

# SN55173, SN65173, SN75173 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

SLLS144E – OCTOBER 1980 – REVISED APRIL 2000

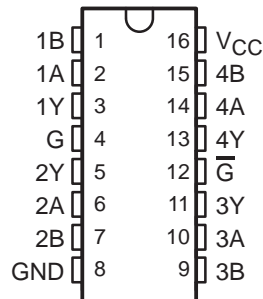
- Meet or Exceed the Requirements of TIA/EIA-422-B, TIA/EIA-423-B, and TIA/EIA-485-A and ITU Recommendations V.10, V.11, X.26, and X.27
- Designed for Multipoint Bus Transmission on Long Bus Lines in Noisy Environments
- 3-State Outputs
- Common-Mode Input Voltage Range of  $-12\text{ V}$  to  $12\text{ V}$
- Input Sensitivity . . .  $\pm 200\text{ mV}$
- Input Hysteresis . . .  $50\text{ mV Typ}$
- High Input Impedance . . .  $12\text{ k}\Omega\text{ Min}$
- Operate From Single 5-V Supply
- Low Power Requirements
- Pin-to-Pin Replacement for AM26LS32

## description

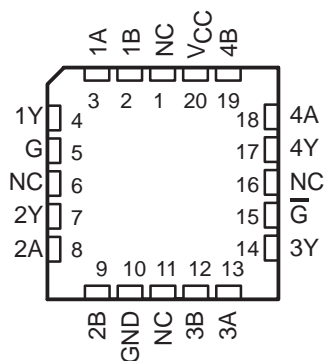
The SN55173, SN65173, and SN75173 are monolithic quadruple differential line receivers with 3-state outputs. They are designed to meet the requirements of TIA/EIA-422-B, TIA/EIA-423-B, TIA/EIA-485-A, and several ITU recommendations. The standards are for balanced multipoint bus transmission at rates up to 10 megabits per second. The four receivers share two OR enable inputs, one active when high, the other active when low. These devices feature high input impedance, input hysteresis for increased noise immunity, and input sensitivity of  $\pm 200\text{ mV}$  over a common-mode input voltage range of  $-12\text{ V}$  to  $12\text{ V}$ . Fail-safe design specifies that if the inputs are open circuited, the outputs are always high. The SN65173 and SN75173 are designed for optimum performance when used with the SN75172 or SN75174 quad differential line drivers.

The SN55173 is characterized over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN65173 is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ . The SN75173 is characterized for operation from  $0^\circ\text{C}$  to  $70^\circ\text{C}$ .

SN55173 . . . J PACKAGE  
SN65173, SN75173 . . . D OR N PACKAGE  
(TOP VIEW)



SN55173 . . . FK PACKAGE  
(TOP VIEW)



NC—No internal connection

**THE SN55173 IS NOT RECOMMENDED  
FOR NEW DESIGNS.**



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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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# SN55173, SN65173, SN75173 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

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## AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGED DEVICES			
	PLASTIC SMALL OUTLINE (D)	PLASTIC CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)
0°C to 70°C	SN75173D	—	—	SN75173N
–40°C to 85°C	SN65173D	—	—	SN65173N
–55°C to 125°C	—	SN55173FK	SN55173J	—

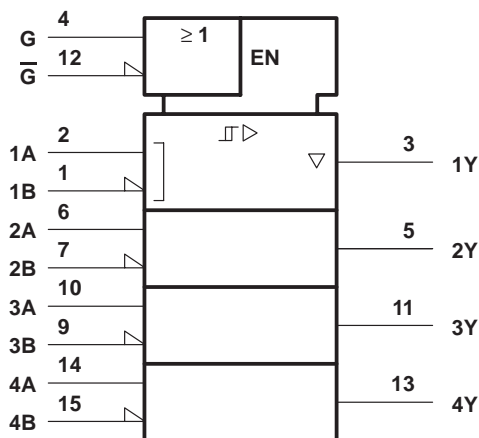
The D package is available taped and reeled. Add the suffix R to the device type (e.g., SN75173DR).

## FUNCTION TABLE (each receiver)

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

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

## logic symbol †

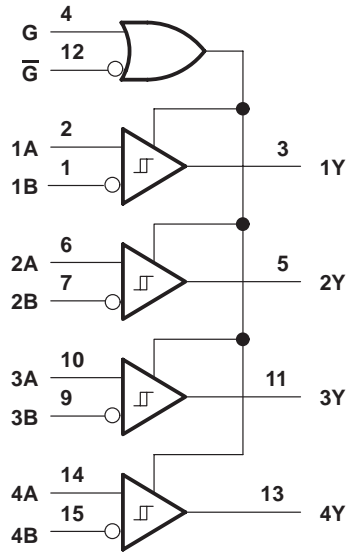


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the D, J, and N packages.

# SN55173, SN65173, SN75173 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

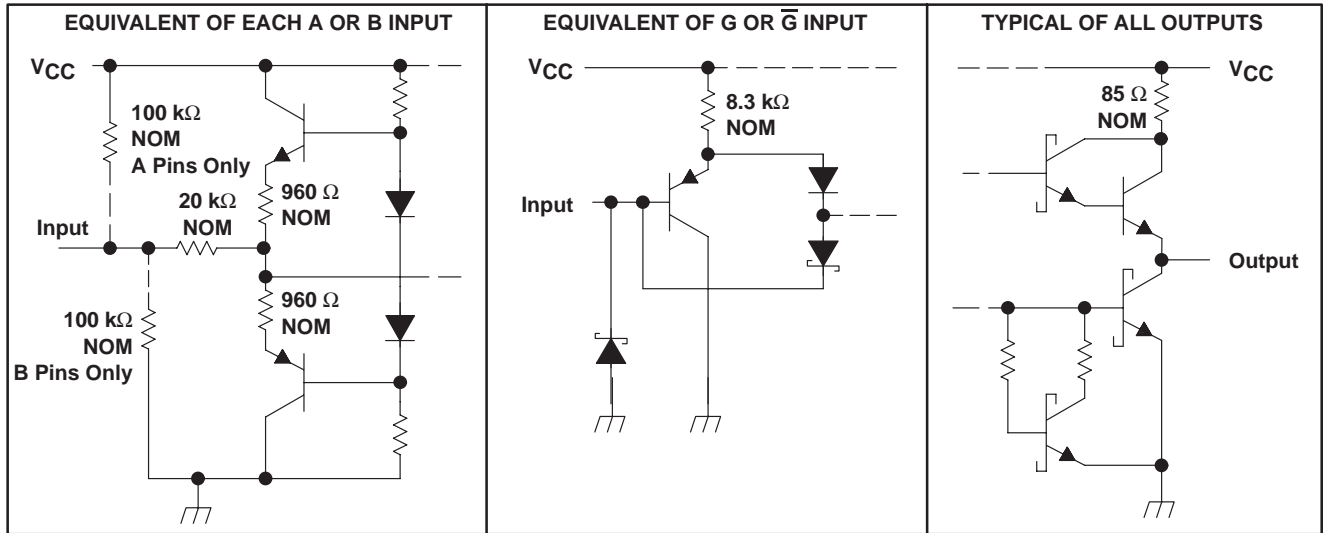
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## logic diagram (positive logic)



Pin numbers shown are for the D, J, and N packages.

## schematics of inputs and outputs



# SN55173, SN65173, SN75173 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 ( $V_I$ or B inputs)	$\pm 25$ V
Differential input voltage, $V_{ID}$ (see Note 2)	$\pm 25$ V
Enable input voltage, $V_I$	7 V
Low-level output current, $I_{OL}$	50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 3): D package	73°C/W
N package	67°C/W
Continuous total dissipation	See Dissipation Rating Table
Case temperature for 60 seconds, $T_C$ : FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or N package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package	300°C
Storage temperature range, $T_{stg}$	-65°C to 150°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.  
 3. The package thermal impedance is calculated in accordance with JESD 51.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
FK	1375 mW	11 mW/°C	880 mW	275 mW
J	1375 mW	11 mW/°C	880 mW	275 mW

## recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, $V_{CC}$	SN55173	4.5	5	5.5	V
	SN65173, SN75173	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, $T_A$	SN55173	-55		125	°C
	SN65173	-40		85	
	SN75173	0		70	



# SN55173, SN65173, SN75173 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
$V_{IT+}$	Positive-going input threshold voltage	$V_O = 2.7\text{ V}$ ,	$I_O = -0.4\text{ mA}$			0.2	V
$V_{IT-}$	Negative-going input threshold voltage	$V_O = 0.5\text{ V}$ ,	$I_O = 16\text{ mA}$	$-0.2\ddagger$			V
$V_{hys}$	Hysteresis ( $V_{IT+} - V_{IT-}$ )	See Figure 4			50		mV
$V_{IK}$	Enable-input clamp voltage	$I_I = -18\text{ mA}$				-1.5	V
$V_{OH}$	High-level output voltage	$V_{ID} = 200\text{ mV}$ ,	$I_{OH} = -400\text{ }\mu\text{A}$	SN55173		2.5	V
				SN65173, SN75173		2.7	V
$V_{OL}$	Low-level output voltage	$V_{ID} = -200\text{ mV}$ ,	See Figure 1	$I_{OL} = 8\text{ mA}$		0.45	V
				$I_{OL} = 16\text{ mA}$		0.5	
$I_{OZ}$	High-impedance-state output current	$V_O = 0.4\text{ V to }2.4\text{ V}$				$\pm 20$	$\mu\text{A}$
$I_I$	Line input current	Other input at 0 V,	See Note 3	$V_I = 12\text{ V}$		1	mA
				$V_I = -7\text{ V}$		-0.8	
$I_{IH}$	High-level enable-input current	$V_{IH} = 2.7\text{ V}$				20	$\mu\text{A}$
$I_{IL}$	Low-level enable-input current	$V_{IL} = 0.4\text{ V}$				-100	$\mu\text{A}$
$r_i$	Input resistance				12		k $\Omega$
$I_{OS}$	Short-circuit output current			-15		-85	mA
$I_{CC}$	Supply current	Outputs disabled				70	mA

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

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

NOTE 3: Refer to TIA/EIA-422-B and TIA/EIA-423-B for exact conditions.

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

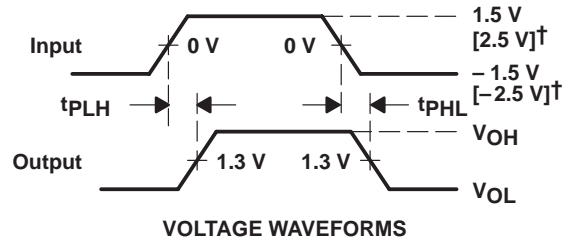
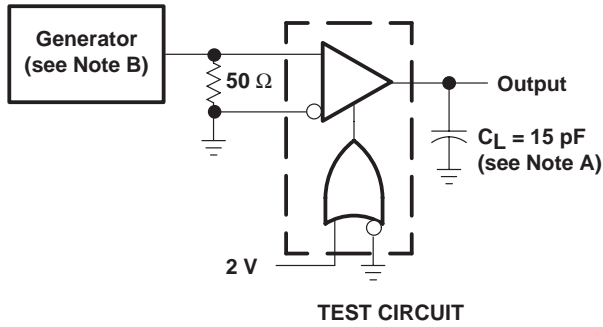
PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$t_{PLH}$	Propagation delay time, low-to-high-level output	$V_{ID} = -1.5\text{ V to }1.5\text{ V}$ ,			20	35	ns
$t_{PHL}$	Propagation delay time, high-to-low-level output	$C_L = 15\text{ pF}$ ,	See Figure 1		22	35	
$t_{PZH}$	Output enable time to high level	$C_L = 15\text{ pF}$ ,	See Figure 2		17	22	ns
$t_{PZL}$	Output enable time to low level	$C_L = 15\text{ pF}$ ,	See Figure 3		20	25	ns
$t_{PHZ}$	Output disable time from high level	$C_L = 5\text{ pF}$ ,	See Figure 2		21	30	ns
$t_{PLZ}$	Output disable time from low level	$C_L = 5\text{ pF}$ ,	See Figure 3		30	40	ns



# SN55173, SN65173, SN75173 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

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## PARAMETER MEASUREMENT INFORMATION

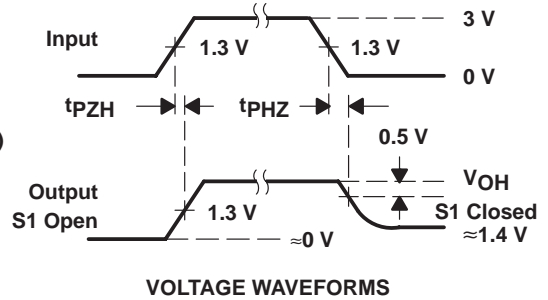
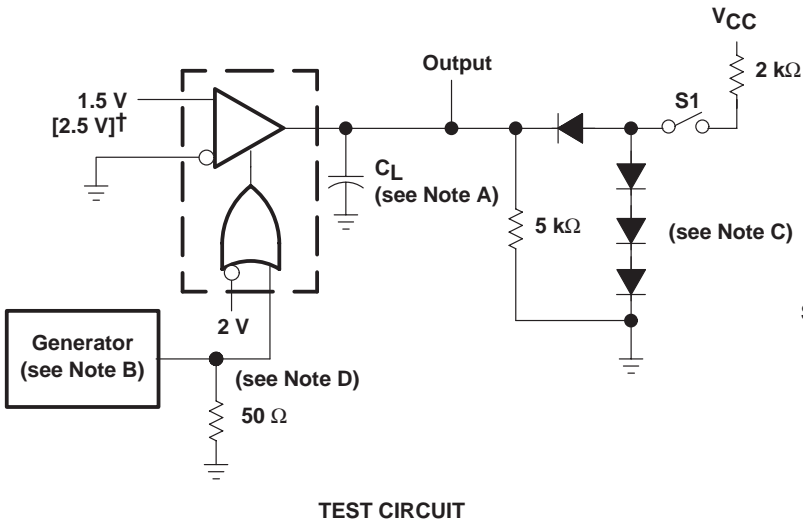


† Voltage for the SN55173 only.

NOTES: A.  $C_L$  includes probe and jig capacitance.

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

Figure 1.  $t_{PLH}$ ,  $t_{PHL}$  Test Circuit and Voltage Waveforms



† Voltage for the SN55173 only.

NOTES: A.  $C_L$  includes probe and jig capacitance.

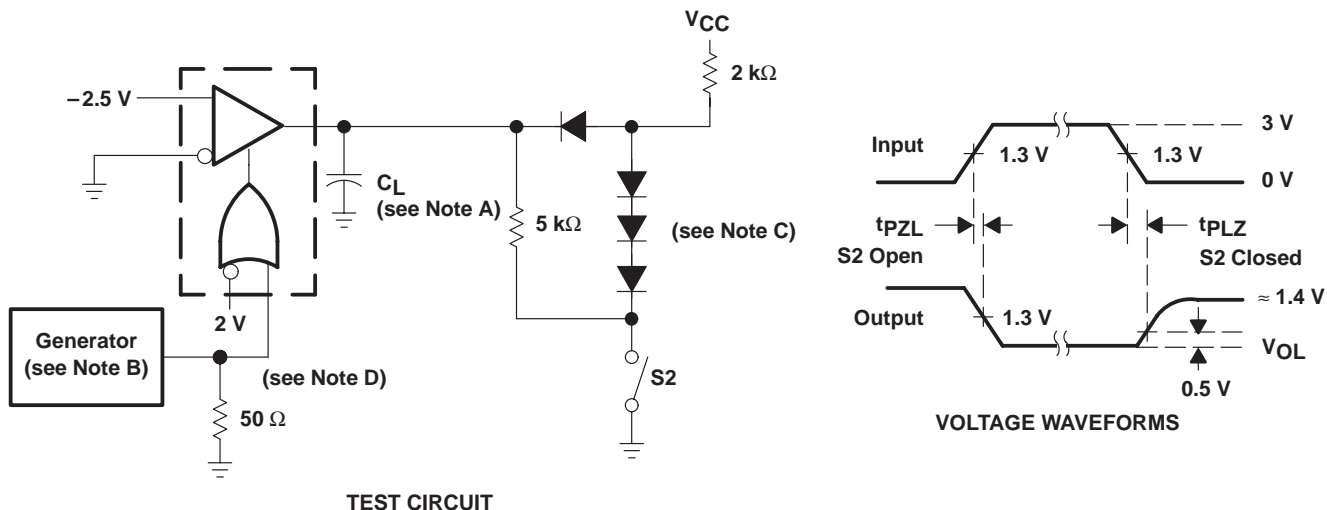
B. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_0 = 50 \Omega$ .

C. All diodes are 1N916, or equivalent.

D. To test the active-low enable  $\overline{G}$ , ground G and apply an inverted input waveform to  $\overline{G}$ .

Figure 2.  $t_{PHZ}$ ,  $t_{PZH}$  Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. The input pulse is supplied by a generator having the following characteristics: PRR = 1 MHz, duty cycle = 50%,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_O = 50 \Omega$ .  
 C. All diodes are 1N916, or equivalent.  
 D. To test the active-low enable  $\overline{G}$ , ground G and apply an inverted input waveform to  $\overline{G}$ .

Figure 3.  $t_{pZL}$ ,  $t_{pLZ}$  Test Circuit and Voltage Waveforms

# SN55173, SN65173, SN75173 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

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## TYPICAL CHARACTERISTICS†

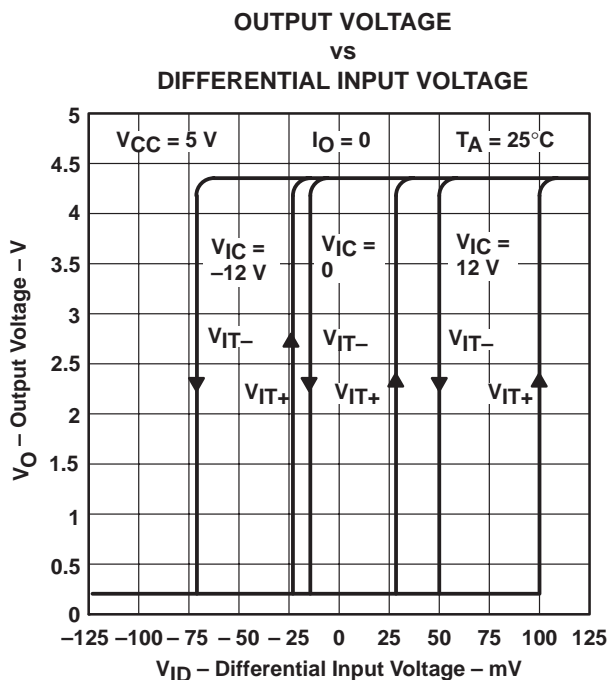


Figure 4

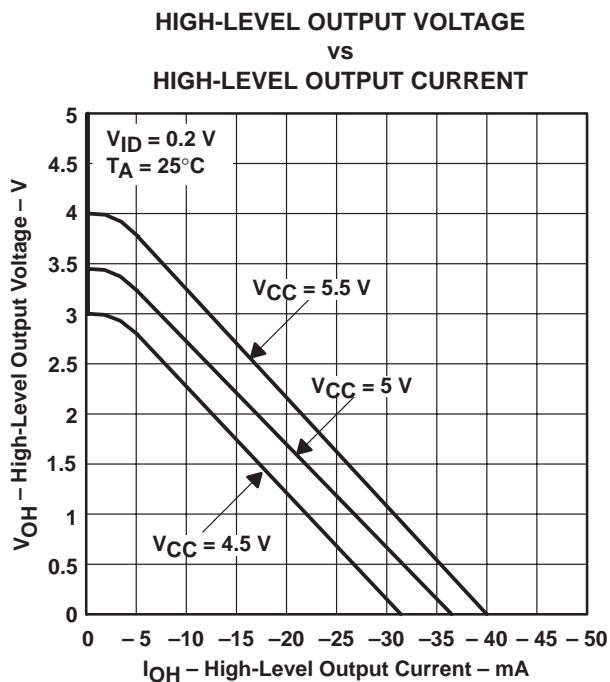


Figure 5

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.



TYPICAL CHARACTERISTICS†

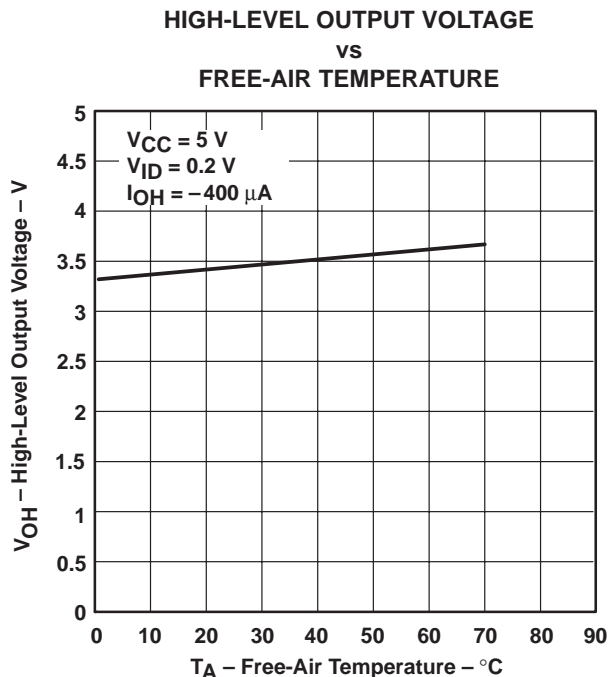


Figure 6

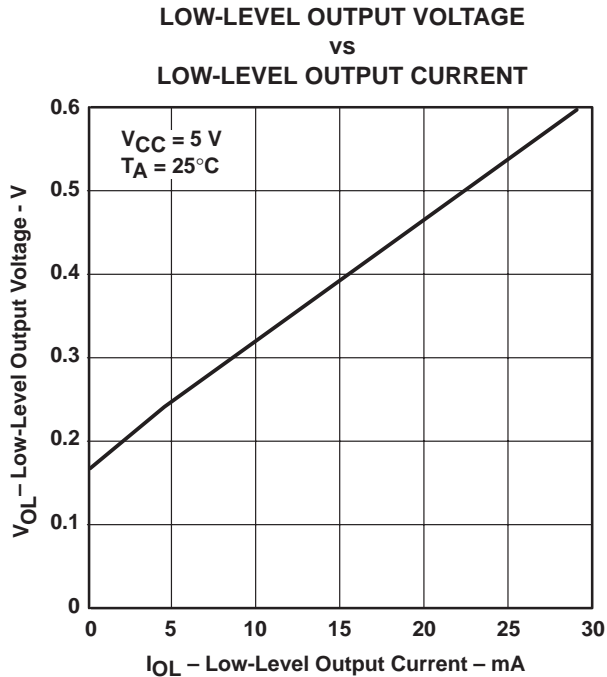


Figure 7

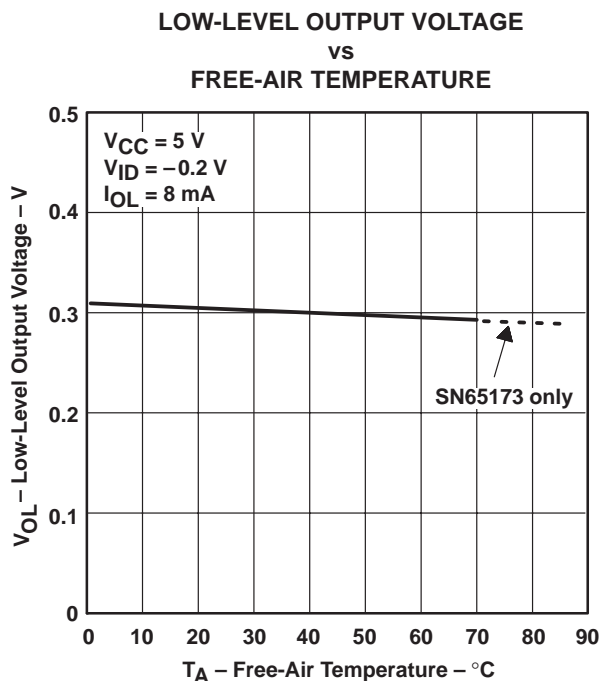


Figure 8

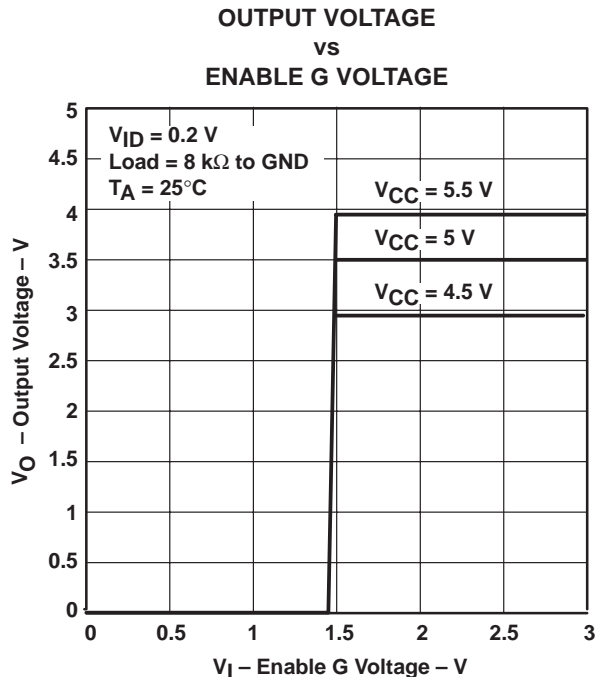


Figure 9

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

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## TYPICAL CHARACTERISTICS

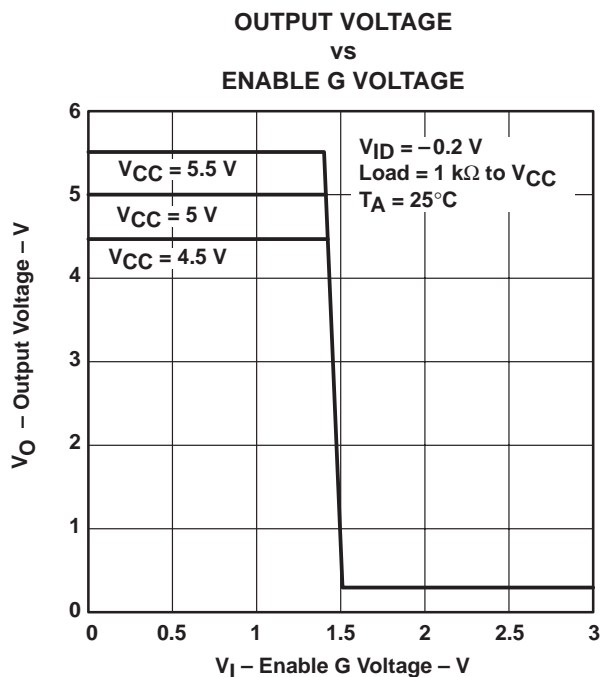


Figure 10

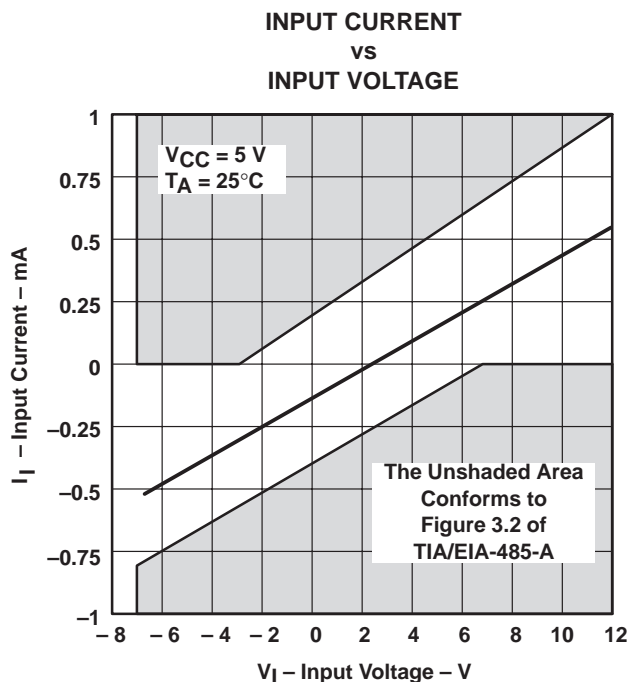
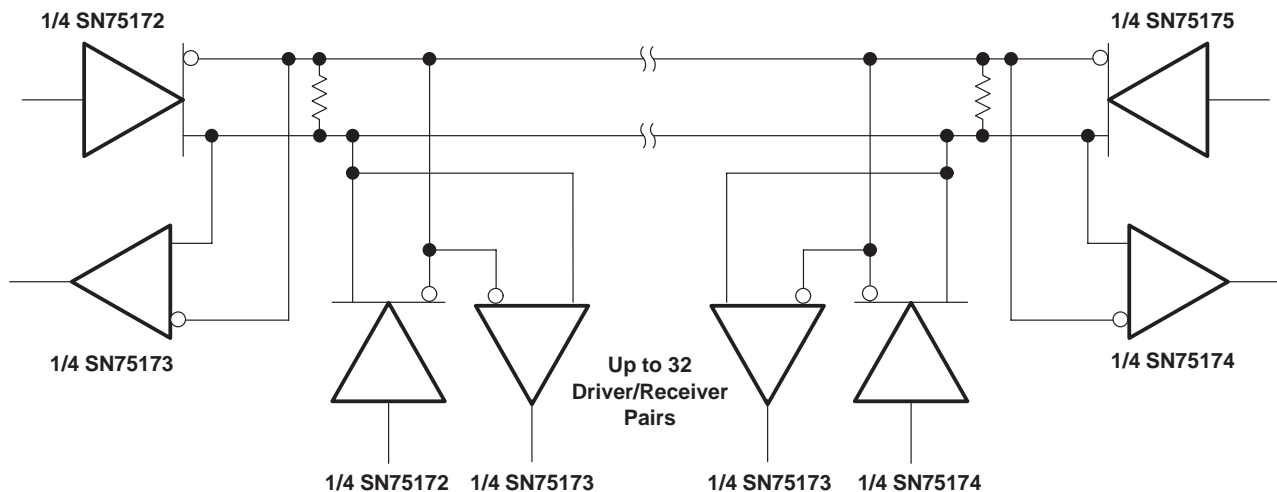


Figure 11

## APPLICATION INFORMATION



NOTE A: The line should be terminated at both ends in its characteristic impedance. Stub lengths off the main line should be kept as short as possible.

Figure 12. Typical Application Circuit

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN55173J	ACTIVE	CDIP	J	16	1	TBD	Call TI	N / A for Pkg Type	-55 to 125	SN55173J	<a href="#">Samples</a>
SN75173D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75173	<a href="#">Samples</a>
SN75173DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75173	<a href="#">Samples</a>
SN75173N	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	NIPDAU	N / A for Pkg Type	0 to 70	SN75173N	<a href="#">Samples</a>
SN75173NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM	0 to 70	SN75173	<a href="#">Samples</a>
SNJ55173J	ACTIVE	CDIP	J	16	1	TBD	Call TI	N / A for Pkg Type	-55 to 125	SNJ55173J	<a href="#">Samples</a>

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

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

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

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

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

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

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

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

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

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

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

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

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

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**OTHER QUALIFIED VERSIONS OF SN55173, SN75173 :**

- Catalog: [SN75173](#)
- Military: [SN55173](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**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
SN75173DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN75173NSR	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)
SN75173DR	SOIC	D	16	2500	333.2	345.9	28.6
SN75173NSR	SO	NS	16	2000	367.0	367.0	38.0

J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package is hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

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.
  - C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - D The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002





D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  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.
  -  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.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

# 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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