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# Product Specification

XBLW SN75176B/SN65176B

Multipoint RS-485/RS-422

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## Description

The SN75176B / SN65176B is a high speed differential TRI-STATE® bus/line transceiver designed to meet the requirements of EIA standard RS485 with extended common mode range (+12V to -7V), for multipoint data transmission . In addition, it is compatible with RS-422 .

The driver and receiver outputs feature TRI-STATE capability, for the driver outputs over the entire common mode range of +12V to -7V . Bus contention or fault situations that cause excessive power dissipation within the device are handled by a thermal shutdown circuit, which forces the driver outputs into the high impedance state . DC specifications are guaranteed over the 0 to 70°C temperature and 4 .75V to 5 .25V supply voltage range .

## Features

- Meets EIA Standard RS485 for Multipoint Bus Transmission and is Compatible with RS-422.
- Small Outline (SOIC) Package Option Available for Minimum Board Space.
- 22 ns Driver Propagation Delays.
- Single +5V Supply.
- -7V to +12V Bus Common Mode Range Permits ±7V Ground Difference Between Devices on the Bus.
- Thermal Shutdown Protection.
- High Impedance to Bus with Driver in TRISTATE or with Power Off, Over the Entire Common Mode Range Allows the Unused Devices on the Bus to be Powered Down.
- Combined Impedance of a Driver Output and Receiver Input is Less Than One RS485 Unit Load, Allowing up to 32 Transceivers on the Bus.
- 70 mV Typical Receiver Hysteresis.

## Connection and Logic Diagram

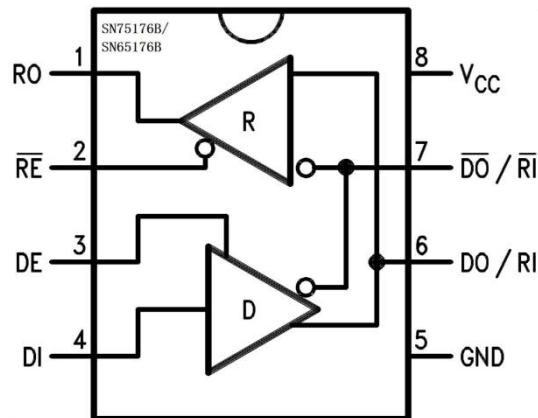


Figure 1. Top View

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## Order Information

Product Model	Package Type	Marking	Packing	Packing Qty
SN65176BN	DIP-8	65176BN	Tube	2000/Box
SN65176BDR	SOP-8	65176B	Tape	2500/Reel
SN75176BN	DIP-8	75176BN	Tube	2000/Box
SN75176BDR	SOP-8	75176B	Tape	2500/Reel

### Absolute Maximum Ratings (1)(2)

Supply Voltage, VCC	7 V	
Control Input Voltages	7 V	
Driver Input Voltage	7 V	
Driver Output Voltages	+15V/ - 10V	
Receiver Input Voltages	+15V/ - 10V	
Receiver Output Voltage	5.5V	
Continuous Power Dissipation @25°C	for SOIC Package	675 mW (3)
	for PDIP Package	900 mW (4)
Storage Temperature Range	-65 °C to +150 °C	
Lead Temperature (Soldering, 4 seconds)	260 °C	
ESD Rating (HBM)	500V	

(1) "Absolute Maximum Ratings" are those beyond which the safety of the device cannot be verified. They are not meant to imply that the device should be operated at these limits. The tables of "Electrical Characteristics" provide conditions for actual device operation.

(2) If Military/Aerospace specified devices are required, please contact the HG Sales Office/Distributors for availability and specifications.

(3) Derate linearly @ 6.11 mW/°C to 400 mW at 70°C.

(4) Derate linearly at 5.56 mW/°C to 650 mW at 70°C.

### Recommended Operating Conditions

	Min	Max	Units
Supply Voltage, VCC	4.75	5.25	V
Units Voltage at AnyBus Terminal (Separate or Common Mode)	-7	+12	V
Operating Free Air Temperature TA			
SN75176B	0	+70	°C
SN65176B	-40	+105	°C
Differential Input Voltage, VID(1)	-12	+12	V

(1) Differential - Input/Output bus voltage is measured at the noninverting terminal A with respect to the inverting terminal B.

### Electrical Characteristics(1) (2)

0°C ≤ TA ≤ 70°C, 4.75V < VCC < 5.25V unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units	
V <sub>OD1</sub>	Differential Driver Output Voltage (Unloaded)	I <sub>O</sub> = 0			5	V	
V <sub>OD2</sub>	Differential Driver Output Voltage (with Load)	R = 50Ω; (RS-422) (3)	2			V	
		R = 27Ω; (RS-485)	1.5			V	
ΔV <sub>OD</sub>	Change in Magnitude of Driver Differential Output Voltage For Complementary Output States	See (Figure 2)			0.2	V	
V <sub>OC</sub>	Driver Common Mode Output Voltage		R = 27Ω			3.0	V
Δ V <sub>OC</sub>	Change in Magnitude of Driver Common Mode Output Voltage For Complementary Output States					0.2	V

(1) All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to device ground unless otherwise specified.

(2) All typicals are given for VCC = 5V and TA = 25°C.

(3) All worst case parameters for which this note is applied, must be increased by 10% for SN75176BT. The other parameters remain valid for -40°C < TA < +85°C.

### Electrical Characteristics <sup>(1)</sup> <sup>(2)</sup> (continued)

0 °C ≤ TA ≤ 70 °C, 4.75V < VCC < 5.25V unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units	
V <sub>IH</sub>	Input High Voltage	DI, DE, RE, E	2			V	
V <sub>IL</sub>	Input Low Voltage				0.8		
V <sub>CL</sub>	Input Clamp Voltage		I <sub>IN</sub> = -18 mA			-1.5	
I <sub>IL</sub>	Input Low Current		V <sub>IL</sub> = 0.4V			-200	pA
I <sub>IH</sub>	Input High Current		V <sub>IH</sub> = 2.4V			20	pA
I <sub>IN</sub>	Input Current	DO / RI, DO / RI V <sub>CC</sub> = 0V or 5.25V DE = 0V			+1.0	mA	
					-0.8	mA	
V <sub>TH</sub>	Differential Input Threshold Voltage for Receiver	-7V ≤ V <sub>CM</sub> ≤ +12V	-0.2		+0.2	V	
ΔV <sub>TH</sub>	Receiver Input Hysteresis	V <sub>CM</sub> = 0V		70		mV	
V <sub>OH</sub>	Receiver Output High Voltage	I <sub>OH</sub> = -400 pA	2.7			V	
V <sub>OL</sub>	Output Low Voltage	RO I <sub>OL</sub> = 16 (3) mA			0.5	V	
I <sub>ozR</sub>	OFF- State ( High Impedance) Output Current at Receiver	V <sub>CC</sub> = Max 0.4V ≤ V <sub>O</sub> ≤ 2.4V			±20	pA	
R <sub>IN</sub>	Receiver Input Resistance	-7V ≤ V <sub>CM</sub> ≤ +12V	12			kΩ	
I <sub>CC</sub>	Supply Current	No Load(3)			55	mA	
		Driver Outputs Enabled			35	mA	
		Driver Outputs Disabled					
I <sub>OSD</sub>	Driver Short-Circuit Output Current	V <sub>O</sub> = -7V (3)			-250	mA	
		V <sub>O</sub> = +12V (3)			+250	mA	
I <sub>OSR</sub>	Receiver Short-Circuit Output Current	V <sub>O</sub> = 0V	-15		-85	mA	

### Switching Characteristics

VCC = 5.0V, TA = 25 °C

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t <sub>PLH</sub>	Driver Input to Output	RLDIFF=60Ω		12	22	ns
t <sub>PHL</sub>	Driver Input to Output	CL1=CL2=100pF		17	22	ns
t <sub>r</sub>	Driver Rise Time	RLDIFF=60Ω CL1=CL2=100pF (Figure 4 and Figure 6)			18	ns
t <sub>f</sub>	Driver Fall Time				18	ns
t <sub>ZH</sub>	Driver Enable to Output High	CL=100pF(Figure5andFigure7)S1 Open		29	100	ns
t <sub>ZL</sub>	Driver Enable to Output Low	CL=100pF(Figure5andFigure7)S2 Open		31	60	ns
t <sub>LZ</sub>	Driver Disable Time from Low	CL=15pF(Figure5andFigure7)S2 Open		13	30	ns
t <sub>HZ</sub>	Driver Disable Time from High	CL=15pF(Figure5andFigure7)S1 Open		19	200	ns
t <sub>PLH</sub>	Receiver Input to Output	CL=15pF(Figure3andFigure8)		30	37	ns
t <sub>PHL</sub>	Receiver Input to Output	S1 and S2 Closed		32	37	ns
t <sub>ZL</sub>	Receiver Enable to Output Low	CL=15pF(Figure3andFigure9)S2 Open		15	20	ns
t <sub>ZH</sub>	Receiver Enable to Output High	CL=15pF(Figure3andFigure9)S1 Open		11	20	ns
t <sub>LZ</sub>	Receiver Disable from Low	CL=15pF(Figure3andFigure9)S2 Open		28	32	ns
t <sub>HZ</sub>	Receiver Disable from High	CL=15pF(Figure3andFigure9)S1 Open		13	35	ns

**AC TEST CIRCUITS**

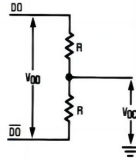


Figure 2.

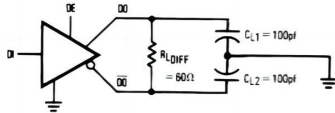
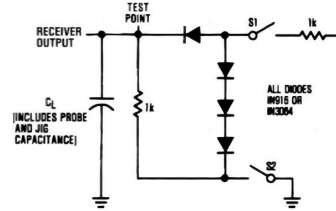
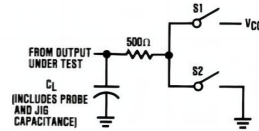


Figure 4.



Note: S1 and S2 of load circuit are closed except as otherwise mentioned.

Figure 3.



Note: Unless otherwise specified the switches are closed.

Figure 5.

**Switching Time Waveforms**

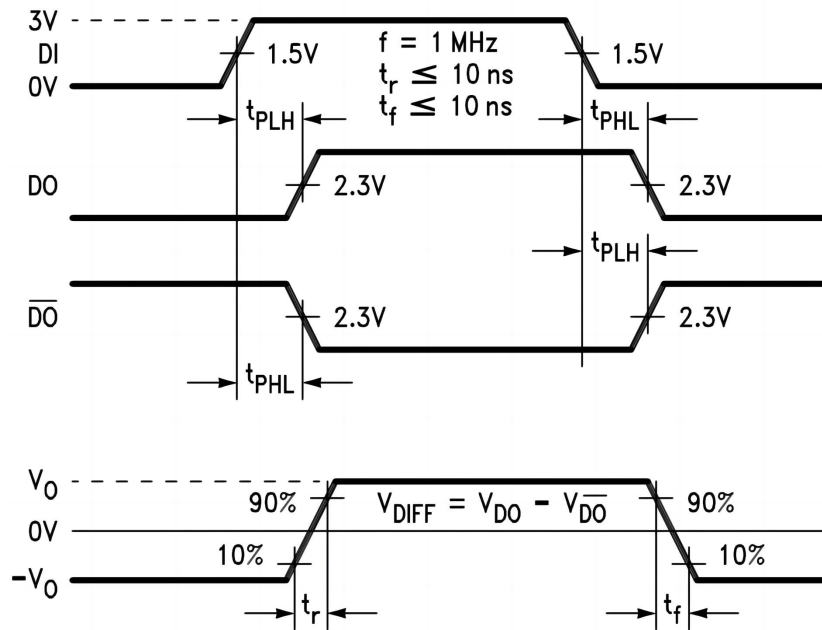


Figure 6. Driver Propagation Delays and Transition Times

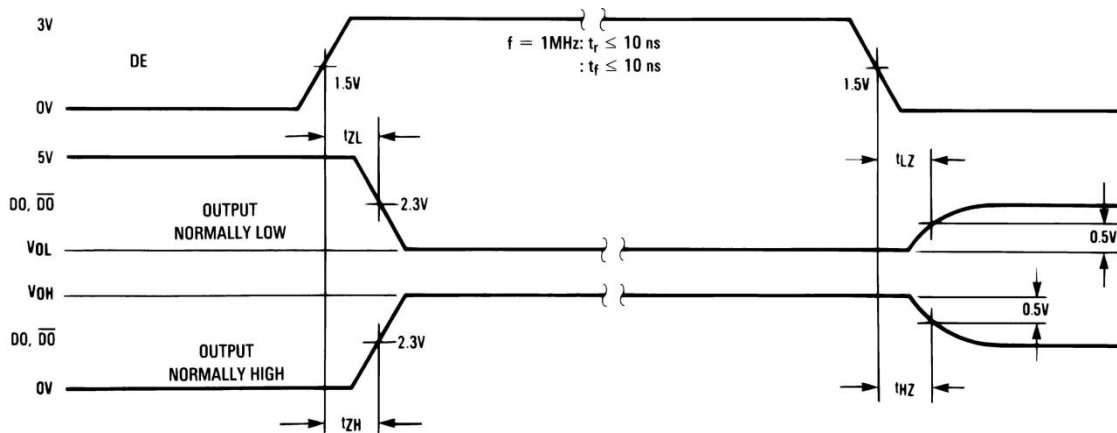
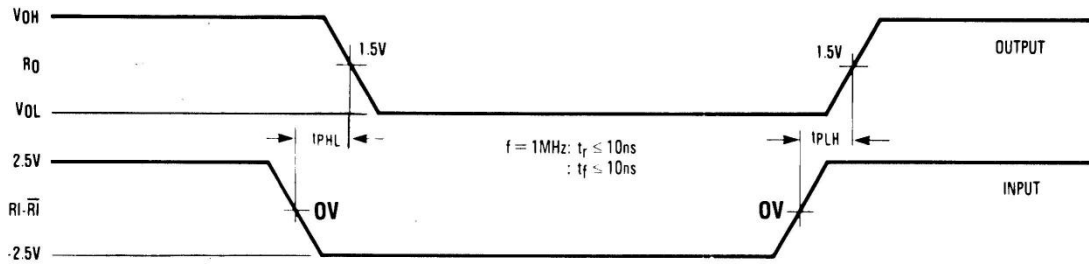


Figure 7. Driver Enable and Disable Times



Note: Differential input voltage may be realized by grounding RI and pulsing RI between +2.5V and -2.5V  
Figure 8. Receiver Propagation Delays

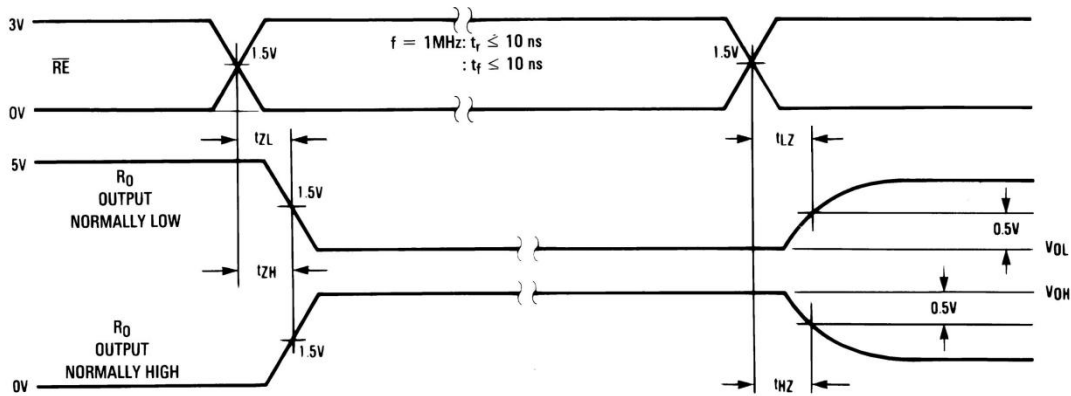


Figure 9. Receiver Enable and Disable Times

## Function Tables

Table 1. SN75176B Transmitting(1)

Inputs			Line Condition	Outputs	
$\overline{RE}$	DE	DI		$\overline{DO}$	DO
X	1	1	No Fault	0	1
X	1	0	No Fault	1	0
X	0	X	X	Z	Z
X	1	X	Fault	Z	Z

X — Don't care condition Z — High impedance state Fault — Improper line conditions causing excessive power dissipation in the driver, such as shorts or bus contention situations \*\*This is a fail safe condition

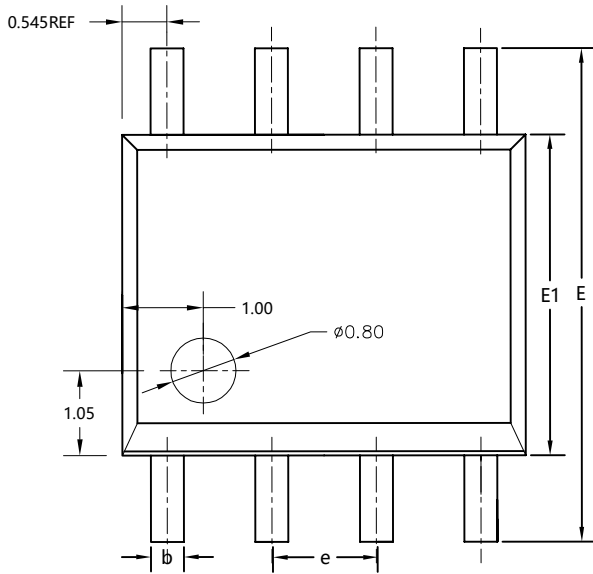
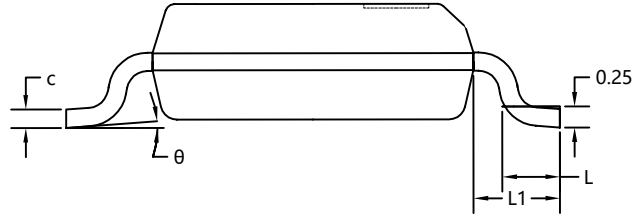
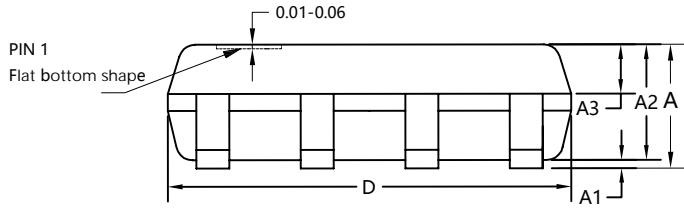
Table 2. SN75176B Receiving(1)

Inputs			Outputs
$\overline{RE}$	DE	RI- $\overline{RI}$	RO
0	0	$\geq +0.2V$	1
0	0	$\leq -0.2V$	0
0	0	Inputs Open**	1
1	0	X	Z

(1) X — Don't care condition Z — High impedance state Fault — Improper line conditions causing excessive power dissipation in the driver, such as shorts or bus contention situations \*\*This is a fail safe condition

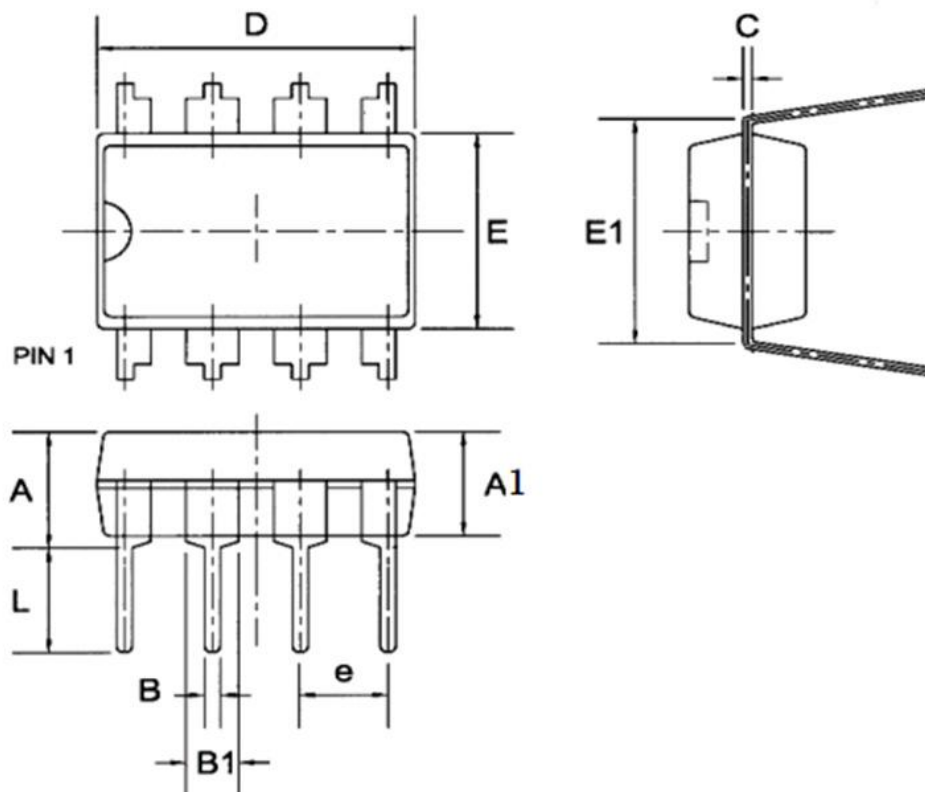
## Package Outline Dimensions

### SOP-8



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.55	1.65	1.75
A1	0.10	0.15	0.20
A2	1.35	1.45	1.55
A3	0.60	0.70	0.80
b	0.30	0.40	0.50
c	0.17	0.20	0.25
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.50	0.60	0.70
L1	1.05REF		
$\theta$	0°	4°	8°

DIP-8



Symbol	Dimensions in Millimeters		
	Min	Nom	Max
A	--	--	4.31
A1	3.15	3.30	3.65
B	0.38	0.46	0.51
B1	1.27	1.55	1.77
C	0.20	0.25	0.30
D	8.95	9.40	9.45
E	6.15	6.20	6.65
E1	--	7.60	--
e	--	2.54	--
L	3.00	3.30	3.60



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