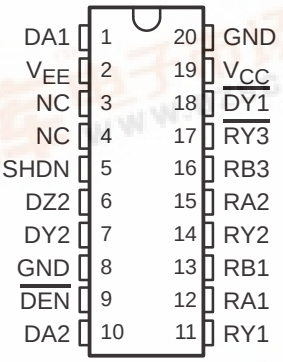
SLLS226A – APRIL 1996 – REVISED NOVEMBER 1997

- **Supports a 9-Pin GeoPort™ Host Interface Standard for the Intelligent Network Port**
- **Designed to Operate up to 4-Mbit/s Full Duplex**
- **±5 V Supply Operation**
- **Provides 6 kV ESD Protection**
- **Has Driver Short-Circuit Protection**
- **Includes Failsafe Mechanism for Open Inputs**
- **Is Backward Compatible with AppleTalk™ and LocalTalk™**
- **Combines Multiple Components into a Single Chip Solution**
- **Complements the SN75LBC772 9-Pin GeoPort Peripheral (DCE) Interface Device**
- **Uses LinBiCMOS™ Process Technology**

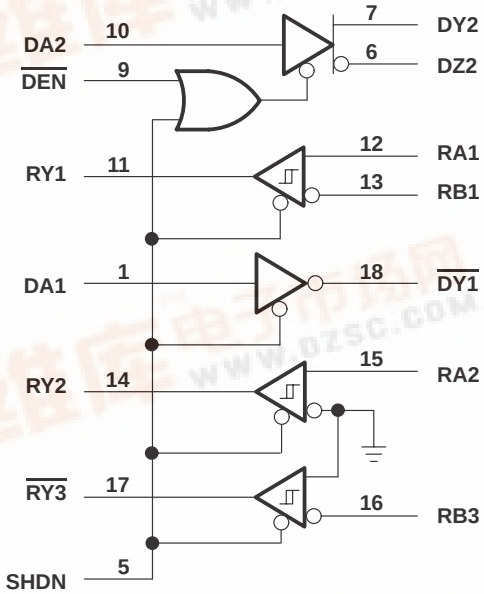
**DW PACKAGE**
**(TOP VIEW)**




## description

The SN75LBC771 is a low-power LinBiCMOS™ device that incorporates the drivers and receivers for a 9-pin GeoPort host interface. GeoPort combines hybrid EIA/TIA-422-B and EIA/TIA-423-B drivers and receivers to transmit data up to four-Mbit/s full duplex. GeoPort is a serial communications standard that is intended to replace the RS-232, AppleTalk, and printer ports all in one connector in addition to providing real-time data transfer capability. The SN75LBC771 provides point-to-point connections between GeoPort-compatible devices with data transmission rates up to 4-Mbit/s full duplex featuring a hot-plug capability. Applications include connection to telephone, ISDN, digital sound and imaging, fax-data modems, and other traditional serial and parallel connections. The GeoPort is backwardly compatible to both LocalTalk and AppleTalk.

## logic diagram (positive logic)




While the SN75LBC771 is powered off ($V_{CC}$ and $V_{EE}$ = 0), the outputs are in a high-impedance state. Also, when the shutdown (SHDN) terminal is high, all outputs go into a high-impedance state. A logic high on the driver enable ($\overline{DEN}$) terminal places the outputs of the differential driver into a high-impedance state. All drivers and receivers have fail-safe mechanisms that ensure a high output state when the inputs are left open.

The SN75LBC771 is characterized for operation over the 0°C to 70°C temperature range.

**FUNCTION TABLES†**

| SINGLE-ENDED DRIVER | | |
|---|---|---|
| **INPUT (DA1)** | **ENABLE (SHDN)** | **OUTPUT ($\overline{DY1}$)** |
| H | L | L |
| L | L | H |
| OPEN | L | L |
| X | H | Z |
| X | OPEN | Z |

| DIFFERENTIAL DRIVER | | | | |
|---|---|---|---|---|
| **INPUT (DA2)** | **ENABLE** | | **OUTPUT** | |
| | **(SHDN)** | **($\overline{DEN}$)** | **(DY2)** | **(DZ2)** |
| H | L | L | H | L |
| L | L | L | L | H |
| OPEN | L | L | H | L |
| X | H | X | Z | Z |
| X | OPEN | X | Z | Z |
| X | X | H | Z | Z |
| X | X | OPEN | Z | Z |

| SINGLED-ENDED RECEIVER | | | |
|---|---|---|---|
| **INPUT (RA2, RA3)** | **ENABLE (SHDN)** | **OUTPUT (RY2)** | **(RY3)** |
| H | L | H | L |
| L | L | L | H |
| OPEN | L | H | H |
| SHORT‡ | L | ? | ? |
| X | H | Z | Z |
| X | OPEN | Z | Z |

| DIFFERENTIAL RECEIVER | | | |
|---|---|---|---|
| **INPUT (RA1)** | **(RB1)** | **ENABLE (SHDN)** | **OUTPUT (RY1)** |
| H | L | L | H |
| L | H | L | L |
| OPEN | | L | H |
| SHORT‡ | | L | ? |
| X | X | H | Z |
| X | X | OPEN | Z |

† H = high level, L = low level, X = irrelevant, ? = indeterminate, Z = high impedance (off)
‡ $-0.2\ V < V_{ID} < 0.2\ V$

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

Positive supply voltage range, $V_{CC}$ (see Note 1) . . . . . –0.5 to 7 V
Negative supply voltage range, $V_{EE}$ (see Note 1) . . . . . –7 to 0.5 V
Receiver input voltage range (RA, RB) . . . . . –15 V to 15 V
Receiver differential input voltage range, $V_{ID}$ . . . . . –12 V to 12 V
Receiver output voltage range (RY) . . . . . –0.5 V to 5.5 V
Driver output voltage range (Power Off) ($\overline{DY1}$, DY2, DZ2) . . . . . –15 V to 15 V
Driver output voltage range (Power On) ($\overline{DY1}$, DY2, DZ2) . . . . . –11 V to 11 V
Driver input voltage range (DA, SHDN, $\overline{DEN}$) . . . . . –0.5 V to $V_{CC}$ +0.4 V
Electrostatic Discharge (see Note 2)
(All pins) Class 3, A . . . . . 6 kV
(All pins) Class 3, B . . . . . 500 V
Continuous total power dissipation . . . . . See Dissipation Rating Table
Operating free-air temperature range, $T_A$ . . . . . 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 are with respect to network ground terminal unless otherwise noted.
2. This rating is per MIL-STD-883C, Method 3015.7.

**DISSIPATION RATING TABLE**

| PACKAGE | $T_A \le 25°C$ POWER RATING | DERATING FACTOR ABOVE $T_A = 25°C$ | $T_A = 70°C$ POWER RATING |
|---|---|---|---|
| DW | 1125 mW | 9.0 mW/°C | 720 mW |

## recommended operating conditions

| | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|
| Positive supply voltage, $V_{CC}$ | 4.75 | 5 | 5.25 | V |
| Negative supply voltage, $V_{EE}$ | –5.25 | –5 | –4.75 | V |
| High-level input voltage, $V_{IH}$ (DA, SHDN, $\overline{DEN}$) | 2 | | | V |
| Low-level input voltage, $V_{IL}$ (DA, SHDN, $\overline{DEN}$) | | | 0.8 | V |
| Receiver common-mode input voltage, $V_{IC}$ | –7 | | 7 | V |
| Receiver differential input voltage, $V_{ID}$ | –12 | | 12 | V |
| Operating free-air temperature, $T_A$ | 0 | | 70 | °C |

## driver electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|
| $V_{OH}$ | High-level output voltage | Single-ended, See Figure 1 | $R_L$= 12 kΩ | | 3.6 | 4.5 | | V |
| | | | $R_L$= 120 Ω | | 2 | 3.6 | | V |
| $V_{OL}$ | Low-level output voltage | | $R_L$= 12 kΩ | | | –4.5 | –3.6 | V |
| | | | $R_L$ = 120 Ω | | | –3.6 | –2 | V |
| $\lvert V_{OD}\rvert$ | Magnitude of differential output voltage $\lvert V_{DY} - V_{DZ}\rvert$ | | $R_L$ = 120 Ω, | See Figure 2 | 4 | | | V |
| $\Delta\lvert V_{OD}\rvert$ | Change in differential voltage magnitude | | | | | | 250 | mV |
| $V_{OC}$ | Common-mode output voltage | | See Figure 3 | | –2 | | 2 | V |
| $\lvert\Delta V_{OC(SS)}\rvert$ | Magnitude of change, common-mode steady-state output voltage | | | | | | 200 | mV |
| $\lvert\Delta V_{OC(PP)}\rvert$ | Magnitude of change, common-mode peak-to-peak output voltage | | | | | 700 | | mV |
| $I_{CC}$ | Positive supply current | | SHDN = $\overline{DEN}$ = 0 V, | No Load | | 4 | 10 | mA |
| $I_{EE}$ | Negative supply current | | | | | –2 | –5 | mA |
| $I_{CC}$ | Positive supply current | | SHDN = $\overline{DEN}$ = 5 V, | No Load | | | 100 | µA |
| $I_{EE}$ | Negative supply current | | | | | | –100 | µA |
| $I_{OZ}$ | High-impedance output current | | $V_{CC}$ = 0 or 5 V, | $-10 \le V_O \le 10$ V | | | ±100 | µA |
| $I_{OS}$ | Short-circuit output current | | $V_{CC}$ = 5.25 V, See Note 3 | $-5$ V $\le V_O \le 5$ V, | | ±170 | ±450 | mA |

NOTE 3: Not more than one output should be shorted at one time.

## driver switching characteristics over operating free-air temperature range

| PARAMETER | | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $t_{PHL}$ | Propagation delay time, high-to-low level output | | Single ended, See Figure 4 | | 42 | 75 | ns |
| $t_{PLH}$ | Propagation delay time, low-to-high level output | | | | 41 | 75 | ns |
| $t_{PZL}$ | Driver output enable time to low-level output | SHDN | | | 25 | 100 | µs |
| $t_{PZH}$ | Driver output enable time to high-level output | SHDN | | | 25 | 100 | µs |
| $t_{PLZ}$ | Driver output disable time from low-level output | SHDN | | | 28 | 100 | ns |
| $t_{PHZ}$ | Driver output disable time from high-level output | SHDN | | | 37 | 100 | ns |
| $t_r$ | Rise time | | | 10 | 25 | 75 | ns |
| $t_f$ | Fall time | | | 10 | 23 | 75 | ns |
| $t_{PHL}$ | Propagation delay time, high-to-low level output | | Differential, See Figure 5 | | 40 | 75 | ns |
| $t_{PLH}$ | Propagation delay time, low-to-high level output | | | | 42 | 75 | ns |
| $t_{PZL}$ | Driver output enable time to low-level output | SHDN | | | 25 | 100 | µs |
| | | $\overline{DEN}$ | | | 29 | 150 | ns |
| $t_{PZH}$ | Driver output enable time to high-level output | SHDN | | | 25 | 100 | µs |
| | | $\overline{DEN}$ | | | 35 | 150 | ns |
| $t_{PLZ}$ | Driver output disable time from low-level output | SHDN | | | 28 | 100 | ns |
| | | $\overline{DEN}$ | | | 34 | 100 | ns |
| $t_{PHZ}$ | Driver output disable time from high-level output | SHDN | | | 37 | 100 | ns |
| | | $\overline{DEN}$ | | | 34 | 100 | ns |
| $t_r$ | Rise time | | | 10 | 27 | 75 | ns |
| $t_f$ | Fall time | | | 10 | 26 | 75 | ns |
| $t_{SK(p)}$ | Pulse skew, $\lvert t_{PLH} - t_{PHL} \rvert$ | | | | | 22 | ns |

## receiver electrical characteristics over recommended operating conditions (unless otherwise noted)

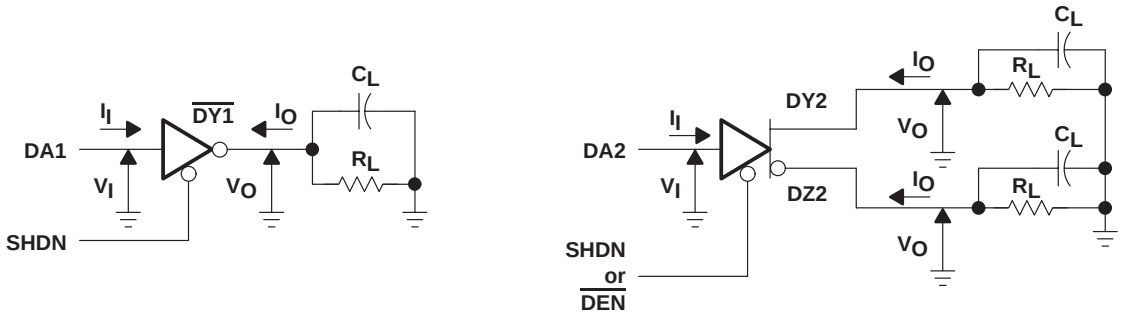
| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{IT+}$ | Positive-going input threshold voltage | See Figure 6 | | | 200 | mV |
| $V_{IT-}$ | Negative-going input threshold voltage | | –200 | | | mV |
| $V_{hys}$ | Differential input voltage hysteresis ($V_{IT+} - V_{IT-}$) | | | 50 | | mV |
| $V_{OH}$ | High-level output voltage (see Note 4) | $V_{IC}$ = 0, $I_{OH}$ = –2 mA, See Figure 6 | 2 | 4.5 | | V |
| $V_{OL}$ | Low-level output voltage | $V_{IC}$ = 0, $I_{OL}$ = 2 mA, See Figure 6 | | 0.4 | 0.8 | V |
| $I_{OS}$ | Short-circuit output current | $V_O$ = 0 | | –45 | –85 | mA |
| | | $V_O$ = 5.25 V | | 45 | 85 | mA |
| $R_{IN}$ | Input resistance | $V_{CC}$ = 0 or 5.25 V, –12 V ≤ $V_I$ ≤ 12 V | 6 | 30 | | kΩ |

NOTE 4: If the inputs are left unconnected, receivers one and two interpret this as a high-level input and receiver three interprets this as a low-level input so that all outputs are at the high level.

## receiver switching characteristics over recommended conditions (unless otherwise noted)

| PARAMETER | | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $t_{PHL}$ | Propagation delay time, high-to-low level output | | $R_L$ = 2 kΩ, $C_L$ = 15 pF, See Figure 6 | | 30 | 75 | ns |
| $t_{PLH}$ | Propagation delay time, low-to-high level output | | | | 30 | 75 | ns |
| $t_r$ | Rise time | | | | 15 | 30 | ns |
| $t_f$ | Fall time | | | | 15 | 30 | ns |
| $t_{SK(P)}$ | Pulse skew $\lvert t_{PLH}-t_{PHL}\rvert$ | | | | | 20 | ns |
| $t_{PZL}$ | Receiver output enable time to low-level output | Differential | $C_L$ = 50 pF, See Figure 7 | | 35 | 100 | ns |
| $t_{PZH}$ | Receiver output enable time to high-level output | | | | 35 | 100 | ns |
| $t_{PLZ}$ | Receiver output disable time from low-level output | | | | 20 | 100 | ns |
| $t_{PHZ}$ | Receiver output disable time from high-level output | | | | 20 | 100 | ns |
| $t_{PZL}$ | Receiver output enable time to low-level output | Single-ended | | | 12 | 25 | ns |
| $t_{PZH}$ | Receiver output enable time to high-level output | | | | 12 | 25 | µs |
| $t_{PLZ}$ | Receiver output disable time from low-level output | | | | 25 | 100 | µs |
| $t_{PHZ}$ | Receiver output disable time from high-level output | | | | 125 | 400 | ns |

## PARAMETER MEASUREMENT INFORMATION




NOTE A: $C_L$ = 50 pF

**Figure 1. Single-Ended Driver DC Parameter Test Circuits**

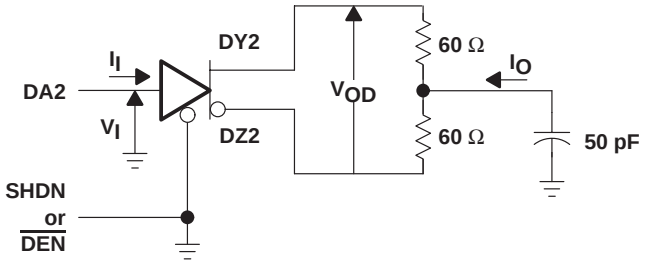
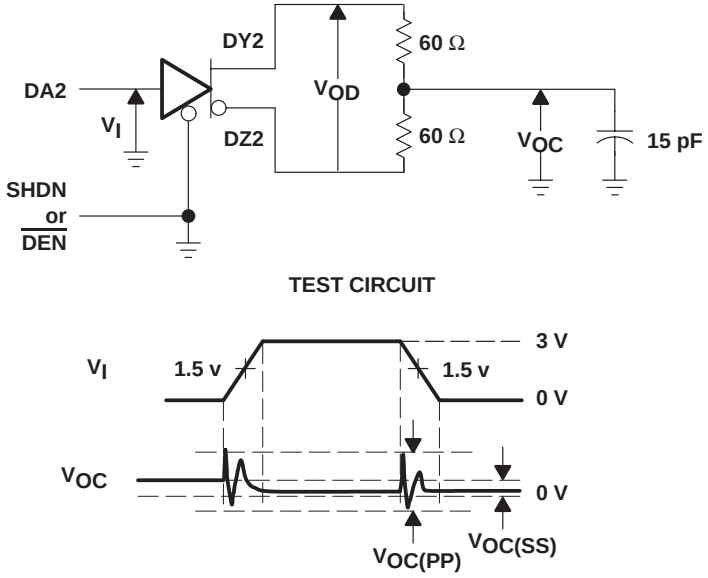


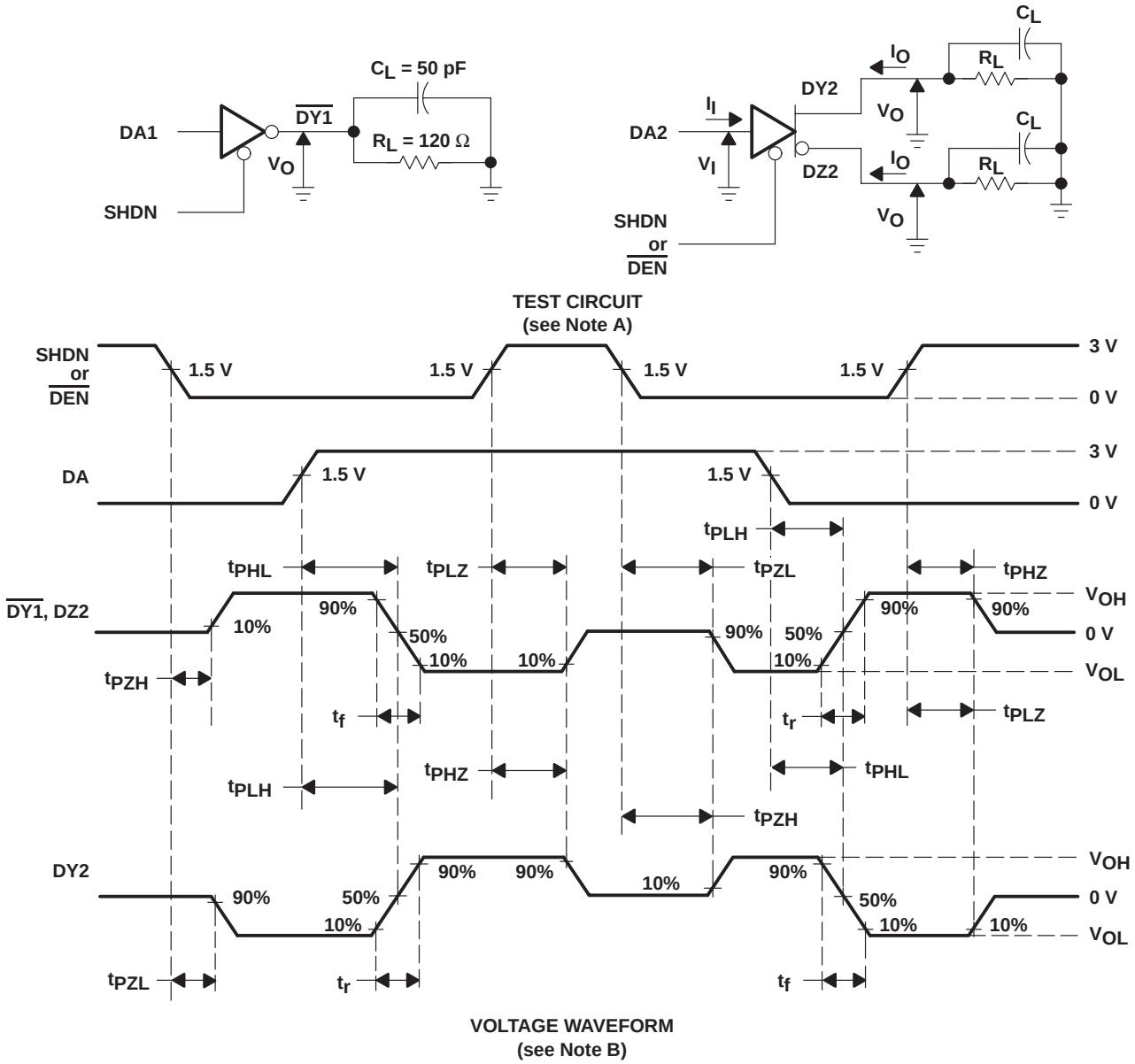

**Figure 2. Differential Driver DC Parameter Test Circuit**




NOTE A: Measured 3dB Bandwidth = 300 MHz

**Figure 3. Differential Driver Common-Mode Output Voltage Test Circuit**

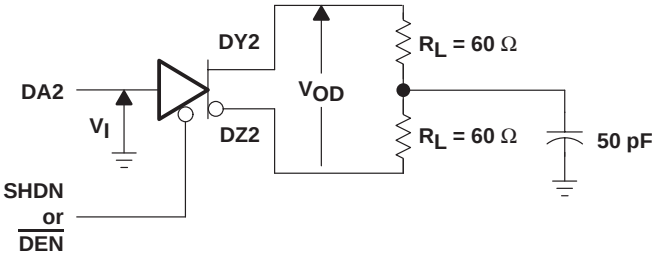
## PARAMETER MEASUREMENT INFORMATION



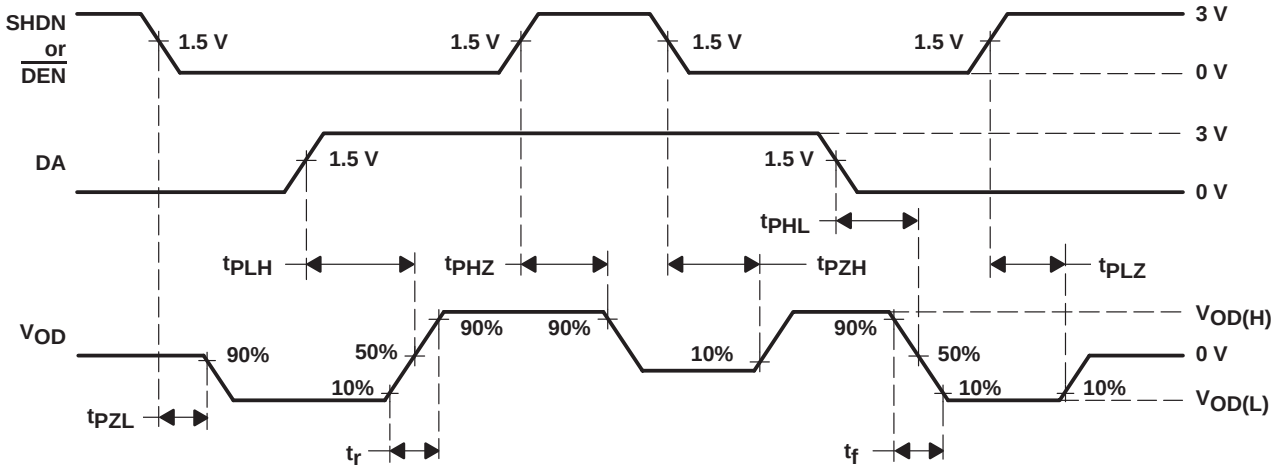

NOTES: A. $C_L$ = 50 pF, $R_L$ = 120 Ω
B. The input waveform $t_r$, $t_f$ ≤ 10 ns.

**Figure 4. Single-Ended Driver Propagation and Transition Times Test Circuits and Waveform**

## PARAMETER MEASUREMENT INFORMATION



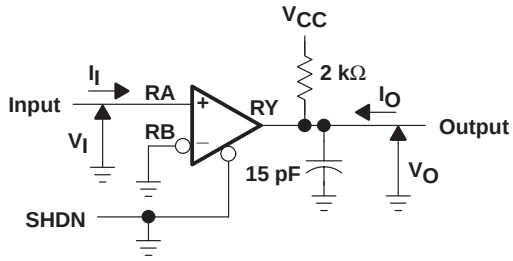

TEST CIRCUIT



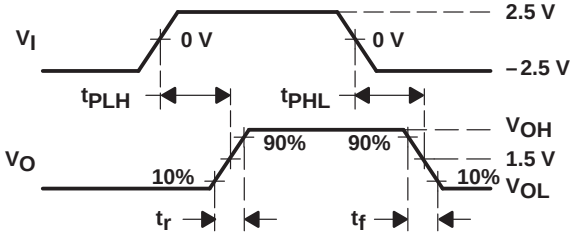

VOLTAGE WAVEFORM
(see Note A)

NOTE A: For the input waveform $t_r$, $t_f$ < = 10 ns

**Figure 5. Differential Driver Propagation and Transition Times Test Circuit and Waveforms**




TEST CIRCUIT

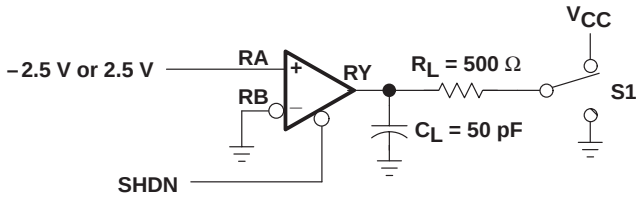



VOLTAGE WAVEFORM
(see Note A)

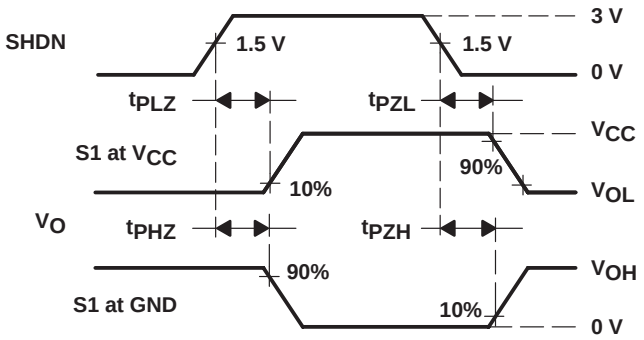
NOTE A: For the input waveform $t_r$, $t_f$ < = 10 ns

**Figure 6. Receiver Propagation and Transition Times Test Circuit and Waveform**

## PARAMETER MEASUREMENT INFORMATION




**TEST CIRCUIT**

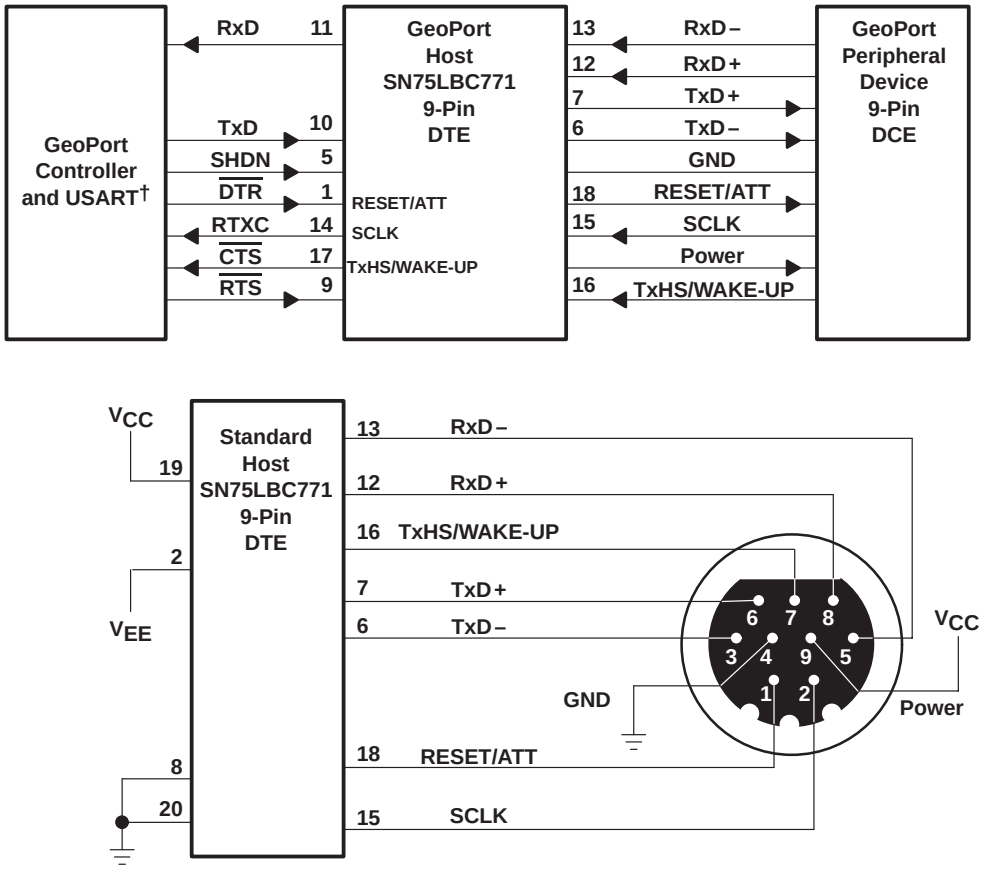



**VOLTAGE WAVEFORM**
**(see Note A)**

NOTE A: For the input waveform $t_r$, $t_f$ < = 10 ns

**Figure 7. Receiver Enable and Disable Test Circuit and Waveforms**

## APPLICATION INFORMATION




† USART = universal synchronous asynchronous receiver transmitter

**Figure 8. GeoPort 9-Pin DTE Connection Application**

### generator characteristics

| PARAMETER | | TEST CONDITIONS | 232/V.28 | | 423/V.10 | | 562 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| $\|V_O\|$ | Output voltage magnitude | Open circuit | | 25 | 4 | 6 | | 13.2 | V |
| | | 3 kΩ ≤ $R_L$ ≤ 7 kΩ | 5 | 15 | NA | | 3.7 | | V |
| | | $R_L$ = 450 Ω | NA | | 3.6 | | NA | | V |
| $I_{OS}$ | Short-circuit output current | $V_O$ = 0 | | 100 | | 150 | | 60 | mA |
| $R_{(OFF)}$ | Power-off source resistance | $V_{CC}$ = 0, $\|V_O\|$ < 2 V | 300 | | NA | | 300 | | Ω |
| $I_{O(OFF)}$ | Power-off output current | $V_{CC}$ = 0, $\|V_O\|$ < 6 V | NA | | | ±100 | NA | | µA |
| SR | Output voltage slew rate | | | 30 | NA | | 4 | 30 | V/µs |
| $t_t$ | Output transition time | ±3.3 V to ±3.3 V | NA | | NA | | 0.22 | 2.1 | µs |
| | | ±3 V to ±3 V | | 0.04 | NA | | NA | | ui‡ |
| | | 10% to 90% | NA | | | 0.3 | NA | | ui‡ |
| $V_{O(RING)}$ | Output voltage ring | | NA | | | 10% | | 5% | |

‡ ui is the unit interval and is the inverse of the signaling rate (bit time).

## APPLICATION INFORMATION

### receiver characteristics

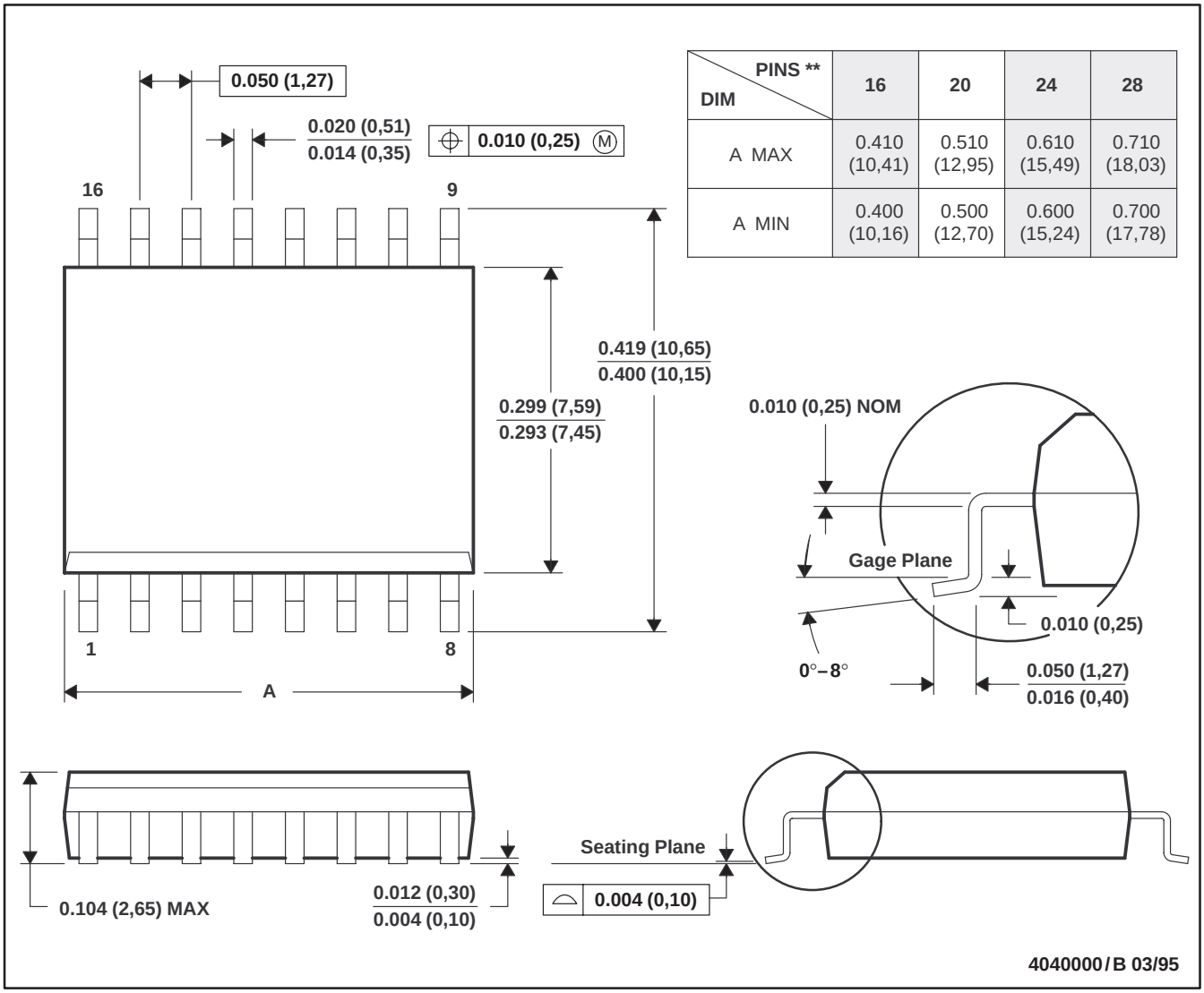
| PARAMETER | | TEST CONDITIONS | 232/V.28 | | 423/V.10 | | 562 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| $\|V_I\|$ | Input voltage | | | 25 | | 10 | | 25 | V |
| $V_{IT}$ | Input voltage threshold | $\|V_I\| < 15$ V | –3 | 3 | NA | | –3 | 3 | V |
| | | $\|V_I\| < 10$ V | NA | | –0.2 | 0.2 | NA | | V |
| $R_I$ | Input resistance | 3 V < $\|V_I\|$ < 15 V | 3 | 7 | NA | | 3 | 7 | kΩ |
| | | $\|V_I\| < 10$ V | NA | | 4 | | NA | | kΩ |

## MECHANICAL INFORMATION

**DW (R-PDSO-G**)** **PLASTIC SMALL-OUTLINE PACKAGE**

**16 PIN SHOWN**

| DIM \ PINS ** | 16 | 20 | 24 | 28 |
|---|---|---|---|---|
| A MAX | 0.410 (10,41) | 0.510 (12,95) | 0.610 (15,49) | 0.710 (18,03) |
| A MIN | 0.400 (10,16) | 0.500 (12,70) | 0.600 (15,24) | 0.700 (17,78) |




NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-013

## IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.