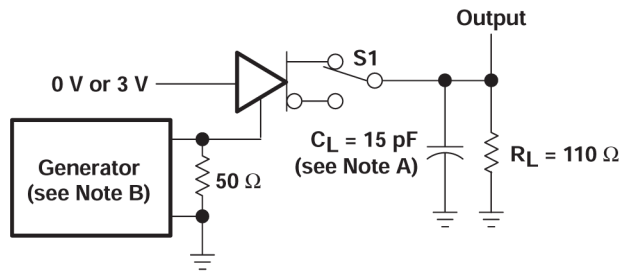
VOLTAGE WAVEFORMS

A.  $C_L$  includes probe and jig capacitance.

B. The pulse generator has the following characteristics:  $PRR \leq 1\text{MHz}$ , 50% duty cycle,  $Z_O = 50\Omega$ ,  $t_r \leq 6\text{ns}$ ,  $t_f \leq 6\text{ns}$ .

Figure 6-4. Driver Propagation-Time Test Circuit and Voltage Waveforms

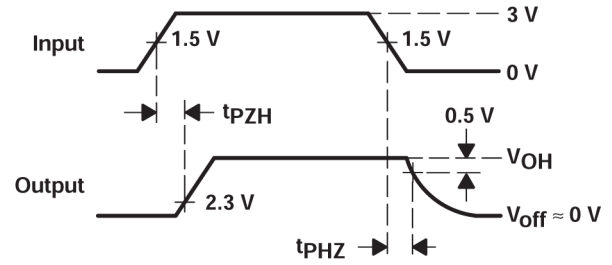




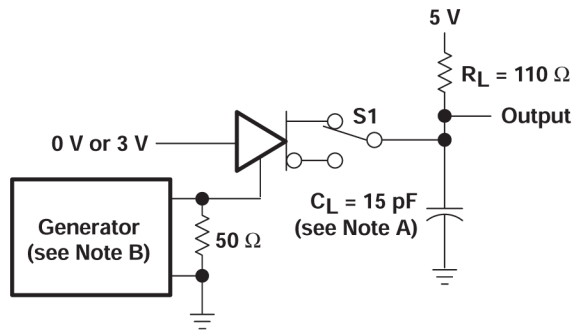
TEST CIRCUIT

- A.  $C_L$  includes probe and jig capacitance.  
B. The pulse generator has the following characteristics:  $PRR \leq 1\text{ MHz}$ , 50% duty cycle,  $Z_O = 50\Omega$ ,  $t_r \leq 6\text{ ns}$ ,  $t_f \leq 6\text{ ns}$ .

**Figure 6-5. Driver Enable- and Disable-Time Test Circuit and Voltage Waveforms**



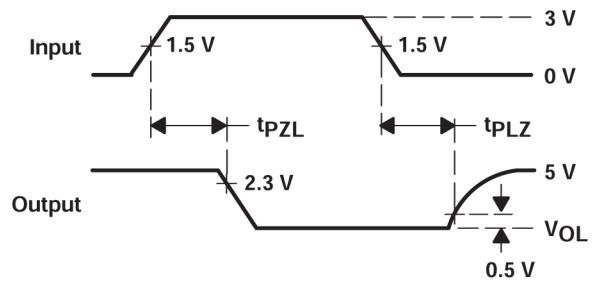
VOLTAGE WAVEFORMS



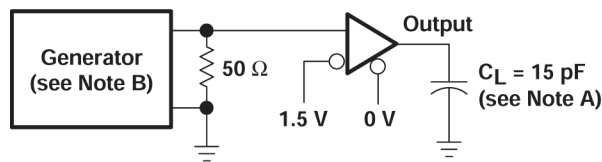
TEST CIRCUIT

- A.  $C_L$  includes probe and jig capacitance.  
B. The pulse generator has the following characteristics:  $PRR \leq 1\text{ MHz}$ , 50% duty cycle,  $Z_O = 50\Omega$ ,  $t_r \leq 6\text{ ns}$ ,  $t_f \leq 6\text{ ns}$ .

**Figure 6-6. Driver Enable- and Disable-Time Test Circuit and Voltage Waveforms**



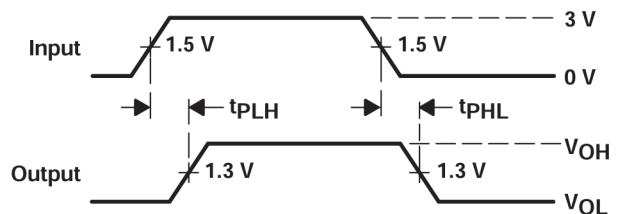
VOLTAGE WAVEFORMS



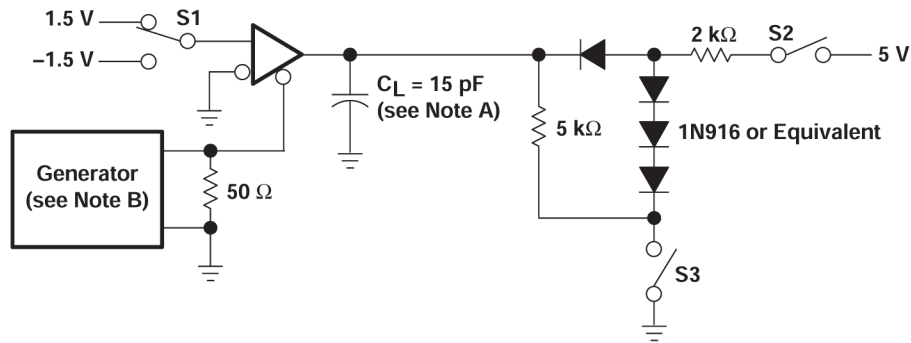
TEST CIRCUIT

- A.  $C_L$  includes probe and jig capacitance.  
B. The pulse generator has the following characteristics:  $PRR \leq 1\text{ MHz}$ , 50% duty cycle,  $Z_O = 50\Omega$ ,  $t_r \leq 6\text{ ns}$ ,  $t_f \leq 6\text{ ns}$ .

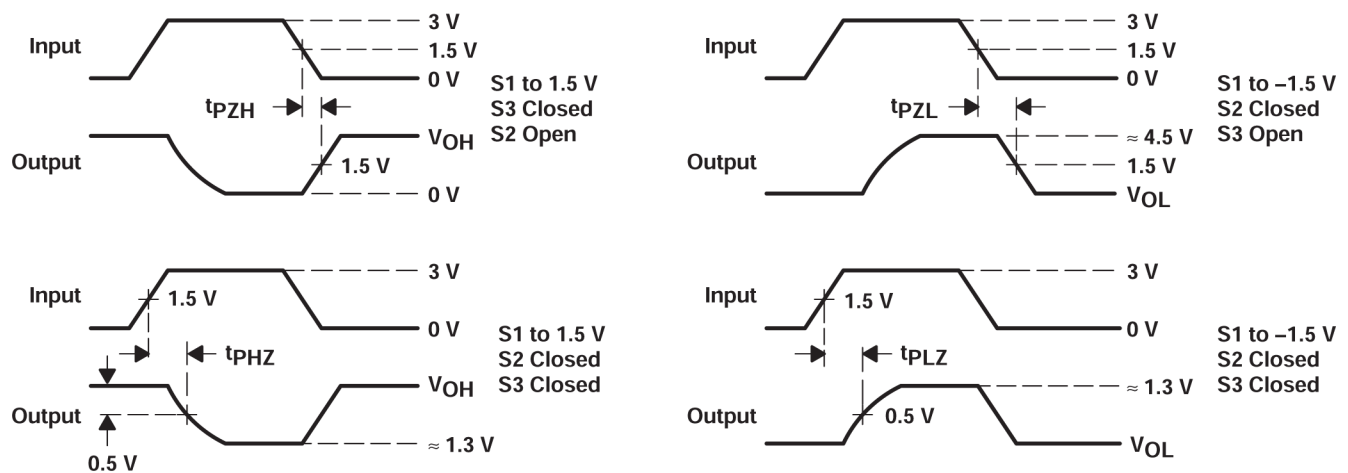
**Figure 6-7. Receiver Propagation-Time Test Circuit and Voltage Waveforms**



VOLTAGE WAVEFORMS



TEST CIRCUIT



VOLTAGE WAVEFORMS

- A.  $C_L$  includes probe and jig capacitance.  
 B. The pulse generator has the following characteristics:  $PRR \leq 1\text{ MHz}$ , 50% duty cycle,  $Z_O = 50\ \Omega$ ,  $t_r \leq 6\text{ ns}$ ,  $t_f \leq 6\text{ ns}$ .

**Figure 6-8. Receiver Output Enable- and Disable-Time Test Circuit and Voltage Waveforms**

## 7 Detailed Description

### 7.1 Device Functional Modes

**Table 7-1. SN751177, SN751178 Functional Table (Each Driver)**

| INPUT D <sup>(1)</sup> | ENABLE DE | OUTPUTS |   |
|------------------------|-----------|---------|---|
|                        |           | Y       | Z |
| H                      | H         | H       | L |
| L                      | H         | L       | H |
| X                      | L         | Z       | Z |

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

**Table 7-2. SN751177 Functional Table (Each Receiver)**

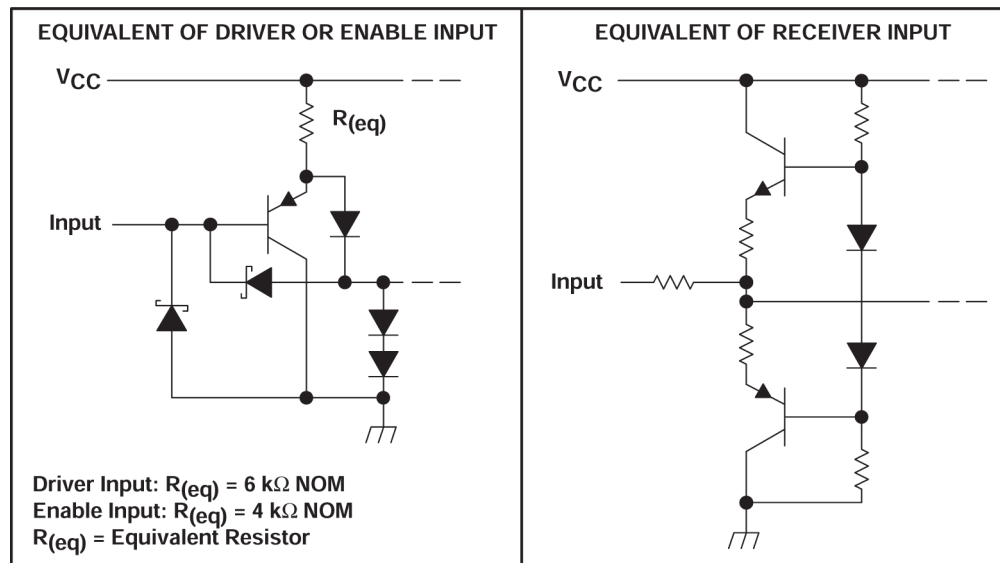
| DIFFERENTIAL INPUTS A – B | ENABLE RE | OUTPUT R <sup>(1)</sup> |
|---------------------------|-----------|-------------------------|
| $V_{ID} \geq 0.2V$        | L         | H                       |
| $-0.2V < V_{ID} < 0.2V$   | L         | ?                       |
| $V_{ID} \leq -0.2V$       | L         | L                       |
| X                         | H         | Z                       |
| Open                      | L         | H                       |

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

**Table 7-3. SN751178 Functional Table (Each Receiver)**

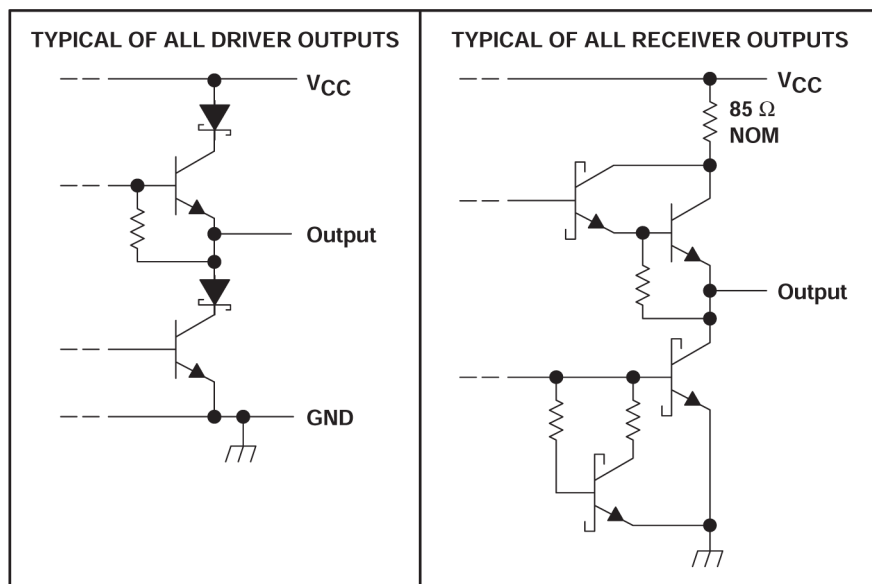
| DIFFERENTIAL INPUTS A – B | OUTPUT R <sup>(1)</sup> |
|---------------------------|-------------------------|
| $V_{ID} \geq 0.2V$        | H                       |
| $-0.2V < V_{ID} < 0.2V$   | ?                       |
| $V_{ID} \leq -0.2V$       | L                       |

(1) H = high level, L = low level, ? = indeterminate



A. All resistor values are nominal.

**Figure 7-1. Schematics of Inputs**



A. All resistor values are nominal.

**Figure 7-2. Schematics of Outputs**

## 8 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

### 8.1 Documentation Support

### 8.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](https://www.ti.com). Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 8.3 Support Resources

TI E2E™ [support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

### 8.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.  
All trademarks are the property of their respective owners.

### 8.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 8.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 9 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision D (May 1999) to Revision E (February 2024)                                      | Page |
|-------------------------------------------------------------------------------------------------------|------|
| • Changed the numbering format for tables, figures, and cross-references throughout the document..... | 1    |

## 10 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

## PACKAGING INFORMATION

| Orderable part number       | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-----------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">SN751177N</a>   | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -20 to 85    | SN751177N           |
| SN751177N.A                 | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -20 to 85    | SN751177N           |
| <a href="#">SN751177NSR</a> | Active        | Production           | SOP (NS)   16  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -20 to 85    | SN751177            |
| SN751177NSR.A               | Active        | Production           | SOP (NS)   16  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -20 to 85    | SN751177            |
| SN751177NSRE4               | Active        | Production           | SOP (NS)   16  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -20 to 85    | SN751177            |
| <a href="#">SN751178N</a>   | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -20 to 85    | SN751178N           |
| SN751178N.A                 | Active        | Production           | PDIP (N)   16  | 25   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -20 to 85    | SN751178N           |
| <a href="#">SN751178NSR</a> | Active        | Production           | SOP (NS)   16  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -20 to 85    | SN751178            |
| SN751178NSR.A               | Active        | Production           | SOP (NS)   16  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -20 to 85    | SN751178            |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts 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.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## TAPE AND REEL INFORMATION

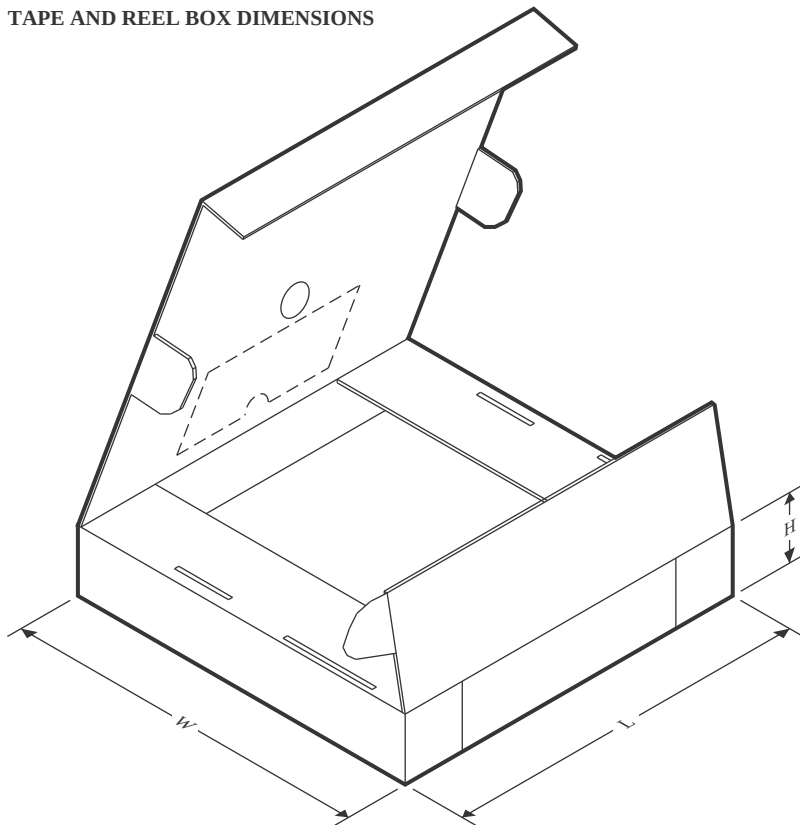


\*All dimensions are nominal

| 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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN751177NSR | SOP          | NS              | 16   | 2000 | 330.0              | 16.4               | 8.1     | 10.4    | 2.5     | 12.0    | 16.0   | Q1            |
| SN751178NSR | SOP          | NS              | 16   | 2000 | 330.0              | 16.4               | 8.1     | 10.4    | 2.5     | 12.0    | 16.0   | Q1            |
| SN751178NSR | SOP          | NS              | 16   | 2000 | 330.0              | 16.4               | 8.45    | 10.55   | 2.5     | 12.0    | 16.2   | Q1            |

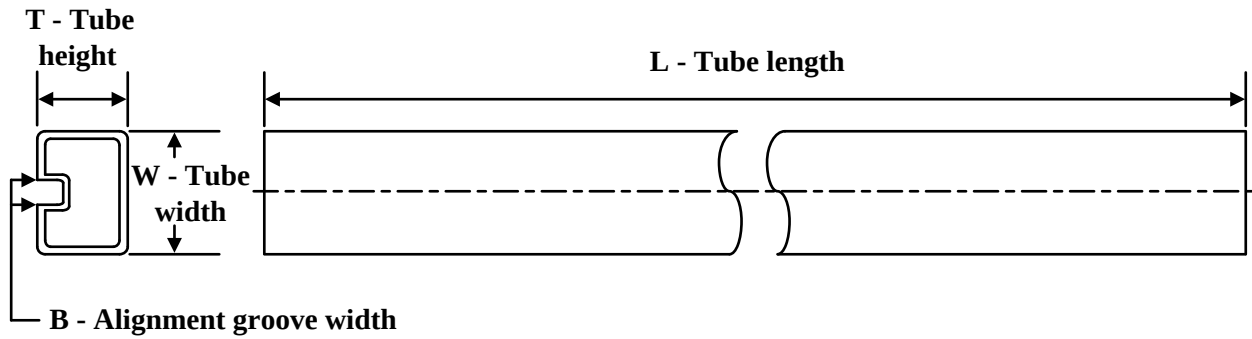


## TAPE AND REEL BOX DIMENSIONS



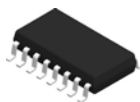
\*All dimensions are nominal

| Device      | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN751177NSR | SOP          | NS              | 16   | 2000 | 353.0       | 353.0      | 32.0        |
| SN751178NSR | SOP          | NS              | 16   | 2000 | 353.0       | 353.0      | 32.0        |
| SN751178NSR | SOP          | NS              | 16   | 2000 | 353.0       | 353.0      | 32.0        |

**TUBE**


\*All dimensions are nominal

| Device      | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN751177N   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN751177N.A | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN751178N   | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN751178N.A | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |

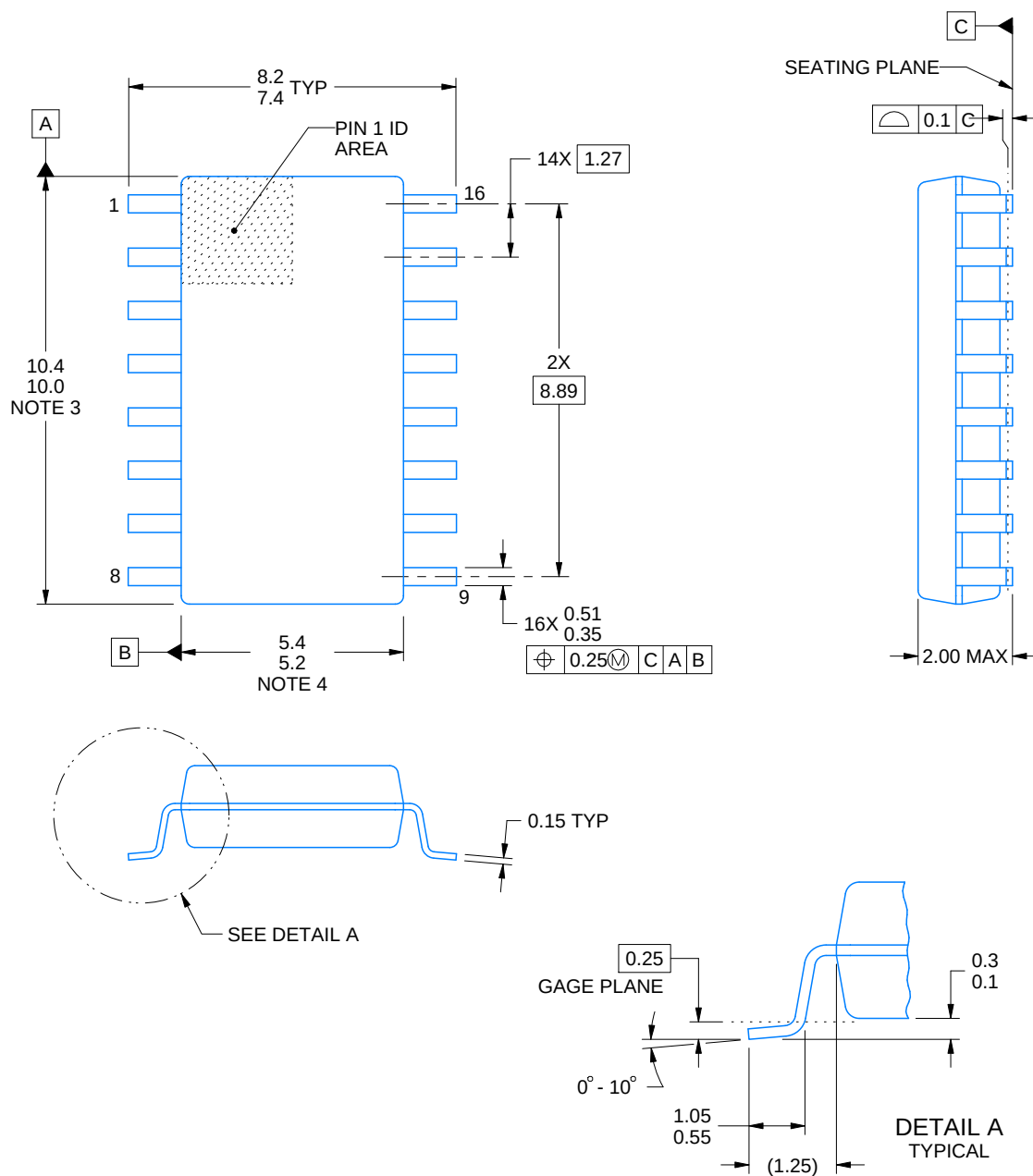


NS0016A

# PACKAGE OUTLINE

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

## NOTES:

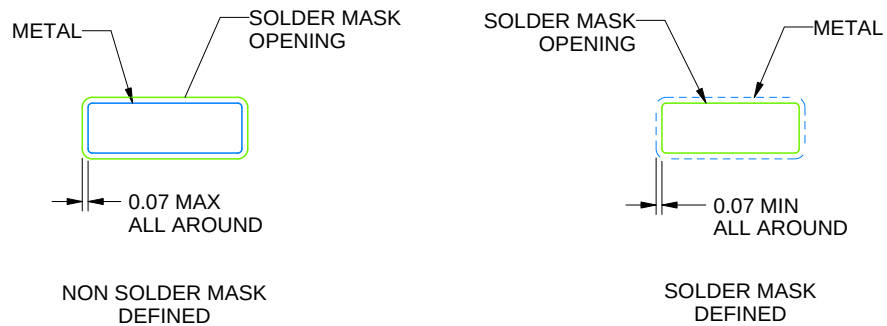
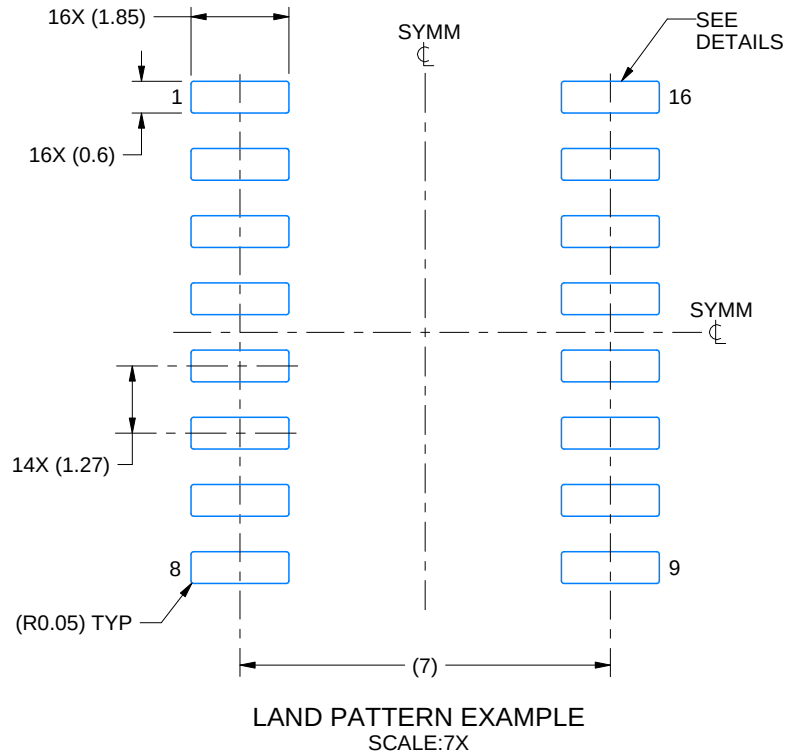
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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



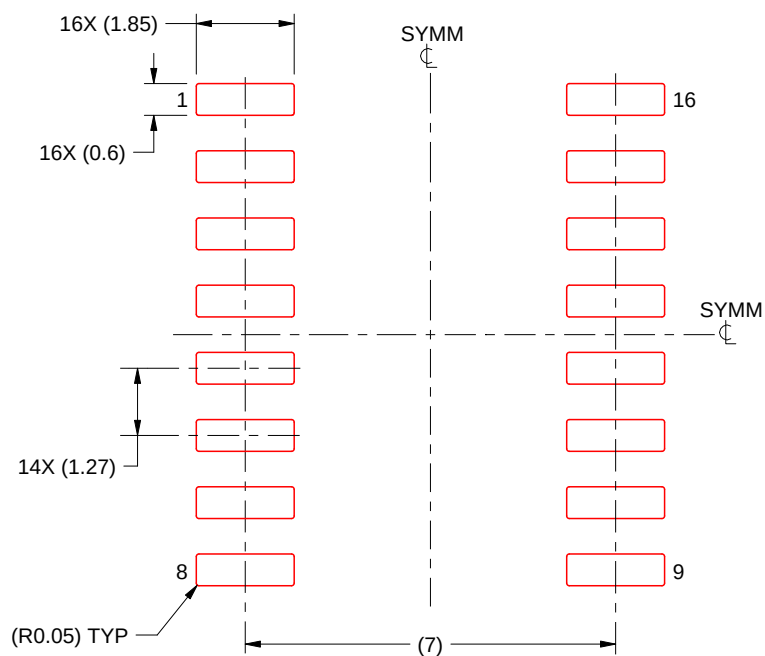
SOLDER MASK DETAILS

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.



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

4220735/A 12/2021

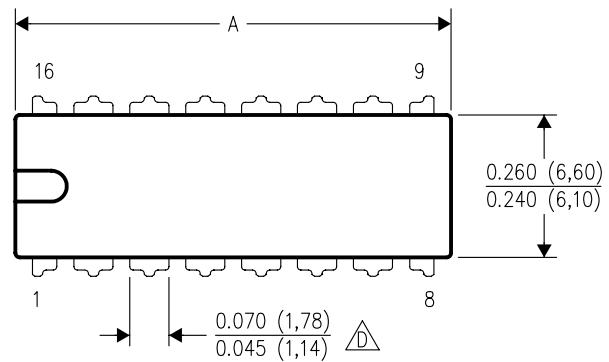
NOTES: (continued)

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.

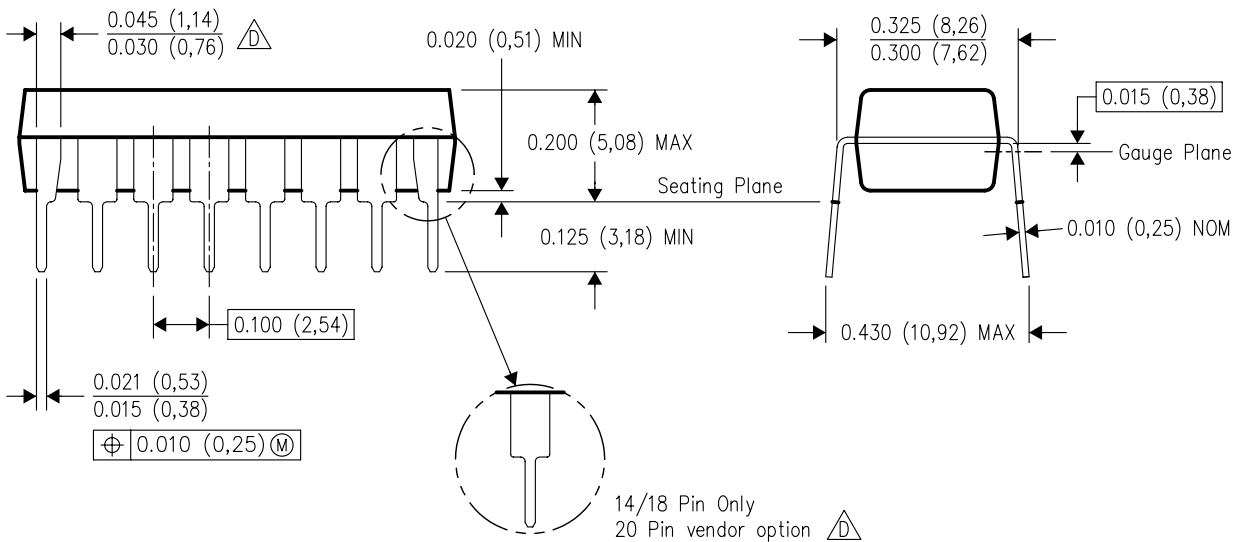
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



14/18 Pin Only  
20 Pin vendor option

4040049/E 12/2002

- 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.

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Last updated 10/2025