

## FEATURES

- Single Chip Provides Complete LocalTalk®/AppleTalk® Port
- Low Power:  $I_{CC} = 1.2\text{mA}$  Typ
- Shutdown Pin Reduces  $I_{CC}$  to  $30\mu\text{A}$  Typ
- Drivers Maintain High Impedance in Three-State or with Power Off
- 30ns Driver Propagation Delay Typ
- 5ns Driver Skew Typ
- Thermal Shutdown Protection
- Drivers are Short-Circuit Protected

## APPLICATIONS

- LocalTalk Peripherals
- Notebook/Palmtop Computers
- Battery-Powered Systems

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## DESCRIPTION

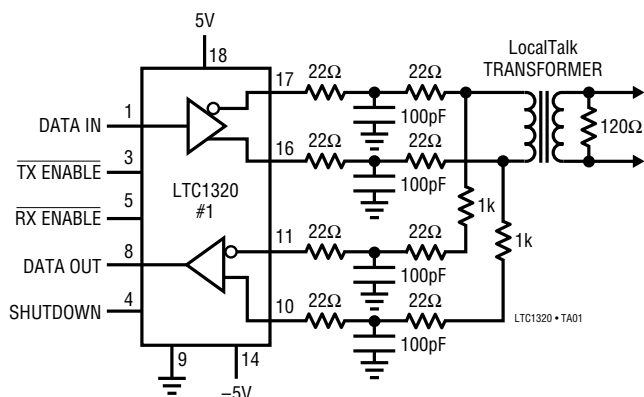
The LTC1320 is an RS422/RS562 line transceiver designed to operate on LocalTalk networks. It provides one differential RS422 driver, one single-ended RS562 driver, two single-ended RS562 receivers, and one differential RS422 receiver. The LTC1320 draws only 1.2mA quiescent current when active and  $30\mu\text{A}$  in shutdown, making it ideal for use in battery-powered devices and other systems where power consumption is a primary concern.

The LTC1320 drivers are specified to drive  $\pm 2\text{V}$  into  $100\Omega$ . Additionally, the driver outputs three-state when disabled, during shutdown, or when the power is off; they maintain high impedance even with output common-mode voltages beyond the power supply rails. Both the driver outputs and receiver inputs are protected against ESD damage to beyond 5kV.

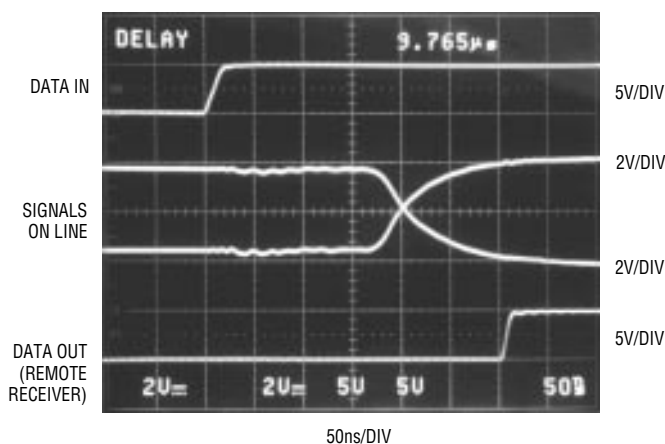
The LTC1320 is available in the 18-pin SOL package.

## TYPICAL APPLICATION

Typical LocalTalk Connection



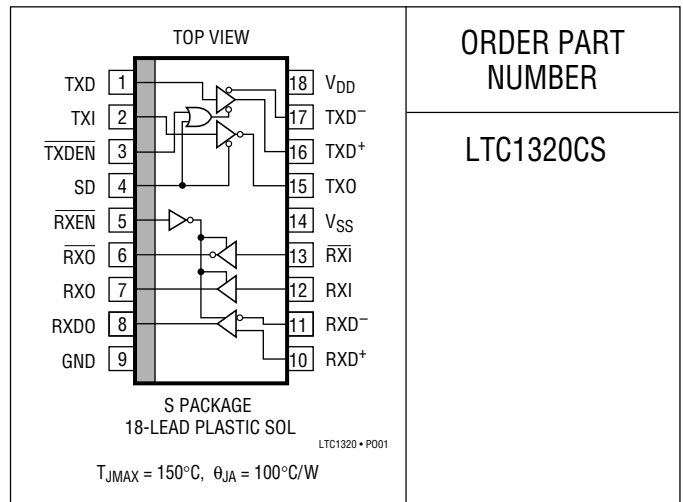
Output Waveforms



## ABSOLUTE MAXIMUM RATINGS

|                                      |                          |
|--------------------------------------|--------------------------|
| Supply Voltage ( $V_{DD}$ )          | 7V                       |
| Supply Voltage ( $V_{SS}$ )          | -7V                      |
| Input Voltage (Logic Inputs)         | -0.3V to $V_{DD} + 0.3V$ |
| Input Voltage (Receiver Inputs)      | $\pm 15V$                |
| Driver Output Voltage (Forced)       | $\pm 15V$                |
| Output Short-Circuit Duration        | Indefinite               |
| Operating Temperature Range          | 0°C to 70°C              |
| Storage Temperature Range            | -65°C to 150°C           |
| Lead Temperature (Soldering, 10 sec) | 300°C                    |

## PACKAGE/ORDER INFORMATION

ORDER PART  
NUMBER

LTC1320CS

Consult factory for Industrial and Military grade parts.

DC ELECTRICAL CHARACTERISTICS  $V_S = \pm 5V \pm 5\%$ ,  $T_A = 0^{\circ}C$  to  $70^{\circ}C$  (Notes 2, 3)

| SYMBOL   | PARAMETER                                                 | CONDITIONS                               | MIN                        | TYP       | MAX        | UNITS         |
|----------|-----------------------------------------------------------|------------------------------------------|----------------------------|-----------|------------|---------------|
| $V_{OD}$ | Differential Driver Output Voltage                        | No Load<br>$R_L = 100\Omega$ (Figure 1)  | ● 8.0<br>● 2.0             |           |            | V<br>V        |
|          | Change in Magnitude of Driver Differential Output Voltage | $R_L = 100\Omega$ (Figure 1)             |                            | 0.2       |            | V             |
| $V_{OC}$ | Driver Common-Mode Output Voltage                         | $R_L = 100\Omega$ (Figure 1)             |                            | 3         |            | V             |
|          | Output Common-Mode Range                                  | SD = 5V or Power Off                     | ●                          |           | $\pm 10$   | V             |
|          | Single-Ended Driver Output Voltage                        | No Load<br>$R_L = 400\Omega$             | ● $\pm 4.0$<br>● $\pm 3.4$ |           |            | V<br>V        |
|          | Input High Voltage                                        | All Logic Input Pins                     | ● 2.0                      |           |            | V             |
|          | Input Low Voltage                                         | All Logic Input Pins                     | ●                          |           | 0.8        | V             |
|          | Input Current                                             | All Logic Input Pins                     | ●                          | $\pm 1$   | $\pm 20$   | $\mu A$       |
|          | Three-State Output Current                                | SD = 5V or Power Off, $-10V < V_O < 10V$ | ●                          | $\pm 2$   | $\pm 100$  | $\mu A$       |
|          | Driver Short-Circuit Current                              | $-5V < V_O < 5V$                         | ● 35                       | 350       | 500        | mA            |
|          | Receiver Input Resistance                                 | $-7V < V_{IN} < 7V$                      | ● 12                       |           |            | k $\Omega$    |
| $V_{OH}$ | Receiver Output High Voltage                              | $I_O = -4mA$                             | ● 3.5                      |           |            | V             |
| $V_{OL}$ | Receiver Output Low Voltage                               | $I_O = 4mA$                              | ●                          |           | 0.4        | V             |
|          | Receiver Output Short-Circuit Current                     | $0V < V_O < 5V$                          | ● 7                        |           | 85         | mA            |
|          | Receiver Output Three-State Current                       | $0V < V_O < 5V$                          | ●                          | $\pm 2$   | $\pm 100$  | $\mu A$       |
|          | Differential Receiver Threshold Voltage                   | $-7V < V_{CM} < 7V$                      | ● -200                     |           | 200        | mV            |
|          | Differential Receiver Input Hysteresis                    | $-7V < V_{CM} < 7V$                      |                            | 70        |            | mV            |
|          | Single-Ended Receiver Input Low Voltage                   |                                          | ●                          |           | 0.8        | V             |
|          | Single-Ended Receiver Input High Voltage                  |                                          | ● 2                        |           |            | V             |
| $I_{DD}$ | Supply Current                                            | No Load, SD = 0V<br>No Load, SD = 5V     | ●<br>●                     | 1.2<br>30 | 3.0<br>350 | mA<br>$\mu A$ |
| $I_{SS}$ | Supply Current                                            | No Load, SD = 5V                         | ●                          | 2         | 350        | $\mu A$       |

## SWITCHING CHARACTERISTICS $V_S = \pm 5V \pm 5\%$ , $T_A = 0^\circ C$ to $70^\circ C$ (Notes 2, 3)

| SYMBOL        | PARAMETER                             | CONDITIONS                                        |   | MIN | TYP | MAX | UNITS |
|---------------|---------------------------------------|---------------------------------------------------|---|-----|-----|-----|-------|
| $t_{PLH, HL}$ | Differential Driver Propagation Delay | $R_L = 100\Omega$ , $C_L = 100pF$ (Figures 2, 8)  | ● |     | 40  | 120 | ns    |
| $t_{SKEW}$    | Differential Driver Output to Output  | $R_L = 100\Omega$ , $C_L = 100pF$ (Figures 2, 8)  | ● |     | 10  | 50  | ns    |
| $t_{r, f}$    | Differential Driver Rise/Fall Time    | $R_L = 100\Omega$ , $C_L = 100pF$ (Figures 2, 8)  | ● |     | 15  | 80  | ns    |
| $t_{ENH, L}$  | Driver Enable to Output Active        | $C_L = 100pF$ (Figures 3, 4, 10)                  | ● |     | 50  | 150 | ns    |
| $t_{H, Ldis}$ | Driver Output Active to Disable       | $C_L = 15pF$ (Figures 3, 4, 10)                   | ● |     | 50  | 150 | ns    |
| $t_{PLH, HL}$ | Single-Ended Driver Propagation Delay | $R_L = 450\Omega$ , $C_L = 100pF$ (Figures 5, 11) | ● |     | 40  | 120 | ns    |
| $t_{r, f}$    | Single-Ended Driver Rise/Fall Time    | $R_L = 450\Omega$ , $C_L = 100pF$ (Figures 5, 12) | ● |     | 15  | 80  | ns    |
| $t_{PLH, HL}$ | Receiver Propagation Delay            | $C_L = 15pF$ (Figures 13, 14)                     | ● |     | 60  | 160 | ns    |
| $t_{ENH, L}$  | Receiver Enable to Output Active      | $C_L = 100pF$ (Figures 6, 7, 15)                  | ● |     | 30  | 100 | ns    |
| $t_{H, Ldis}$ | Receiver Output Active to Disable     | $C_L = 15pF$ (Figures 6, 7, 15)                   | ● |     | 30  | 100 | ns    |

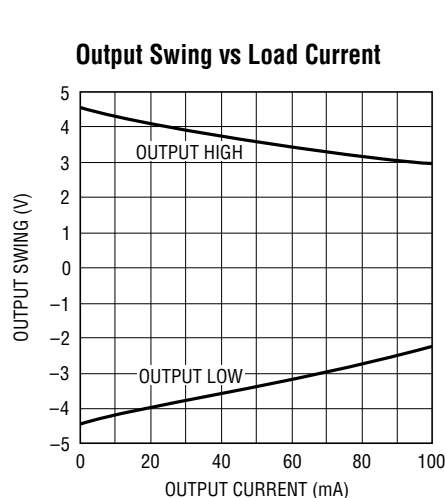
The ● denotes specifications which apply over the full operating temperature range.

**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

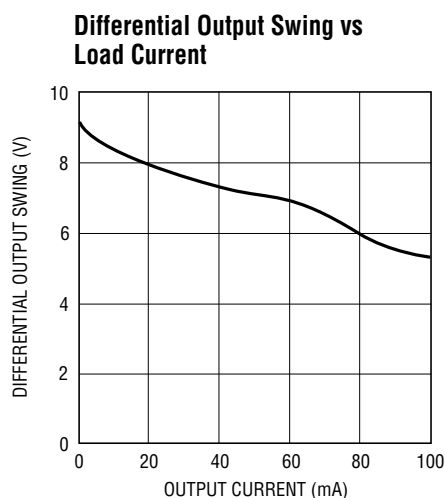
**Note 2:** All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to ground unless otherwise specified.

**Note 3:** All typicals are given at  $V_S = \pm 5V$ ,  $T_A = 25^\circ C$ .

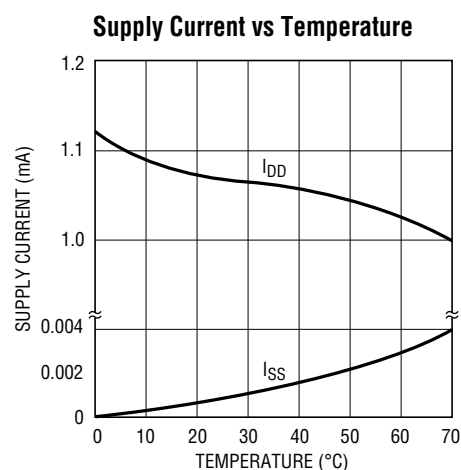
## TYPICAL PERFORMANCE CHARACTERISTICS



LTC1320 • G01



LTC1320 • G02



LTC1320 • G03

## PIN FUNCTIONS

**TXD (Pin 1):** RS422 Differential Driver Input (TTL Compatible).

**TXI (Pin 2):** RS562 Single-Ended Driver Input (TTL compatible).

**TXDEN (Pin 3):** RS422 Differential Driver Output Enable (TTL Compatible). A high level on this pin forces the

RS422 driver into three-state; a low level enables the driver. This input does not affect the RS562 single-ended driver.

**SD (Pin 4):** Shutdown Input (TTL Compatible). When this pin is high, the chip is shut down: all driver outputs three-state and the supply current drops to 30μA. A low on this pin allows normal operation.

## PIN FUNCTIONS

**RXEN (Pin 5):** Receiver Enable (TTL Compatible). A high level on this pin disables the receivers and three-states the logic outputs; a low level allows normal operation. To prevent erratic behavior at the receiver outputs during shutdown, RXEN should be pulled high along with SD.

**RXO (Pin 6):** Inverting RS562 Single-Ended Receiver Output.

**RXO (Pin 7):** Noninverting RS562 Single-Ended Receiver Output.

**RXDO (Pin 8):** RS422 Differential Receiver Output.

**GND (Pin 9):** Ground Pin.

**RXD<sup>+</sup> (Pin 10):** RS422 Differential Receiver Noninverting Input. When this pin is  $\geq 200\text{mV}$  above RXD<sup>-</sup>, RXDO will be high; when this pin is  $\geq 200\text{mV}$  below RXD<sup>-</sup>, RXDO will be low.

**RXD<sup>-</sup> (Pin 11):** RS422 Differential Receiver Inverting Input.

**RXI (Pin 12):** Noninverting RS562 Receiver Input. This input controls the RXO output; it has no effect on the RXO output.

**RXI (Pin 13):** Inverting RS562 Receiver Input. This input controls the RXO output; it has no effect on the RXO output.

**V<sub>SS</sub> (Pin 14):** Negative Supply.  $-4.75\text{V} \geq V_{SS} \geq -5.25\text{V}$ . The voltage on this pin must never exceed ground on power up or power-down.

**TXO (Pin 15):** RS562 Single-Ended Driver Output.

**TXD<sup>+</sup> (Pin 16):** RS422 Differential Driver Noninverting Output.

**TXD<sup>-</sup> (Pin 17):** RS422 Differential Driver Inverting Output.

**V<sub>DD</sub> (Pin 18):** Positive Supply.  $4.75\text{V} \leq V_{DD} \leq 5.25\text{V}$ .

## TEST CIRCUITS

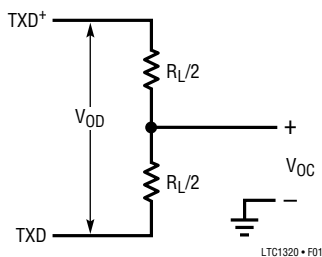


Figure 1

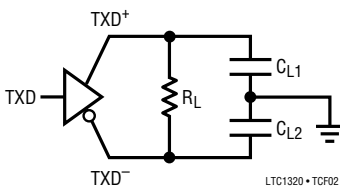


Figure 2

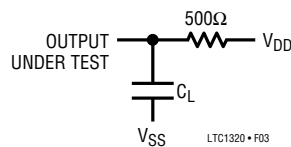


Figure 3

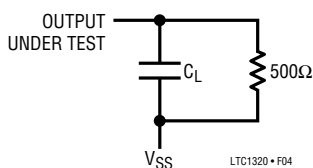


Figure 4

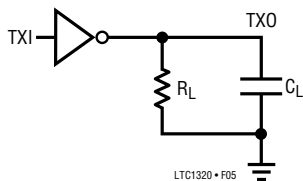


Figure 5

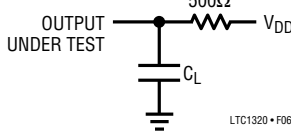


Figure 6

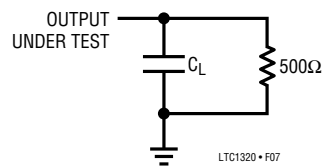


Figure 7

## SWITCHING WAVEFORMS

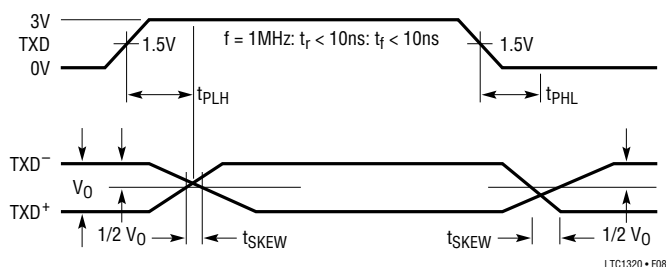


Figure 8

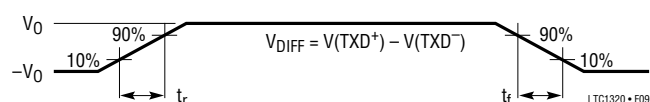


Figure 9

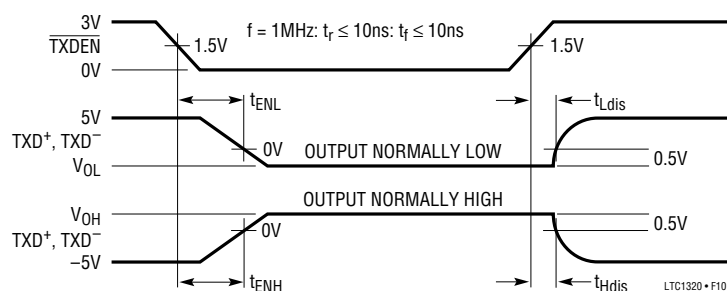


Figure 10

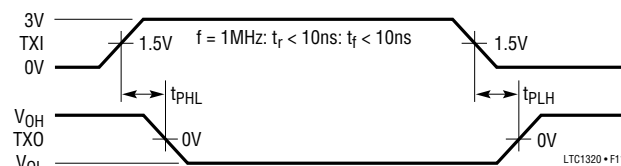


Figure 11

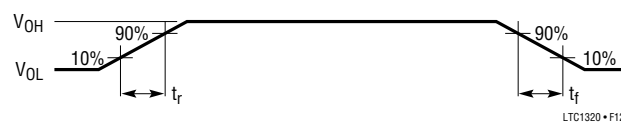


Figure 12

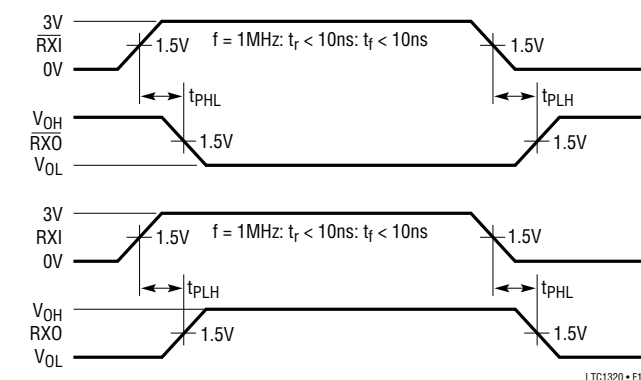


Figure 13

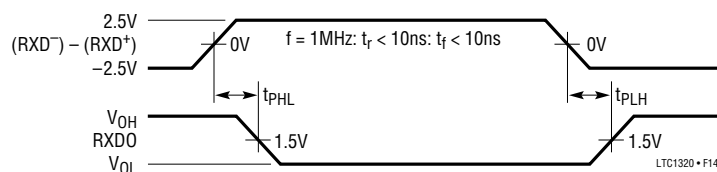


Figure 14

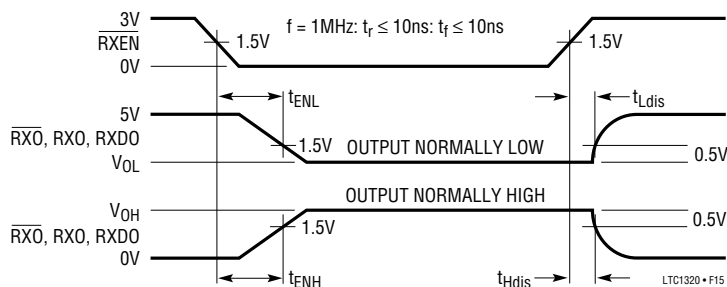


Figure 15

## APPLICATIONS INFORMATION

### Thermal Shutdown Protection

The LTC1320 includes a thermal shutdown circuit which protects the part against prolonged shorts at the driver outputs. If any driver output is shorted to another output or to the power supply, the current will be initially limited to 450mA max. The die temperature will rise to about 150°C, at which point the thermal shutdown circuit turns off the driver outputs. When the die cools to about 130°C, the outputs re-enable. If the shorted condition still exists, the part will heat again and the cycle will repeat. When the short is removed, the part will return to normal operation. This oscillation occurs at about 10Hz and prevents the part from being damaged by excessive power dissipation.

### Power Shutdown

The power shutdown feature of the LTC1320 is designed primarily for battery-powered systems. When SD (pin 4) is forced high, the part enters shutdown mode. In shut-

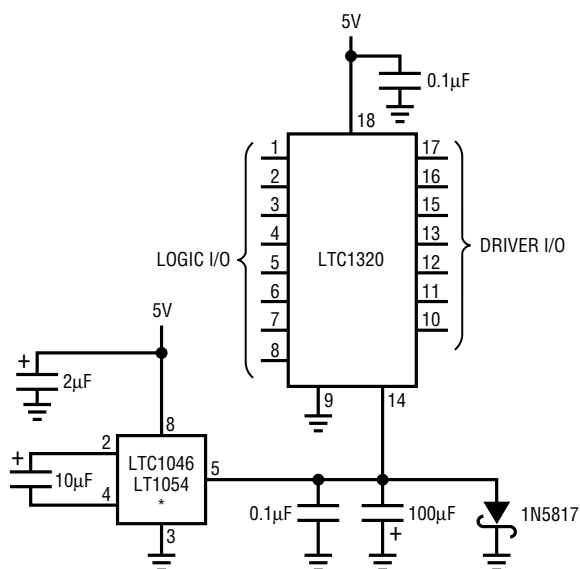
down, the supply current drops from 1.2mA to 30µA typ. The driver outputs are three-stated and the power to the receivers is removed. The receiver outputs are not automatically three-stated in shutdown, and can toggle erroneously due to feedthrough from the inputs. This can be prevented by pulling  $\overline{\text{RXEN}}$  high along with SD; this will three-state the receiver outputs and prevent the generation of spurious data.

### Supply Bypassing

The LTC1320 requires that both  $V_{DD}$  and  $V_{SS}$  are well bypassed; data errors can result from inadequate bypassing. Bypass capacitor values of 0.1µF to 1µF from  $V_{DD}$  to ground and from  $V_{SS}$  to ground are adequate. Lead lengths and trace lengths between the capacitors and the chip should be short to minimize lead inductance.

## TYPICAL APPLICATIONS

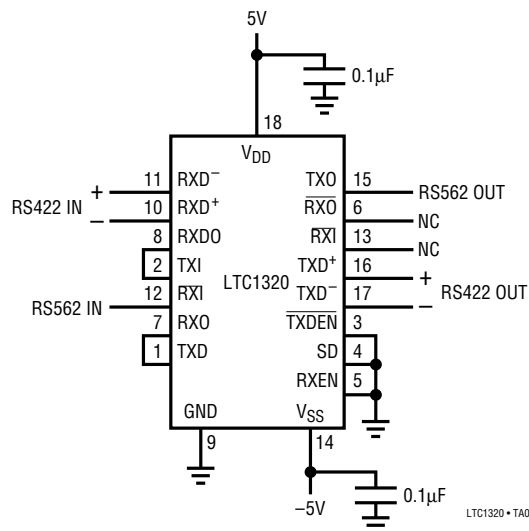
Single 5V Supply



\*LTC1046 GIVES 300µA QUIESCENT CURRENT WHEN LTC1320 IS SHUT DOWN  
LT1054 PROVIDES HIGHER OUTPUT DRIVE

LTC1320 • TA03

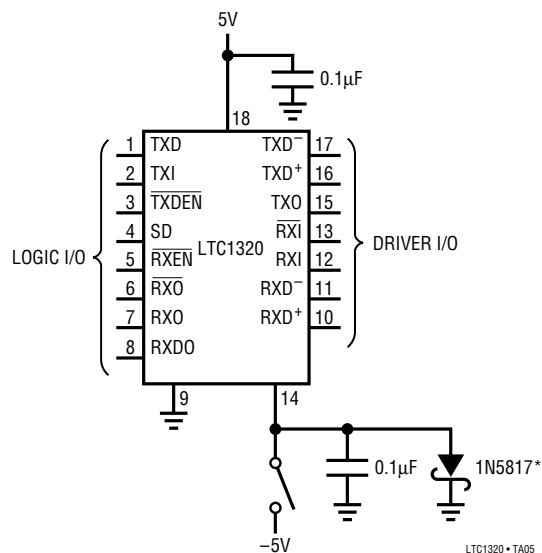
RS422 to RS562/RS562 to RS422 Converter



LTC1320 • TA04

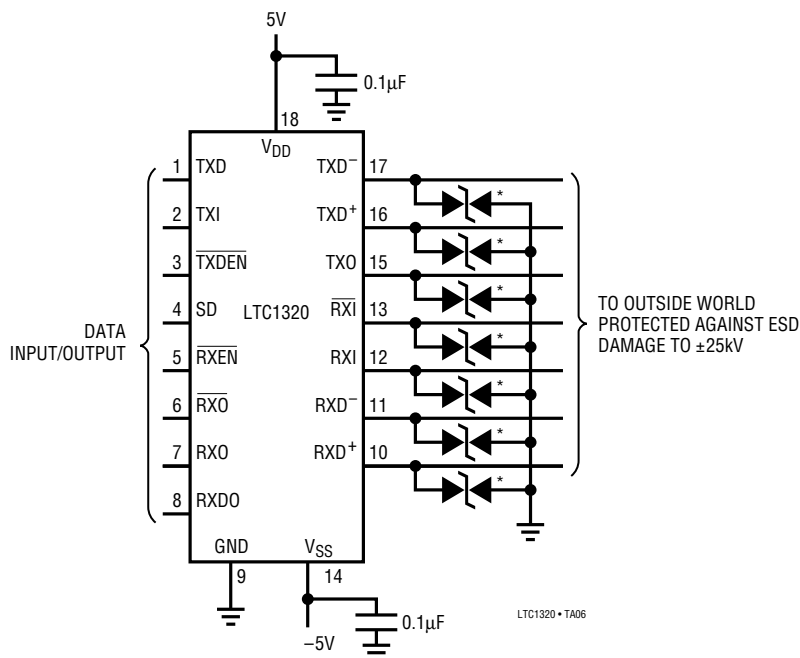
## TYPICAL APPLICATIONS

## Switched Negative Supply



\*SCHOTTKY DIODE PREVENTS  $V_{SS}$  FROM EXCEEDING GND ON POWER-UP OR POWER-DOWN

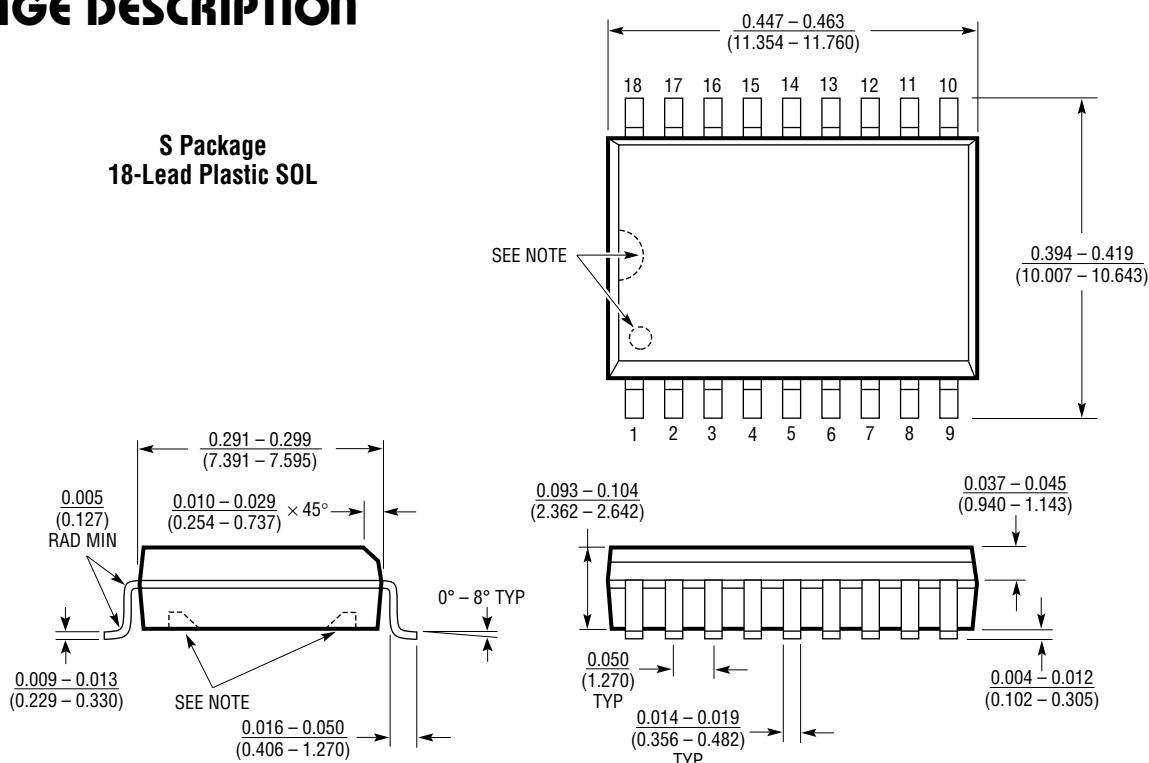
LTC1320 • TA05

 $\geq 25k$  ESD Protection

\*GENERAL SEMICONDUCTOR ICTE-22C OR EQUIVALENT

LTC1320 • TA06

## PACKAGE DESCRIPTION

S Package  
18-Lead Plastic SOL

NOTE:  
PIN 1 IDENT, NOTCH ON TOP AND CAVITIES ON THE BOTTOM OF PACKAGES ARE THE MANUFACTURING OPTIONS.  
THE PART MAY BE SUPPLIED WITH OR WITHOUT ANY OF THE OPTIONS.

SOL18 0392

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