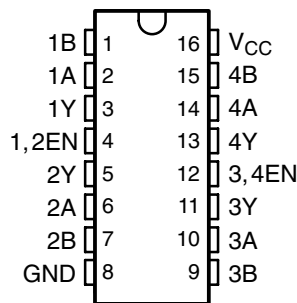


# SN65175, SN75175 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

SLLS145C – OCTOBER 1990 – REVISED NOVEMBER 2006

- Meet or Exceed the Requirements of ANSI Standard EIA/TIA-422-B, RS-423-B, and RS-485
- Meet ITU Recommendations V.10, V.11, X.26, and X.27
- Designed for Multipoint Bus Transmission on Long Bus Lines in Noisy Environments
- 3-State Outputs
- Common-Mode Input Voltage Range –12 V to 12 V
- Input Sensitivity . . .  $\pm 200$  mV
- Input Hysteresis . . . 50 mV Typ
- High Input Impedance . . . 12 k $\Omega$  Min
- Operate From Single 5-V Supply
- Low-Power Requirements
- Plug-In Replacement for MC3486

D OR N PACKAGE  
(TOP VIEW)



## description

The SN65175 and SN75175 are monolithic quadruple differential line receivers with 3-state outputs. They are designed to meet the requirements of ANSI Standards EIA/TIA-422-B, RS-423-B, and RS-485, and several ITU recommendations. These standards are for balanced multipoint bus transmission at rates up to 10 megabits per second. Each of the two pairs of receivers has a common active-high enable.

The receivers feature high input impedance, input hysteresis for increased noise immunity, and input sensitivity of  $\pm 200$  mV over a common-mode input voltage range of  $\pm 12$  V. The SN65175 and SN75175 are designed for optimum performance when used with the SN75172 or SN75174 quadruple differential line drivers.

The SN65175 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ . The SN75175 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

FUNCTION TABLE  
(each receiver)

DIFFERENTIAL A – B	ENABLE	OUTPUT Y
$V_{ID} \geq 0.2$ V	H	H
$-0.2$ V $< V_{ID} < 0.2$ V	H	?
$V_{ID} \leq -0.2$ V	H	L
X	L	Z
Open circuit	H	?

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



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

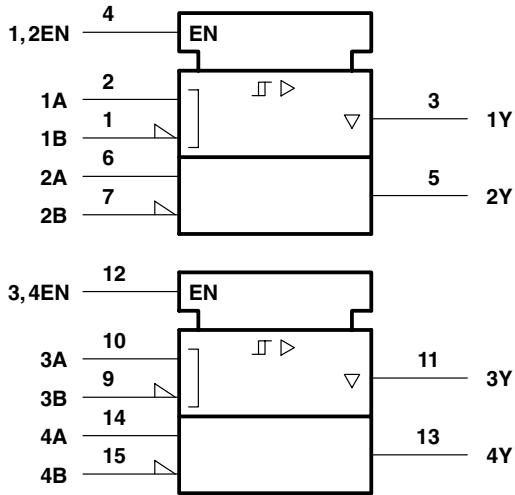
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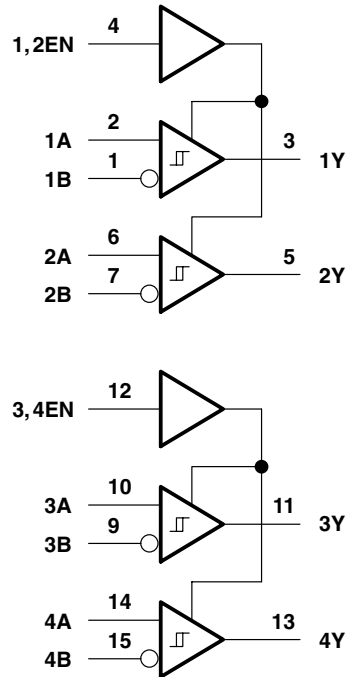
# SN65175, SN75175 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

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## logic symbol†

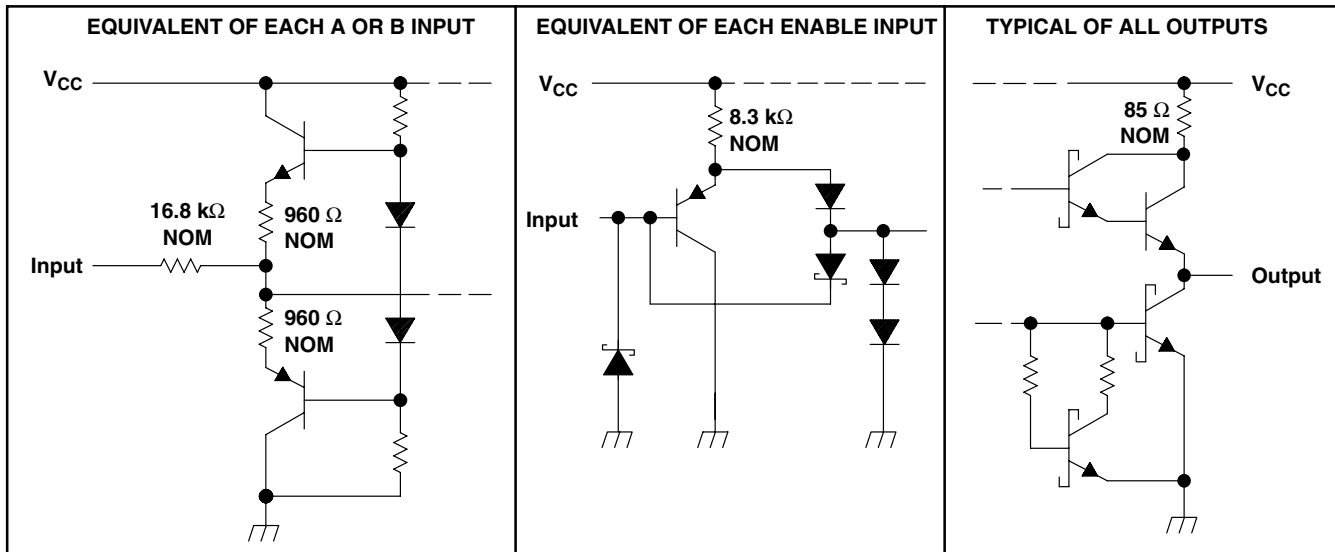


## logic diagram (positive logic)



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

## schematics of inputs and outputs



# SN65175, SN75175 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

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

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage $V_I$ , (A or B inputs)	$\pm 25$ V
Differential input voltage, $V_{ID}$ (see Note 2)	$\pm 25$ V
Enable input voltage, $V_I$ , EN	7 V
Low-level output current, $I_{OL}$	50 mA
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, $T_A$ : SN65175	–40°C to 85°C
SN75175	0°C to 70°C
Storage temperature range, $T_{stg}$	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltage values, except differential input voltage, are with respect to network ground terminal.  
 2. Differential-input voltage is measured at the noninverting input with respect to the corresponding inverting input.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING
D	950 mW	7.6 mW/°C	608 mW	494 mW
N	1150 mW	9.2 mW/°C	736 mW	598 mW

## recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, $V_{CC}$	4.75	5	5.25	V
Common-mode input voltage, $V_{IC}$			$\pm 12$	V
Differential input voltage, $V_{ID}$			$\pm 12$	V
High-level enable-input voltage, $V_{IH}$	2			V
Low-level enable-input voltage, $V_{IL}$			0.8	V
High-level output current, $I_{OH}$			–400	$\mu\text{A}$
Low-level output current, $I_{OL}$			16	mA
Operating free-air temperature, $T_A$	SN65175	–40	85	°C
	SN75175	0	70	



# SN65175, SN75175 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

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## electrical characteristics over recommended ranges of common-mode input voltage, supply voltage and operating free-air temperature

PARAMETER	TEST CONDITIONS	MIN	TYP†	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> = 16 mA	-0.2‡			V
V <sub>hys</sub> Hysteresis voltage (V <sub>IT+</sub> - V <sub>IT-</sub> )	See Figure 4		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 Figure 1	2.7			V
V <sub>OL</sub> Low-level output voltage	V <sub>ID</sub> = -200 mV, See Figure 1			I <sub>OL</sub> = 8 mA	0.45
				I <sub>OL</sub> = 16 mA	0.5
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 at 0 V, See Note 3			V <sub>I</sub> = 12 V	1
				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		12			kΩ
I <sub>OS</sub> Short-circuit output current§		-15		-85	mA
I <sub>CC</sub> Supply current	Outputs disabled			70	mA

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

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

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

NOTE 3: Refer to ANSI Standards EIA/TIA-422-B, RS-423-B, and RS-485 for exact conditions.

## switching characteristics, 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	See Figure 2		22	35	ns
t <sub>PHL</sub> Propagation delay time, high- to low-level output			25	35	ns
t <sub>PZH</sub> Output enable time to high level	See Figure 3		13	30	ns
t <sub>PZL</sub> Output enable time to low level			19	30	ns
t <sub>PHZ</sub> Output disable time from high level	See Figure 3		26	35	ns
t <sub>PLZ</sub> Output disable time from low level			25	35	ns



## PARAMETER MEASUREMENT INFORMATION

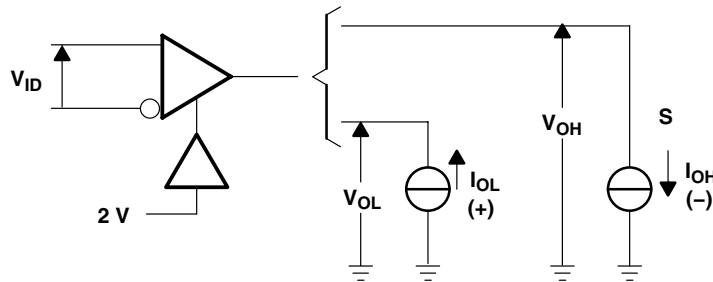
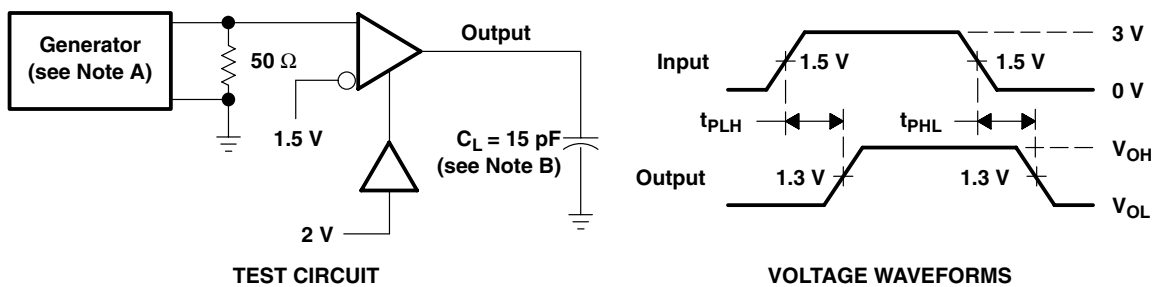


Figure 1.  $V_{OH}$ ,  $V_{OL}$



TEST CIRCUIT

VOLTAGE WAVEFORMS

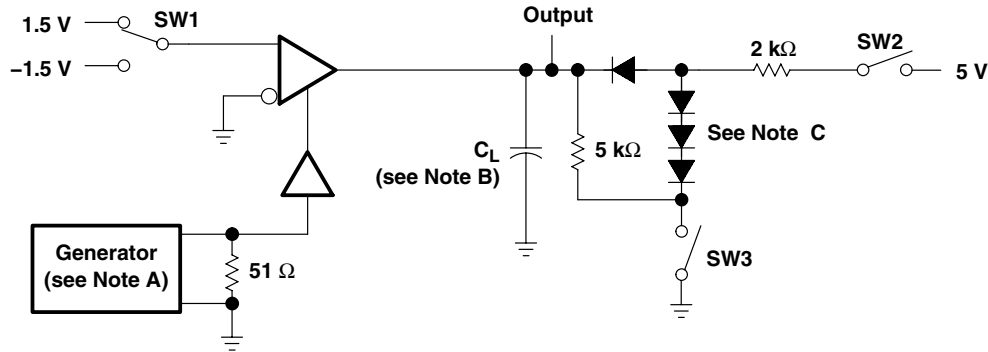
- NOTES: A. The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 1$  MHz, duty cycle = 50%,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_O = 50 \Omega$ .  
 B.  $C_L$  includes probe and stray capacitance.

Figure 2. Test Circuit and Voltage Waveforms

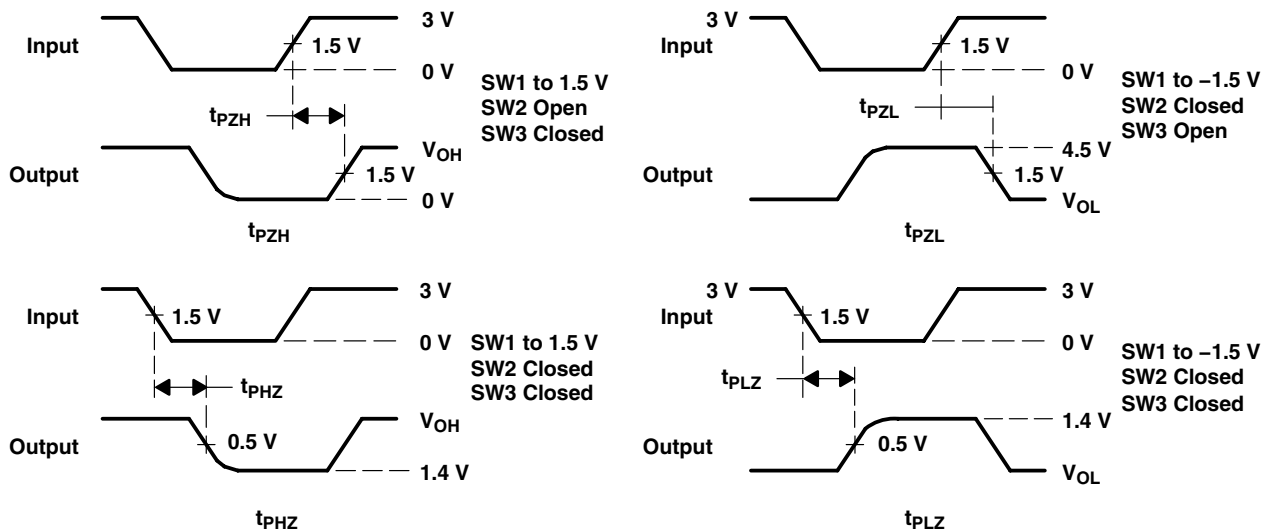
# SN65175, SN75175 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

SLLS145C – OCTOBER 1990 – REVISED NOVEMBER 2006

## PARAMETER MEASUREMENT INFORMATION



### TEST CIRCUIT

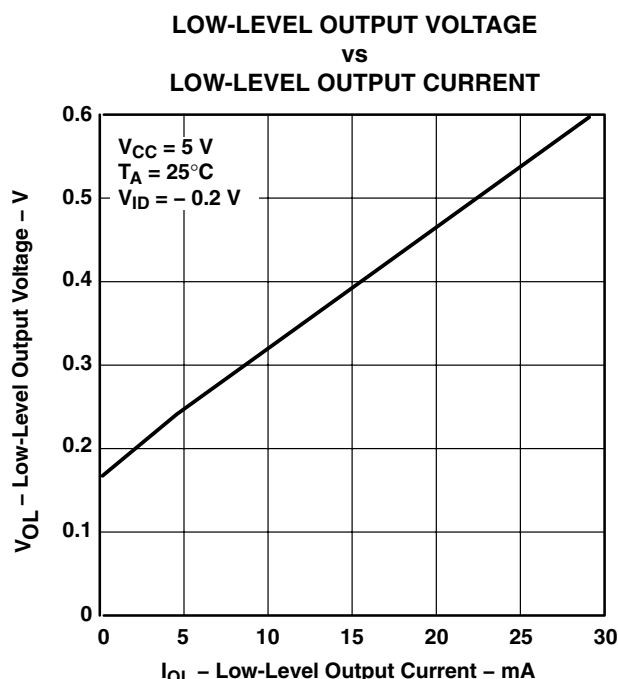
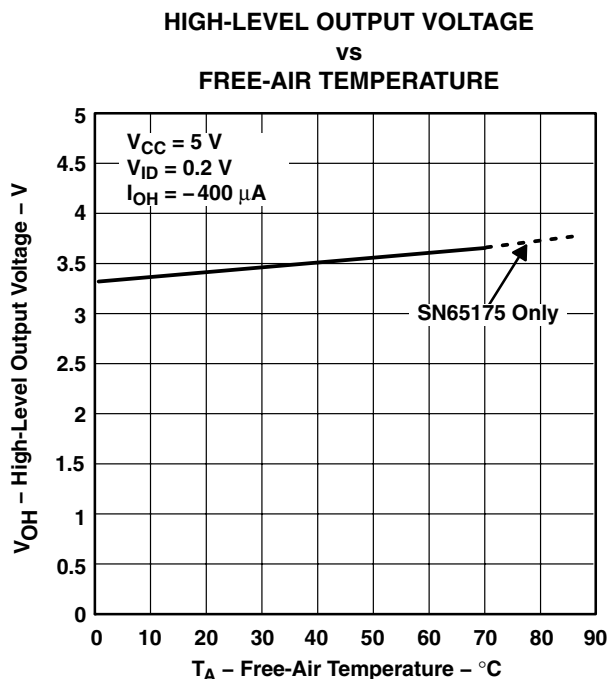
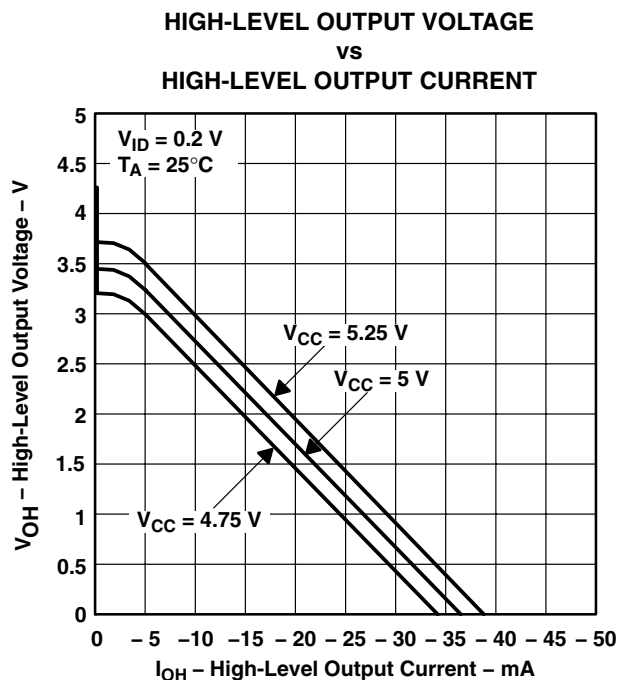
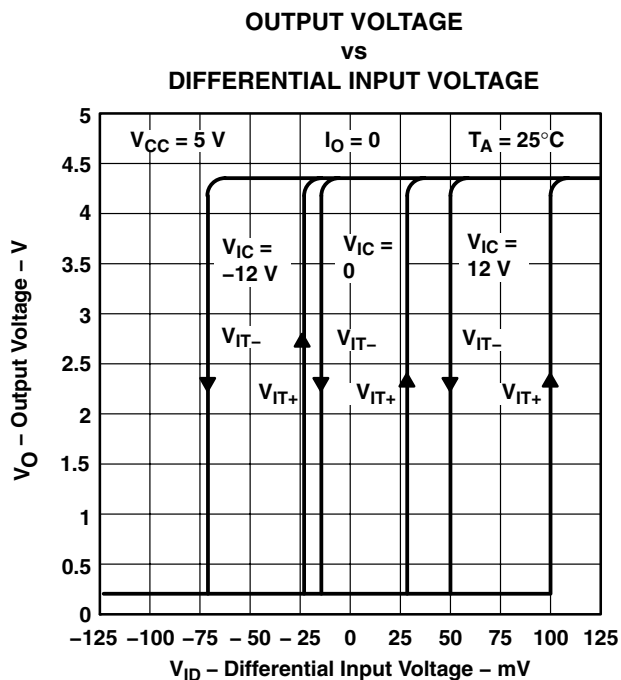


### VOLTAGE WAVEFORMS

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

Figure 3. Test Circuit and Voltage Waveforms

## TYPICAL CHARACTERISTICS



# SN65175, SN75175 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

SLLS145C – OCTOBER 1990 – REVISED NOVEMBER 2006

## TYPICAL CHARACTERISTICS

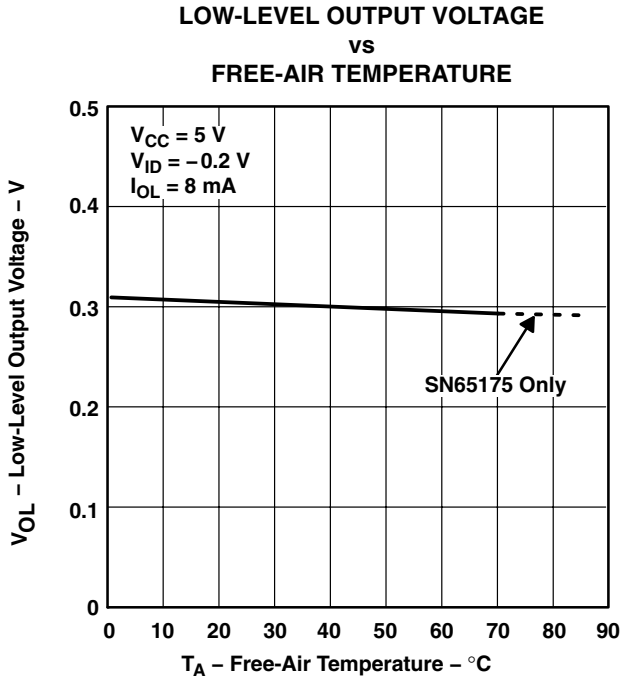


Figure 8

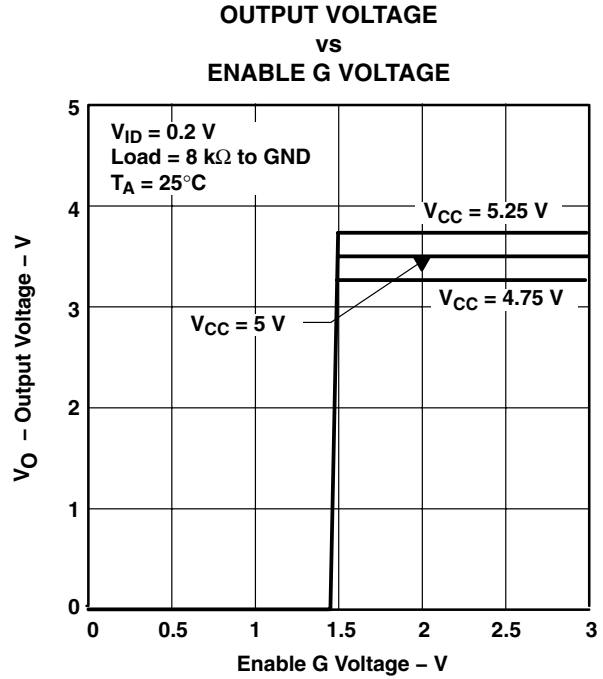


Figure 9

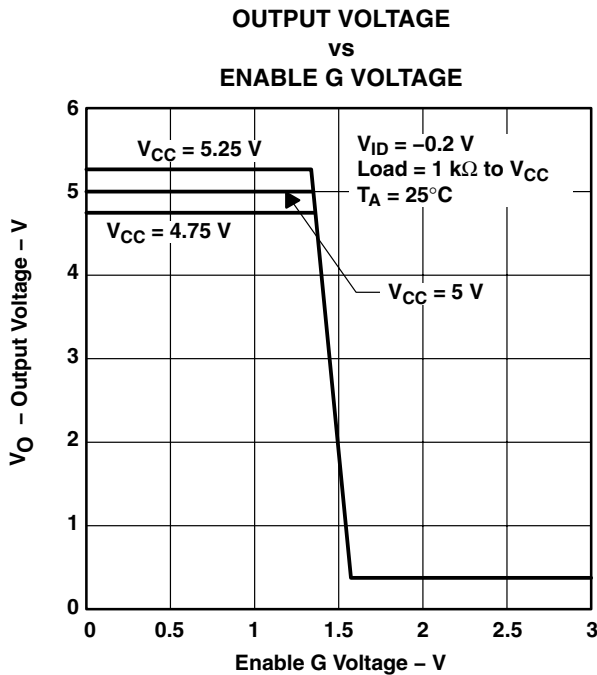


Figure 10

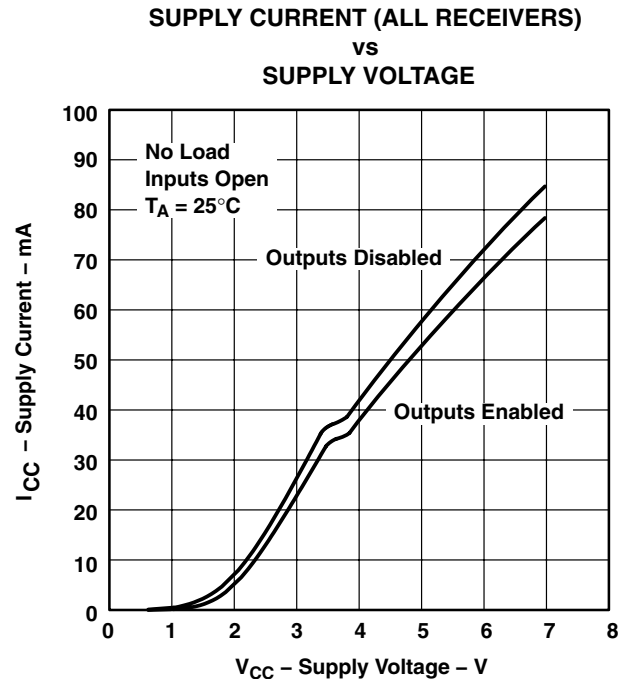
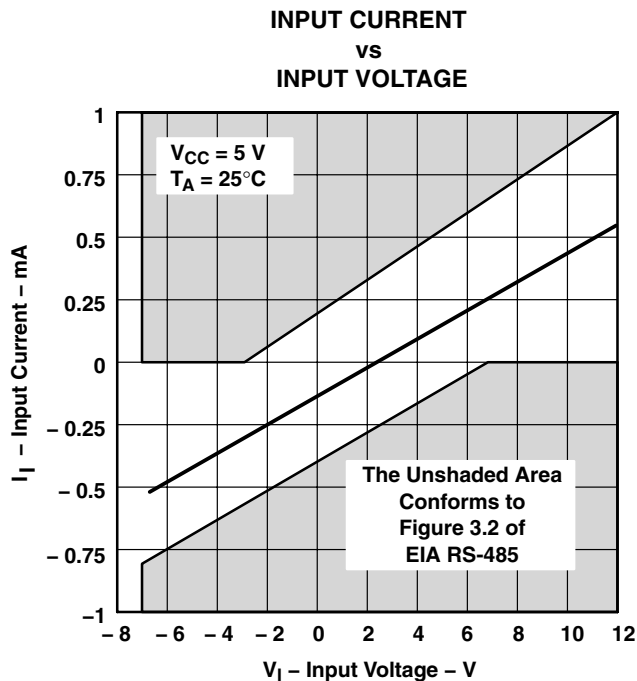


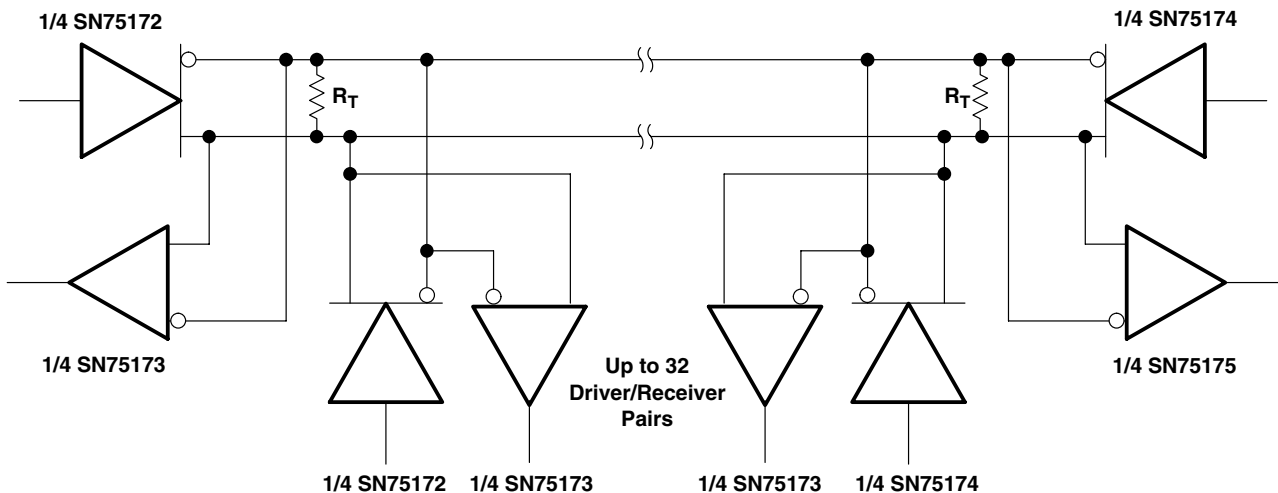
Figure 11



## TYPICAL CHARACTERISTICS



## APPLICATION INFORMATION



NOTE A: 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 13. Typical Application Circuit**

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN65175D	LIFEBUY	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	SN65175	
SN65175DR	LIFEBUY	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	SN65175	
SN75175D	LIFEBUY	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75175	
SN75175DE4	LIFEBUY	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75175	
SN75175DR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75175	Samples
SN75175N	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	0 to 70	SN75175N	Samples
SN75175NSR	ACTIVE	SO	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75175	Samples
SN75175NSRG4	ACTIVE	SO	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75175	Samples

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSELETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**TAPE AND REEL INFORMATION**

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


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN65175DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN75175DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN75175DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN75175NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65175DR	SOIC	D	16	2500	340.5	336.1	32.0
SN75175DR	SOIC	D	16	2500	356.0	356.0	35.0
SN75175DR	SOIC	D	16	2500	340.5	336.1	32.0
SN75175NSR	SO	NS	16	2000	356.0	356.0	35.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN65175D	D	SOIC	16	40	507	8	3940	4.32
SN75175D	D	SOIC	16	40	506.6	8	3940	4.32
SN75175D	D	SOIC	16	40	507	8	3940	4.32
SN75175DE4	D	SOIC	16	40	506.6	8	3940	4.32
SN75175DE4	D	SOIC	16	40	507	8	3940	4.32
SN75175N	N	PDIP	16	25	506	13.97	11230	4.32

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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



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



# PACKAGE OUTLINE

## NS0016A

### SOP - 2.00 mm max height

SOP



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



4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

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

# EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



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

4220735/A 12/2021

NOTES: (continued)

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

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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