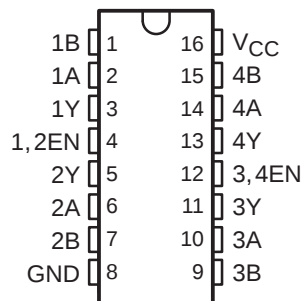


# SN65175, SN75175 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

SLLS145B – OCTOBER 1990 – REVISED MAY 1995

- 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<br>A – B       | ENABLE | OUTPUT<br>Y |
|-----------------------------|--------|-------------|
| $V_{ID} \geq 0.2$ V         | H      | H           |
| $-0.2$ V $< V_{ID} < 0.2$ V | H      | ?           |
| $V_{ID} \geq -0.2$ 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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**TEXAS  
INSTRUMENTS**

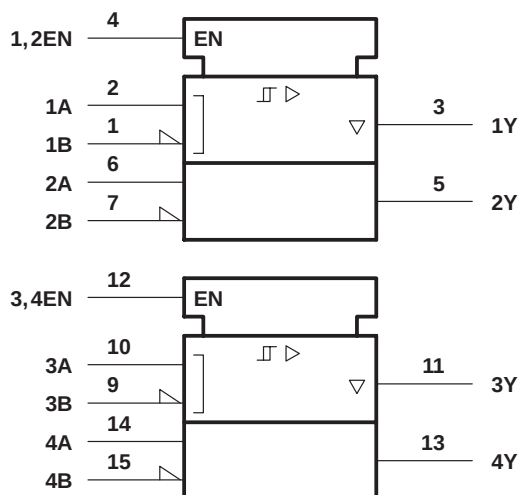
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# SN65175, SN75175 QUADRUPLE DIFFERENTIAL LINE RECEIVERS

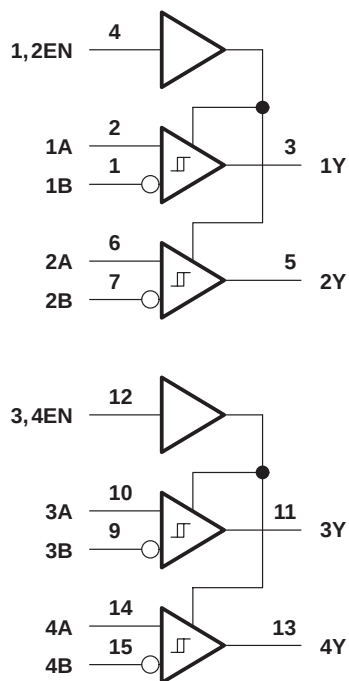
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## logic symbol†

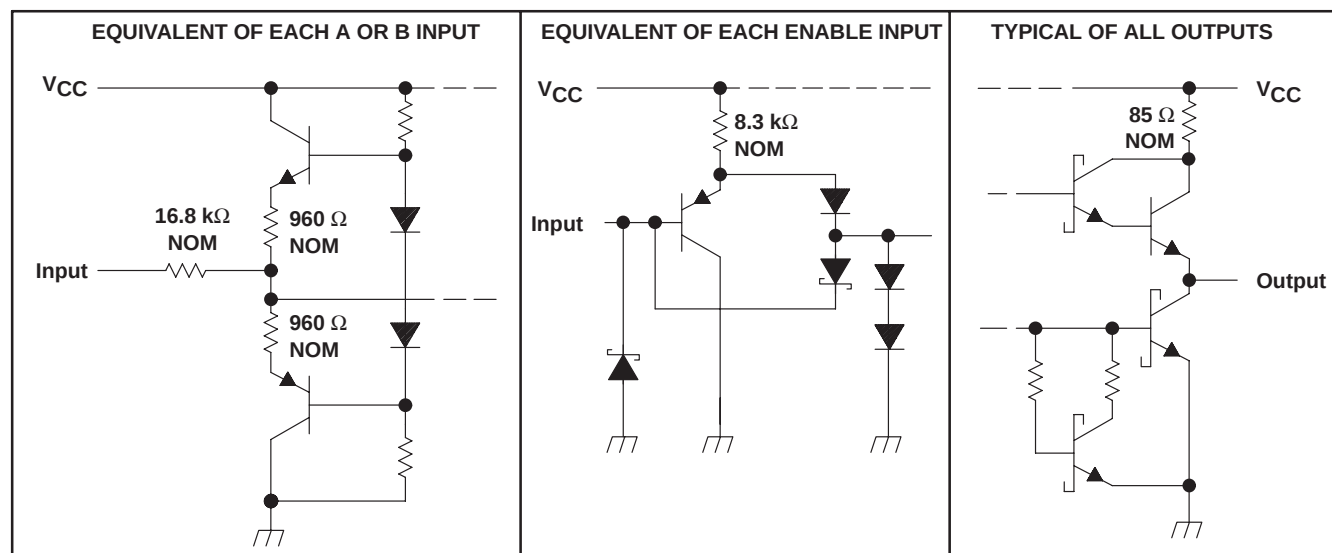


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## logic diagram (positive logic)



## 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)<sup>†</sup>

|                                                              |                                                |
|--------------------------------------------------------------|------------------------------------------------|
| 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        | $-40^{\circ}\text{C}$ to $85^{\circ}\text{C}$  |
| SN75175                                                      | $0^{\circ}\text{C}$ to $70^{\circ}\text{C}$    |
| Storage temperature range, $T_{stg}$                         | $-65^{\circ}\text{C}$ to $150^{\circ}\text{C}$ |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | $260^{\circ}\text{C}$                          |

<sup>†</sup> 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 | $T_A \leq 25^{\circ}\text{C}$<br>POWER RATING | DERATING<br>FACTOR         | $T_A = 70^{\circ}\text{C}$<br>POWER RATING | $T_A = 85^{\circ}\text{C}$<br>POWER RATING |
|---------|-----------------------------------------------|----------------------------|--------------------------------------------|--------------------------------------------|
| D       | 950 mW                                        | 7.6 mW/ $^{\circ}\text{C}$ | 608 mW                                     | 494 mW                                     |
| N       | 1150 mW                                       | 9.2 mW/ $^{\circ}\text{C}$ | 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       | $^{\circ}\text{C}$ |
|                                           | 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 <sup>†</sup> | 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 voltage ( $V_{IT+} - V_{IT-}$ ) | 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                   | $V_{ID} = 200\text{ mV}$ , $I_{OH} = -400\text{ }\mu\text{A}$ , See Figure 1 | 2.7               |                  |          | V             |
| $V_{OL}$ Low-level output voltage                    | $V_{ID} = -200\text{ mV}$ , See Figure 1                                     |                   |                  | 0.45     | V             |
|                                                      |                                                                              |                   |                  | 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                                               |                   |                  | 1        | mA            |
|                                                      |                                                                              |                   |                  | -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 <sup>§</sup>   |                                                                              | -15               |                  | -85      | mA            |
| $I_{CC}$ Supply current                              | Outputs disabled                                                             |                   |                  | 70       | mA            |

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

<sup>‡</sup> 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.

<sup>§</sup> 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,  $V_{CC} = 5\text{ V}$ ,  $C_L = 15\text{ pF}$ ,  $T_A = 25^\circ\text{C}$**

| PARAMETER                                                   | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-------------------------------------------------------------|-----------------|-----|-----|-----|------|
| $t_{PLH}$ Propagation delay time, low- to high-level output | See Figure 2    |     | 22  | 35  | ns   |
| $t_{PHL}$ Propagation delay time, high- to low-level output |                 |     | 25  | 35  | ns   |
| $t_{PZH}$ Output enable time to high level                  | See Figure 3    |     | 13  | 30  | ns   |
| $t_{PZL}$ Output enable time to low level                   |                 |     | 19  | 30  | ns   |
| $t_{PHZ}$ Output disable time from high level               | See Figure 3    |     | 26  | 35  | ns   |
| $t_{PLZ}$ Output disable time from low level                |                 |     | 25  | 35  | ns   |

## PARAMETER MEASUREMENT INFORMATION

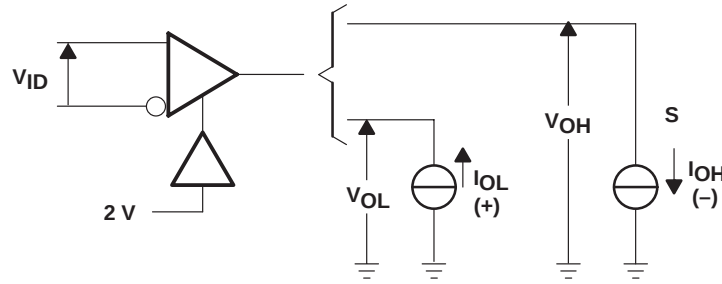
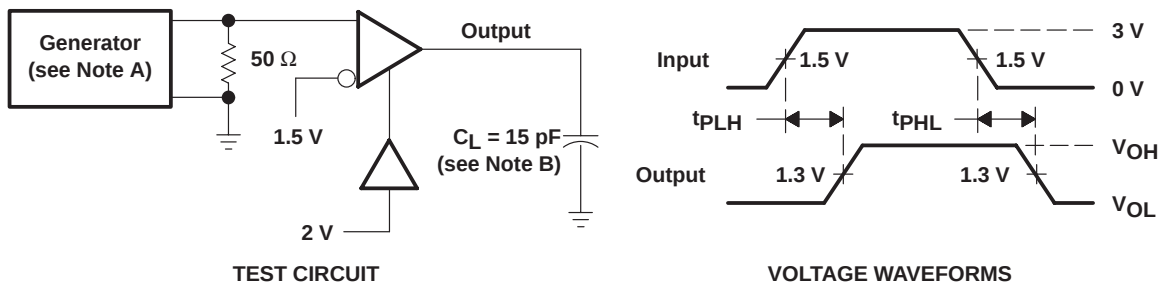


Figure 1.  $V_{OH}$ ,  $V_{OL}$



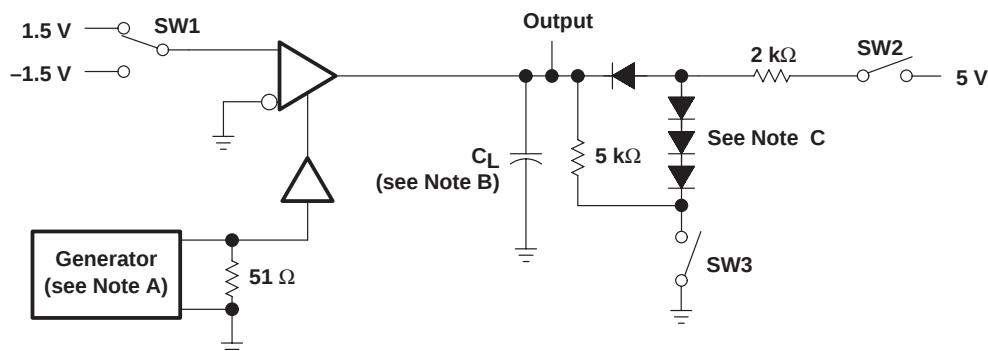
- NOTES: A. The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 1 \text{ MHz}$ , duty cycle = 50%,  $t_r \leq 6 \text{ ns}$ ,  $t_f \leq 6 \text{ ns}$ ,  $Z_O = 50 \Omega$ .  
B.  $C_L$  includes probe and stray capacitance.

Figure 2. Test Circuit and Voltage Waveforms

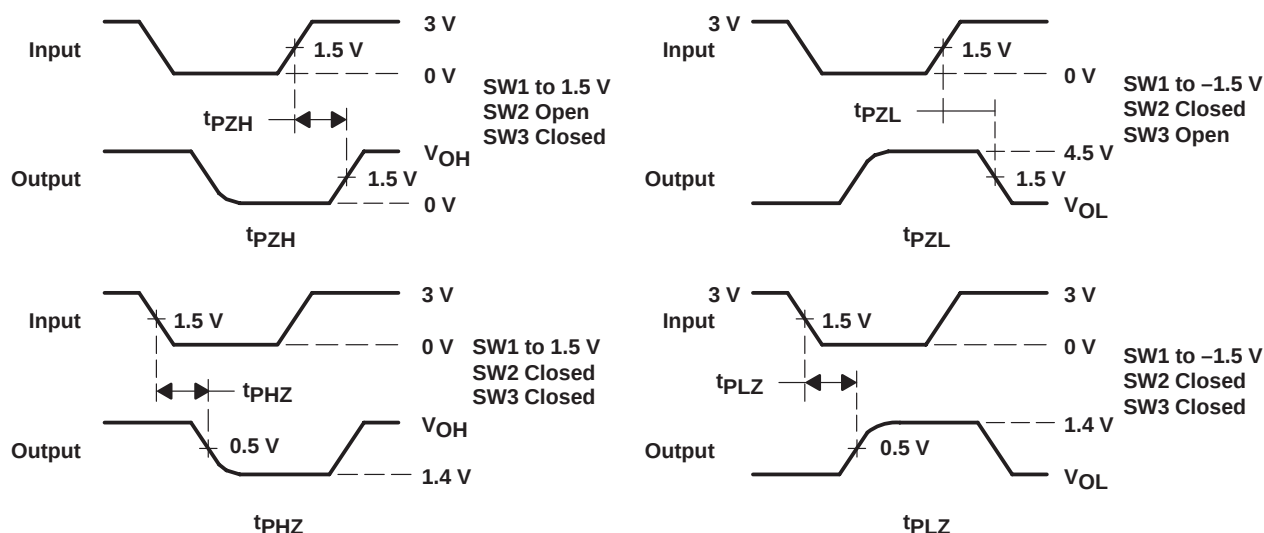
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## PARAMETER MEASUREMENT INFORMATION



## TEST CIRCUIT



## VOLTAGE WAVEFORMS

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

Figure 3. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

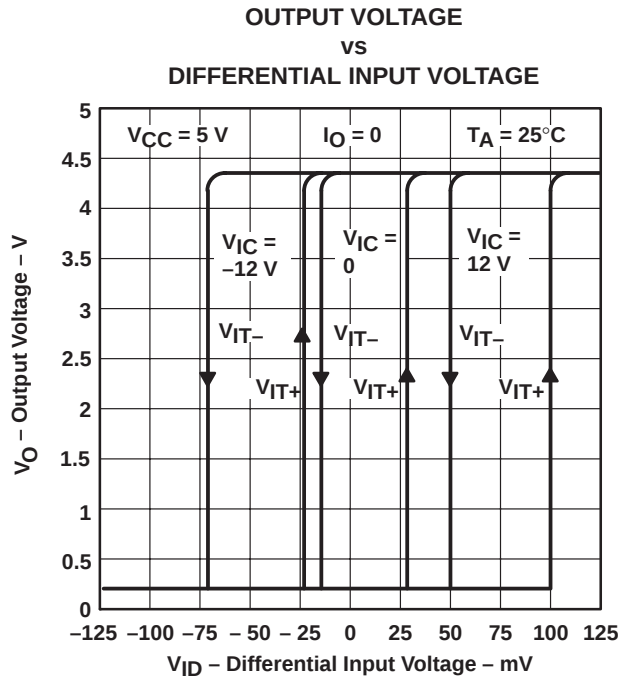


Figure 4

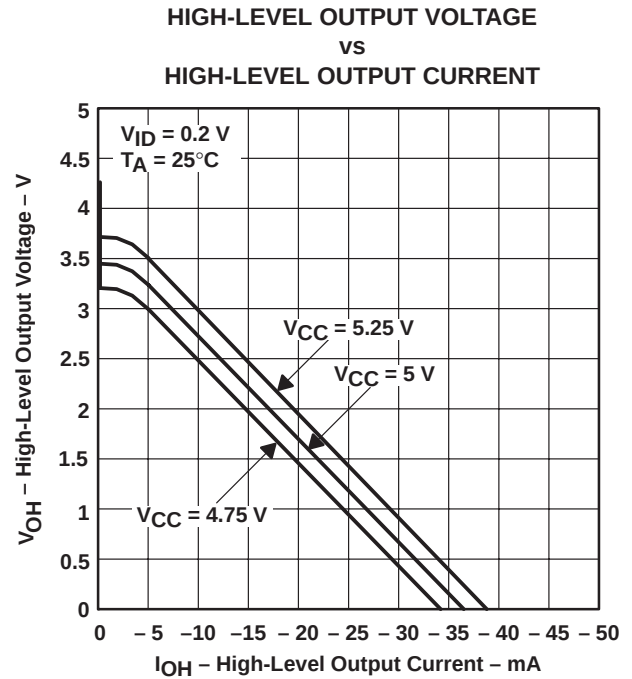


Figure 5

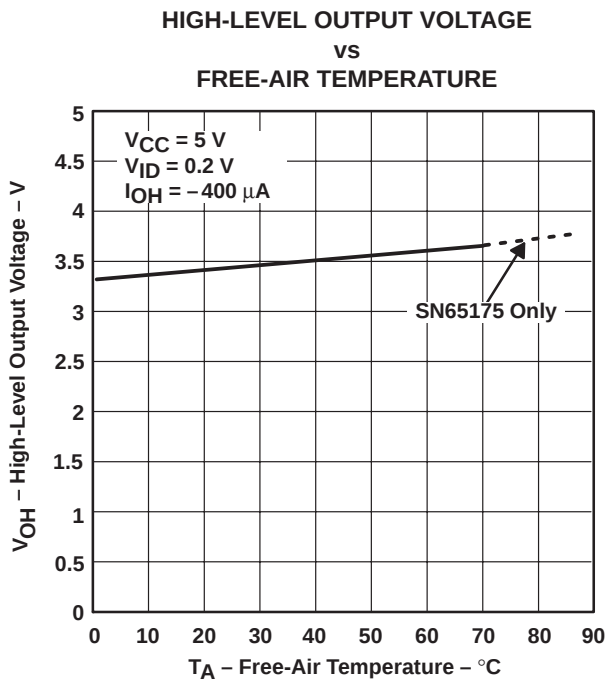


Figure 6

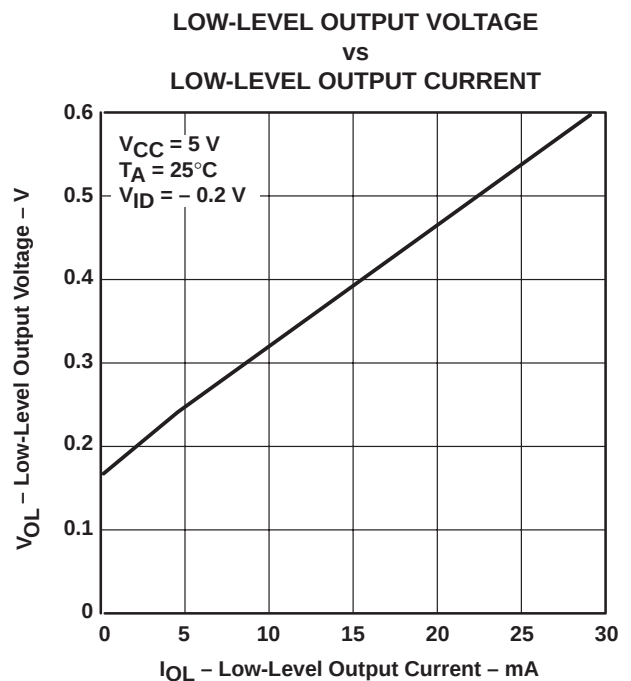


Figure 7

SN65175, SN75175  
QUADRUPLE DIFFERENTIAL LINE RECEIVERS

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TYPICAL CHARACTERISTICS

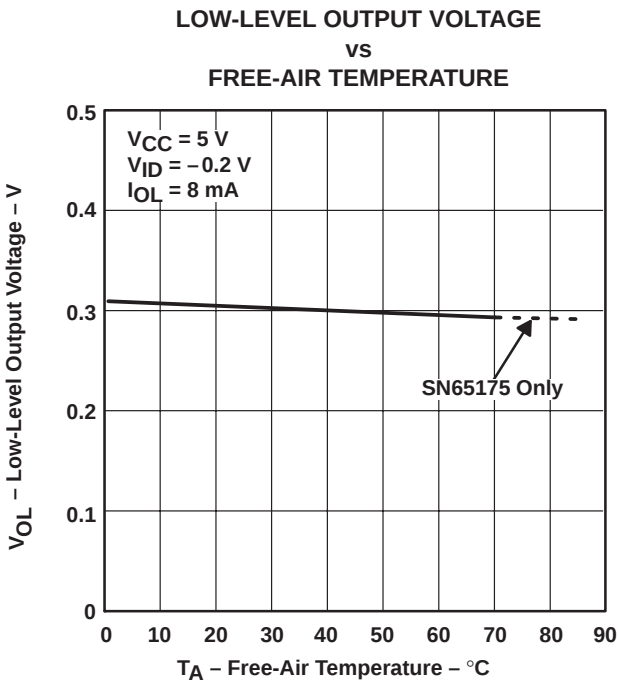


Figure 8

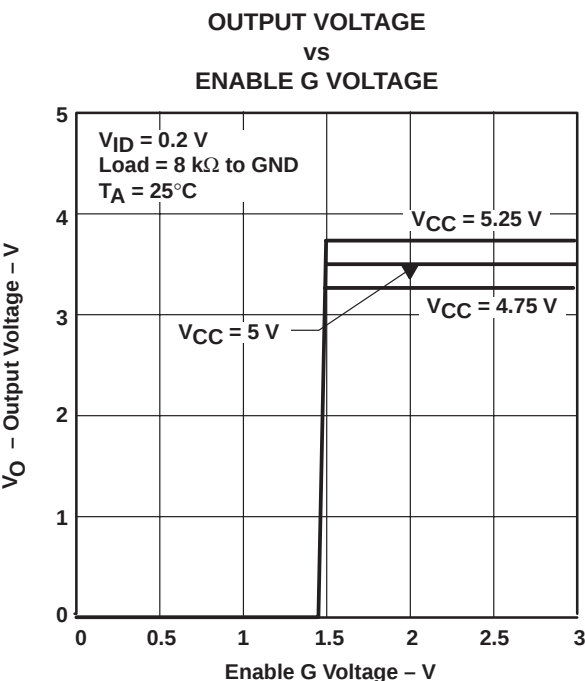


Figure 9

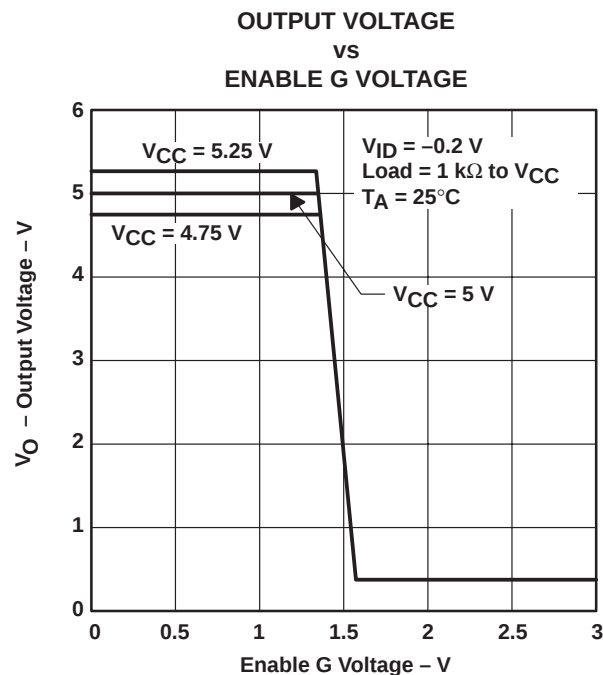


Figure 10

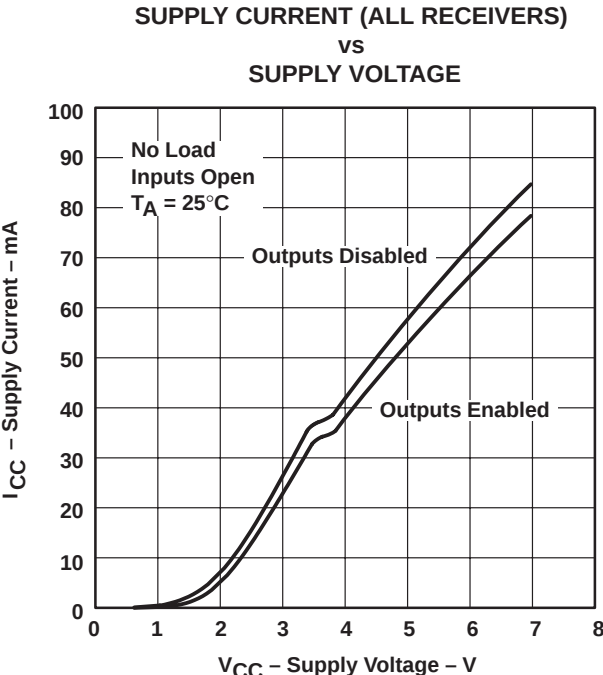
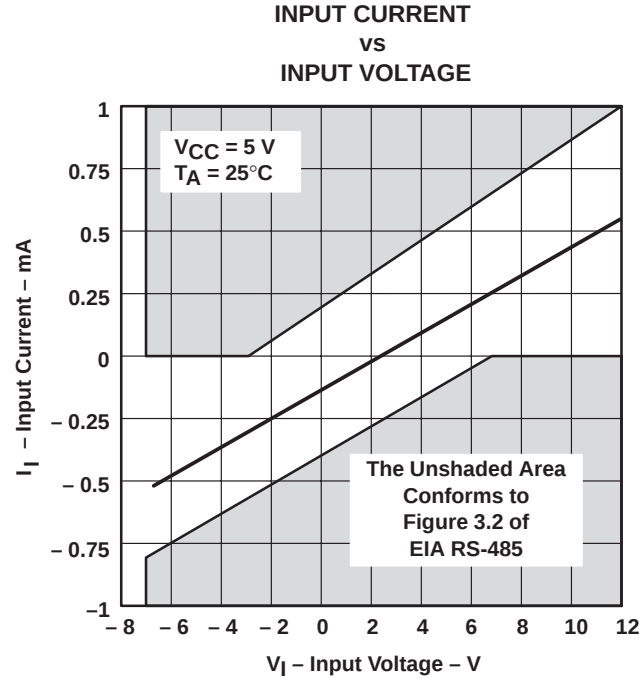
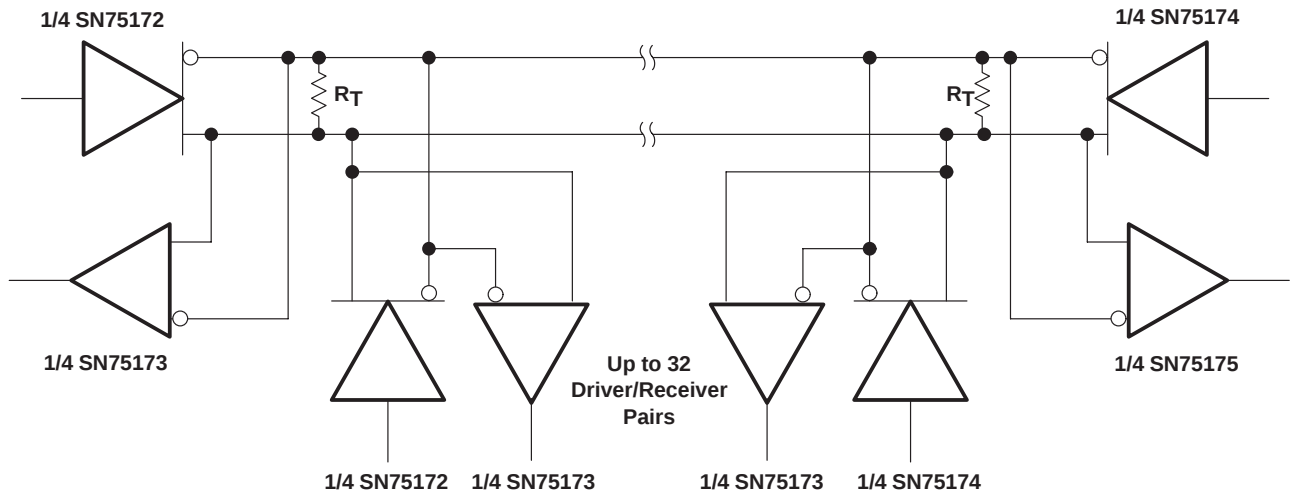


Figure 11

## 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

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