

## SNx5176B Differential Bus Transceivers

### 1 Features

- Bidirectional transceivers
- Meet or exceed the requirements of ANSI standards TIA/EIA-422-B and TIA/EIA-485-A and ITU Recommendations V.11 and X.27
- Designed for multipoint transmission on long bus lines in noisy environments
- 3-State driver and receiver outputs
- Individual driver and receiver enables
- Wide positive and negative input/output bus voltage ranges
- $\pm 60$ -mA Maximum driver output capability
- Thermal shutdown protection
- Driver positive and negative current limiting
- 12-k $\Omega$  Minimum Receiver Input Impedance
- $\pm 200$ -mV Receiver input sensitivity
- 50-mV Typical receiver input hysteresis
- Operate from single 5-V supply

### 2 Applications

- [Chemical and gas sensors](#)
- Digital signage
- HMI (human machine interfaces)
- [Motor controls](#): AC induction, brushed and brushless dc, low- and high-voltage, stepper motors, and permanent magnets
- TETRA Base stations
- Telecom towers: remote electrical tilt units (ret) and tower mounted amplifiers (TMA)
- Weigh scales
- Wireless repeaters

### 3 Description

The SN65176B and SN75176B differential bus transceivers are designed for bidirectional data communication on multipoint bus transmission lines. They are designed for balanced transmission lines and meet ANSI Standards TIA/EIA-422-B and TIA/EIA-485-A and ITU Recommendations V.11 and X.27.

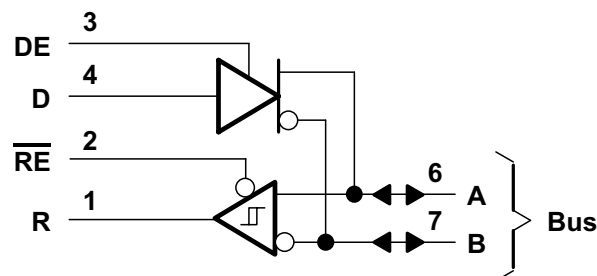
The SN65176B and SN75176B devices combine a 3-state differential line driver and a differential input line receiver, both of which operate from a single 5-V power supply. The driver and receiver have active-high and active-low enables, respectively, that can be connected together externally to function as a direction control. The driver differential outputs and the receiver differential inputs are connected internally to form differential input/output (I/O) bus ports that are designed to offer minimum loading to the bus when the driver is disabled or  $V_{CC} = 0$ . These ports feature wide positive and negative common-mode voltage ranges, making the device suitable for party-line applications.

The driver is designed for up to 60 mA of sink or source current. The driver features positive and negative current limiting and thermal shutdown for protection from line-fault conditions. Thermal shutdown is designed to occur at a junction temperature of approximately 150°C. The receiver features a minimum input impedance of 12 k $\Omega$ , an input sensitivity of  $\pm 200$  mV, and a typical input hysteresis of 50 mV.

#### Device Information

PART NUMBER	PACKAGE (PIN) <sup>(1)</sup>	BODY SIZE (NOM)
SNx5176	SOIC (8)	4.90 mm × 3.91 mm
	PDIP (8)	9.81 mm × 6.35 mm
	SOP (8)	6.20 mm × 5.30 mm

(1) For all available packages, see the orderable addendum at the end of the datasheet.



Simplified Schematic



## Table of Contents

<b>1 Features</b> .....	1	7.3 Feature Description.....	12
<b>2 Applications</b> .....	1	7.4 Device Functional Modes.....	13
<b>3 Description</b> .....	1	<b>8 Application and Implementation</b> .....	14
<b>4 Revision History</b> .....	2	8.1 Application Information.....	14
<b>5 Pin Configuration and Functions</b> .....	3	8.2 Typical Application.....	14
<b>6 Specifications</b> .....	4	8.3 System Examples.....	15
6.1 Absolute Maximum Ratings.....	4	<b>9 Power Supply Recommendations</b> .....	16
6.2 Recommended Operating Conditions.....	4	<b>10 Layout</b> .....	16
6.3 Thermal Information.....	4	10.1 Layout Guidelines.....	16
6.4 Electrical Characteristics – Driver.....	5	10.2 Layout Example.....	16
6.5 Electrical Characteristics – Receiver.....	6	<b>11 Device and Documentation Support</b> .....	17
6.6 Switching Characteristics – Driver.....	6	11.1 Related Links.....	17
6.7 Switching Characteristics – Receiver.....	6	11.2 Trademarks.....	17
6.8 Typical Characteristics.....	7	11.3 Electrostatic Discharge Caution.....	17
<b>Parameter Measurement Information</b> .....	9	11.4 Glossary.....	17
<b>7 Detailed Description</b> .....	12	<b>12 Mechanical, Packaging, and Orderable Information</b> .....	17
7.1 Overview.....	12		
7.2 Functional Block Diagram.....	12		

## 4 Revision History

### Changes from Revision G (July 2021) to Revision H (December 2021) Page

- Changed  $\psi_{JT}$  From 78.8 to 8.8 for the D package in the *Thermal Information* table..... 4

### Changes from Revision F (January 2015) to Revision G (July 2021) Page

- Changed the *Thermal Information* table..... 4
- Changed the  $V_O$  Output voltage MAX value from: 6 V to:  $V_{CC}$  in the *Electrical Characteristics – Driver* ..... 5
- Changed the  $V_{ODI}$  Differential output voltage MAX value from: 6 V to:  $V_{CC}$  in the *Electrical Characteristics – Driver* ..... 5

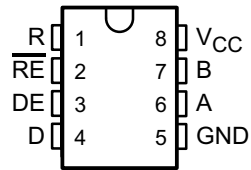
### Changes from Revision E (January 2014) to Revision F (January 2015) Page

- Added *Applications*, *Device Information* table, *Pin Functions* table, *ESD Ratings* table, *Thermal Information* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section..... 1
- Moved *Typical Characteristics* inside of the *Specifications* section..... 7

### Changes from Revision D (April 2003) to Revision E (January 2014) Page

- Updated document to new TI data sheet format - no specification changes..... 1
- Deleted *Ordering Information* table..... 1

## 5 Pin Configuration and Functions



**Figure 5-1. Top View**

**Table 5-1. Pin Functions**

PIN		TYPE	DESCRIPTION
NAME	NO.		
R	1	O	Logic Data Output from RS-485 Receiver
$\overline{\text{RE}}$	2	I	Receive Enable (active low)
DE	3	I	Driver Enable (active high)
D	4	I	Logic Data Input to RS-485 Driver
GND	5	—	Device Ground Pin
A	6	I/O	RS-422 or RS-485 Data Line
B	7	I/O	RS-422 or RS-485 Data Line
V <sub>CC</sub>	8	—	Power Input. Connect to 5-V Power Source.

## 6 Specifications

### 6.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage <sup>(2)</sup>		7	V
	Voltage range at any bus terminal	-10	15	V
V <sub>I</sub>	Enable input voltage		5.5	V
T <sub>J</sub>	Operating virtual junction temperature		150	°C
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 [Section 6.2](#) is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values, except differential input/output bus voltage, are with respect to network ground terminal.

### 6.2 Recommended Operating Conditions

		MIN	TYP	MAX	UNIT
V <sub>CC</sub>	Supply voltage	4.75	5	5.25	V
V <sub>I</sub> or V <sub>IC</sub>	Voltage at any bus terminal (separately or common mode)	-7		12	V
V <sub>IH</sub>	High-level input voltage	D, DE, and $\overline{RE}$	2		V
V <sub>IL</sub>	Low-level input voltage	D, DE, and $\overline{RE}$		0.8	V
V <sub>ID</sub>	Differential input voltage <sup>(1)</sup>			±12	V
I <sub>OH</sub>	High-level output current	Driver		-60	mA
		Receiver		-400	µA
I <sub>OL</sub>	Low-level output current	Driver		60	mA
		Receiver		8	
T <sub>A</sub>	Operating free-air temperature	SN65176B	-40	105	°C
		SN75176B	0	70	

- (1) Differential input/output bus voltage is measured at the non-inverting terminal A, with respect to the inverting terminal B.

### 6.3 Thermal Information

THERMAL METRIC <sup>(1)</sup>	SNx5176			UNIT	
	D (SOIC)	PS (SO)	P (PDIP)		
	8 PINS				
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	114.4	113.2	88.1	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	55.1	57.9	65.9	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	61.6	69.0	69.0	°C/W
ψ <sub>JT</sub>	Junction-to-top characterization parameter	8.8	14.6	35.2	°C/W
ψ <sub>JB</sub>	Junction-to-board characterization parameter	60.8	68.1	64.3	°C/W

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report ([SPRA953](#)).

## 6.4 Electrical Characteristics – Driver

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

PARAMETER		TEST CONDITIONS <sup>(1)</sup>		MIN	TYP <sup>(2)</sup>	MAX	UNIT
V <sub>IK</sub>	Input clamp voltage	I <sub>I</sub> = -18 mA				-1.5	V
V <sub>O</sub>	Output voltage	I <sub>O</sub> = 0		0		V <sub>CC</sub>	V
V <sub>OD1</sub>	Differential output voltage	I <sub>O</sub> = 0		1.5	3.6	V <sub>CC</sub>	V
V <sub>OD2</sub>	Differential output voltage	R <sub>L</sub> = 100 Ω, see Figure 7-1		½ V <sub>OD1</sub> or 2 <sup>(4)</sup>			V
		R <sub>L</sub> = 54 Ω, see Figure 7-1		1.5	2.5	5	
V <sub>OD3</sub>	Differential output voltage	See <sup>(5)</sup>		1.5		5	V
Δ V <sub>OD</sub>	Change in magnitude of differential output voltage <sup>(3)</sup>	R <sub>L</sub> = 54 Ω or 100 Ω, see Figure 7-1				±0.2	V
V <sub>OC</sub>	Common-mode output voltage	R <sub>L</sub> = 54 Ω or 100 Ω, see Figure 7-1		-1		+3	V
Δ V <sub>OC</sub>	Change in magnitude of common-mode output voltage <sup>(3)</sup>	R <sub>L</sub> = 54 Ω or 100 Ω, see Figure 7-1				±0.2	V
I <sub>O</sub>	Output current	Output disabled <sup>(6)</sup>	V <sub>O</sub> = 12 V			1	mA
			V <sub>O</sub> = -7 V			-0.8	
I <sub>IH</sub>	High-level input current	V <sub>I</sub> = 2.4 V				20	μA
I <sub>IL</sub>	Low-level input current	V <sub>I</sub> = 0.4 V				-400	μA
I <sub>OS</sub>	Short-circuit output current	V <sub>O</sub> = -7 V				-250	mA
		V <sub>O</sub> = 0				-150	
		V <sub>O</sub> = V <sub>CC</sub>				250	
		V <sub>O</sub> = 12 V				250	
I <sub>CC</sub>	Supply current (total package)	No load	Outputs enabled		42	70	mA
			Outputs disabled		26	35	

- (1) The power-off measurement in ANSI Standard TIA/EIA-422-B applies to disabled outputs only and is not applied to combined inputs and outputs.
- (2) All typical values are at V<sub>CC</sub> = 5 V and T<sub>A</sub> = 25°C.
- (3) Δ|V<sub>OD</sub>| and Δ|V<sub>OC</sub>| are the changes in magnitude of V<sub>OD</sub> and V<sub>OC</sub>, respectively, that occur when the input is changed from a high level to a low level.
- (4) The minimum V<sub>OD2</sub> with a 100-Ω load is either ½ V<sub>OD1</sub> or 2 V, whichever is greater.
- (5) See ANSI Standard TIA/EIA-485-A, Figure 3.5, Test Termination Measurement 2.
- (6) This applies for both power on and off; refer to ANSI Standard TIA/EIA-485-A for exact conditions. The TIA/EIA-422-B limit does not apply for a combined driver and receiver terminal.

## 6.5 Electrical Characteristics – Receiver

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 <sub>IT+</sub>	Positive-going input threshold voltage	V <sub>O</sub> = 2.7 V, I <sub>O</sub> = –0.4 mA			0.2	V		
V <sub>IT–</sub>	Negative-going input threshold voltage	V <sub>O</sub> = 0.5 V, I <sub>O</sub> = 8 mA	–0.2 <sup>(2)</sup>			V		
V <sub>hys</sub>	Input hysteresis voltage (V <sub>IT+</sub> – V <sub>IT–</sub> )			50		mV		
V <sub>IK</sub>	Enable Input clamp voltage	I <sub>I</sub> = –18 mA			–1.5	V		
V <sub>OH</sub>	High-level output voltage	V <sub>ID</sub> = 200 mV, I <sub>OH</sub> = –400 μA, see <a href="#">Figure 7-2</a>	2.7			V		
V <sub>OL</sub>	Low-level output voltage	V <sub>ID</sub> = –200 mV, I <sub>OL</sub> = 8 mA, see <a href="#">Figure 7-2</a>			0.45	V		
I <sub>OZ</sub>	High-impedance-state output current	V <sub>O</sub> = 0.4 V to 2.4 V			±20	μA		
I <sub>I</sub>	Line input current	Other input = 0 V <sup>(3)</sup>			V <sub>I</sub> = 12 V	1	mA	
					V <sub>I</sub> = –7 V	–0.8		
I <sub>IH</sub>	High-level enable input current	V <sub>IH</sub> = 2.7 V			20	μA		
I <sub>IL</sub>	Low-level enable input current	V <sub>IL</sub> = 0.4 V			–100	μA		
r <sub>I</sub>	Input resistance	V <sub>I</sub> = 12 V	12			kΩ		
I <sub>OS</sub>	Short-circuit output current		–15		–85	mA		
I <sub>CC</sub>	Supply current (total package)	No load			Outputs enabled	42	55	mA
					Outputs disabled	26	35	

(1) All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

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

(3) This applies for both power on and power off. Refer to EIA Standard TIA/EIA-485-A for exact conditions.

## 6.6 Switching Characteristics – Driver

V<sub>CC</sub> = 5 V, R<sub>L</sub> = 110 Ω, T<sub>A</sub> = 25°C (unless otherwise noted)

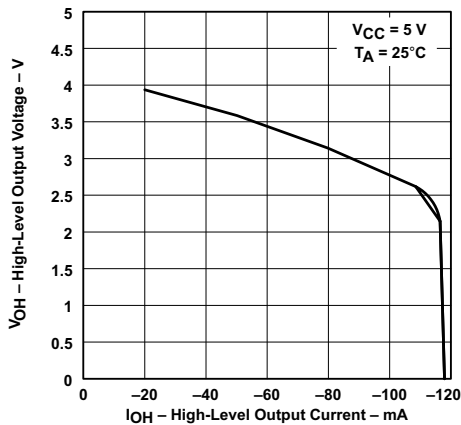
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>d(OD)</sub>	Differential-output delay time	R <sub>L</sub> = 54 Ω, see <a href="#">Figure 7-3</a>		15	22	ns
t <sub>t(OD)</sub>	Differential-output transition time	R <sub>L</sub> = 54 Ω, see <a href="#">Figure 7-3</a>		20	30	ns
t <sub>PZH</sub>	Output enable time to high level	See <a href="#">Figure 7-4</a>		85	120	ns
t <sub>PZL</sub>	Output enable time to low level	See <a href="#">Figure 7-5</a>		40	60	ns
t <sub>PHZ</sub>	Output disable time from high level	See <a href="#">Figure 7-4</a>		150	250	ns
t <sub>PLZ</sub>	Output disable time from low level	See <a href="#">Figure 7-5</a>		20	30	ns

## 6.7 Switching Characteristics – Receiver

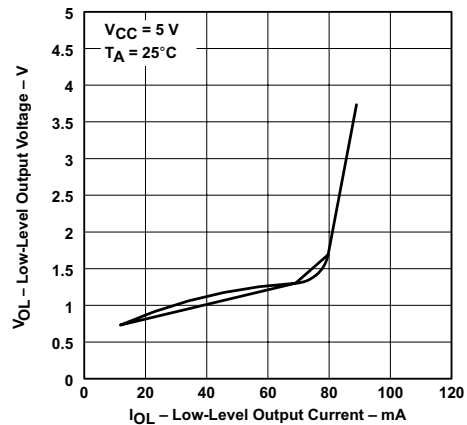
V<sub>CC</sub> = 5 V, C<sub>L</sub> = 15 pF, T<sub>A</sub> = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	Propagation delay time, low- to high-level output	V <sub>ID</sub> = 0 to 3 V, see <a href="#">Figure 7-6</a>		21	35	ns
t <sub>PHL</sub>	Propagation delay time, high- to low-level output			23	35	
t <sub>PZH</sub>	Output enable time to high level	See <a href="#">Figure 7-7</a>		10	20	ns
t <sub>PZL</sub>	Output enable time to low level			12	20	
t <sub>PHZ</sub>	Output disable time from high level	See <a href="#">Figure 7-7</a>		20	35	ns
t <sub>PLZ</sub>	Output disable time from low level			17	25	

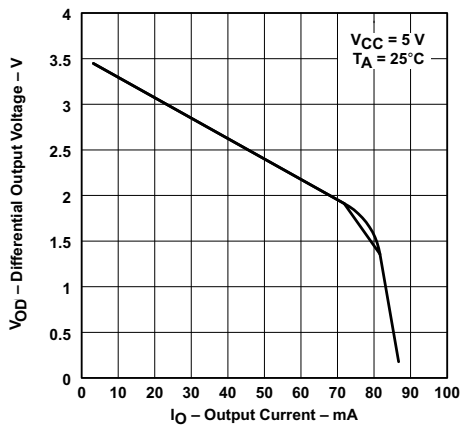
### 6.8 Typical Characteristics



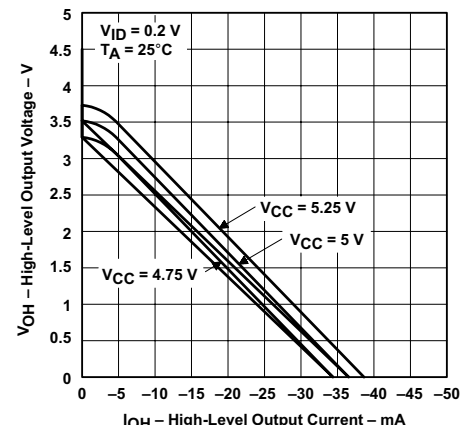
**Figure 6-1. Driver High-Level Output Voltage vs High-Level Output Current**



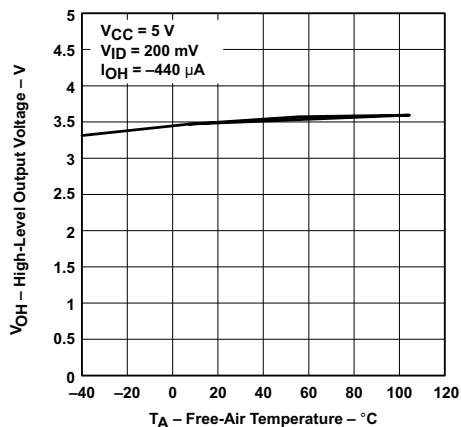
**Figure 6-2. Driver Low-Level Output Voltage vs Low-Level Output Current**



**Figure 6-3. Driver Differential Output Voltage vs Output Current**

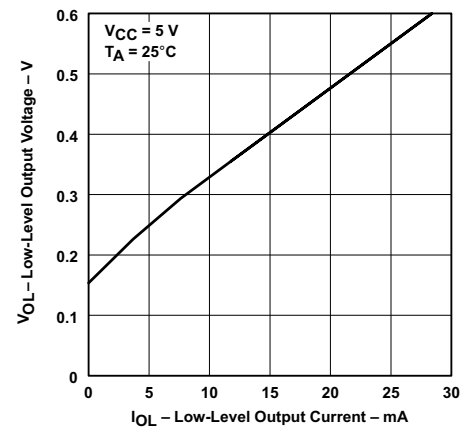


**Figure 6-4. Receiver High-Level Output Voltage vs High-Level Output Current**



Only the 0°C to 70°C portion of the curve applies to the SN75176B device.

**Figure 6-5. Receiver High-Level Output Voltage vs Free-Air Temperature**



**Figure 6-6. Receiver Low-Level Output Voltage vs Low-Level Output Current**

### 6.8 Typical Characteristics (continued)

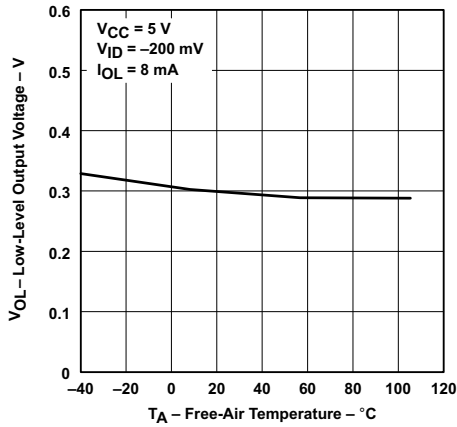


Figure 6-7. Receiver Low-Level Output Voltage vs Free-Air Temperature

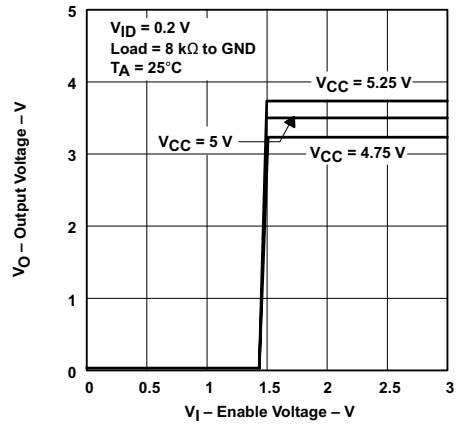


Figure 6-8. Receiver Output Voltage vs Enable Voltage

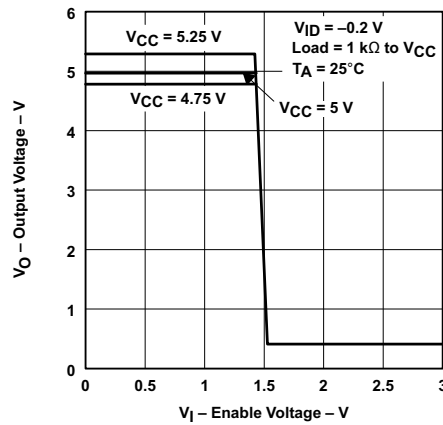


Figure 6-9. Receiver Output Voltage vs Enable Voltage

## Parameter Measurement Information

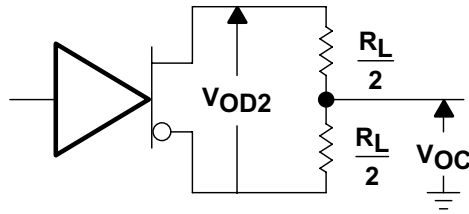


Figure 7-1. Driver  $V_{OD}$  and  $V_{OC}$

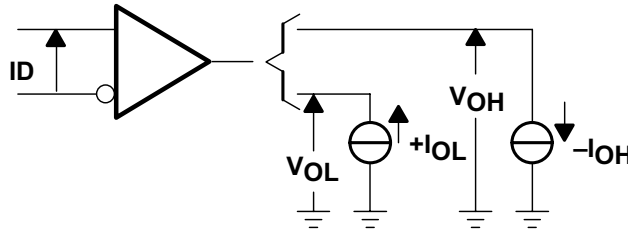
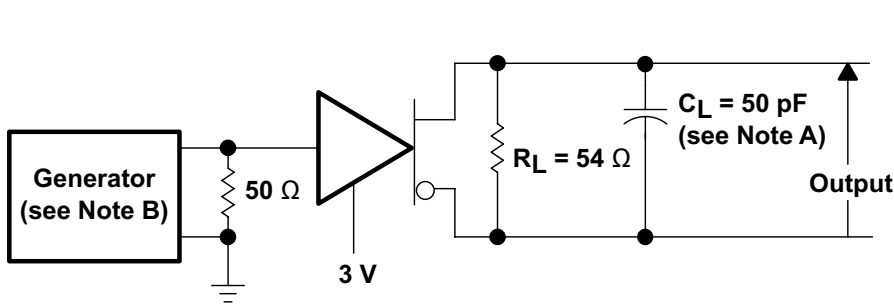
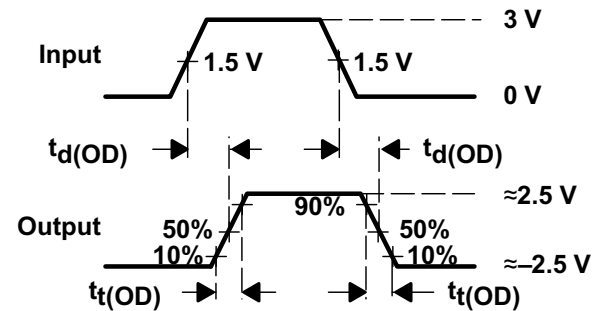


Figure 7-2. Receiver  $V_{OH}$  and  $V_{OL}$



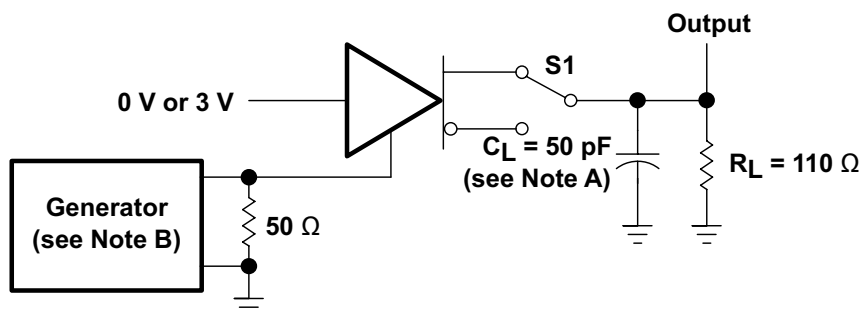
TEST CIRCUIT



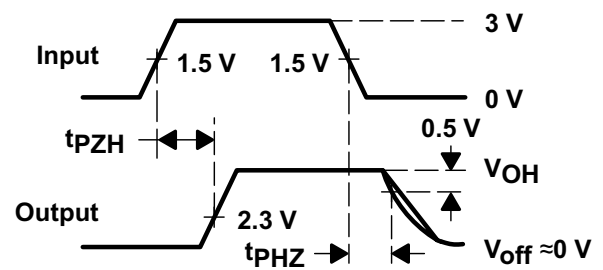
VOLTAGE WAVEFORMS

- A.  $C_L$  includes probe and jig capacitance.  
B. The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 1$  MHz, 50% duty cycle,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_0 = 50$   $\Omega$ .

Figure 7-3. Driver Test Circuit and Voltage Waveforms



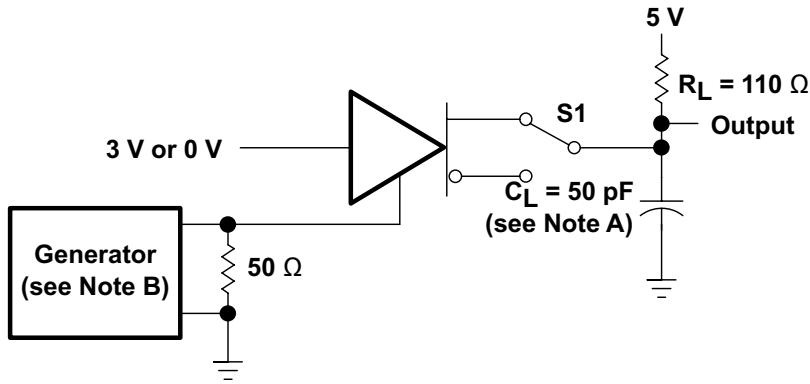
TEST CIRCUIT



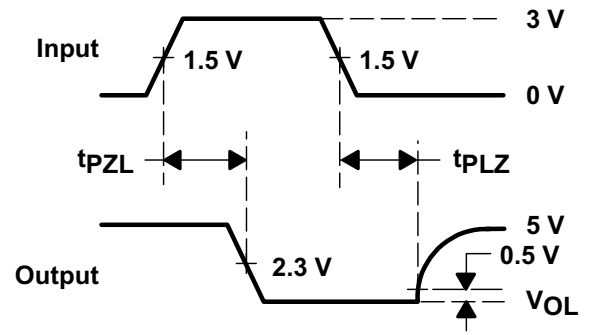
VOLTAGE WAVEFORMS

- A.  $C_L$  includes probe and jig capacitance.  
B. The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 1$  MHz, 50% duty cycle,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_0 = 50$   $\Omega$ .

Figure 7-4. Driver Test Circuit and Voltage Waveforms



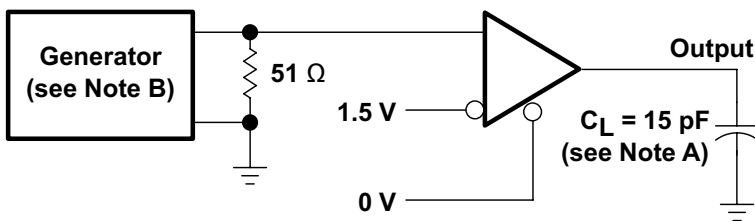
TEST CIRCUIT



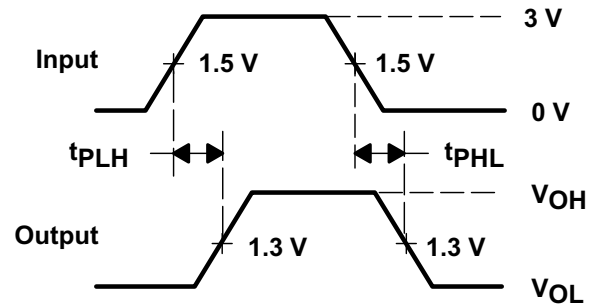
VOLTAGE WAVEFORMS

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

Figure 7-5. Driver Test Circuit and Voltage Waveforms



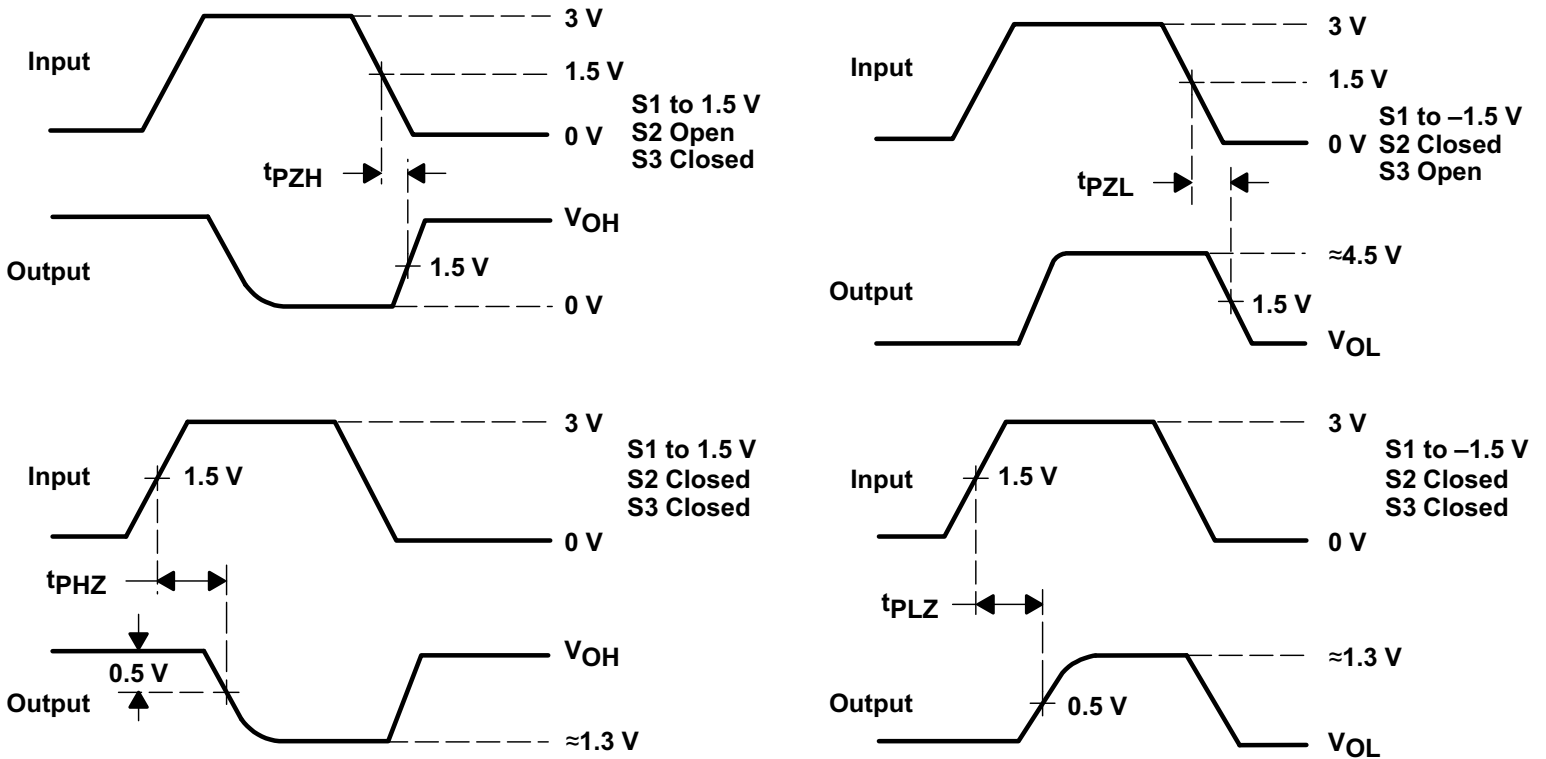
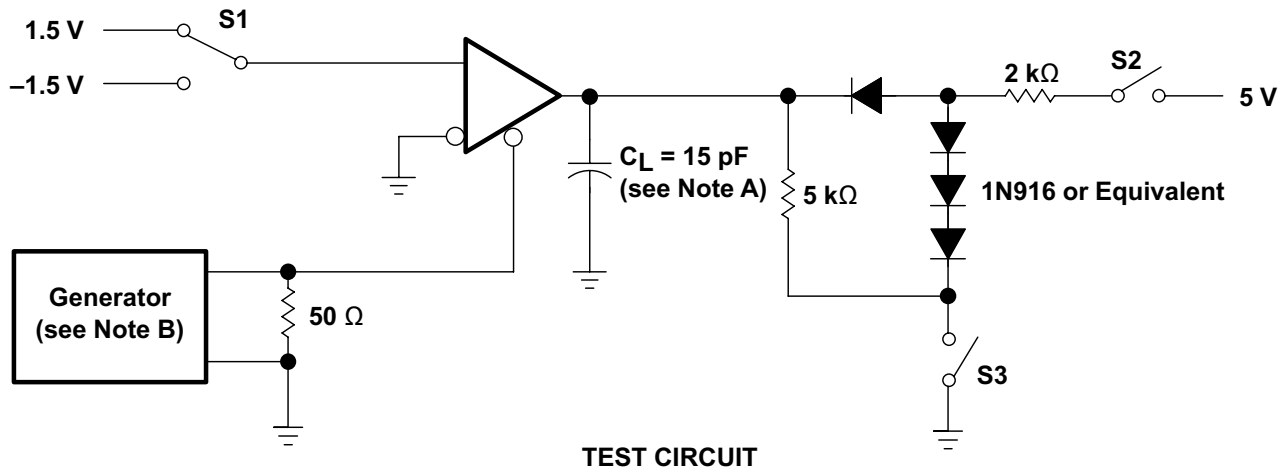
TEST CIRCUIT



VOLTAGE WAVEFORMS

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

Figure 7-6. Receiver Test Circuit and Voltage Waveforms



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

**Figure 7-7. Receiver Test Circuit and Voltage Waveforms**

## 7 Detailed Description

### 7.1 Overview

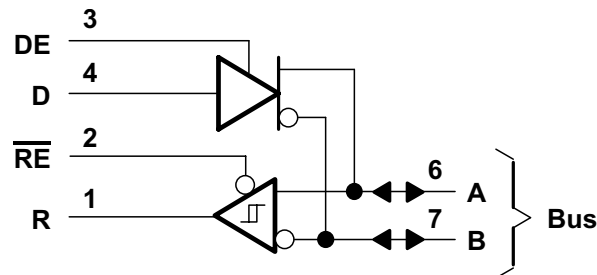
The SN65176B and SN75176B differential bus transceivers are integrated circuits designed for bidirectional data communication on multipoint bus transmission lines. They are designed for balanced transmission lines and meet ANSI Standards TIA/EIA-422-B and TIA/EIA-485-A and ITU Recommendations V.11 and X.27.

The SN65176B and SN75176B devices combine a 3-state differential line driver and a differential input line receiver, both of which operate from a single 5-V power supply. The driver and receiver have active-high and active-low enables, respectively, that can be connected together externally to function as a direction control. The driver differential outputs and the receiver differential inputs are connected internally to form differential input/output (I/O) bus ports that are designed to offer minimum loading to the bus when the driver is disabled or  $V_{CC} = 0$ . These ports feature wide positive and negative common-mode voltage ranges, making the device suitable for party-line applications.

The driver is designed for up to 60 mA of sink or source current. The driver features positive and negative current limiting and thermal shutdown for protection from line-fault conditions. Thermal shutdown is designed to occur at a junction temperature of approximately 150°C. The receiver features a minimum input impedance of 12 kΩ, an input sensitivity of ±200 mV, and a typical input hysteresis of 50 mV.

The SN65176B and SN75176B devices can be used in transmission-line applications employing the SN75172 and SN75174 quadruple differential line drivers and SN75173 and SN75175 quadruple differential line receivers.

### 7.2 Functional Block Diagram



### 7.3 Feature Description

#### 7.3.1 Driver

The driver converts a TTL logic signal level to RS-422 and RS-485 compliant differential output. The TTL logic input, DE pin, can be used to turn the driver on and off.

**Table 7-1. Driver Function Table<sup>(1)</sup>**

INPUT D	ENABLE DE	DIFFERENTIAL OUTPUTS	
		A	B
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)

### 7.3.2 Receiver

The receiver converts a RS-422 or RS-485 differential input voltage to a TTL logic level output. The TTL logic input,  $\overline{RE}$  pin, can be used to turn the receiver logic output on and off.

**Table 7-2. Receiver Function Table<sup>(1)</sup>**

DIFFERENTIAL INPUTS A-B	ENABLE $\overline{RE}$	OUTPUT R
$V_{ID} \geq 0.2\text{ V}$	L	H
$-0.2\text{ V} < V_{ID} < 0.2\text{ V}$	L	U
$V_{ID} \leq -0.2\text{ V}$	L	L
X	H	Z
Open	L	U

- (1) H = high level,  
L = low level,  
U = unknown,  
Z = high impedance (off)

## 7.4 Device Functional Modes

### 7.4.1 Device Powered

Both the driver and receiver can be individually enabled or disabled in any combination. DE and  $\overline{RE}$  can be connected together for a single port direction control bit.

### 7.4.2 Device Unpowered

The driver differential outputs and the receiver differential inputs are connected internally to form differential input/output (I/O) bus ports that are designed to offer minimum loading to the bus when the driver is disabled or  $V_{CC} = 0$ .

### 7.4.3 Symbol Cross Reference

**Table 7-3. Symbol Equivalents**

DATA SHEET PARAMETER	TIA/EIA-422-B	TIA/EIA-485-A
$V_O$	$V_{oa}, V_{ob}$	$V_{oa}, V_{ob}$
$ V_{OD1} $	$V_o$	$V_o$
$ V_{OD2} $	$V_t @ L = 100\ \Omega$	$V_t @ L = 54\ \Omega$
$ V_{OD3} $		$V_t$ (test termination measurement 2)
$\Delta V_{OD} $	$  V_t  -  \overline{V}_t  $	$  V_t  -  \overline{V}_t  $
$V_{OC}$	$ V_{os} $	$ V_{os} $
$\Delta V_{OC} $	$ V_{os} - \overline{V}_{os} $	$ V_{os} - \overline{V}_{os} $
$I_{OS}$	$ I_{sa} ,  I_{sb} $	
$I_O$	$ I_{xa} ,  I_{xb} $	$I_{ia}, I_{ib}$

## 8 Application and Implementation

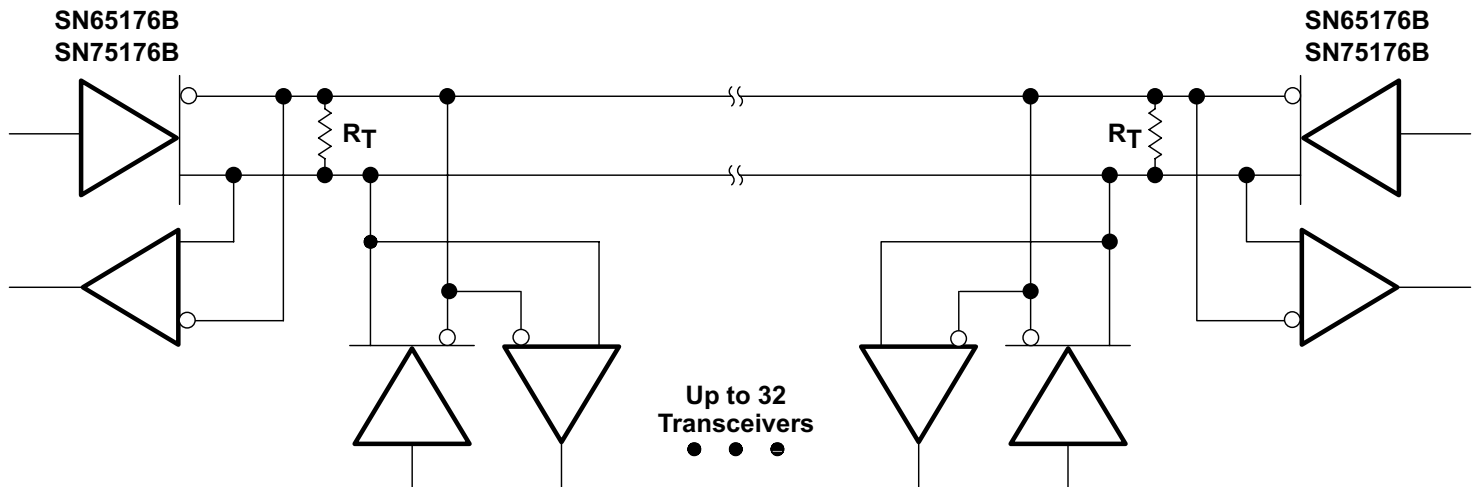
### Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

### 8.1 Application Information

The device can be used in RS-485 and RS-422 physical layer communications.

### 8.2 Typical Application



The line should be terminated at both ends in its characteristic impedance ( $R_T = Z_0$ ). Stub lengths off the main line should be kept as short as possible.

**Figure 8-1. Typical RS-485 Application Circuit**

#### 8.2.1 Design Requirements

- 5-V power source
- RS-485 bus operating at 10 Mbps or less
- Connector that ensures the correct polarity for port pins
- External fail safe implementation

#### 8.2.2 Detailed Design Procedure

- Place the device close to bus connector to keep traces (stub) short to prevent adding reflections to the bus line
- If desired, add external fail-safe biasing to ensure +200 mV on the A-B port.

### 8.2.3 Application Curves

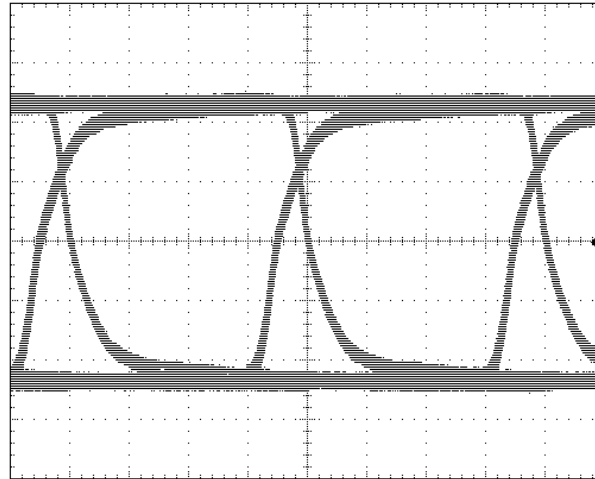


Figure 8-2. Eye Diagram for 10-Mbits/s over 100 feet of standard CAT-5E cable 120-Ω Termination at both ends. Scale is 1 V per division and 25 nS per division

### 8.3 System Examples

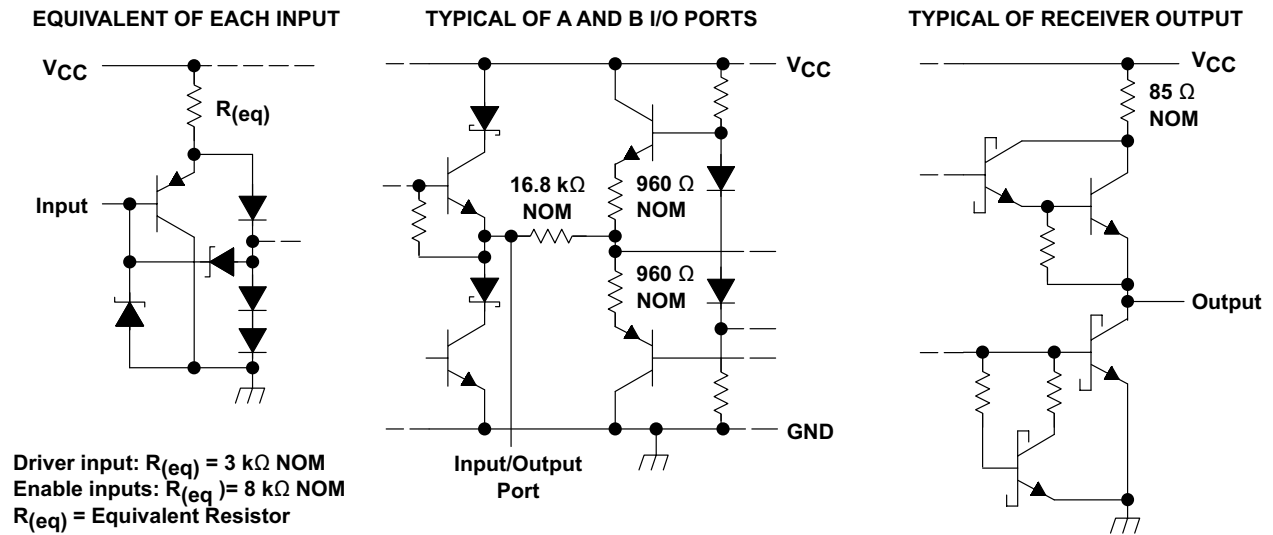


Figure 8-3. Schematics of Inputs and Outputs

## 9 Power Supply Recommendations

Power supply should be 5 V with a tolerance less than 10%

## 10 Layout

### 10.1 Layout Guidelines

Traces from device pins A and B to connector must be short and capable of 250 mA maximum current.

### 10.2 Layout Example

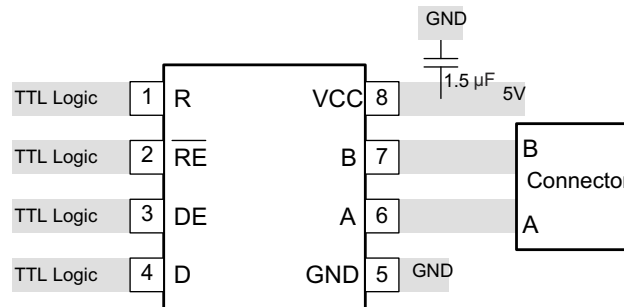


Figure 10-1. Layout Diagram

## 11 Device and Documentation Support

### 11.1 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

**Table 11-1. Related Links**

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN65176B	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
SN75176B	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>

### 11.2 Trademarks

All trademarks are the property of their respective owners.

### 11.3 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.

### 11.4 Glossary

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

## 12 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 (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">SN65176BD</a>	Obsolete	Production	SOIC (D)   8	-	-	Call TI	Call TI	-40 to 105	65176B
<a href="#">SN65176BDR</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	65176B
SN65176BDR.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	65176B
SN65176BDRE4	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	65176B
<a href="#">SN65176BDRG4</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	65176B
SN65176BDRG4.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	65176B
<a href="#">SN65176BP</a>	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 105	SN65176BP
SN65176BP.A	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 105	SN65176BP
<a href="#">SN75176BD</a>	Obsolete	Production	SOIC (D)   8	-	-	Call TI	Call TI	0 to 70	75176B
SN75176BDG4	NRND	Production	null (null)	75   TUBE	-	Call TI	Call TI	0 to 70	
<a href="#">SN75176BDR</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75176B
SN75176BDR.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75176B
SN75176BDRE4	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75176B
<a href="#">SN75176BDRG4</a>	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75176B
SN75176BDRG4.A	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75176B
<a href="#">SN75176BP</a>	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN75176BP
SN75176BP.A	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN75176BP
SN75176BPE4	Active	Production	PDIP (P)   8	50   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN75176BP
<a href="#">SN75176BPSR</a>	Active	Production	SO (PS)   8	2000   LARGE T&R	Yes	NIPDAU   NIPDAU	Level-1-260C-UNLIM	0 to 70	A176B
SN75176BPSR.A	Active	Production	SO (PS)   8	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	A176B
SN75176BPSRG4	Active	Production	SO (PS)   8	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	A176B

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

(2) **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.

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

(4) **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.

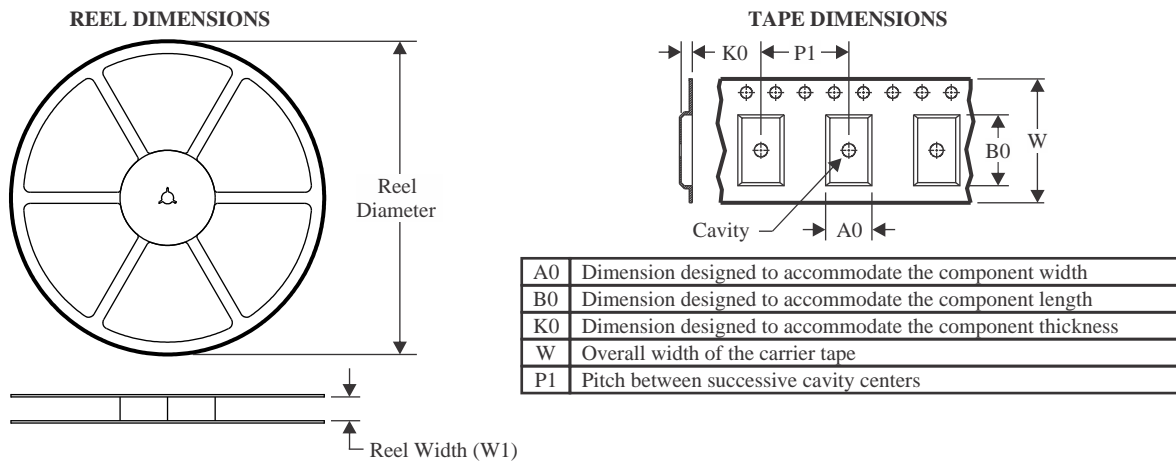
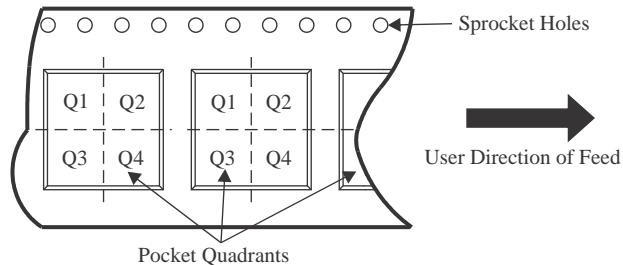
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will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

(6) **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.

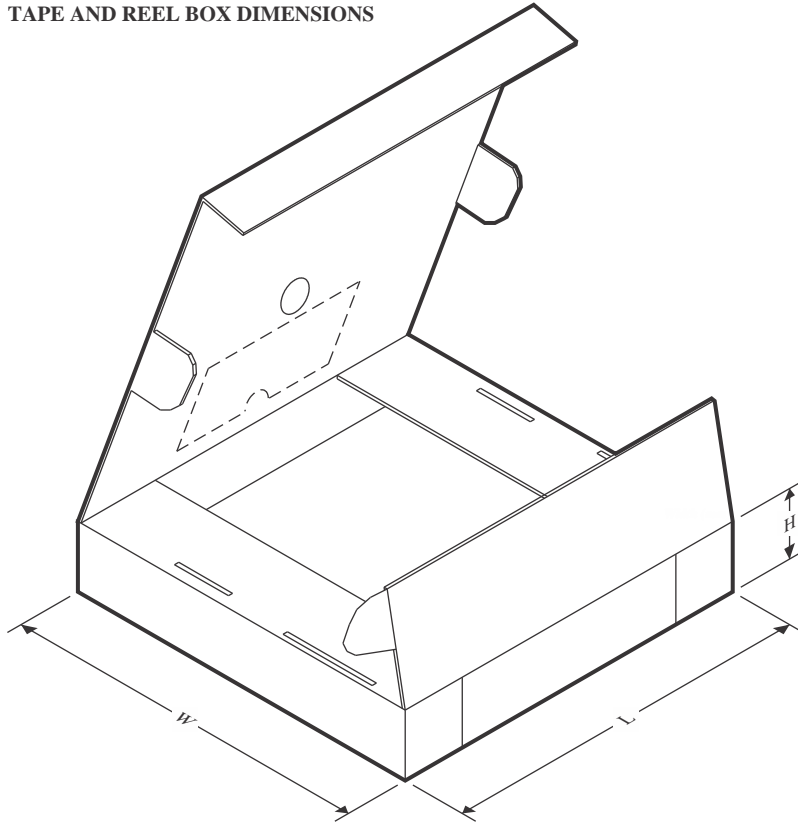
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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


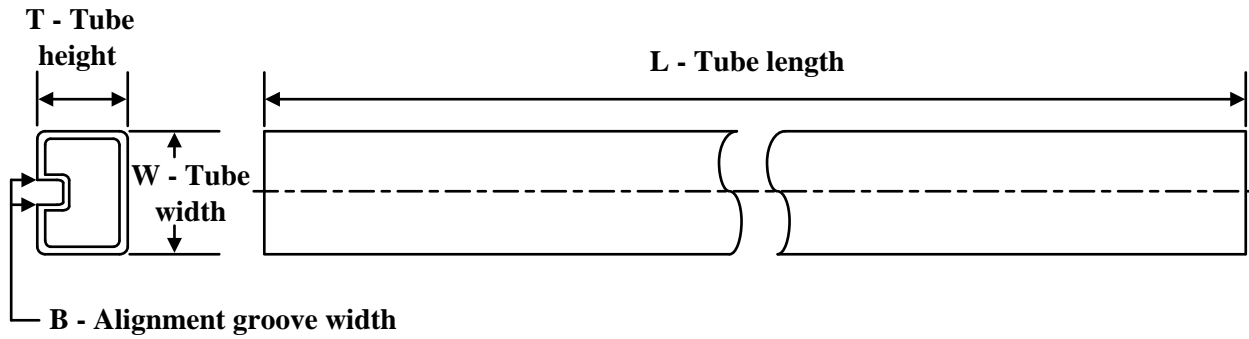
\*All dimensions are nominal

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
SN65176BDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN65176BDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN65176BDRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN75176BDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN75176BDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN75176BDRG4	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
SN75176BPSR	SO	PS	8	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN75176BPSR	SO	PS	8	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


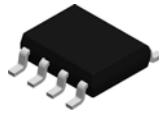
\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65176BDR	SOIC	D	8	2500	340.5	338.1	20.6
SN65176BDR	SOIC	D	8	2500	353.0	353.0	32.0
SN65176BDRG4	SOIC	D	8	2500	356.0	356.0	35.0
SN75176BDR	SOIC	D	8	2500	353.0	353.0	32.0
SN75176BDR	SOIC	D	8	2500	340.5	338.1	20.6
SN75176BDRG4	SOIC	D	8	2500	367.0	367.0	35.0
SN75176BPSR	SO	PS	8	2000	356.0	356.0	35.0
SN75176BPSR	SO	PS	8	2000	367.0	367.0	38.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN65176BP	P	PDIP	8	50	506	13.97	11230	4.32
SN65176BP.A	P	PDIP	8	50	506	13.97	11230	4.32
SN75176BP	P	PDIP	8	50	506	13.97	11230	4.32
SN75176BP.A	P	PDIP	8	50	506	13.97	11230	4.32
SN75176BPE4	P	PDIP	8	50	506	13.97	11230	4.32

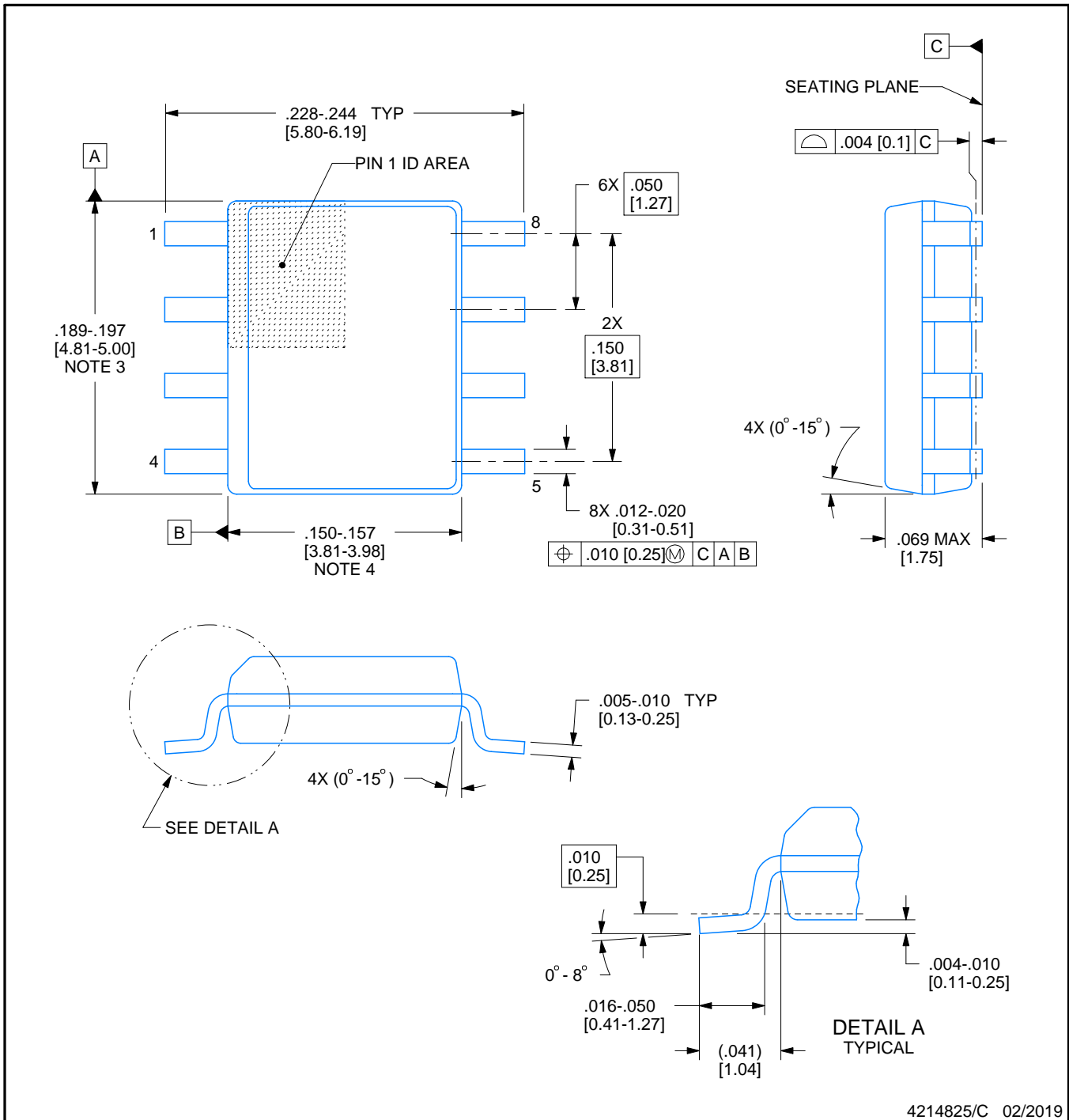


D0008A

# PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

NOTES:

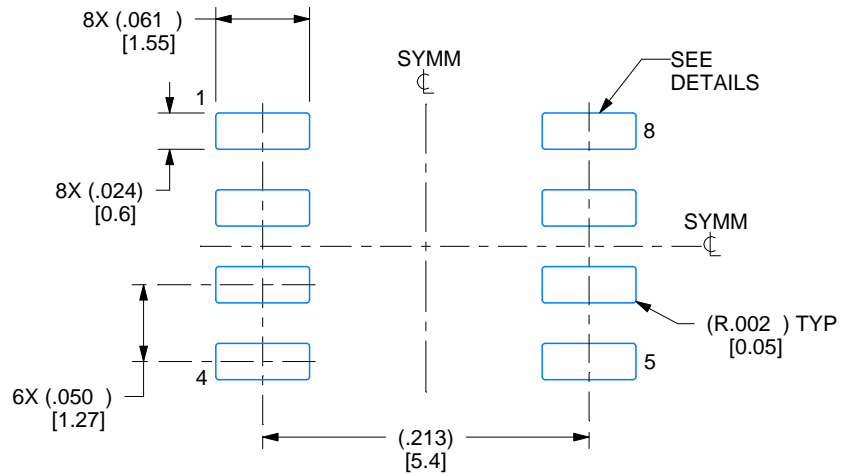
1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed  $.006$  [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.

# EXAMPLE BOARD LAYOUT

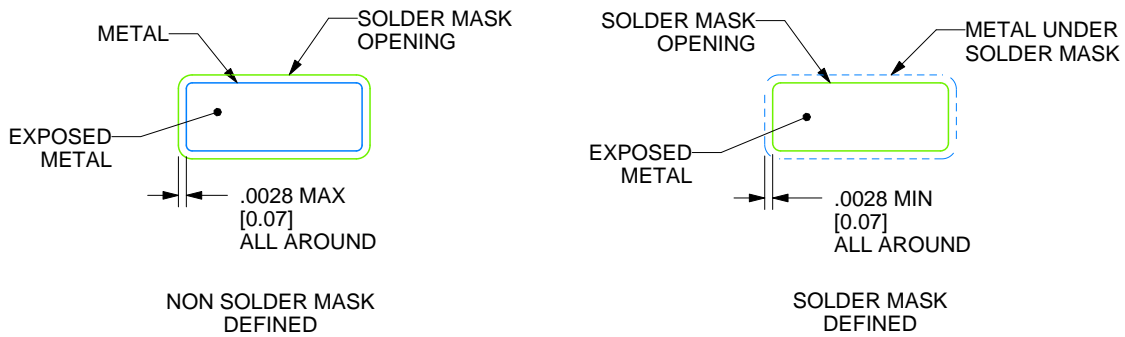
D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
 EXPOSED METAL SHOWN  
 SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

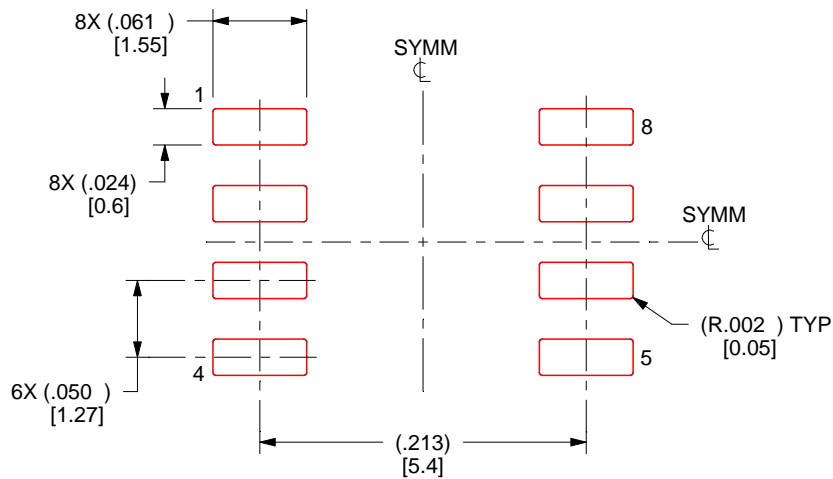
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.125 MM] THICK STENCIL  
SCALE:8X

4214825/C 02/2019

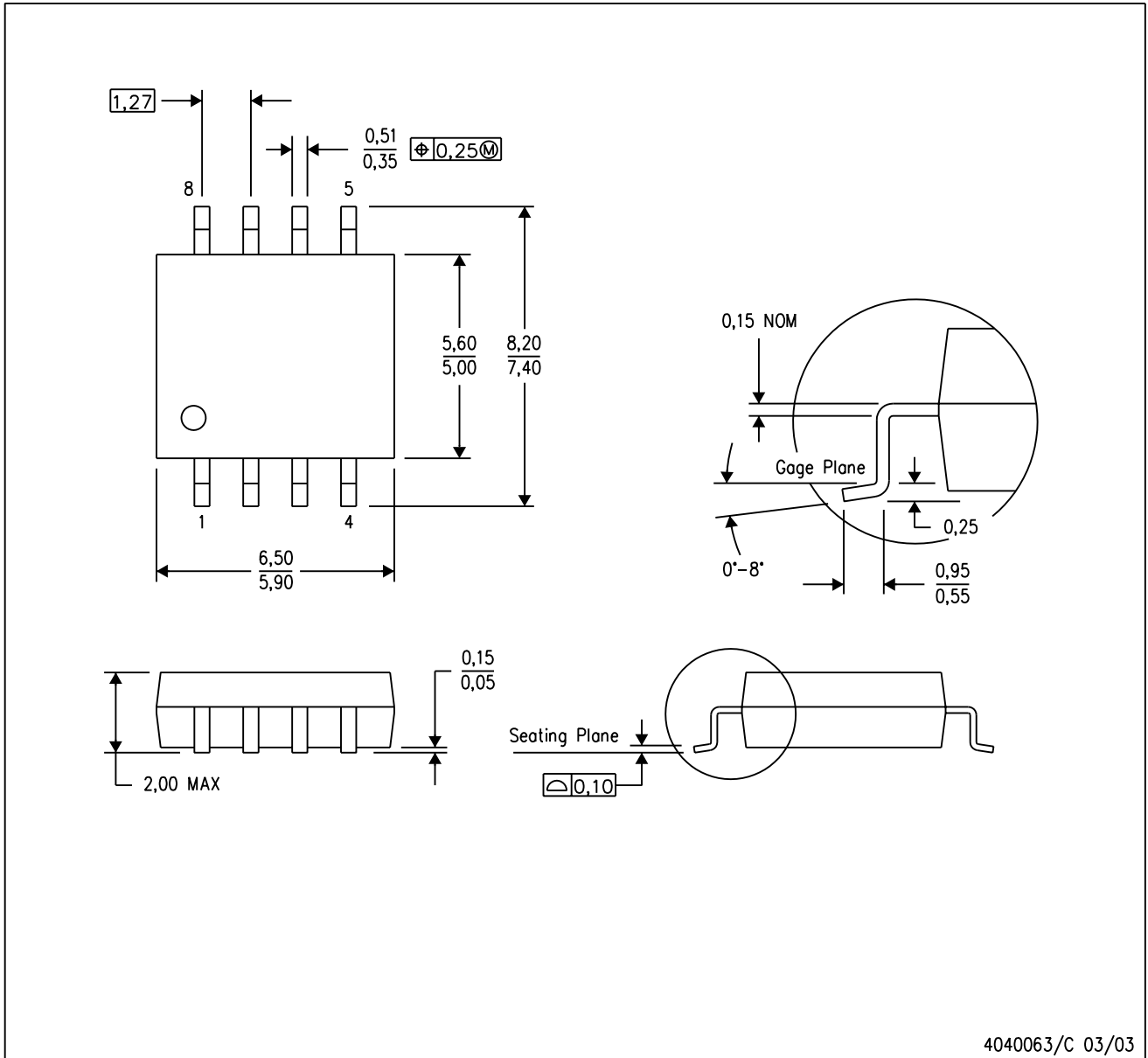
NOTES: (continued)

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

## MECHANICAL DATA

PS (R-PDSO-G8)

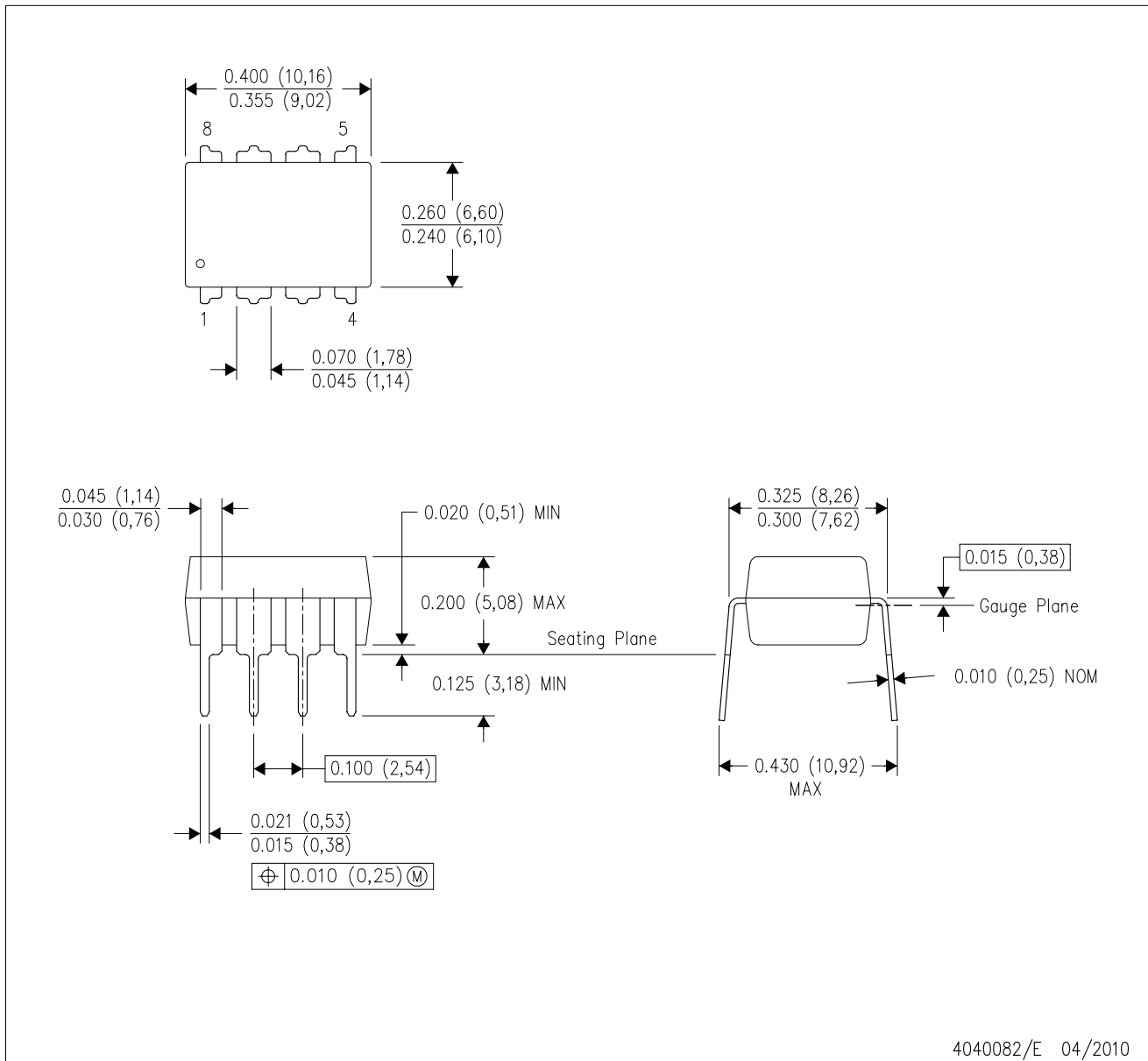
PLASTIC SMALL-OUTLINE PACKAGE



- 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.

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MS-001 variation BA.

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